ICONARP

International Journal of Architecture & Planning

INDEXED IN
EMERGING SOURCES CITATION
(Web of Science)
CLARIVATE ANALYTICS

E-ISSN: 2147-9380
Volume 10
Issue 2
DECEMBER 2022

International Journal of Architecture & Planning
Volume 10, Issue 2, December 2022
DOI: 10.15320 / E-ISSN: 2147-9380
Online: http://iconarp.ktun.edu.tr

ICONARP

Contact: *ICONARP Konya Teknik Üniversitesi Mimarlık ve Tasarım Fakültesi Akademi Mah. Yeni İstanbul Cad. No: 235/1 Selçuklu/KONYA* ***Tel:*** *+90332 2051000* ***E-mail:*** *iconarp.editor@ktun.edu.tr*

ICONARP INTERNATIONAL JOURNAL OF ARCHITECTURE & PLANNING

ICONARP as a free academic e-journal considers original research articles and viewpoints in peer-reviewed.

Architecture, Planning and Design are strongly affected by other disciplines such as fine arts, philosophy, engineering, geography, economics, politics, sociology, history, psychology, geology, information technology, ecology, law, security and management. However, there are not enough academic journals which specifically focus on the connections of architecture, planning and design with other fields of science. ICONARP aims to fill that gap. Our scope is to provide a suitable space for theoretical, methodological and empirical papers, which use global and local perspectives together, in architectural and urban studies.

ICONARP aims to be a reputable platform for the studies of Architecture, Planning and Design. ICONARP's objectives are:

- To question global and local interactions in the field of Architecture, Planning and Design,
- To discover the relationship between Architecture, Planning and Design,
- To increase the contribution of Architecture, Planning and Design to social and behavioral sciences,
- To discover the relationship of Architecture, Planning and Design with other fields of science that are affected and affect,
- To develop theoretical and methodological foundations of Architecture, Planning and Design,
- To discuss the role of architects, planners and designers today and in the future,
- To compare the differences between architecture, planning and design research, practices and education in different countries,
- To bring a scientific view of current issues and discussions in field of Architecture, Planning and Design,
- To discover innovative methods and techniques in the field of Architecture, Planning and Design.

ABSTRACTING AND INDEXING

ICONARP is an Open Access Journal which presents its content freely for online researches with the aim of contributing to the global exchange of knowledge. ICONARP believes that providing free online access ensures a wider spectrum of research base and reading rate to develop the related literature.

"The abstracting, database and indexing services that ICONARP is included are:
Emerging Sources Citation Index (ESCI) (Web of Science ESCI), DOAJ, Tubitak Ulakbim TR Dizin, Iconda Bibliographic (The International Construction Database), Avery Index to Architectural Periodicals, Erihplus, EbscoHost, Ulrichsweb, NSD Norwegian Register for Scientific Journals, OpenAIRE, OCLC WorldCat, BASE (Bielefeld Academic Search Engine), Scilit, ROAD (Directory of Open Access)"

Cover Photo: Chicago, USA (2011), Cover Owner: Selçuk Sayın, Cover Design: Ceyhan Tazefidan

International Journal of Architecture & Planning
Online: http://iconarp.ktun.edu.tr

ICONARP

CONTENTS

Volume 10, Issue 2, December 2022
DOI: 10.15320 /E-ISSN: 2147-9380

International Journal of Architecture & Planning
Online: http://iconarp.ktun.edu.tr

ICONARP

Research Article

ICONARP
International Journal of Architecture and Planning
Received:19.12.2021 Accepted: 09.12.2022
Volume 10, Issue 2/ Published: 20.12.2022
DOI: 10.15320/ICONARP.2022.207 E- ISSN:2147-380

ICONARP

Architectural Inventories. Evolution of Graphic Documentation of Heritage

Marta Quintilla-Castán*
Luis Agustín-Hernández **

Abstract

One of the main problems of the inventory of architectural heritage is managing and storing large amounts of information in different formats, in addition to the need to organize and manage the information generated by collaborative work between the different technicians who participate in the documentation process. The solution involves the development of a model capable of incorporating information on a layered support and allowing analysis and management, as well as interoperability between tools and other systems throughout the entire life cycle of the building. To carry out this work, two methodologies have been selected to verify their effectiveness in the field of architectural heritage inventory, covering the specific needs of generating a complete graphic database of the building. The Arches platform, a free open source software developed to carry out inventories, has been chosen for its interoperability, specificity and all the characteristics and functions described above. In turn, a WebGIS has been developed using free software standards and technology, to examine the possibilities it offers in relation to specific inventory programs. As a result, the creation of an Information System of the Mudejar Architectural Heritage of Aragón has been proposed, with the purpose of integrating under a common support, all the documentation and graphic information available on the heritage asset. The research limitations are the creation of a geo-referenced database, with geometric information on each building, which addresses the cataloguing of more than 200 assets, due to the uniqueness of this architectural style. The information is stored complying with the documentation standards to ensure interoperability and accessibility to the data.

Keywords:
Architectural heritage, graphic documentation, information system, inventories, mudejar

* Department of Architecture. School of Engineering and Architecture, University of Zaragoza. Zaragoza, Spain. (*Corresponding author)*
E-mail: mquintilla@unizar.es

** Department of Architecture. School of Engineering and Architecture, University of Zaragoza. Zaragoza, Spain.
E-mail: lagustin@unizar.es

To cite this article: Quintilla-Castán, M., & Agustín-Hernández, L. (2022). Architectural inventories. Evolution of graphic documentation of heritage. *ICONARP International Journal of Architecture and Planning,* 10 (2), 379-409. DOI: 10.15320/ICONARP.2022.207

INTRODUCTION

The preservation of the cultural values of the architectural heritage must be properly safeguarded, by registering the volumetric information and all the complementary information associated with the property. In this way, thanks to a correct graphic documentation, its investigation, conservation and dissemination is ensured (Gómez González, 2013). To carry out the work of documenting the architectural heritage, the storage of a large amount of information is required, which must be processed in various formats from experts from different areas of knowledge. This diversity of information hinders collaboration and proper communication between the professionals involved in documentation work, making interoperability and accessibility one of the biggest problems to be solved. Another disadvantage of traditional work methods is the limited transmission of information between different entities, not only between researchers or administrations, nor does it favor dissemination among the general public (Finat et al, 2010).

Traditionally, the information contained in architecture catalogues was made up of plans, photographs and texts, in two-dimensional format. But with the evolution of representation systems, their transformation has been linked to computer development. With current data acquisition techniques, exhaustive documentation of the heritage assets is generated, that allows obtaining a 3D geometric model, on which to dump data from the investigation. This situation implies new challenges, such as the storage and accessibility of information in an easy and intuitive way. The electronic dissemination of information is considered a solution that responds to most of the problems mentioned, since it allows permanent updating, flexibility, the ability to introduce any type of support, selective distribution, interaction with the user and lower costs of production (Gómez González, 2015).

This ability to generate information has favored the evolution of heritage records, by incorporating more complete and precise graphic documentation with respect to traditional architectural inventories. As a consequence, one of the main problems of the architectural heritage inventory is managing and storing large amounts of information in different formats and for multiple uses. It is an essential requirement to develop a methodology that organizes the process of data collection and information processing to ensure proper storage and accessibility to information. For this reason, the standardization and systematization of information from different sources is essential.

The objective is to generate an inventory management system that contributes to optimizing the management of stored information, as well as its updating, enabling interaction with other databases and thus, contributing to the dissemination of knowledge and the inventory of heritage. A common support that contains all the available materials of a heritage asset with the purpose of being stored, processed and analyzed, in order to facilitate its use for multiple purposes such as protection, restoration, conservation or dissemination, among others.

DOI: 10.15320/ICONARP.2022.207

The study area selected to carry out the graphic inventory of architectural heritage is the region of Aragon in Spain, since it concentrates a large list of assets, an example of the Mudejar heritage, exclusive to the Iberian Peninsula, whose time includes the twelfth century to the seventeenth century. Mudejar art is the result of the confluence of Muslim, Jewish and Christian artistic traditions in the peninsula, which has its own peculiarities in the Aragonese territory. This architectural singularity has favored its declaration as World Heritage by UNESCO. The complete registration of the Mudejar Architectural Heritage through the creation of a database represents a differentiating element with respect to the current state of the records available by the administration, by incorporating two-dimensional and three-dimensional graphic documentation that will provide more information regarding the registered buildings in a digital and accessible environment.

THE GRAPHIC DOCUMENTATION OF HERITAGE THROUGH INVENTORIES

Historical context of the evolution of heritage protection

The concept of heritage is a relatively recent term. The concept itself is constantly evolving and has been varying and expanding to the present day. The conceptual evolution of the term through the modification of the different regulations, have been altering and incorporating new meanings to understand how the treatment of these issues, derive in the need to carry out an exhaustive documentation of the heritage for its protection, conservation, management and diffusion.

The construction of the concept is flexible, and it is a recent process that began in the 18th century and continues to this day, as it is an open debate. The end of the 20th century has meant a renewal of conceptual and methodological approaches to the issue of Cultural Heritage (Azkárate et al, 2003).

In the 18th century, in the midst of the "century of enlightenment", reason and science prevailed in all fields of society. In the field of Heritage, documents, monuments and archaeology are beginning to be valued as sources of knowledge that must be preserved and transmitted, with the first debates regarding the selection of monuments to be preserved appearing. The search for historical truth, the rational criticism of the past, brought with it the development of archaeology and the appearance of the History of Art (Martínez Pino, 2012). As a consequence of the review of the past and the measures aimed at the conservation of the historical heritage, the first catalogues and inventories were proposed, as well as the first theories of restoration. Throughout the 19th century, after the French Revolution, the French Constituent Assembly made ecclesiastical, Crown and emigrant property available to the State, becoming part of the nation's heritage. This situation brought with it the need to deal with the management of innumerable assets, both movable and immovable, from an economic

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

point of view, “If antiquities are transformed into wealth, recent architectural works start to acquire, for their part, the historical and affective meanings typical of national antiquities. The concept of heritage thus induces a homogeneity of meaning in values" (Choay, 2007). The management model implemented entailed carrying out of inventories, the creation of surveillance and control mechanisms, through the Monuments Commissions, and the adaptation of the assets to new uses.

In the 19th century, the first theories of restoration emerged when considering the restoration of historical heritage as a scientific discipline. Highlight, the stylistic restoration led by Viollet-le-Duc, who advocated restoration, the archaeological restoration carried out by G. Valadier and R. Stern, or the theories of J. Ruskin, who advocated the conservation of monuments. Follower of these last theories, William Morris wrote in 1877 a manifesto questioning the stylistic restoration of Viollet-le-Duc. Later, Camilo Boito proposed the identification of the monument within a period and style, as well as the need to differentiate the transformations suffered during the consolidation process. Already in the twentieth century the architectural monument began to be valued in relation to its context. One of its exponents, G. Giovannoni heads the theory of scientific restoration, reflecting on the problems of the defense of historic centers, environmental respect and minor architectures. This theory is the basis of the international recommendations developed during the final decades of the 20th century.

It was in the last decades of the 20th century when the traditional concept of "historical-artistic monuments" was expanded, thanks to the texts generated by international legislation. There have been different texts that have given normative form to this conceptual and methodological evolution, such as the Athens Charter of 1931, the Venice Charter of 1964, the Amsterdam Charter of 1975, the Krakow Charter of 2000 or the Madrid Charter of 2011, among others. These Charters, have served to expand the concept of architectural heritage, replacing the concept of "monument" with others such as "cultural asset" or "heritage", as well as the expansion of the areas of protection of architectural heritage to the Complexes, to the Historical-Center, industrial architecture, vernacular architecture, etc. Specifically, the Athens Charter defines the artistic and archaeological heritage as a means to encourage the conservation of artistic and historical monuments, on the other hand, the Venice Charter, expands the previous views regarding the concepts of historical monument and monumental heritage, by including within these qualifications the most modest works.

The agents involved in the protection of Heritage, driven by the great changes, considered necessary the revision of the Venice Charter (1964), in which the international principles of conservation and restoration of monumental works were regulated to adapt them to the culture of each territory and the importance of "accurate documentation, consisting of analytical and critical reports illustrated with drawings and photographs," was specified. Since the 1972 UNESCO Convention

DOI: 10.15320/ICONARP.2022.207

(UNESCO 1972), whose purpose was to promote the needs of conservation and protection of Heritage, as well as "adopt the appropriate legal, scientific, technical, administrative and financial measures to identify, protect, conserve, revalue and rehabilitate that heritage", the different disciplines have collaborated to carry out this work jointly.

Historical context of the evolution of heritage protection

The advances that have been taking place since 2000, in the development of digital photogrammetry and laser scanning instrumentation, have constituted a revolution in data collection procedures, being able to obtain a large amount of very precise information, very quickly. In the same way, as this technology evolves, the information processing programs have been updated and numerous specialized programs have emerged in the treatment of very specific pieces of information.

This is precisely why, in the year 2000, the so-called Krakow Charter was born, in which for the first time a specific recommendation was made for the use of new technologies in the field of built heritage, defining in its fifth article "In the protection and public preservation of archaeological sites, the use of modern technologies, data banks, information systems and virtual presentations should be promoted". This fact, will officially mark the beginning of the use of new technologies as an effective tool in the conservation and dissemination of archaeological and architectural heritage. But it is in the ICOMOS Charter or Ename Chapter (2008), where the importance of the use of "virtual reconstructions" in the field of historical heritage is definitely exhibited, in the fourth section of Principle 2, "Visual reconstructions, whether by artists, architects or computer-designed, must be based on a detailed and systematic analysis of environmental, archaeological, architectural and historical data, including the study of written, oral and iconographic sources, as well as of the photograph". Its inclusion will constitute an important step in the search for the most suitable tool for virtual reconstruction, which brings together all the information ordered in the same database.

One of the main problems of the inventory of architectural heritage is managing and storing large amounts of information in different formats: alphanumeric information of technical and scientific data, raster and vector format of plans, maps, images, drawings, etc. In addition to the need to organize and manage the information generated by the collaborative work between the different technicians who participate in the heritage documentation process, which is why it is necessary to unify it in a common database. That is why for the complete documentation of the heritage and to be able to have exhaustive and useful inventories for all the contemplated uses, the Spatial Information Systems provide all the required functionalities.

An Architectural Heritage Information System requires a database that can incorporate information related to identification and location, historical data, type of protection, geometric and constructive characteristics, state of conservation and types of intervention, and many more. The solution involves the development of a geometric model that allows including and relating information related to it. The format is a 3D model capable of incorporating information on a stratified support and allowing subsequent analysis and management, as well as interoperability between tools and other systems throughout the entire life cycle of the object.

There are numerous investigations, such as those studied below, that develop methodologies to document, intervene and restore architectural heritage using the potential of 3D models, but there is still no tool that integrates all the needs that architectural heritage requires, from the point of view of cataloguing. The integration of the volumetric model in the Information Systems is one of the determining aspects for the choice of the appropriate methodology for its implementation. It specifies that the information stored in the 3D model from the different technicians is not incomplete and is available for analysis. There are different technologies that allow information to be stored in the same model, such as HBIM (Historic Building Information Modelling), but the objective of this research is to focus on defining a georeferenced system for the inventory of Architectural Heritage. The solution to the problem requires adopting a methodology similar to Geographic Information Systems (GIS), which allow the storage of information in layers, the use of vector and raster data, as well as the use of analysis tools.

TOOLS FOR INTEROPERABILITY AND ACCESSIBILITY

Heritage documentation implies the management of large volumes of information, which must be stored under an organized and accessible structure for consultation. Various disciplines intervene in the sector, with highly specialized fields, which have to work simultaneously and together, so coordination and communication is essential to ensure the preservation and transmission of data in documentation processes. For this reason, the creation of a common data model favors interoperability and accessibility to stored information, thanks to the use of international standards related to the field of representation of architectural heritage, that facilitate the association of specific vocabularies and the use of formal ontologies. The use of open source software and language, guarantees the correct exchange of information and ensures its permanence and maintenance over time, despite continuous technological advances, helping institutions to maintain their wealth management systems. Another essential field to take into account is the use of semantic organization, integrating international standards for heritage inventory and documentation to carry out useful management of all data generated and implemented by all disciplines involved in heritage.

DOI: 10.15320/ICONARP.2022.207

Standardization

Cultural heritage requires the use of databases as an instrument to manage and inventory information. The collection, classification, analysis and presentation of information requires the use of protocols to order and use in a comprehensible and coherent way. To achieve compatibility between them, regardless of the information format, whether it is on paper or digital, multiple institutions are in charge of coordinating and adopting standards necessary for harmonization between them at different scales, in order to guarantee the survival and migration of data without long-term risks.

To allow interoperability between databases, there are a series of international standards related to the field of representation of cultural heritage and specifically architectural heritage, which allow the linking of specific vocabularies. The "Core Data Index to Historic Buildings and Monuments of the Architectural Heritage" Institute (1992) is a standard devised by the Council of Europe and the Getty Information in order to facilitate the documentation and standardization of architectural heritage and provide recommendations for technical standards for data capture and exchange. The standard was developed in parallel to another basic standard such as the "Core data standard for archaeological sites and monuments" (1995), a consequence of the collaboration between the CIDOC documentation committee of the International Council of Museums (ICOM) and the archaeological documentation group of the Council of Europe and whose mission is to complement the Core Data Index to Historical Buildings and Monuments of the Architectural Heritage in order to facilitate the integration of both in a single database.

In the field of heritage documentation, international inventory and documentation standards must be integrated, in order to carry out a useful management of all the data generated and implemented by all disciplines. To achieve these objectives, the ISO 15489 standard for Document Management was created. It is made up of two parts, the first contemplates a more generic scope, where the basic concepts, principles and requirements of document management are defined, in order to ensure the protection of information and that it can be retrieved effectively. The second part is a technical report focused on the methodological definition of the implementation of the contents exposed in the first part of the standard, where guidelines are established that shape the document management processes and instruments, as well as the need of use of metadata for the management of electronic documents and the requirements that must be met (Alonso, García-Alsina & Lloveras, 2007).

Finally, from the point of view of standardization in the field of geographic information, one of the main regulations to take into account is that established by the technical committee ISO TC211, whose purpose is standardization in the field of digital geographic information. In parallel, the OGC (Open Geospatial Consortium), based on the aforementioned ISO standards, has developed the GML (Geographic

Markup Language) standard, based on XML, focused on displaying geographic objects with the aim of allowing interoperability through the web. In addition, it is essential to name CityGML, an open data standard developed by the Special Interest Group 3D of the Geodata Infrastructure North-Rine Westphalia (GDI NRW) initiative, which is based on the ISO 191xx family of standards. It deals with the graphical and semantic representation at different scales of urban and landscape entities, based on time or structured at different levels of detail.

Ontologies

In the field of cultural heritage, to allow maximum interoperability and accessibility, the use of open source software and language, guarantees the correct exchange of information and ensures its permanence and maintenance over time despite continuous technological advances, favoring that institutions can maintain their heritage management systems, thanks to the use of formal ontologies (Doerr, 2009).

For the specific case of the dissemination of heritage through web platforms, it is necessary to take into account the use of Open Semantic Web Technologies in order to favor interoperability between 3D models and software, reducing the speed of visualization and effective use. of the resources. The person in charge of developing recommendations and standards for the exchange of information is being carried out by the W3C (World Wide Web Consortium) through the creation of standards such as XML, OWL, RDF or SPARQL. The use of these standards allows, in the field of architectural heritage documentation, to manage the amount of data stored in Information Systems, including 3D models.

The essential available tools for the development of the semantic web are ontologies and standard data models, which unequivocally specify the structure of the data and prescribe how it should be interpreted. There are several ontologies that deal with concepts or entities, which could be considered for some aspects of the study of architectural heritage. The main ontology used for the management of cultural heritage documentation is CIDOC-CRM "CIDOC Conceptual Reference Model", recognized since 2006 as an international standard ISO21127: 2014. CIDOC-CRM is compatible with other vocabularies such as those developed by the Getty Institute. The Art and Architecture Thesaurus (AAT) prepared by the Getty Institute is used to provide the semantic infrastructure, providing an ontology for the exchange of information on cultural heritage and the integration of heterogeneous sources. Specifically intended to cover contextual information, such as historical, geographical and theoretical backgrounds, it is composed of terms to be used in the description, access and exchange of information of objects related to art and architecture.

DOI: 10.15320/ICONARP.2022.207

GIS FOR THE ANALYSIS AND DISSEMINATION OF THE ARCHITECTURAL HERITAGE

Many different approaches have been taken to 3D visualization of heritage. For decades, it has been possible to verify how the use of Geographic Information Systems (GIS), are an adequate tool for the storage of information and its subsequent analysis, being able to effectively relate graphic information with any other type of data. This technology solves many of the visualization and annotation problems on geometric models, not only on terrain models or archaeological excavations, but also on objects and especially on buildings (Soler et al, 2017).

One of the main virtues of Geographic Information Systems is their ability to analyze large amounts of information in very different formats and for disparate uses. GIS technology allows multiple types of information analysis to be carried out, thanks to the use of overlay operations, network analysis, buffering and the like, as well as the use of thematic data to perform statistics, graphs, interpolations or thematic queries. The main characteristic that Geographic Information Systems provide is spatial analysis. When we talk about the documentation of architectural heritage, we are not only interested in the building, but also in its relationship with the urban environment in which it is located, as well as its relationship with the territory and the landscape. It is this capacity that differentiates it from other technologies that are also useful for the representation of heritage, such as BIM technology.

Traditionally, GIS have been designed to perform spatial analysis of the territory, allowing the inclusion of 2.5D geometric data such as DTM (digital terrain model) and DSM (digital surface model) models, in this way, surface analysis can be carried out, such as the calculation of slopes or elevations, and thus extract information about its shape to be related to other attributes. This same procedure can be used in the field of architectural heritage, especially in conservation and restoration tasks, since it allows 3D models to be integrated into the application from which information, such as deformations or profiles, can be extracted through the use of algorithms. Additionally, the organization of information is favored by the use of semantics through the use of ontologies that allow relating concepts and attributes in a given domain.

GIS technology is in constant development, its origin was thinking to work in 2D, but over time it has had to adapt and implement 2.5 D and 3D capabilities to be able to manage and analyze more complex data. These new requirements have meant great difficulties for GIS when it comes to managing 3D geometries and their topology, as well as for the analysis and geoprocessing of information. Currently, the OGC (Open Geospatial Consortium) continues to work to address the integration of 3D models resulting from different GIS, CAD and BIM technologies and favor the interoperability of the different formats for the creation of complete and fully accessible models. In the heritage field, the ability of GIS to add the time factor to spatial data is a useful feature to show the transformations suffered by a building over time and thus detect its deformations or other physical changes, obtaining a temporary 4D model.

In the field of architectural heritage documentation, different technicians intervene, such as architects, archaeologists, historians, engineers or curators, who must work on a common data model on which they must be able to consult and edit the information produced by each one of them in a database that stores different types of varied information in multiple formats. Therefore, an effective solution that facilitates interoperability and accessibility to archived information and its use by different actors for multiple and varied uses, is the publication of a GIS on the web. The so-called WebGIS allows access to information from any location, view, consult, analyze or export information in different formats. Structured data can be accessed that are accessible through an interface with different display styles that are adaptable depending on the use made of the information, and may be more technical or informative, opening the scope of possibilities of use.

GIS methodologies developed for the documentation of architectural heritage

The use of GIS requires the elaboration of precise models that allow to incorporate information and data in a detailed way to its surface, that entails work that must be carried out by an experienced person and in which considerable time must be invested to introduce the data (Scopigno et al, 2017). GIS technology originated to represent 2,5D models (terrain) or flat surfaces (building facades), but the latest developments in Information Systems, allow the incorporation of 3D models of point clouds, which help researchers to efficiently and accurately manage the documentation gathered during the study, analysis and intervention processes.

Methodologies focused on the use of GIS for conservation work are under development. In a first stage, it made use of two-dimensional images to represent views of the building (floors, elevations, sections), obtained with CAD tools, which were later used to create vector maps on which to link the information. An example of this typology is ARKIS (Salonia et al, 2003), an Information System focused on the restoration of historic buildings.

The incorporation of geometric information on buildings through the inclusion of 3D volumetric models in information systems opens up new possibilities in the field of graphic representation of heritage. Regarding the generation of the 3D model, different approaches can be distinguished, the first of which builds the model using parametric software (Autocad, 3DS Max, Rhinoceros), which is later integrated into the GIS. This form of modelling limits the accuracy of the documentation, as the level of detail in the model depends on the modelling process. Additionally, the use of GIS facilitates the incorporation of new requirements, such as the use of semantics to create an organized and accessible information structure over time. In this way, the database

DOI: 10.15320/ICONARP.2022.207

manages the information in an orderly manner and allows its relationship with other databases.

The MayaArch3D project develops a 3D WebGIS with the aim of creating an online archaeological repository, called QueryArch3D (Von Schwerin et al, 2013). In a spatial database, it incorporates 2D and 3D data in multiple resolutions and with different levels of detail, which allow to link archaeological data and make queries in real time in a virtual reality environment. The GIRAPIM software is made up of a Documentation System, an Information System and a Management System, which make up a modular architecture made up of three components: a viewer, a semantic repository and a CityGML manager (Calle et al, 2010).

The second of the approaches for creating a 3D model that is incorporated into an information system is through the implementation of a textured model, obtained by means of photogrammetry and laser scanner, from which a precise geometric model is obtained that represents the current state of the building. An example of this methodology is the SICAR Information System, promoted by the Ministero dei Beni e delle Attività Culturali e del Turismo (MiBACT) of Italy, as a tool to be used in restoration projects (Fabiani et al, 2016). Much of the information can be overlaid in vector shapes on the model using layers that allow data analysis. It is an open-source and on-line system dedicated to restoration, which allows georeferenced graphic, photographic and alphanumeric documentation, as well as it can be used to carry out queries, such as editing information. The University of Granada has developed the Information System called Agata (Soler et al, 2017), allowing specialists to interact with a 3D model and annotate vector and raster information directly on the model surface. In addition, it includes tools for spatial analysis, based on the topological, geometric or volumetric characteristics of the polygonal model. Agata is based on the Chisel system (Soler et al, 2012), which was discontinued because it did not support vector layers, semantic information, or large 3D models, being the wrong program structure.

The latest advances in GIS technology are related to the ability to incorporate information directly on the 3D model, that is used as a reference on which to link documentation or as a basis for obtaining two-dimensional data, as proposed in the framework of the Swedish Pompeei Project (Dell´Unto et al, 2016). The basic principle of this information source is to transfer a value from a traditional 2D layer (raster or vector) to the corresponding mesh element (triangle) that belongs to the horizontal copy of the facade superimposed on that 2D layer. In this way, all the information is layered in the GIS and linked to alphanumeric information (Campanaro et al, 2016).

The latest contributions in this field, focus on the development of information systems accessible in real time through web platforms and created with open source standards and technologies. These systems are capable of storing and managing information, prioritizing characteristics such as accessibility and manageability by non-expert users. At the same time, the visualization and consultation of the 3D model is facilitated, thanks to its construction according to a semantic structure on which to record information stored in a database. Fulfilling these characteristics, Neptune Information System was devised, specifically developed to manage the documentation generated during the restoration process of the Bolonia Fountain of Neptune monument. (Apollonio et al, 2018). The system integrates a volumetric model divided according to a semantic structure, on which information is linked to each of the corresponding elements. The viewer is complemented by a panel where the information associated with the 3D model is represented and supports data analysis and operations. The solution generated to document the Neptune fountain has made it possible to develop a more complete information system called Sacher 3D Life cycle Management, specifically for management and restoration work (Apollonio et al, 2019). The system maintains the characteristics of the semantic model, and incorporates geographic, analysis and administration tools.

The examples described, must deal with the management of a large amount of information available in heterogeneous formats that must be organized in a suitable way to be accessible and useful. From the first examples, in which the representations were two-dimensional, to the inclusion of 3D models, an attempt has been made to optimize the visualization of the object and the data associated with it, thanks to the possibility of visualization through multiple views, the representation of time, the use of multiple formats or the management of relational and object-oriented structures.

Information Systems have evolved towards technologies developed with open source software, the use of standards, ontologies and the structuring of information and the 3D model itself under a semantic hierarchy. In this way, interoperability between databases is favored and long-term maintenance of applications is ensured, without large investments and ensuring accessibility for different types of users. The possibility of exchanging information through the web and its dissemination in different media and formats for disparate uses, is one of the great advances made to the representation of architectural heritage. However, there are still many issues to implement and improve.

It is necessary to point out the limitation of the functionalities of editing 3D models from the information system itself, which is why it is necessary to use external software for the development and management of complex projects such as those related to the conservation and restoration of heritage. These projects require detailed information on the components and structure of construction objects, which due to their complexity cannot be carried out exclusively through GIS systems. For this, many investigations use BIM technology. The integration of both favors the creation of a complete database capable of managing semantically enriched 3D models in a spatial environment (Saygi et al, 2013). For this reason, the use of data exchange standards such as IFC

DOI: 10.15320/ICONARP.2022.207

(Industrial Foundation Class) and CityGML (City Geography Markup Language) are of vital importance. Platforms that integrate HBIM/GIS have been developed, such as the so-called PINTA (Processing Information System for Architecture), a system that combines the functionalities of CAD and GIS systems, integrating different tools according to the AIM & SHAPE methodology. The reference model is a point cloud on which thematic layers of information are superimposed, working in a similar way to GIS. El modelo posee una estructura semántica jerárquica que se obtiene con algoritmos que permiten la auto-segmentación (San José-Alonso et al, 2009).

Siarch3D-Univaq (Centofanti et al, 2012) is another proposal whose purpose is to create a single 3D model created under a semantic structure capable of managing different documentation formats that, through the use of data and elements, allows relationships between them to be obtained. More recently CHIMERA (Bruno et al, 2020) is a web system oriented to the simultaneous input and visualization of data such as 3D meshes, point clouds, information, images, plans, etc. The information is organized in five hierarchical levels that allow managing objects according to the use that is going to be made of them. These allow the transition between different scales of representation without the need to create replicas of the objects at different levels of detail, the "object" being the central entity of the system.

As has been seen, all the applications developed have been specifically programmed for a specific project, since there is still no tool that includes all the needs that heritage documentation requires. The unique characteristics of historical heritage suggest that BIM / GIS integration can be the definitive tool for obtaining a complete management system.

Table 1. Comparative of the different methodologies developed for the documentation of architectural heritage

Reference	Platform	Mehtodology
Salonia et al, 2003	ARKIS	GIS information system, to organize all kinds of information, available as a web platform, WebGIS. Use the "Avenue" programming system to transfer specific functions of the GIS to the architecture. It has GIS functions, since it works with attribute tables associated with topological elements. Relate descriptive and graphic information, locating information in an exact geometric point.
Von Schwerin et al, 2013	QueryArch 3D	It integrates and visualizes 2D and 3D data in multiple resolutions and with different levels of detail, allowing 3D models to be linked to archaeological data and real-time queries in a virtual reality environment of attributes stored in a spatial database.
Calle et al, 2010	GIRAPIM	Creation of an integral hybrid system, composed of a Documentation System (Viewer), Information System (GIS) and Administration System. The Documentation System provides a common model to the systems, on which the information is provided, for which attributes are assigned to make queries. In order for the three systems to converge, it is necessary to define standards. The software of the three systems is made up of a Viewer (.collada), CityGML Manager, and a Semantic Repository. The 3D model is created with traditional programs (not point cloud), and has raster and vector documentation. To

		navigate through the content, there is a menu with a tree structure with a hierarchy of concepts to navigate through the content. It is not a web environment.
Fabiani et al, 2016	SICAR	Promoted by the Ministero dei Beni e delle Attività Culturali e del Turismo (MiBACT) of Italy, to be used in restoration projects. Much of the information can be overlaid in vector forms on the model using layers that allow data analysis.
Soler et al, 2012	CHISEL	Proposal for an information system based on octree. Design of a 3D information system that allows information to be associated with the surface of the object using technology that is similar to that used in GIS. The information is associated with its position in space, organizing the information in raster layers on the surface of the object, which is a triangular mesh. Focused on creating layers of information in models of small pieces of heritage. The Chisel system was discontinued because it did not support vector layers, semantic information and did not support large 3d models, being the wrong program structure.
Soler et al, 2017	AGATA	Agata is based on the Chisel system. It allows to interact with a 3d model and annotate vector and raster information. It is possible to query from the surface to the metadata and vice versa, since the data structure allows bidirectional relationships. It includes spatial analysis tools, based on the topological, geometric or volumetric characteristics of the polygonal model.
Dell´Unto et al, 2016	Swedish Pompeei Project	Objective to develop a set of digital methods to be used and adopted by conservation specialists using 3D GIS. Creating a three-dimensional system for data management, combining 3D visualization and analysis offered by GIS. The work methodology is the creation of 3D features generated from two-dimensional map attributes, that is, dividing the 3D model into flat facades and drawing on them the 2D thematic layers, and drawing a plan that is used as a system of reference. In this way, all the information is layered in the GIS and linked to alphanumeric information.
Apollonio et al, 2018	Neptune Informatio n System	Information system capable of storing and managing information in real time, accessible through web platforms and created under standard technologies that allow interoperability between different databases, prioritizing features such as ease of use by non-expert users and model visualization. The program uses 3dhop technology to display the model. It works by creating a semantic 3D model, divided into elements according to a hierarchical structure, in which, through operations, information is associated with each of these elements that will be linked to the corresponding 3D model. The model is a high density point cloud with 1mm resolution.
Apollonio et al, 2019	Sacher 3D Life cicle Manageme nt	Proposal for the creation of an information system to manage the needs of cultural heritage. Based on the Neptune Information System. Specific for management and restoration work. The system maintains the characteristics of the semantic model, and incorporates geographic, analysis and administration tools. The 3D model has a semantic structure and information is associated with the model through thematic layers on the surface. In this case they have added geolocation and it is more focused on architecture. It is based on GIS, by having the information in thematic layers.

DOI: 10.15320/ICONARP.2022.207

San-José Alonso et al, 2009	PINTA	Development of a comprehensive 3DGIS solution, which integrates different tools for information processing, administration and visualization. The reference model is a point cloud on which thematic layers of information are superimposed, working in a similar way to GIS. This data can be raster or vector. To be an accessible and interoperable system, the model has a hierarchical semantic structure, which is obtained with algorithms that allow auto-segmentation and for which lexicons, thesauri and taxonomies must be specified. This semantic structure allows working with different levels of detail and interoperability with other databases.
Centofanti et al, 2012	Siarch3D-Univaq	Creation of an information system called Siarch3D-Univaq focused on being integrated with the Italian "Risk map" database. Use of ArcScene to visualize the 3D model created with traditional programs (it does not include a point cloud) since it maintains dimensions, georeferencing, topology and applied textures. Complementary information is already linked to the model. The 3D model cannot be made as a point cloud mesh, orthophotos of the different facades can be incorporated as textures on the model.
Bruno et al, 2020	CHIMERA	Web system oriented to the simultaneous input and visualization of data such as 3D meshes, point clouds, information, images, plans, etc. The information is organized in five hierarchical levels that allow managing objects according to the use that is going to be made of them. These allow the transition between different scales of representation without the need to create replicas of the objects at different levels of detail, the "object" being the central entity of the system.

Systems for the management and inventory of heritage

Technological advances in the field of Geographic Information Systems offer tools for the management of spatial databases, 2D and 3D visualization, analysis and web access. The union of all this technology focused on its use for inventory management, is a very powerful tool that is constantly growing and evolving.

Based on the need for standardization and standardization of information, we find several examples of Heritage Inventory and Management Systems, whose primary component is Geographic Information Systems. First, we describe SAHRIS (South African Heritage Resources Information System), created in 2011 by "The South African Heritage Resources Agency (SAHRA), whose main mission is to report crimes against heritage (Smuts, 2015). The Management System is an open source web platform, developed through Drupal, a content manager (CMS), which in combination with the Linux operating system, Apache web server, MySQL database and PHP language configure a system that integrates with GIS technology. SAHRIS has among its main functions: be a comprehensive system that serves as a repository of national heritage for the conservation and management of heritage, the management of permits to regulate the export and import of heritage objects, movements between museums, as well as the monitoring of heritage crimes.

The results of the study of various proposals focused on the development of heritage inventories, result in ad-hoc programs, that is, they do not use a specific and common software for the preparation of

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

inventories. For this reason, Arches highlights an open source geographic information web platform developed by the Getty Conservation Institute (GCI) and the World Monuments Fund (WMF) for the purpose of creating and managing inventories of cultural heritage (Myers et al, 2016). Since its launch in 2013, organizations around the world are using the system to manage resources, such as the Barbados National Registry of Historic Places, Nepal Heritage Documentation Project (NHDP), Armed Forces Retirement Home (AFRH), Endangered Archaeology in the Middle East and North Africa or Global Digital Heritage (GDH) a private non-profit research and education organization dedicated to documenting, monitoring and preserving the global cultural and natural heritage.

Arches design has focused on solving the challenges faced by heritage institutions for the development and maintenance of inventories:

- Economy: Arches is open source software that has no cost.
- Customizable: Open source and a system structured in modules, allows it to be expandable, in different languages and configure any geographical location.
- Ease of use.
- Different levels of accessibility: You can create different user roles, allowing you to control access to the system.
- Standardized: For the maintenance and interoperability between databases it has been chosen to use international standards. The “International Core Data Standard for Archaeological and Architecture Heritage” (CDS) which is used as the basis for defining the fields in the generic version of the system, and the “Conceptual Reference Model” (CRM) used to provide the semantic infrastructure (Carlisle et al, 2014). In addition to the use of open source, it has been designed to access and process geospatial data based on standards from the "Open Geospatial Consortium" (OGC), making it compatible with GIS applications, as well as the main browsers and map services.

PROPOSAL FOR THE CREATION OF AN INFORMATION SYSTEM FOR THE INVENTORY OF MUDEJAR HERITAGE IN ARAGON

The region of Aragon (Spain) concentrates a large list of assets, representatives of the Mudejar architectural heritage, built during the period between the 12th and 17th centuries. Highlights the Mudejar architecture of Teruel, declared a World Heritage Site by UNESCO on December 28, 1986, to later extend the protection to all the Mudejar architecture of Aragon on December 14, 2001. It is a mixture of styles characteristic of the Iberian Peninsula, with its own particularities in the Aragonese territory, which reflects the survival of Muslim culture, while in the rest of the Christian West Gothic architecture predominates.

In Mudejar architecture, the typologies of fortress-churches are significant, as well as churches with a single nave with a polygonal apse with five or seven sides and simple ribbed vaults. Representative of this period are the structure of the towers, which resemble the minarets of

DOI: 10.15320/ICONARP.2022.207

Muslim mosques, composed of two towers, one inside the other, the stairs are located between them and the body is crowned with the bell tower, usually with a polygonal format. For construction it is common to use materials such as brick, stucco, wood, ceramics or plaster, the latter used especially for the realization of singular ornamentation, through the representation of geometric shapes and plant themes.

Due to the uniqueness of this architectural style, it is necessary to address the cataloguing of the more than 200 listed buildings that represent the Mudejar architectural heritage in Aragon and are part of the World Heritage, to ensure their correct documentation (Figure 1). For this, the creation of an Information System of the Architectural Heritage is required, that allows incorporating any type of graphic, documentary and informative information, relative to the identification and location, geometric, construction, protection, historical, conservation or intervention characteristics. A common support that allows housing all kinds of documentation on a geometric model of the patrimonial asset, for the elaboration of a graphical database that allows managing the diversity of contents and available functionalities, in a coordinated way, to the specialists involved in the protection, conservation, restoration and dissemination of heritage.

Figure 1. Examples of the Mudejar architectural heritage of Aragon (Spain)

To carry out this work, two methodologies have been selected to verify their effectiveness in the field of architectural heritage inventory, covering the specific needs of generating a complete graphic database of the building. The Arches platform, a free open source software developed to carry out inventories, has been chosen for its interoperability, specificity and all the characteristics and functions described above. In turn, a WebGIS has been developed using free software standards and technology, to examine the possibilities it offers in relation to specific inventory programs. The technical characteristics and functionalities of both tools will be analyzed, making a comparison between the two selected systems, in order to develop one of them in greater depth to carry out the digital graphic inventory of the Mudejar architectural heritage in Aragon.

Inventory using the Arches platform

Arches is a program developed by the Getty Institute, specifically for the preparation of inventories, study and manage heritage resources, both movable, immovable, people or events, as well as intangibles, related to historical and cultural heritage. Thanks to the characteristics of Arches, digital inventories can be created that describe geographic information, types, materials or conditions of heritage elements, which allow establishing relationships between resources.

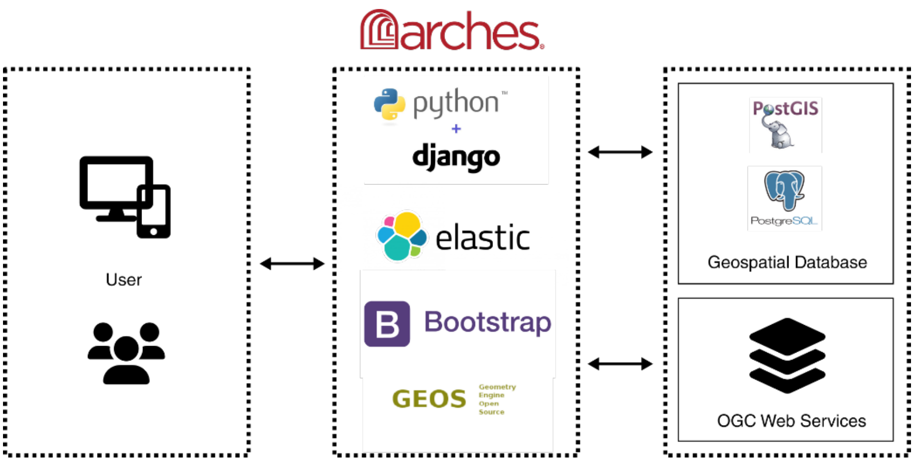


Figure 2. Conceptual structure of the Arches Heritage Inventory Package (HIP)

The Arches application is based on Python and Django and consists of a PostgreSQL relational database with PostGIS to store the spatial data. Arches uses the Elasticsearch search engine, which is built on top of the Apache Lucene library to perform scalable full-text search across large data sets quickly and easily. The information is accessible through a Bootstrap-based user interface, which uses Javascript. In addition, GEOS (Geometry Engine Open Source) is used to process geometries and perform spatial operations (Figure 2). Arches is distributed under an AGPLv3 license which allows users to copy and modify the application without restriction. The open source system allows for easy upgrades and modifications to requirements providing flexibility of extension and customization. On this basis, the incorporation or modification of the information associated with the record to be inventoried is simpler and more efficient, with more complete, exhaustive and accessible information. The registry is standardized and can contain as much written documentation related to the asset as necessary, created under the structure established by the main authorities in charge of inventory management, however, the incorporation of graphical documentation is limited.

DOI: 10.15320/ICONARP.2022.207

The system incorporates web and geospatial data processing standards, such as the OGC standard, which ensures compatibility with GIS applications and most web browsers. In addition, it is compatible with GeoJSON, KML and shapefile formats. Access to the inventory can be done through a web page with a standard environment and a search engine. As well as any type of base map can be used, such as the maps available from Google, Open Street Maps, Bing or other types of images provided by other geographic information services. Additionally, with the latest program updates, Arches Esri Link is now able to connect to ArcGIS Pro, making it easier for users to edit and add more information from within GIS software (Figure 3).

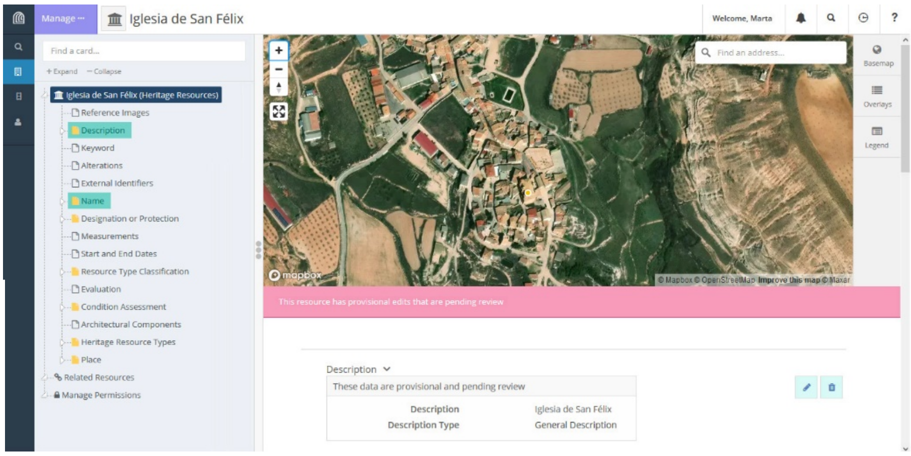


Figure 3. Inside the Arches Management System and the various features that can be populated from records. Example of the Church of San Félix in Torralba de Ribota (Zaragoza).

The database architecture makes it easy to implement any type of data model in a flexible way. For it, through the Arches Heritage Inventory Package (HIP) and with a differentiated data interface, different categories are established, such as: heritage resources, heritage resource groups, activities, historic events, actors and information objects.

The creation of the inventory database can be done in three ways, depending on the volume of data to be incorporated. Through the Resource Data Manager (RDM) form, you can enter the data manually in case the data is not numerous, since it is easy to use, but it is inefficient when you want to incorporate large volumes of data. To do this, it is possible to import the information from a file created with GIS, which allows geometry and attributes to be imported. Additionally, it is possible to import the information through a text file in "Arches" format.

Through the use of conceptual data models, Arches provides an overview of stored data and establishes a framework for organizing the data using a graphical data model (Figure 4). The model uses terminology defined by established controlled vocabularies, thesauri such as The Getty Art and Architecture Thesaurus (AAT), which favor unique identification and relationship building through the Reference Data Manager (RDM). Arches incorporates in its basic configuration, the international standards for the management of cultural heritage, CIDOC (International Commitee for documentation). To define the data types, properties, or relationships that describe a resource, the CDS standard

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

(Core Data Standard) to cover generic data and CRM standard (Conceptual Reference Model) to cover the semantic framework of data usage. The incorporation of this data with semantic content, allows to establish relationships and carry out advanced searches in the database itself, as well as between external databases, thus allowing interoperability between systems and the migration and conservation of data over time.

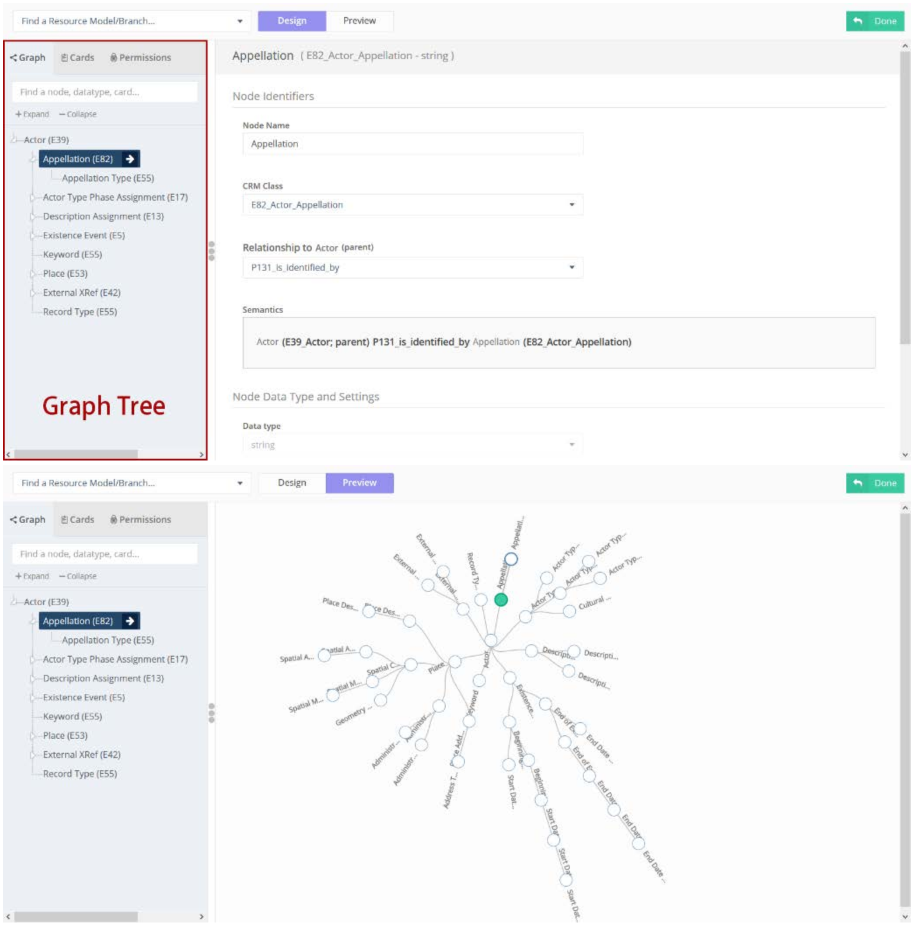


Figure 4. Arches provides an overview of stored data and establishes a framework for organizing the data using a graphical data model. Example from the Arches Modeling Documentation.

From the point of view of the visualization of two-dimensional and three-dimensional geometric documentation, the incorporation of graphic information is limited. Graphic documentation such as images or plans can be managed directly on the platform, but more complex documentation such as point clouds or meshes that represent volumetric information of the registered asset cannot be incorporated. For this, external platforms such as 3DHOP (Potenziani et al, 2015) or Potree (Schütz, 2016), both developed with open source software and based on WebGL systems capable of displaying high-resolution point clouds or meshes. Through an integrated viewer, allow access to graphic information of the textured three-dimensional model, where you can measure on the model itself or find additional information linked directly onto the 3D model.

DOI: 10.15320/ICONARP.2022.207

Inventory through WebGIS development

To carry out the inventory of the Mudejar Heritage in Aragon, a WebGIS has been developed in order to carry out administrative and protection tasks. The database allows the incorporation of information on the inventoried buildings, relative to the identification and location, historical data, type of protection, geometric and constructive characteristics, state of conservation and types of intervention. In addition, together with urban information and other types of information on the territory, they favor the generation of graphic information for spatial analysis and its use in conservation and dissemination tasks, since they contribute to provide a vision of the building on an urban and territorial scale, not only as an isolated entity (Figure 5).

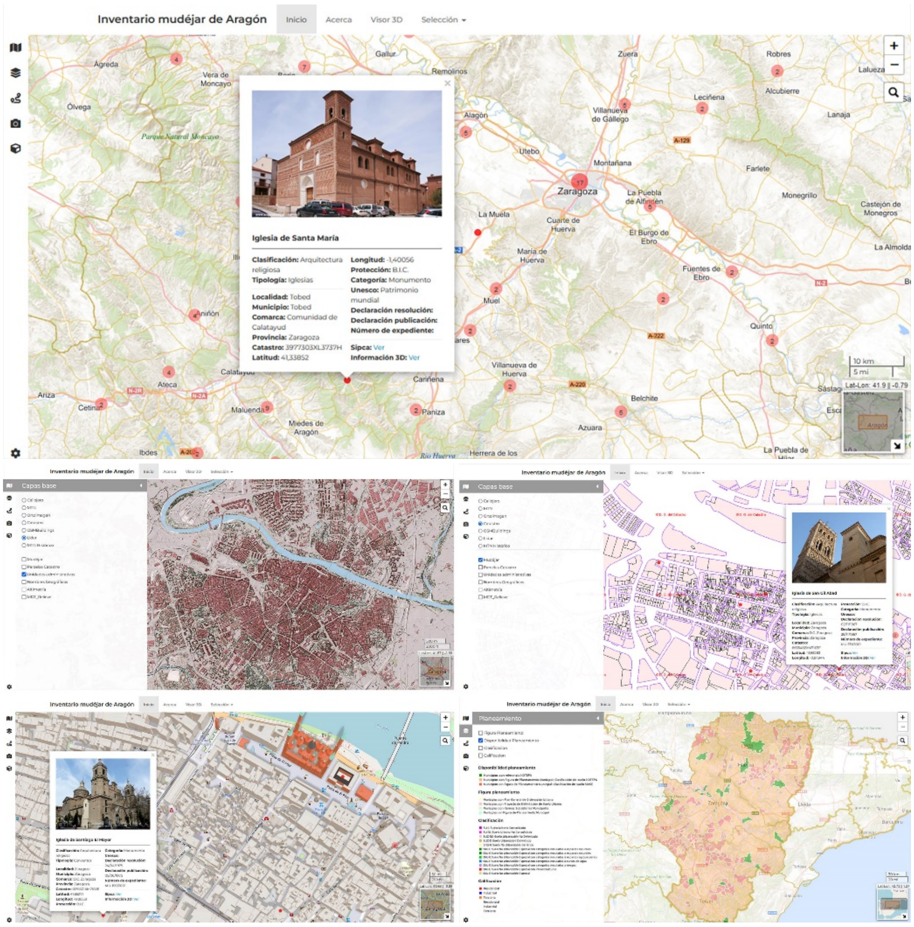


Figure 5. A WebGIS prepared for the dissemination of the Mudejar Architectural Heritage in Aragon. View of different thematic layers of information that provide urban information about the territory and the location and use of inventoried assets, as well as descriptive inventory information.

The accessibility to the information through a WebGIS, facilitates the access to structured data, consultation, analysis and export of the information in different formats, through an interface that allows to adapt the display style according to the use that the information is going to have, opening the scope of possibilities of use.

The System has been developed using tools that meet specific standards related to fields of cultural heritage, documentation, cartography or spatial data management, as well as the use of ontologies. The architecture of the system is made up of the QGIS software, a multi-platform Geographic Information System for the editing, visualization, analysis and management of spatial data, which allows managing raster and vector formats, as well as databases. PostgreSQL is used to manage object-oriented relational database systems through its PostGIS extension. It supports geographic objects allowing the creation of attribute tables with geometric and spatial information that are stored in a Geo-DB and performing analyzes through spatial SQL queries or through connection to Geographic Information Systems. Spatial Data Infrastructure services offered by different organizations that publish information through standardized web services and catalogue it using metadata have been used. The data is published through OGC standards, such as WMS, WMTS, WFS or WCS. Finally, the Leaflet JavaScript library is used to create web map applications, to be executed on the browser (Figure 6).

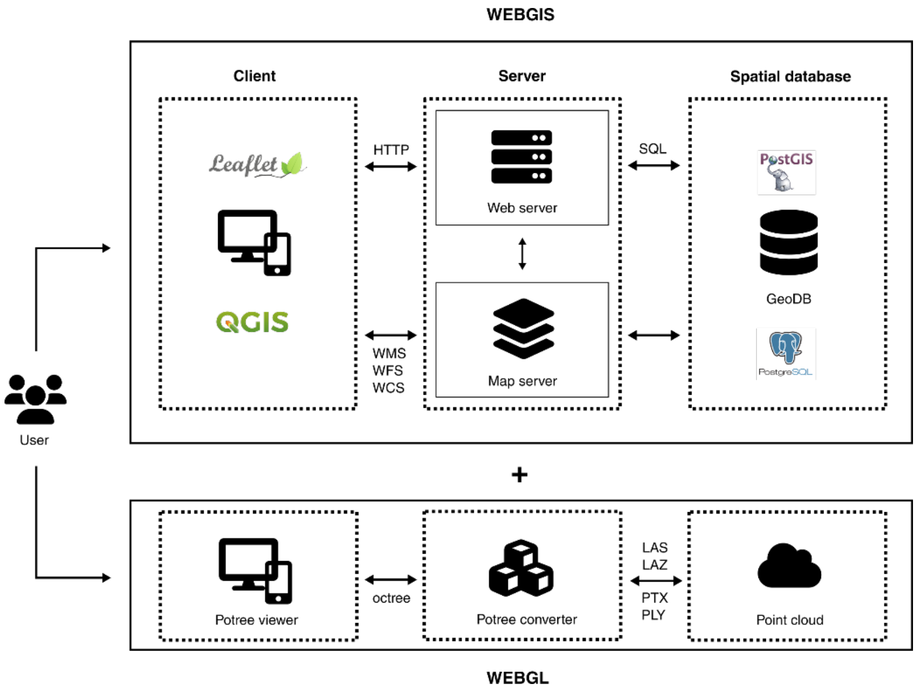


Figure 6. Conceptual structure of the web platform created for the Aragonese Mudejar Inventory.

The geometric documentation of heritage is represented by different levels of detail (LoD) in order to facilitate access to data, reduce latency and compression, by viewing and analyzing the same object at different scales and resolutions (Scopigno et al, 2017). The different scales range from the most generic vision, such as the LoD level 0, which represents the scale of the territory and the landscape, to the LoD 4, which describes the highest level of detail of the building, when representing constructive elements of the model. Intermediate levels of detail, such as LoD 1 reproduce the urban scale, without showing differentiated textures or structures, LoD 2 shows architectural models from an external view and LoD 3 defines the interior of architectural models (Figure 7). The first phase of WebGIS development has focused on reaching a LoD 0 and LoD 1 documentation level that provides an overview at the scale of the territory and landscape in the geographical area of Aragon and LoD 1 at the urban scale of the different locations where the inventoried assets are

DOI: 10.15320/ICONARP.2022.207

located. The graphic information consists of cartography, Digital Terrain Models, orthophotos, parcel and urban information, all of them coming from the IGN (National Geographic Institute), IDEARAGÓN (Spatial Data Infrastructure of Aragon) and the Cadastre. The different layers of information used in the viewer have been incorporated through a WMS (Web Map Service) and WMTS (Web Map Tile Service) request to the corresponding spatial data infrastructures. All the cartography has taken the ETRS89 Reference System, which corresponds to Spain and specifically for the study area, the UTM 30 projection axis is used.

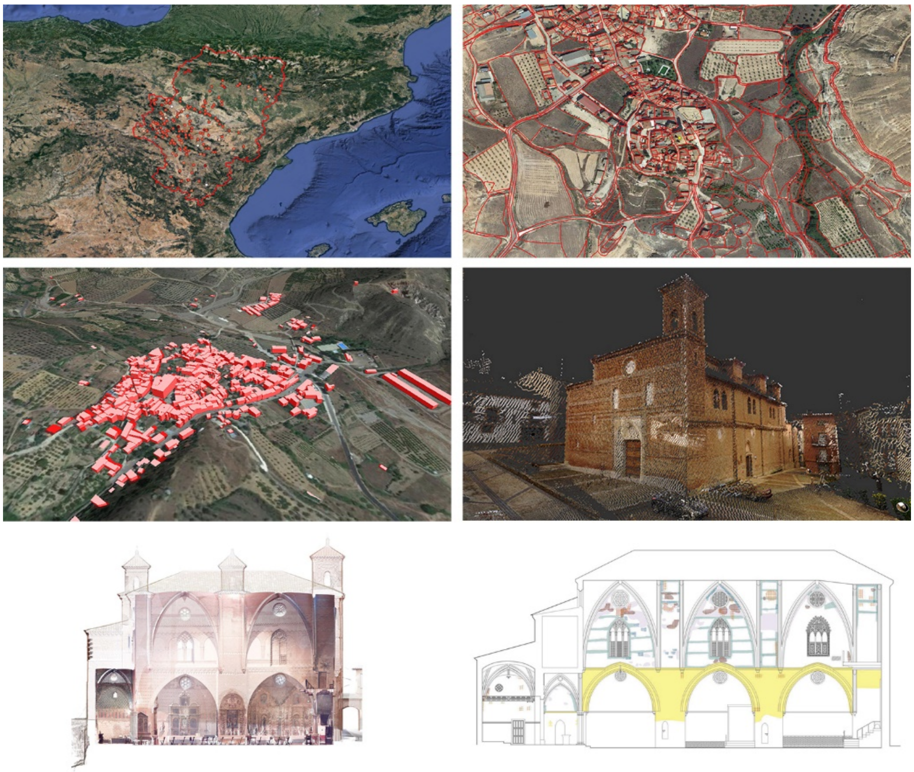


Figure 7. Different levels of detail (LoD) for the representation of heritage.

The information regarding the list of Mudejar architectural heritage assets in Aragon has been prepared manually after searching in various databases, since the Aragonese Cultural Heritage Information System does not have all the information and most of the records are not geographically located. The information regarding the inventory of the Mudejar heritage is stored in the Geo-DB by means of an attribute table that incorporates all the records organized in a hierarchical way and with a semantic structure according to the methodological framework of the project, using the "Core Data Index to Historic Buildings and Monuments for the Architectural Heritage" standard. The incorporation of urban and cadastral information, related to the list of inventoried and geolocated assets, allows more exhaustive analysis to be carried out and additional information to be obtained, by being able to relate the building to its surroundings (Figure 8).

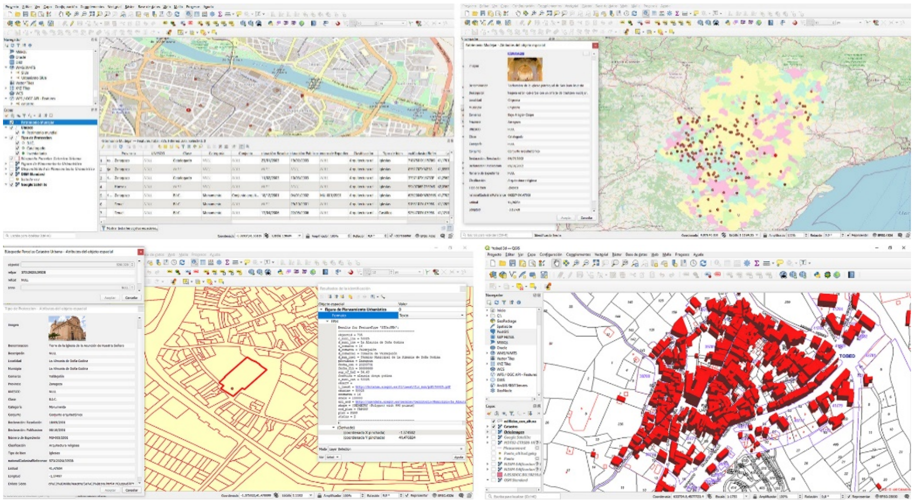
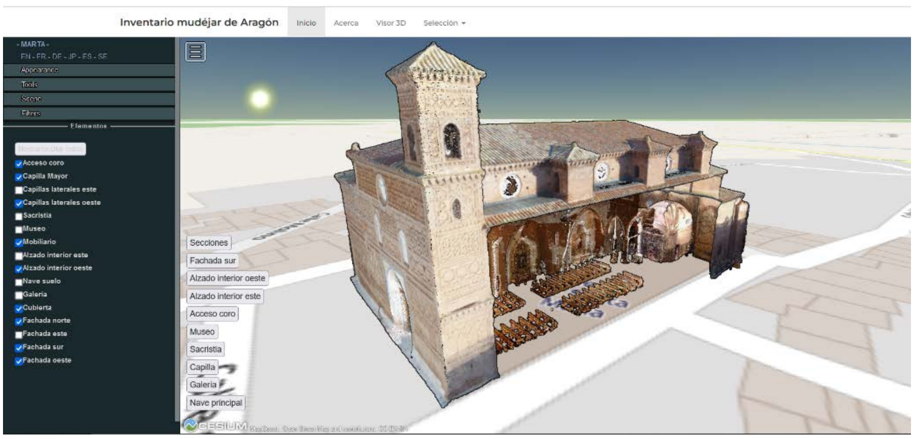


Figure 8. GIS showing thematic layers of cadastral information and urban regulations related to the inventoried building. (LoD 1 and LoD 2).

Through WebGIS, access is given to geometric information of the inventoried buildings using the open source Potree viewer, based on WebGL technology. It is a high-density point cloud viewer that allows you to manage two-dimensional and three-dimensional information on inventoried assets in a digital and accessible environment. The viewer displays 3D content through web browsers without the need to install additional software, providing great display speed. In addition, it has numerous functionalities to manage the point cloud and all the information associated with it (Figure 9). It is possible to modify aspects related to the appearance of the point cloud or the definition of the level of detail, as well as facilitating different types of navigation and access to data. It also has measurement capabilities and provides access through annotations on the model to other types of data with complementary information, such as text, plans, links, images, etc.

To complete the graphic information of the inventoried assets, in a second phase of work, the volumetric model of the inventoried buildings will be integrated into the information system itself, which will allow the thematic layers of information to be incorporated into the model itself (Dell´Unto et al, 2016), without the need to resort to external platforms. In this way, the value of the information will be enriched by contributing a greater volume of useful data to architectural inventories and with greater geometric precision.



DOI: 10.15320/ICONARP.2022.207

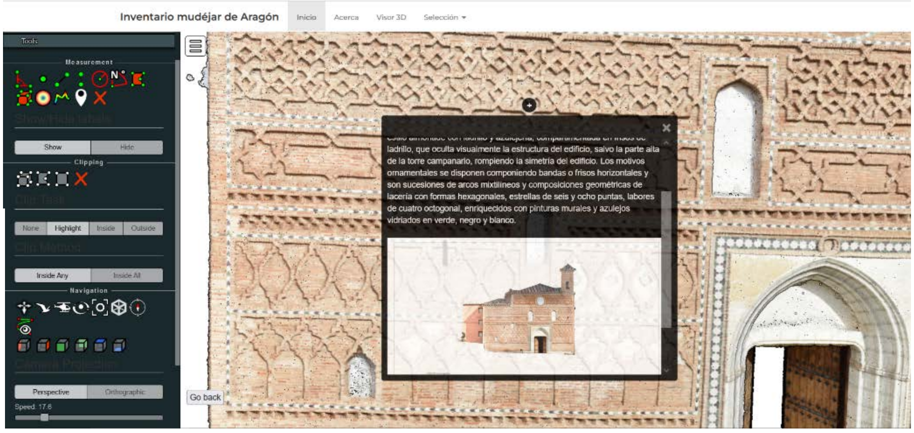


Figure 9. WebGL environment with the 3D point cloud of the Santa Maria church (Tobed, Spain) over the OpenStreet map layer (top). Example of complementary information associated to the general pointcloud view (bottom).

RESULTS

The main purpose of an inventory is the creation of an orderly database that allows the management of large volumes of information and is accessible. This accessibility, as stated above, is achieved through the use of standards for correct data storage, but also to facilitate the establishment of relationships between the different registered objects. To solve these needs, Arches is a powerful tool for the inventory and management of heritage resources, developed by expert professionals in the management of information and cultural heritage, which provides many advantages over other types of records. The main one is the ability to implement international standards such as CIDOC-CRM for the management of cultural heritage documentation, essential to promote interoperability between databases, as well as ensure their integrity. Like Arches, the WebGIS option also allows the use of international documentation standards for content management, however, the solution is better implemented in Arches since the graphic data model that structures the information is organized based on these standards. This content manager is easy to use and has numerous documentation and tutorials for the correct management of information, however, incorporating large volumes of information into the database is a challenge.

In this regard, GIS programs are capable of managing complex databases with varied information stored in very different formats, which provides the ability to analyze information from multiple points of view. In the case of architectural heritage, it implies the ability to establish relationships from a spatial and territorial perspective that has economic, social, environmental or cultural variables, among others, and must be understood as a network of relationships with the environment in which it is inserted.

Arches has many functionalities to manage the records, taking into account the maintenance of the data, the ability to evaluate the resources by updating criteria or managing them by reviewing the edition history. This ensures a properly organized and updated data structure that facilitates the maintenance of the application and the quality of the database. Due to its characteristics, the use of the tool by entities related to cultural heritage involves little economic investment, but requires a developer with sufficient skills for its implementation. The software needs updates and sometimes there are problems due to new versions of the various components of the application. Like Arches, by developing WebGIS with open source software, the investment required to maintain the system is reduced and thus its maintenance is facilitated thanks to updates. This ensures accessibility to information and interoperability of data.

Both systems employ geospatial standards, such as those developed by OGC, with the aim of enabling interoperability through the web. The use of web standards also facilitates the creation of a multiplatform system that ensures easy access to information. In the case of Arches, it favors the development of a system capable of incorporating geographic information generated by other GIS applications, which facilitates the incorporation of additional layers of information for the study of heritage assets in relation to their surroundings. However, this capability is limited to overlaying information layers without the ability to perform spatial analysis, unlike what traditional desktop GIS programs can do by using overlay operations, network analysis, buffering, and the like. as well as the use of thematic data to carry out statistics, graphs, interpolations or thematic queries.

Finally, the ability to incorporate graphic documentation regarding inventoried goods is limited. Currently, and especially in the case of architectural heritage, thanks to the use of photogrammetry and laser scanning, 3D geometric models are available that provide extra information of great value on the objects inventoried. This information must also be correctly recorded and incorporated into the inventory. Arches needs the incorporation of external viewers to be able to visualize this type of information, so the model cannot be related to the spatial information of the GIS. The proposed WebGIS also allows the incorporation of 3D models through the use of external viewers, however, GIS have the ability, natively, to display 2.5D and 3D information. In the case of point cloud management, proposals are being developed for the creation of 3DGIS applications that are capable of displaying information efficiently and quickly, a problem that is constantly being updated and evolving through continuous updates of the software.

Choosing the right tool to create the architectural heritage record depends on the final use to be made of it. From the point of view of heritage inventory only, the Arches platform represents a great advance over traditional inventories by incorporating the geolocation of buildings and facilitating interoperability between databases. But for the specific case of architectural heritage, the component of spatial and territorial analysis is a value to be taken into account.

Once the differentiating characteristics of using Arches or the development of a WebGIS have been analyzed, it can be deduced that both options are good solutions for managing an inventory. However, in the specific case of the creation of a digital graphic inventory of the Mudejar

DOI: 10.15320/ICONARP.2022.207

architectural heritage in Aragon, it has been decided to completely develop the inventory through a WebGIS. In this case, it was desired to obtain an inventory with a large graphic component, both two-dimensional and three-dimensional, as well as to make use of the analysis tools provided by geographic information systems. In addition, it is desired to use the application as an element to promote Mudejar architecture, for which layers of information have been incorporated into the viewer for the realization of tourist routes as a means of valuing heritage.

Information on the inventoried building is generated from different points of view, spatial, geometric, metric or informative, which provides greater knowledge regarding traditional architectural inventories. The developed viewer is available at https://www.inventariomudejar.es/

CONCLUSIONS

The incorporation of Geographic Information Systems in the field of heritage inventory has meant an advance for the management by the organizations in charge of its elaboration, since it allows for complex analysis of the information, in addition to contemplating the geographic component. These characteristics facilitate its use for multiple purposes such as protection, restoration, conservation, planning and education. The creation of an Information System of the Mudejar Architectural Heritage of Aragon has been proposed, with the purpose of integrating under a common support, all the documentation and graphic information available on the heritage asset, with the purpose of preparing an inventory that serves various objectives, in this case, that enables spatial analysis for its conservation and dissemination. For this, two types of systems have been compared that allow obtaining a complete database of heritage.

Arches is an application developed specifically for the management of cultural heritage, designed with an extensive set of functionalities that allow the platform to be adapted for use by different areas and contexts. This versatility is obtained thanks to the use of the CIDOC CRM standard for the definition and storage of data. The use of open source software and standards facilitates their adoption and adaptation based on interests and needs, for the creation of data management tools in the area of architectural heritage. Its ease of use and the low cost due to the use of open source software, has motivated its use by organizations and entities that do not have IT departments or have limited funds, and in turn enables interoperability between heritage databases, favoring their management and integration in other databases, as well as their use for different utilities.

Arches represents a significant improvement over traditional architectural inventories, by introducing standards and facilitating interoperability between databases, but the incorporation of more complex graphical documentation remains to be resolved, with volumetric information on which to obtain complete information and the ability to perform spatial analysis provided by Geographic Information Systems. In addition to the documentation related to the geometric model of the building, the GIS provide the additional value of spatial information, which together with the information related to urban planning, the territory and the landscape, they contribute to obtaining a global vision of the inventoried asset, since the buildings are not isolated entities, they are the consequence of their interaction with the urban and territorial environment.

At the moment, there is no system that includes all the characteristics of both technologies to create a graphical database that allows a complete inventory of the heritage and its use for multiple purposes. As has been seen, there are many proposals aimed at obtaining a system that allows managing information on a 3D geometric model, being a field that is constantly evolving.

The application of the technologies exposed throughout the investigation in the specific case of the Inventory of the Mudejar Architectural Heritage of Aragon has the objective of promoting its use by the administration as a means of activating new processes of knowledge, enhancement and use. Aragón has an enormous cultural and landscape heritage that is implanted in a territory that is not very accessible and dispersed, so it is essential to carry out actions to revitalize the territory from an economic and cultural perspective. The Information System provides an instrument that gives visibility to the architectural heritage as a means of analysis to identify the potential of the asset and the possible interventions to ensure its conservation, protection, promotion and management.

Currently, most of the registered assets lack precise graphic information, since due to the characteristics of the territory they are difficult to access for registration as they are located in rural environments. The creation of a digital repository made up of two-dimensional and three-dimensional information integrated into a geographic information system helps to consider heritage from a territorial perspective and provides the context to recognize its identity and cultural values.

ACKNOWLEDGEMENTS

The Architecture Research Group of the University of Zaragoza GIA, to which the authors of this work belong, is financed by the Government of Aragon (Reference Group T37_17R) and is part of the Institute of Heritage and Humanities (IPH) of the University of Zaragoza.

REFERENCES

Alonso, J. A., García-Alsina, M., LLoveras, M. R. (2007). La norma ISO 15489: un marco sistemático de buenas prácticas de gestión documental en las organizaciones. *Revista de Biblioteconomia i Documentació*, 47, 41-70.

Apollonio, F. I., Basilissi, V., Callieri, M., Dellepiane, M., Gaiani, M., Ponchio, F., … Sobra´, G. (2018). A 3D-centered information system for the documentation of a complex restoration intervention. *Journal of Cultural Heritage*, 29, 89–99.

DOI: 10.15320/ICONARP.2022.207

Apollonio, F. I., Gaiani, M., Bertacchi, S. (2019). Managing cultural heritage with integrated services platform. *ISPRS - International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, XLII-2/W11, 91–98.

Azkarate, A., Ruiz de Ael, M. J., Santana, A. (2003). *El Patrimonio Arquitectónico. Plan vasco de cultura*. Vitoria, Servicio Central de Publicaciones del Gobierno Vasco.

Bruno, N., Rechichi, F., Achille, C., Zerbi, A., Roncella, R. & Fassi, F. (2020). Integration of historical GIS data in a HBIM system. *ISPRS - International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, XLIII-B4-2020, 427–434.

Calle, J., Martínez, R., Delgado, F., Finat, J., Hurtado, A. (2010). Towards an integration of documentation, information and management systems in a common framework. *ISPRS - International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, XXXVIII-4.

Campanaro, D. M., Landeschi, G., Dell'Unto, N., Leander Touati, A.M. (2016). 3D GIS for cultural heritage restoration: A 'white box' workflow. *Journal of Cultural Heritage*, 18, 321–332.

Carlisle, P. K., Avramides, I., Dalgity, A., Myers, D. (2014). The Arches Heritage Inventory and Management System: a standards-based approach to the management of cultural heritage information. In *CIDOC Conference: Access and Understanding - Networking in the digital era*. Dresden, Germany.

Centofanti, M., Continenza, R., Brusaporci, S., Trizio, I. (2012). The architectural information system SIARCH3D-UNIVAQ for analysis and preservation of architectural heritage. *ISPRS - International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, XXXVIII–5, 9–14.

Cerutti, E., Noardo, F., Spanò, A. (2015). Architectural heritage semantic data managing and sharing in GIS. In *GISTAM 2015 - 1st International Conference on Geographical Information Systems Theory, Applications and Management, Proceedings*, pp. 121-128. Barcelona, SciTePress.

Choay, F. (2007). *Alegría del patrimonio*. Barcelona, Gustavo Gili, 85-88.

CIDOC Conceptual Reference Model (2022). CIDOC CRM Special Interest Group. https://cidoc-crm.org/

Core Data Standard for Archaeological Sites and Monuments (1992). Documenting the Cultural Heritage. Los Angeles: J. Paul Getty Trust.

Core Data Index to Historic Buildings and Monuments of the Architectural Heritage (1995). Documenting the Cultural Heritage. Los Angeles, J. Paul Getty Trust.

Dell'Unto, N., Landeschi, G., Leander Touati, A.-M., Dellepiane, M., Callieri, M., Ferdani, D. (2016). Experiencing Ancient Buildings from a 3D GIS Perspective: a Case Drawn from the Swedish Pompeii Project. *Journal of Archaeological Method and Theory*, 23(1), 73–94.

Doerr, M. (2009). Ontologies for cultural heritage. In *Handbook on Ontologies*, 463-486. Springer Berlin Heidelberg.

Fabiani, F., Grilli, R., Musetti, V. (2016). Verso nuove modalità di gestione e presentazione della documentazione di restauro: SICAR web la piattaforma in rete del Ministero dei Beni e delle Attività Culturali e del Turismo. *"Bollettino Ingegneri", Collegio Degli Ingegneri Della Toscana*, 3, pp. 3–13.

Finat, J., Delgado Del Hoyo, F. J., Martínez García, R., Fernández Martín, J. J., San José Alonso, J. I., Martínez Rubio, J. (2010). Hacia una integración de los Sistemas de Documentación, Información y Gestión del Patrimonio. Resultados y retos. In *Jornadas sobre "Documentación Gráfica del Patrimonio.*

Presente y Futuro" organizadas por el Instituto de Patrimonio Cultural de España, 15-17 November 2010: 164–177. Madrid, IPCE/Ministerio de Cultura.

Gómez González, Ll. (2013). *Estudio y adaptación al PNCPCSXX de los inventarios de arquitectura de España*. Madrid, Instituto del Patrimonio Cultural de España, Ministerio de Educación, Cultura y Deporte.

Gómez González, Ll. (2015). *Inventarios de arquitectura, ingeniería y urbanismo del s. XX en España. Estado de desarrollo por las Comunidades Autónomas*. Patrimonio Cultural de España, (10), 185–193.

Martínez Pino, J. (2012). La gestión del patrimonio histórico artístico en el siglo XIX: fuentes para su documentación. *Tejuelo: Revista de ANABAD*, 12, 10-21.

Myers, D., Dalgity, A., Avramides, I. (2016). The Arches heritage inventory and management system: a platform for the heritage field. *Journal of Cultural Heritage Management and Sustainable Development*, 6(2), 213-224.

Potenziani, M., Callieri, M., Dellepiane, M., Corsini, M., Ponchio, F., Scopigno, R. (2015). 3DHOP: 3D Heritage Online Presenter. *Computers & Graphics*, 52, 129–141.

Salonia, P., Negri, A. (2003). Historical buildings and their decay: data recording, analysing and transferring in an ITC environment. *ISPRS-International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, XXXIV(5/W12), 302–306.

San José Alonso, J. I., Finat, J., Pérez-Moneo, J. D., Fernández Martín, J. J. & Martínez Rubio, J. (2009). Information and knowledge systems for integrated models in cultural heritage. *ISPRS-International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences. Proceedings of the 3rd ISPRS International Workshop 3D-ARCH 2009*, XXXVIII-5(W1).

Saygi, G. y Remondino, F. (2013). Management of Architectural Heritage Information in BIM and GIS: State-of-the-Art and Future Perspectives. *International Journal of Heritage in the Digital Era*, 2(4), 695–713.

Schütz, M. (2016). *Potree: Rendering Large Point Clouds in Web Browsers*. Faculty of Informatics at the Vienna University if Technology.

Scopigno, R., Callieri, M., Dellepiane, M., Ponchio, F., Potenziani, M. (2017). Delivering and using 3D models on the web: are we ready?. Virtual *Archaeology Review*, 8(17), 1–9.

Smuts, K. (2015). Sahris: Using the South African heritage register to report, track and monitor heritage crime. *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences - ISPRS Archives*, 40(5W7), 395–402.

Soler, F., Torres, J. C., León, A. J., Luzón, M. V. (2012). Design of an Information System for Cultural Heritage. In I. Navazo & G. Patow (Eds.), *CEIG - Spanish Computer Graphics Conference*, pp. 113–122. Jaén, The Eurographics Association.

Soler, F., Melero, F. J., Luzón, M. V. (2017). A complete 3D information system for cultural heritage documentation. *Journal of Cultural Heritage*, 23, 49–57.

Stefani, C., Brunetaud, X., Janvier-Badosa, S., Beck, K., De Luca, L., Al-Mukhtar, M. (2014). Developing a toolkit for mapping and displaying stone alteration on a web-based documentation platform. *Journal of Cultural Heritage*, 15(1), 1–9.

UNESCO. (1972). *Convencion sobre la proteccion del patrimonio mundial, cultural y natural*. World Heritage Comitee

Von Schwerin, J., Richards-Rissetto, H., Remondino, F., Agugiaro, G., Girardi, G. (2013). The MayaArch3D project: A 3D WebGIS for analyzing ancient

DOI: 10.15320/ICONARP.2022.207

architecture and landscapes. *Literary and Linguistic Computing*, 28(4), 736–753.

Resume

Dr. Marta Quintilla-Castán is Assistant professor of the Graphic Expression Area Architect of the School of Engineering and Architecture of the University of Zaragoza (Spain). She combines professional work with research oriented to the application of new media computers for the restitution and dissemination of architectural heritage.

Dr. Luis Agustín-Hernández is Professor at the University School, responsible for the Area of Architectural Graphic Expression and Director of the Department of Architecture at the School of Architecture and Engineering from the University of Zaragoza. He does research work in two complementary lines: Study of the heritage architecture works developed in architecture Mediterranean Gothic in the Crown of Aragon, studies on Mudejar architecture and contemporary architecture. Technology of architectural representation, BIM, Photogrammetry, Scanner Laser, virtual reality and photorealistic.

ICONARP
International Journal of Architecture and Planning
Received: 09.12.2021 Accepted: 06.19.2022
Volume 10, Issue 2/ Published: 20.12.2022
Research Article *DOI: 10.15320/ICONARP.2022.208 E- ISSN:2147-9380*
ICONARP

Models of Diagnosis and Concept in the Pioneering Architects in Recent Architecture

Dilek Yasar*
Şengül Öymen Gür**

Abstract

Architectural sphere evolved into a different direction within the last three decades due to both the development of digital tools and the economic boom, accompanied by the discourses suggesting that radical changes were underway in design and production. In the context thereof, the present study aimed to understand, what today's leading architects considered design input, what factors led them to form, and the conceptual nature of the association they established between form and content. The available texts inked by the renowned architects on their public buildings built between 1990-2020 were accessed via their own web sites and publications. Those briefs were reviewed using textual analysis based on issue and concept notions, remaining loyal to the intra-text context. The conceptual information was then transformed into conceptual categories. The architects were selected among the renowned architects, where the Google Hits method was used to determine the status of being renowned. Accordingly, a total 1146 architectural briefs by 66 renowned architects on their public buildings were analyzed with an aim to transparently see, what was defined as a problem by the designer and by which concepts the designer sought solutions to identified problems. The approaches of recent architects suggested that the architectural discipline maintained its ancient design paradigms, including the quest for function, surroundings, and form, but the way those parameters were addressed and questioned was changed. Furthermore, the spatial configuration-oriented, ecology-oriented, and city-oriented concepts came to the fore, while metaphor and analogy were frequently used. The present study was limited to the own briefs of the renowned architects on public buildings designed between 1990-2020. Unlike the previous studies in the relevant literature, which focused on recent architectural approaches, the present study addressed the subject based on the architects' own texts. Thus, the architect's expression but not the author's interpretation comes to the fore, contributing in the objectivity of the study.

Keywords:
Architectural issues; architectural concepts; leading architects; today's architectural approach

*Department of Interior Architecture, Faculty of Architecture and Design, Istanbul Aydın University, İstanbul, Turkey

Email: dilekyasar@aydin.edu.tr

**Department of Architecture, Faculty of Engineering and Architecture, T.C. Beykent University, İstanbul, Turkey

Email: sengul@gur.com

To cite this article: Yasar, D., & Gür, Ş.Ö. (2022). Models of Diagnosis and Concept in The Pioneering Architects in Recent Architecture. *ICONARP International Journal of Architecture and Planning,* 10 (2), 410-427. DOI: 10.15320/ICONARP.2022.208

INTRODUCTION

The advancements in the communication and computer technologies by the second half of the 20th century led to the information revolution, which was also described as the "global village" by McLuhan (1962), as the "information age" by Castells (1997), as the "post-industrial society" by Bell (1973), and as the "third wave" by Toffler (1980). The information revolution had a widespread effect on a number of fields throughout the world, including the economic, political, social, and cultural spheres, and drove the discipline of architecture as closely related to above, into a rapid process of change. The architectural milieu evolved into a new domain and the ways by which the buildings were designed, produced, and represented changed almost radically with the rapidly developing computer technologies especially after the 1990s. As Mitchell (2001) suggested, the architects, who were inclined to draw what they could build and build what they could draw, focused on building the most unusual and extraordinary forms taking advantage of the opportunities created by this revolution.

Occasionally, the great changes as a product of those revolutions were also criticized. For example, although it emerged as a school, which adopted the dominance of the mind and science, attached importance to such concepts as freedom, democracy, and progress, and promoted rationality and therefore prioritized the faculty of thinking, the modernism, which was developed with the industrial revolution, had been the target of serious criticism by certain scholars following the 1960s: George Ritzer, for example, criticized modernism based on rationality referring to the Holocaust and argued that this would not happen in a less rationalized society in his work titled as "The McDonaldization of Society" published in 1993. At the urban level, Kevin Lynch criticized modernist approaches to the city and made certain suggestions for the reconstruction of cities, including Los Angeles, Boston, and Jersey City in his book "The Image of the City" published in 1960. Jane Jacobs' book, i.e., "The Death and Life of Great American Cities" published in 1961, is another example, which demonstrated, how the urban planners ignored true people, based on rich examples. In this book, Jacobs suggested that urban diversity and vitality were destructed by powerful architects and urban planners. Rem Koolhaas wrote in "What Ever Happened to Urbanism?" in 1995 that the alchemist promise of modernism failed, and suggested that the effort to transform quantity into quality through abstraction and repetition was just a deception and useless magic. Nevertheless, the enthusiastic modern architects and city planners of the period focused on increasing the welfare level of the individual and the society by means of their innovative, creative, and theoretical/experimental approaches, and they worked on to organize not only the physical environment, but also the human life through their functional, plain, and unadorned structures. The prominent architects of the period, including Frank Lloyd Wright, Le Corbusier, Mies van der Rohe, Walter Gropius, and Alvar Aalto strived for creating dwellings and

DOI: 10.15320/ICONARP.2022.208

cities that would accommodate the needs of modernizing societies, and in the said process they paved the way for a universal architectural language. As a result of the adverse conditions of the World War I and II and the rising neo-liberal values, modernism was not able to fully realize the idealized order it promised, however. Thus, the logic based on a dichotomy of either right or wrong, the roots of which can be traced back to Aristotle, was replaced by both the wrong and right, or in other words, substituted by the proposition of "and", "or", and "both".

In 1966, Robert Venturi proposed a pluralistic approach in architecture based on his work titled as "Complexity and Contradiction in Architecture". This intellectual rupture aimed to distance from the theoretical elements of modernism and to present both the familiar, and the unusual, by the reuse of historical elements. Accordingly, it was intended to establish a new bond between architecture and the public. In the context of this new proposition, the concepts of chaos/contradiction/pluralism were brought to the forefront. In contrast to the absolute geometrical order of modern architecture that focused on functional efficiency, the post-modern architecture proposed imprecise, heterogeneous, and ambiguous buildings. Post-modern architects such as Venturi and Denise Scott Brown, as well as Charles Moore, Michael Graves, Robert Stern, Aldo Rossi, and James Stirling resorted to architectural symbolism to reinstate the lost depth of meaning, over the pure expression of a functional form. Accordingly, the regular geometries of modern architecture were replaced by the irregular and the architectural object was envisaged in a more pluralist direction with radical eclecticism corresponding to a multiplicity of tastes" (Jencks, 1991).

On the other hand, the changes associated with the information revolution altered the nature of postmodern architecture as well. The first traces of the above changes appeared during the "Deconstructivist Architecture" exhibition held in the Museum of Modern Arts (MOMA) in New York in 1988, featuring the works of Coop Himmelblau, Peter Eisenman, Frank Gehry, Zaha Hadid, Rem Koolhaas, Daniel Libeskind, and Bernard Tschumi, among others. According to Wigley & Johnson (1988), the common grounds that brought those architects together were not that their works were similar in nature, but that they created their own rhetoric outside of the postmodern establishment. Wigley (1989) described the deconstructive architect as someone, whose objective was to find the internal dilemmas and structural flaws of the buildings, but not someone that torn them into shreds. As a matter of fact, similar to what Mc Leod (1989) suggested, deconstructivism incorporated certain aspects of modern architecture, including the preference for abstract forms, rejection of tradition, and interest in technological images, despite adopting a modality against the form-function relationship and purity of form.

By the 1990s, the architectural milieu has begun to change direction once again thanks to the developments in digital tools. Lynn (1993) underscored that during that period, architects sought continuity of form against the deconstructivism cult and that was transformed into a theory of mathematical continuity. Leach (2002) investigated the above novel approach in the context of the city and suggested that the cities were being transformed by digital technologies; and that new technologies were beginning to exert a significant impact on the way the cities were designed and imagined. Mehaffy (2004) once again enunciated that architecture evolved into a new paradigm during the introductory speech for his “New Science, New Urbanism, New Architecture?” conference.

Carpo underlined that architects from the deconstructive tradition, including Zaha Hadid, Frank Gehry, and Peter Eisenmann, offered "a deliberate mediation or synthesis between 'postmodern unity of form' and 'deconstructivist fragmentation'" as a new alternative, and called that change a “digital turn” in 2013, and described the physical manifestation of that new paradigm as follows:

"In fact, in the first instance, a meaningful building of the digital age is not just any building that was designed and built using digital tools: it is one that could not have been either designed or built without them. Alert designers have ideas about what the new tools are and what they can do, and this intelligence – among many other things – inspires them to imagine unprecedented solutions." (2013:8)

As it is evident in Carpo's statement, the technological advances paved the way for radical changes in the design and production and accordingly, an understanding of form that did not compromise its autonomy and unusual representations started to emerge. Nevertheless, projects from certain geographies that allocated large budgets with an aim to serve as a tool for identity and representation and as a self-promoting attempt drove an explosion of and race for forms, especially regarding the public buildings, and as a result, the relations between re-shaped architecture and society were subject to an intense environment of dispute (Daley, 2013; Tamari, 2019; Mcguigan, 2010). The main emphasis of those criticisms was that architecture was morphed into a spectacle and that both the "architect" and the "architecture" were evolved into mere commodities.

Seeking answers for such questions as which concepts were taken as a basis to establish those relations, whether the formerly powerful concepts were still valid for where we were today, and which concepts came to the fore in today's production practices, is of particular importance today, where the urban space and urban life are re-produced, the bridges between art and economy, the city and the citizen are rebuilt and criticized at the same time. As a first step with an aim to answer above questions, 66 architects were identified based on the recognition status using the Google's hit (GH) method, and thereafter their own accounts of the public buildings built thereby between 1990 and 2020 were retrieved. Those briefs were considered important sources of information and analyzed on the basis of the relationship between issue and concept. The accordingly identified conceptual information were

DOI: 10.15320/ICONARP.2022.208

then translated into conceptual categories in the next step in order to explain 'what were the considered design problems by the recent pioneering architects', 'the conceptual attribute of the relationship they established between form and content', and 'the way they approached design'. In addition, the present study also discussed whether the well-known contemporaneous architects adopted a shared language in terms of approach to design and whether they had similarities and/or differences compared to the previous periods.

The present study aimed to create a discussion framework that could serve in the making of a theoretical basis for recent architecture. Up to today, no comprehensive research has been conducted on the data that today's leading architects started with the design, the factors that led them to the form, and which concepts and how they used them in the face of these factors. In this sense, the study makes an important contribution to the literature.

The study also provides important clues on the architectural approaches of the future. Considering that the discipline of architecture is in constant motion and search, the study also forms a basis for future evaluations.

RESEARCH METHODOLOGY

One of the main sources of acquiring knowledge is the written language and textual description, the forms by which knowledge is conceptualized and organized (Oxman, 2004). In this sense, the present study analyzed the written texts by architects on their own works, which were important sources of information, where theory and practice could be evaluated together, and accordingly sought to reach conceptual information.

Firstly, architects, who actively worked between 1990-2020 were identified upon a preliminary review. Then, the Google hits (GH) method was used to select well-known architects from among these architects. Google Hits is the number of webpages returned in a Google search for a person's name. The method is a recent scientific method to identify well-known status of individuals (Schulman, 1999; Bagrow, 2004; Simkin, 2013; Simkin, 2015; Yücesoy & Barabasi, 2016). The GH analysis was based on the "number of searches on the Internet" using the "Pageviews Analysis" platform. In the context thereof, searches in all languages were included in the analysis. Architects, including Kenzo Tange, Philip Johnson, Jorn Utzon, Arata İsozaki, Alvaro Siza, Gae Aulenti, Balkrishna Doshi, Lina Bo Bardi, Luco Costa, James Stirling, Paolo Soleri, Tomas Taveira, Ralph Erskine, Paolo Portoghesi, Oswald M. Ungers, Charles Moore, Leon Krier, and Tom Wright were excluded from the first list, because their own accounts of the works could not have been accessed. As a result, 66 well-known architects with GH scores above average number of hits were identified. Those architects are given in Table 1 in alphabetical order.

Table 1. Architects by Recognition Status and the Number of Texts Included in the Study

	Architects	Number of public buildings whose texts were analyzed		Architects	Number of public buildings whose texts were analyzed		Architects	Number of public buildings whose texts were analyzed
1	Adrian Smith	6	33	Mario Botta	11	63	Toyo Ito	2
2	Alberto Campo Baeza	9	34	Massimiliano Fuskas	13	64	Winy Maas	14
3	Aldo Rossi	2	35	Ma Yansong	15	65	Yvonne Farrell	7
4	Ben Van Berkel	28	36	Michael Graves	10	66	Zaha Hadid	43
5	Bernard Tschumi	18	37	Michael Sorkin	2			
6	Bjarke Ingels	45	38	Moshe Safdie	19			
7	Dominique Perrault	11	39	Nicholas Grimshaw	49			
8	Cesar Pelli	44	40	Norman Foster	59			
9	Christian Portzamparc	12	41	Oscar Niemeyer	4			
10	Daniel Libeskind	28	42	Peter Eisenman	6			
11	David Adjaye	24	43	Peter Zumthor	2			
12	David Childs	74	44	Rafael Moneo	9			
13	David Chipperfield	21	45	Rafael Vinoly	34			
14	Eduardo Souto De Moura	5	46	Rem Koolhaas	33			
15	Francine Houben	57	47	Renzo Piano	34			
16	Frank Gehry	6	48	Ricardo Bofill	10			
17	Hans Hollein	2	49	Richard Meier	12			
18	Hans Kollhoff	1	50	Richard Rogers	12			
19 20	Helmut Jahn & Murphy Jahn	6	51	Robert A. M. Stern	30			
21	Herman Hertzberger	16	52 53	Robert Venturi & Denise Scott Brown	13			
22	Ieoh Ming Pei	20	54	Santiago Calatrava	38			
23 24	Jacques Herzog & Pierre De Meuron	29	55	Shigeru Ban	11			
25	Jeanne Gang	18	56	Sou Fujimoto	3			
26	Jean Nouvel	19	57	Steven Holl	28			
27	Jon Jerde	2	58	Tadao Ando	2			
28 29	Kazuyo Sejima & Ryue Nishizawa	3	59	Tatiana Bilbao	7			
30	Kengo Kuma	58	60	Terry Farrell	12			
31	Ken Yeang	4	61	Thomas Heatherwick	7			
32	Kevin Roche	6	62	Thom Mayne	21		**TOTAL**	**1146**

Secondly, the buildings to be included in the analysis were decided. The selection of the buildings was limited to the public buildings commissioned between 1990 and 2020.

Thirdly, the available texts inked by the renowned architects accessed via their own web sites and publications on their public buildings built between 1990-2020 were reviewed using textual analysis based on issue and concept notions, remaining loyal to the intra-text context, and the conceptual information were then transformed into conceptual categories. Each text was analyzed in the contexts of issue (yellow legend) and concept (orange legend) and with respect to their intra-textual context (Figure 1).

DOI: 10.15320/ICONARP.2022.208

ZAHA HADID: EVELYN GRACE ACADEMY

An opportunity to broaden the educational diversity of this active and historic London area. Following the principle of 'schools within schools'. the design generates natural patterns of division within highly functional spaces which give each of the four smaller schools a distinct identity, both internally and externally.

The Evelyn Grace Academy not only broadens the educational diversity of Brixton, but also augments the built environment in a predominantly residential area. The Academy presents itself as an open, transparent and welcoming addition to the community's local urban regeneration process.

The strategic location of the site within two main residential arteries naturally causes the built form to be coherent and to assume a strong urban character and identity, legible to both local and neighbouring zones.

The Academy offers a learning environment that is spatially reassuring and able to engage students actively, creating an atmosphere for progressive teaching.

Its highly functional spaces present generous environments with maximum levels of natural light, ventilation and understated but durable textures. The communal spaces — shared by all the schools—encourage social communication with aggregation nodes that weave together the extensive accommodation schedule.

Similarly, in order to generate a setting that encourages interaction, the external shared spaces are layered to create informal social and teaching areas at various levels based on the convergence of multiple functions. The scheme provides an educational complex that is equally esteemed and cherished by the pupils and community.

Source: Zaha Hadid Architects: https://www.zaha-hadid.com/architecture/evelyn-grace-academy/ Erişim: 11.06.2020

Figure 1. Analysis of Briefs in the Contexts of Issue and Concept.

STUDIES AIMED TO EXPLAIN RECENT ARCHITECTURE

As a result of the increasing effect of digital technologies on design and production practices, the architectural environment entered a new era during the transition to the 21st century and a design approach emerged, accommodating the power of digital technologies (Mallgrave & Goodman, 2011; Lynn, 1993; Leach, 2002; Mehaffy, 2004; Carpo, 2013). In that sense, the Guggenheim Museum designed by F. Gehry in Bilbao (1991-1997) illustrated one of the first buildings that represented the zeitgeist of the new age. Subsequently, the traces of that new approach were evident also at the Venice Biennale organization held in 2000 and 2004. As a matter of fact, those biennials were of particular importance being the first platforms that sought to theorize the evolution and transition innate to the discourse and practice of architecture (Oxman, 2005). Patrick Schumacher presented his Parametrism Manifesto for the first time during the 2008 biennial, suggesting the precedence of the variability, continuity, and differentiation potential concepts.

As regards the textual productions on the theoretical context of the digital, Greg Lynn's series, which started with "Folding in Architecture" in 1993, followed by "Folds, Blobs, and Bodies" in 1995, and "Animate Form" in 1999, were among the prominent studies that engaged in the architectural agenda the most.

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

During this new period defined as the "Digital Baroque" by Muschamp (2000), the form production was liberalized and the digital technologies accelerated novel architectural possibilities (Kolerevic & Klinger, 2008), facilitating the appearance of new types of form that were formerly not possible to build. As Cache (1995: 88) suggested the objects were now being calculated instead of being designed.

According to Picon (2010), the new possibilities made available by digital simulation allowed the architects to be liberated from the limited repertoire of modern architecture, and therefore, adopting a particular understanding of form on the basis of creating scenarios that represented a radical break from traditional planning. Leach (2009) asserted that architects were responsible not only for the production and the form of the space in this new period, but also for the generative processes that composed that space. Therefore, the basic components of design, including presentation, production, performance, and evaluation were re-defined in the light of the digital technique (Oxman, 2005).

There are other attempts to define the contemporary architecture based on differing perspectives. Relevant examples include but not limited to the pioneer-innovative architecture (advanced architecture) by Gausa et al. (2003), new digital architectures by Kolarevic (2003), quantum architecture by Jencks (1997), and relational architecture by Lozano-Hemmer (1999).

Digital technologies were not considered merely a tool in the production of architectural form, but at the same time had an impact of the production of knowledge and thought as suggested by Colletti (2017) and Heidegger (1977). However, this does not alter the fact that the design is unique to the individual. Therefore, no framework has yet been suggested in the relevant literature that encompass the intentions of the pioneering architects of the recent period, what they consider as a design problem, what data they incorporate into their designs, and by means of which concepts they seek solutions to such problems. In this context, it is of particular importance to elaborate on the architectural approach of the contemporary period based on the phenomena of issue and concept, which comprise the two factors in the transformation of architecture.

ISSUES AND CONCEPTS AS TWO FUNDAMENTAL FACTORS IN TRANSFORMING THE ARCHITECTURE

In the implementation of architectural design and production, issue is intertwined with the phenomena of form and concept. The architect operates in line with the fundamental issues of the act of design, including the client, function, terrain, and representation, when deciding on the form. The architects seek to achieve original and rational outcomes by establishing inter-conceptual relations and different connections, to the extent of their knowledge and experience. In this process, concepts serve as the key elements allowing the architects to formulate and solve the problems, and to recognize and express the connections and relationships between various areas (Cowdroy & Graaf, 2005). Concept

DOI: 10.15320/ICONARP.2022.208

plays an active role in imagining new realities and acquiring creative skills in design. Lawson & Dorst, (2009) defined the relation between concept and creativity as reframing the design problems. In this sense, thinking in concepts can also be considered a process by which the designer navigates through an abstract problem space and resorts to various strategies to elaborate the problem definition (Gero & Neill, 1998). On the other hand, it is sometimes not possible to predict a work of art before it is ever produced (Bergson, 1922). At this point, concepts act as a kind of mental glue, as Murphy (2002) suggests. They keep together the ideas freely floating in the mind and form a basis or a theme for further design decisions.

The architect, who tackles the production of form, or one of the most important elements in deciding the quality of architectural design, within the scope of problems, has to oversee the social ideals, vital interests, and aesthetic values as well. At the same time, in such cases, mostly the dialectical opposition between issues and form phenomena emerges. For example, a form that has been shaped as a result of considering topography a problem may conflict with its content or may not be able to connect with its environment/city. The architect accommodates the conceptual unification ability with an aim to overcome such situations and achieve the goal. In this context, the concept functions as a bridge between the form and the problem, i.e., the foundation of its production. Therefore, the phenomena of issues, concept, and form are not independent from each other, but rather create/complement each other. In the present study, taking above as a point of departure, the approaches adopted by the recent pioneering architects towards design were discussed based on issues and concept parameters.

FIELD STUDY

The present study aimed to draw a theoretical framework towards recent architecture, and therefore, architectural texts on 1146 public buildings built between 1990 and 2020 by 66 well-known architects were elaborated using an analytical process-based method. The public buildings analyzed within the above framework included 479 cultural, 250 educational, 138 transportation, 51 health, 40 sports, and 188 administrative buildings and social areas.

RESULTS

The data indicated that the design problems identified by the recent pioneering architects were highly varied, yet it was possible to categorize them. First, it was seen that the pioneering architects identified 19 distinct design issues under 7 basic categories. Among the identified issues, the concerns for the physical surroundings took the first place, followed by function and program concerns and natural environmental concerns. The legal-administrative limitation concerns and internal factors were the least mentioned issues. The identified issues and their frequency of emphasis numerically are as follows (Table 2):

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

Table 2. Conceptual Categories Related to the Issues

451	CONCERNS ABOUT PHYSICAL SURROUNDINGS	Factors about the Physical Surroundings (290)	Concerns about close surroundings, such as to be located in an exquisite neighborhood, establishing relations with existing buildings, located between the boulevard and the road, re-defining the relations between the existing and the new, located in an industrial coastal area, located along the railway line or highway, located in a financial district, and located on a historical trade route, etc.
		Factors about the Land Itself (161)	Concerns stemming from the land itself, such as a form imposed by the geometry of the land, orientation of a triangular plot, the small-, large-size of the plot, and the area-scale dilemma
430	FUNCTIONAL AND PROGRAM-FOCUSED CONCERNS	Factors about the Function (325)	Functional and program-focused concerns, such as being versatile and multi-purpose, providing the requirements of the program, responding to increasing demands and intensity, offering a future-oriented working area, and meeting ever changing needs
		Factors about the Spatial Configuration (82)	Concerns that focus on reflecting on the relationships between the space and the user, such as providing continuity between the interior and the exterior, to be located side by side or on top of each other, located in front of or inside, transmissivity, adjacency, orientation, centrality, continuity, and separation
		Factors about the Physical and Emotional Comfort (19)	Concerns about ensuring the user's physical and emotional comfort, such as making use of natural light and ventilation, noise control, acoustics, thermal comfort, offering landscape vista, reassuring, privacy, belonging, and providing different experiences
		Factors about Social Sust. in Design (4)	Concerns regarding the sustainable design approaches, such as creating a sustainable and inclusive architecture, accessibility, design for all, and conforming to universal design criteria
200	CONCERNS ABOUT THE FORM	Concerns about creating an image (68)	Concerns about the image of the architectural form, such as being symbolic, presenting a remarkable image, creating an iconic form, constructing a form in human dimensions, and to be visible from anywhere
		Concerns about Reflecting the Mission and Vision (132)	Concerns mostly about reflecting the mission and vision on the form, such as emphasizing democracy, demonstrating impartiality, reflecting power and status, building confidence, and reflecting the theme
411	NATURAL ENVİRONMENTAL CONCERNS	Factors about the Geography (132)	Concerns based on geographical factors such as to be located by the sea, connecting the river to the promenade, located on a steep slope, surrounded by rivers, mountains, and lakes, located along the river, and providing sea transportation
		Factors about the Biotic Environment (125)	Concerns based on the biotic environment, such as to be located in an agricultural region, preserving the rural features, protecting the existing landscape, and preserving the natural life
		Ecologic Concerns (106)	Ecology-based concerns such as producing more than the consumption, the necessity of being ecological, minimizing energy and resource consumption, caring for the use of limited resources, and minimizing harm to the natural environment
		Factors about the Abiotic Environment (48)	Climatic concerns expressed in such phrases as responding to harsh climatic conditions, protection from excessive sunlight, protection from sandstorms, standing up to the power of cold climate, and reducing rainwater and snow load
293	CONCERNS ABOUT SOCIAL FACTORS	Urban Factors (221)	Concerns based on the interface of the city and society and/or urban arrangements, such as establishing inter-regional relations, creating public spaces, providing an intersection on the city road, need for a new dialogue with the city, strengthening the modernization, and enriching the public life
		Sociocultural Factors (45)	Concerns of both social and cultural origin based on tradition, culture and social actions, such as the protection of urban heritage, fostering multiculturalism, and representing values
		Socioeconomic Factors (27)	Concerns arising from both the social and economic relations, and the relations between the two, such as renewing the city in economic terms, creating a popular area that would attract tourists, being a part of economic development
119	CONCERNS FOR LEGAL AND ADMINISTRATIVE RESTRICTIONS	Concerns about Building and Const. Challenges (60)	Concerns over structure, shell, and materials, such as constructional challenges, juxtaposing different building typologies, manufacture, assembly, transportation, and flows
		Customer-originated Factors (53)	Concerns about meeting the expectations and demands of the client, such as a tight budget, limited time allotted for construction, and colors and forms of client's choice
		Factors about Legal Restrictions (6)	Concerns arising from zoning permits and legal requirements, such as floor heights, roof slope, and building typology
67	INTERNAL FACTORS	Inherent and Reflective Factors (67)	Concerns about adopting an attitude based on certain cases, such as creating an architectural landmark, adding one's own interpretation, following a maestro, exhibiting resistance, and introducing a new architecture, etc.

The results were indicative of the fact that the pioneering architects of the age had highly diverse considerations to achieve the form and based the syntactic structure of the form on concrete data. Furthermore, it was found that the land and the concerns for physical surroundings were the most frequently emphasized issues by the architects, who embarked on the data obtained therefrom as important inputs to be incorporated into the design. The pioneering architects of the era most frequently referred to land-associated data, including whether the area was narrow or wide, or had different geometries, and/or the topographic features in addition to the data collected from the surroundings, e.g., being located in a commercial area or a historical district or being close to important buildings.

DOI: 10.15320/ICONARP.2022.208

Another marked design issue was pertaining to the functional and programmatic concerns. Challenges such as being able to relax while walking, making maximum use of natural light and natural ventilation, presenting diverse functions as a whole, interacting with the surroundings, providing different experiences in different spaces, and creating exciting spaces were the main concerns of almost all the architects included in the study.

Natural environmental concerns were also frequently expressed by the architects. In this context, natural environmental factors such as abiotic and biotic components, geography, and ecology were attached importance in the scope of the design problems referred to as by the recent architects.

In addition to the three design issues above raised by the architects included in the study, the concerns towards social factors involving in socioeconomic, sociocultural, and urban components were also considered challenges to be addressed. As frequently expressed in the texts, such concerns as creating new urban spaces at the interface of the city and society, reflecting cultural values, branding the city, providing the city with a new face, and contributing to the economic development of the city were among the important design inputs for the recent architects.

The recent architects also pointed out their concerns about form. The architects, who rather worried about whether the form of their creation reflected their own mission and vision, acted upon such concerns as manifesting the status of their affiliated institution, reflecting the power of the city, emphasizing the importance attached to democracy, and designing a form worthy of a given school's name. Although the concerns about 'creating an image' were also included in this category, the texts rather indicated distinctive themes on how the form should be in a formal sense, with the inclusion of creating a striking image, being visible from everywhere, presenting a signature figure, and presenting a powerful form.

Concerns about legal-administrative constraints, which implicated the factors associated with building and construction, legal restrictions, and customer demands, were also referred in the design issues mentioned by the recent architects, albeit less frequently compared to other concerns.

Inherent, reflective, and autonomous factors were also less frequently underlined by the architects.

The concepts that were produced, preferred, and utilized by the recent architects towards a solution for the identified design issues were also highly diverse. However, it was possible to categorize those concepts based on their focal points. In this context, 20 different conceptual foci were identified under 9 categories that were used by the recent pioneering architects to solve the design issues. Among those, especially the function- and program-focused concepts, followed by the natural environment- and form-focused concepts, were the prioritized concept

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

groups. The identified conceptual foci and their frequency of emphasis numerically are as follows (Table 3):

Table 3. Conceptual Categories

1907	CONCEPTS FOCUSED ON FUNCTION AND PROGRAM	Concepts Focused on Spatial Configuration (834)	Concepts that focus on configuration of the space such as a fluid circulation, gathering people in the center, intertwined spaces, moving the exterior to the interior, offering a visual connection between spaces, and an uninterrupted articulation
		Concepts Focused on Function (462)	Function-based concepts such as offering a convenient plan, shell's responsiveness to the interior organization, diversity, temporality, harmony of form and function, and reflecting and highlighting the function
		Concepts Focused on Physical and Emotional Comfort (443)	Concepts that focus on the physical comfort of the user, such as infusion of natural light, spreading sound evenly, thermal comfort; and concepts focusing on the emotional comfort of the user, such as allowing the view, creating areas for meditation, offering impressive and surprising encounters, creating much-needed moments of calm and relaxation, and offering rich experiences
		Human-focused Concepts (168)	People-focused concepts such as accessibility, inclusivity for all the diverse groups, offering a flexible design approach, acting according to inclusive design principles, and attracting people of all ages
1233	CONCEPTS FOCUSED ON FORM	Concepts Focused on Scale and Geometry of Form (1010)	Concepts that focus on the scale and geometry of form, such as an iconic building of monumental size, a hybrid form, a cylinder rising up to the sky, an abstract form, convex and concaves that broaden and narrow horizontally and an elongated tower, and quadrilaterals stacked on top of each other
		Mission and Vision-Focused Concepts (223)	Concepts that reflect the values of the affiliated institution, such as striking a democratic stance, an appropriate form for its status, a transparent image, reflecting the values of the school, and a solid form symbolizing justice
1234	CONCEPTS FOCUSED ON NATURAL ENVIRONMENT	Ecology-focused Concepts (412)	Ecology-based concepts such as creating an energy-efficient building, creating an ecological construct, self-sufficiency, production according to the consumption, vertical gardens, green roof, sustainability, and energy-efficiency
		Concepts Focused on Biotic Environment (365)	Biotic environment-focused concepts such as moving the vegetation to interior, strolling with bird calls, glorifying the landscape, protecting the rural area, and adapting to the natural landscape, etc.
		Geography-focused Concepts (238)	Concepts based on geographical data such as making the island more prominent, reflecting the valley, stretching towards the sea, connecting the sea and land, and heading towards the hills
		Climate-focused Concepts (219)	Concepts based on climatic data such as making use of the island's pleasant climate, minimizing harsh shadows, creating a structure that captures natural light, taking advantage of the local microclimate, modulating the wind, providing the dynamism of daylight, allowing the breezes in, and benefiting from daylight
1014	CONCEPTS FOCUSED ON CITY AND SOCIETY	City-focused Concepts (739)	Urban-focused concepts such as creating independent urban attributes, offering generous public spaces, translating the city directions and contours, creating a meeting node inside the city, making an important contribution to the city, and giving cthe city a strong identity
		Concepts Focused on the Sociocultural (256)	Concepts based on the socio-cultural values of the city such as conforming to the daily life of the community, belonging to the local culture, respecting the traditions and customs of the region, being in conformance with local tradition, complying and inspired by traditions, etc.
		Concepts Focused on the Socioeconomic (19)	Concepts based on strengthening the city's economy, such as offering a very important economic gateway for the region, creating economic miracles, proving to be an important element of urban development, and attracting both domestic and foreign visitors
675	METAPHOR AND ANALOGY	Metaphor and Analogy (675)	Metaphorical concepts that focus on the indirect relations/abstractions established with "biology" such as existence, growth, evolution, metamorphosis, a growing organism, simulation of growth processes, grapes on vine and/or with "objects" like a machine, reminiscent of musical notes, such as branches of a tree and analogic concepts that focus on the directly established relationships/tangibles such looking as a spacecraft, in the form of a bird, a star symbolizing the Holocaust, and a sailboat floating in water
461	LEGAL- AND ADMINISTRATIVE-FOCUSED CONCEPTS	Concepts Focused on the Building and Construction (461)	Technical and structural concepts such as providing innovative construction technology, focusing on assembly details, using advanced technology, unusual materials, making use of traditional construction methods; concepts based on legal limitations such as turning limitations into opportunities, spreading horizontally instead of rising vertically, capturing the extraordinary within constraints; and concepts that focus on customer demands and desires such as achieving international standards, reducing costs, making the most of the budget and fast completion
406	CONCEPTS FOCUSED ON PHYSICAL ENVIRONMENT	Concepts Integrating with the Existing (195)	Concepts based on integration with the given environment, such as providing continuity with the existing context, a meaningful coexistence of the existing and the new, being inspired by the provocative existence of the existing art building, and commonality
		Area-focused Concepts (167)	Concepts based on the scale and shape of the area, such as maximizing the length of the area, adopting an approach that is appropriate for the area, utilizing the shape of the area, conforming to the geometry of the area, according the topography of the area, and taking advantage of the topography
		Concepts in Conflict with the Existing (44)	Concepts that create a contrast with the existing surroundings, such as creating a multi-layered perspective, offering a heterodox element, obviously distinguished from the others, being different and original, and striking a different stance
225	QUALITATIVE CONCEPTS	Concepts Focused on Qualitative Characteristics (255)	Concepts focusing on quality such as dynamic, luxury, striking, beautiful, simple, plain, straightforward, subtle, complex, contemporary, modern, classic, and spectacular
221	CONCEPTS FOCUSING ON INTERNAL FACTORS	Inherent- Reflective-focused Concepts (221)	Concepts based on the knowledge and experience of the architect such as offering a glimpse of 21st century art, ushering a new era, receiving high admiration, realizing the dream of every architect, creating one's own museography, offering the natural scheme of things, offering a unique language, paving the way for a new understanding of architecture, and going beyond the beknown

The results showed that the recent pioneering architects framed the identified design issues through a variety of concepts, where the function- and program-focused concepts were on the top of the list. The most frequently used expressions that suggested function- and program-focused concepts included providing the users with different experiences, presenting surprising places, arousing strong emotions, creating an invigorating atmosphere, strengthening emotional interaction, providing an extraordinary circulation, promoting creativity, and a lofty ascension. However, these concepts were based on an

DOI: 10.15320/ICONARP.2022.208

approach, which targeted the emotions and feelings of users instead of an understanding based on the organization of functions and/or relations.

Natural environment-focused concepts constitute another important group of concepts that shape today's architectural approach. Naturally, concepts focusing on climate, geography, and biotic environment were always incorporated into the architectural discipline. However, the prominent natural environment-focused concepts today are far above of the concepts pertaining to the traditional architecture that focused on coping with natural conditions, and that the new approach is marked with acting sensitive and in protection of the environment.

Another notable group of concepts were embodied in the form-focused concepts. The texts analyzed in the scope of the study suggested that the recent architects frequently mentioned such semantic concepts as being sculptural, an organic form, a moving shell, an asymmetrical layout, a wavy form, reflecting the energy of the museum, presenting a democratic image, and creating a form appropriate for the status of the education received, all focusing on both the scale and geometry of the form and the reflection of the mission and vision. At this point, it would be more accurate to consider the form-focused concepts based on metaphor and analogy notions. As a matter of fact, the analyzed texts indicated that form-focused concepts were often inspired by biological metaphors and analogies. The relevant examples included metaphors suggesting the growing branches of a tree, the corolla of a desert rose, a glacier, an inverted mountain, and a hard oyster protecting the soft elements inside, and analogies, including a shattered guitar, a sailboat floating on the water, and a flying bird.

The concepts focused on the city and society were also used by the pioneering architects of the age. Textual analyzes suggested that the architects in question were inclined to reinforce the existing and/or forgotten relationships, albeit in a different way, rather than creating new relationships between the city and society. The foregoing approach of the architects, who apparently intended to establish a closer relationship between the city and the citizens, based on the use of such concepts as providing public spaces, creating a focal point for the city and its inhabitants, being in harmony with the city, and approximating the city and the resident society, suggested that they considered the city as a whole with the people.

Another concept group identified as a result of the study was the building and construction-focused concepts. Architects of this century occasionally used building- and construction-focused concepts such as employing innovative technologies, extraordinary use of ordinary materials, maintaining the tradition of working with reinforced concrete, combining local skills with advanced technologies, and reducing the costs.

Physical environment-focused concepts were also used by the recent architects. Concepts that were incorporated into the existing, that were area-focused, and that were in conflict with the existing, respectively, were included in this group. The relevant examples included standing as an extension of the street, reflecting the existing structures, entering into a harmonious dialogue with the nearby façades, resonating with the medieval landscape, being an entity on its own, creating a contrast with the existing, standing out from its immediate surroundings, following the geometry of the area, adapting to the topography, and adapting to the scale of the field.

Qualitative concepts and inherent-reflective concepts were used the least in the 1146 texts that were analyzed in the scope of the study.

DISCUSSION

By its nature, the architectural discipline is in constant motion. That motion can be traced back throughout the history. For example, unlike the modernist architects, who rejected the historical texture surrounding the site and tried to create brand new physical environments, the post-modern architects strived for establishing an asymmetrical dialogue between the building and its surroundings in the following period. The aforementioned concerns about the physical environment also drive today's architectural approach. Nevertheless, unlike the past practices, today's architects embrace the physical environment as a guide, and in this context, the data collected from the physical environment both at the scale of the area, and the surrounding environment serves as an important resource for architects as regards presenting an original design.

It is possible to trace the function- and program-focused concerns, i.e., another prominent issue, back to much older times in history, as early as Vitruvius. The function, which the Roman architect Marcus Vitruvius Pollio (c. 90 - c. 20 BCE) emphasized as one of the three pillars of successful architecture, was weaponized by the modernist architecture against the traditional architecture, by the post-modern architecture against the modernist architecture, and by the deconstructivist architecture against the both. Although the way the function is addressed and questioned over time has changed, it still maintains its role as the main concern of architecture. Nevertheless, concern for function is recently addressed through an approach that is far from conflict, without imperative obedience or opposition to the form and without one prevailing over the other, but on the contrary, a balance is sought between form and content. Nevertheless, the function concept today is built upon an approach that refers to the mind of the user and strives for evoking different emotions and feelings through spatial arrangements that have been intended to be rich and unconventional.

Another input that helps shaping today's architectural approach is the natural environment. However, as a result of the analysis of the texts included in the study, today's approach adopts a sensitive attitude towards the environment and protects it, far beyond the concepts of traditional architecture that focused on coping with natural conditions. As a result of the analysis of the texts included in the study, the

DOI: 10.15320/ICONARP.2022.208

aforementioned approach is not based on an attitude that aims to protect the environment from people, but on the contrary, it is fed upon an understanding of natural environment that still embraces a human-based perspective and keeps focusing on preserving the natural environments, on which human beings can live for thousands of years. Having been based on principles of sustainability, including energy conservation, making use of the climate, acting in harmony with the geography, protecting the rural areas, and creating a green architecture, these concepts are suggestive of the fact that architecture is now considered in conjunction with ecology.

As an ancient issue, the concern about social factors can be traced back to Plato's State. That gained importance once again, especially during the modern period, and architects such as Le Corbusier imagined to radically change the social life as inspired by the desire to create the ideal society. However, the social factors are being neglected in profit-oriented projects by today's architects, dominated by an approach, where cities are branded and brand structures come to the fore, and thus, the same are interpreted substantially different from the previous approaches.

The analysis of the texts in question suggested that today the way by which the concerns about form were addressed has also changed. The form that modern era architects suggested to act as per the function, that post-modern era expected to convey meaning with historical references, and that deconstructive architects aimed to bring a new interpretation upon discussion, is considered by today's architects based on the concern of creating unique, signature forms that would become a brand. Form-focused concepts are rather based on biological metaphors and analogies, and are shaped based on those concepts. Therefore, these concepts seem to have evolved into a different channel diverging from the conception of modernist architecture based on pure geometry, the conception of post-modern architecture focusing on historical references, and the conception of deconstructive architecture embracing on the fragmentation of form.

In summary, it was seen that the ancient design problems of the architectural discipline and the identified concepts are still valid today, but the way they are addressed and questioned has changed notably. In that sense, although the architectural discipline is in constant motion and quest, it has not immensely changed. The aforementioned change can be considered as an important indication that the pioneering architects of the era tended to engage in a quest for multifarious forms. As a matter of fact, today the architects have started to generate a wide array of forms, paving the way for the advent of a vast repertoire of form. In this sense, the recent architects, who are involved in a quest of form inspired by diverse factors, follow a substantially different route compared to the modernist architects with similar points of departure, the postmodernist architects, who aimed to contribute to the production of meaning, and the deconstructivist architects, who minded to reflect the contradictions in the society by means of the contrasts between the buildings of their creation and their surroundings (as well as by the contrasts between the intrinsic elements of the buildings). On the other hand, given that function and performance were still considered important factors, the recent trend matched up with the modernist architecture and hence, the importance of function in architecture was underscored.

The results of the study, as a whole, shed light on the approaches that shape today's architecture, and furthermore, provide important clues on the future architectural approaches. On the grounds that the architectural discipline is in constant motion and quest, the present study also paves the way for future evaluations. As Güzer (2016) suggested, it becomes increasingly important to discuss the conditions and consequences that shape the buildings at certain legs of an ever-accelerated milieu of construction and urban transformation.

REFERENCES

Bagrow, J. P., Rozenfeld, H. D., Bollt, E. M., & Ben-Avraham, D. (2004). How famous is a scientist? - Famous to those who know us. Europhysics Letters (EPL), 67(4), 511–516. https://doi:10.1209/epl/i2004-10104-y

Bell, D. (1973). The Coming of Post-Industrial Society: A Venture in Social Forecasting. Basic Books.

Bergson H. (1922). Creative evolution. Macmillan and Co, Limited St.

Cache, B. (1995). Earth moves: The furnishing of territories. MIT Press.

Carpo M. (2013). Introduction twenty years of digital design. In M. Carpo (Eds.), Digital turn in architecture 1992-2012 (pp.8-14). Wiley and Sons Publication.

Castells, M. (1997). The power of identity. The information age: Economy, society and culture. (Vol. II), A John Wiley & Sons, Ltd. Publication.

Colletti, M. (2017). Digital poetics: An open theory of design-research in architecture. Routledge.

Cowdroy, R., & de Graaff, E. (2005). Assessing highly-creative ability1. Assessment & Evaluation in Higher Education, 30(5), 507–518. https://doi:10.1080/02602930500187113

Daley, S. (2013, September 24). A star architect leaves some clients fuming. New York Times. https://www.nytimes.com/2013/09/25/arts/design/santiago-calatrava-collects-critics-as-well-as-fans.html.

Gausa, M., Guallart, V., Muller, W., Soriano, F., Porras, F., & Morales, J. (2003). The metapolis dictionary of advanced architecture. Actar.

Gero, J. S., & Mc Neill, T. (1998). An approach to the analysis of design protocols. Design Studies, 19(1), 21–61. https://doi:10.1016/s0142-694x(97)00015-x

Güzer, C. A. 2016. Bienal. Antalya'dan geleceğe bakmak. Mimarlık (387): 0–0. https://hdl.handle.net/11511/71477.

Heidegger, M. (1977) The question concerning technology and other essays, W. Lovitt (trans.). Garland Publishing, INC.

Jacobs, J. (1961). The death and life of great American cities, Random House.

Jencks, C. (1997). Nonlinear architecture - new science - new architecture. Architectural Design, (129), 6-7.

Jencks, C. (1991). The Language of Post-modern Architecture. London: Academy edition, Sixth edition, 9.

Kolarevic, B. (2003). Architecture in the digital age. Design and manufacturing. Taylor & Francis.

Kolerevic, B. & Klinger, K. (2008) Manufacturing material effects: rethinking design and making in architecture. Routledge,

DOI: 10.15320/ICONARP.2022.208

Koolhaas, R. (1995). Whatever happened to urbanism? Design Quarterly, (164), 28-31.

Lawson, B. & Dorst, K. (2013). Design expertise. Routledge.

Lozano-Hemmer, R. (1999). Utterance 4 relational architecture. Performance Research, 4(2), 52-56.

Leach, N. (2002). Designing for a digital world. John Wiley & Sons Ltd.

Leach, N. (2009). Digital morphogenesis. Architectural Design, 79(1), 32-37

Lynch, K. (1960). The image of the city. The M.I.T. Press.

Lynn, G. (1993). Introduction, folding in architecture. Architectural Design, 63 (3-4), 9-13.

Lynn, Greg. 1998. Fold, Bodies & Blobs. Collected Essays. Ed. Michèle Lachowsky and Joël Benzakin. Books by Architects

Lynn, G. (1999) Animate Form. Princeton Architectural Press, New York.

Mallgrave, F. & Goodman, D. (2011). An introduction to architectural theory, 1968 to the present. Wiley-Blackwell.

Mcguigan, C. (2010, June 10). The death of starchitecture. Newsweek. https://www.newsweek.com/death-starchitecture-73049.

Mc Leod, M. (1989). Architecture and politics in the Reagan era: from postmodernism to deconstructivism. Assemblage, (8), 22-59.

Mc Luhan, M. (1962). The gutenberg galaxy: the making of typographic man. University of Toronto Press.

Mehaffy, M. W. (2004, September 20). Introduction. The Prince's Foundation for the Built Environment, The Order of Nature. New Science, New Urbanism, New Architecture, London. http://www.katarxis3.com

Mitchell, W. J. (2001). Roll over euclid: how Frank Gehry designs and builds. Guggenheim Museum Publications.

Murphy, G.L. (2002). The big book of concepts. MIT Press.

Muschamp, H. (2000, May 26). When Ideas Took Shape and Soared. New York Time. http://www.nytimes.com

Oxman, R. (2004). Think-maps: teaching design thinking in design education. Design Studies, 2(5), 63-91. https://doi.org/10.1016/S0142-694X(03)00033-4

Oxman, R. (2005). Theory and design in the first digital age. Design Studies, 27 (3): 229-265.

Picon, A. (2010). Digital culture in architecture. Birkhäuser.

Ritzer, G. (1993). The McDonaldization of society: an investigation into the changing character of contemporary social life. Pine Forge Press,

Schulman E. (1999). Can fame be measured quantitatively? Annals of Improbable Research, 5(3), 16-17.

Simkin, M.V. & Roychowdhury, V.P. (2013). A mathematical theory of fame. Journal of Statistical Physics, 151(1-2), 319-328. https://doi.org/10.1007/s10955-012-0677-5

Simkin, M. V., & Roychowdhury, V. P. (2015). Chess players' fame versus their merit. Applied Economics Letters, 22(18), 1499–1504. https://doi:10.1080/13504851.2015.1042135

Tamari, T. (2019). Star architects, urban spectacles, and global brands: exploring the case of the Tokyo olympics 2020. International Journal of Japanese Sociology, 28(1), 45–63. https://doi:10.1111/ijjs.12099

Toffler, A. (1980). The third wave, William Morrow And Company.

Venturi, R. (1966). Complexity and contradiction in architecture. New York, Museum of Modern Art.

Wigley, M. & Johnson, P. (1988). Deconstructivist architecture. The Museum of Modern Art.

Wigley, M. (1989). The Translation of Architecture, the Production of Babel. Assemblage, (8), 7-21

Yücesoy, B., & Barabási, A.L. (2016). Untangling performance from success. EPJ Data Science, 5(1). https://doi:10.1140/epjds/s13688-016-0079-z

Resume

Dilek Yasar holds a master's degree from Department of Architecture, Faculty of Engineering and Architecture, Beykent University in 2012 and a PhD degree from the same university in 2021. She acts as the instructor and coordinator of the interior architecture project courses at Istanbul Aydın University since 2016. She is also the co-head of the interior architecture department. Her research interests include universal design, architectural design and interior architecture, and she published scientific studies on her areas of interest.

Dr. Gür, a graduate of the University of Pennsylvania (GSAS-PhD, 1978), received a Fulbright Scholarship (1972-77) and a grant from the DAAD (2002; 2008). She served at KTU (1971-2009). In 1989, she was promoted to a professorship. Currently, she teaches at Beykent University in Istanbul. She is an active member of CICA (International Committee of Architectural Critics), WA (World Architecture), and the Chamber of Architects, and an intermittent member of IAPS, DRS, CIB W84, and IAHS. She is an honorary member of BTI (Bund Türkischer Ingenieure und Akademiker e. V) and SEA (The Sustainable Environment Association). She also serves as a reviewer of SRE, e-Books, JADE, JAAP, MEGARON, A/Z, Gazi, Uludağ, Trakya, Tasarım+Kuram. She is the author and co-author of 28 books and over 400 articles. She mentored over 100 academics. She is married and has two children.

DOI: 10.15320/ICONARP.2022.208

Research Article

ICONARP
International Journal of Architecture and Planning
Received: 22.12.2021 Accepted: 24.10.2022
Volume 10, Issue 2/ Published: 20.12.2022
DOI: 10.15320/ICONARP.2022.209 E- ISSN:2147-9380

ICONARP

Objective Exploration of the Effects of Architectural Components on Users' Spatial Evaluation: A Neuroimaging Approach

Navid Khaleghimoghaddam*

Abstract

A review of the studies that have been conducted in the field of architectural evaluation reveals that there is insufficient evidence on objective understanding of how architectural components psychologically affect users. This study draws on advances in neuroscience and aims to objectively examine the neurological process of spatial evaluation to create a pleasant environment for users. Research has used quantitative and experimental methods such as surveys and functional magnetic resonance imaging (fMRI). To observe the brain's neural responses and to understand how it works when users evaluate architectural spaces, 36 participants' brains were scanned with an MRI scanner. In addition, 250 volunteers were asked to participate in a survey experiment to determine the contribution of each sensational and perceptional component to the users' spatial evaluation. The results showed that the spatial experience of architecture is involved in the brain's regional, emotional, perceptual, beauty judgment, and evaluation system. Also, the results revealed that pleasant spaces contribute much better to architectural design than unpleasant spaces due to higher attention and memory effects. Furthermore, the results showed that the texture and geometry have a greater ability to produce a pleasant and unpleasant sensation and perception. The high number of patients referred to the radiology polyclinic during the week posed serious problems for the researcher in renting an fMRI scanner and performing the imaging. It is expected that incorporating neuroscience findings into an architectural experience in the form of data can create new perspectives and solutions for qualified architectural design that addresses users' psychological responses and considers their environmental behavior and satisfaction.

Keywords:
Objective spatial evaluation, architectural components, functional magnetic resonance imaging, users' brain

*Department of Interior Architecture, Faculty of Engineering and Architecture, Konya Food and Agriculture University, Konya, Turkey
Email: navid.khaleghi1363@gmail.com

To cite this article: Khaleghimoghaddam, N. (2022). Objective Exploration of the Effects of Architectural Components on Users' Spatial Evaluation: A Neuroimaging Approach. *ICONARP International Journal of Architecture and Planning,* 10 (2), 428-443. DOI: 10.15320/ICONARP.2022.209

INTRODUCTION

Nowadays, with the increasing development of technology, the image of the city and architecture are constantly changing. In such a situation, it is more necessary than ever to pay attention to the importance of quality in architectural design and its impact on human perception and emotion. Therefore, to create a pleasant environment, the relationship between people's emotional-perceptual states and the constituent components of the built environment must be fundamentally determined. Many researchers over the past decades have studied the evaluation of architecture and its emotional-perceptual experience to understand and explain how an architectural experience affects people's psyche, preferences, behavior, and quality of life. A variety of methods and approaches have been used in this regard. For example, Pallasmaa (2012) introduced some attributes such as multisensory experience, material poetics, and fragility to create an experience based on human emotions and perceptions. Steven Holl *et al*. (2007) described stimulating perceptions and argued that architecture could be considered a series of partial experiences that correspond to the perceptual and emotional phenomena of the senses, such that dimensions such as color, light, proportion, geometry, material, etc., influence perception and emotion. Concerning the emotional-perceptual evaluation of the environment, Mehrabian and Russell have proposed the ''arousal-pleasure'' model, and Russell (2003) has mentioned the concept of affect and emotional evaluation as a ''core affect'' that provides a theoretical framework for studying the role of physical environmental qualities in people's emotions. Accordingly, in studies conducted by Bowera *et al.* (2019) and Bakker *et al.* (2014), they aimed to determine dialing the sensory inputs evoked by physical attributes with emotional and perceptual processes. In other studies, Abdollahi (2021), Iraji and Zolfagharzadeh (2020), Barati and Soleymannejad (2011), and Ryu and Jang (2008) provided an overview of various effective elements such as light, color, and largeness in architectural space that arouse users' emotions. In their studies, Maroofi *et al.* (2019) and Teh *et al.* (2018) considered proportion and volume components and Shemesh *et al.* (2017) considered geometry as physical stimuli; Elbaiuomy *et al.* (2019), Gogoi (2017), Eun Cho and Kim (2017), and Radberg and Steffner (2003), regarded material and texture; and Ma *et al.* (2018) considered sound as sensory stimuli that appeal to people's emotional-perceptual responses. From the evaluation of these studies, it can be deduced that the process of the emotional-perceptual experience of architecture includes integral steps such as sensation and perception. The step of sensation is physiologically processed by the five senses (vision, touch, auditory, olfaction, gustation), transmitting the collected environmental information to the brain. In the perception phase, the brain selects and organizes specific information to add meaning to them (Pakzad & Bozorg, 2012). Zaredar (2015) showed that the perception of the senses in architecture explains how they function and influence each

DOI: 10.15320/ICONARP.2022.209

other and the differences between them. She considers all the senses in the context of architecture because they consciously or spontaneously influence the perception of space and make it a place that remembers with five senses. The study of Reghukumar (2019) has shown that the five senses give meaning to architectural spaces and increase human spatial behavior and efficiency.

In general, whatever could be taken from reviewing the studies mentioned above and other endeavors (Bowera *et al.,* 2019; Bakker *et al.,* 2014; Barati & Soleymannejad, 2011; Ryu & Jang, 2008; Vogles, 2008; Bigne *et al.,* 2005; Ellsworth & Scherer, 2003; Galindo & Rodriguez, 2000), it can be inferred that studies conducted in the field of architectural perception or affective assessment have been subjectively evaluated. Indeed, the results of the cases reviewed show that affective qualities, through perceptions and sensations evoked by features of a space, constitute a subjective experience that leads to reactions or behavior. It is time to investigate how the perceptual process is objectively influenced by architectural components. For this purpose, it is necessary to examine the cortical behavior of the brain as an organ responsible for organizing the perceptual process. Based on recent achievements in neuroscience, some studies have shown that a perceptual appraisal of architecture activates brain regions associated with visual perception (Djebbara *et al.,* 2019; Zhang *et al.,* 2019: Choo *et al.,* 2017; Lowe *et al.,* 2017), rewarding system (Barker *et al.,* 2019; Vartanian *et al.,* 2015: Kirk *et al.,* 2009), and esthetic judgments (Coburn *et al.,* 2017; Vartanian et al., 2015). This means that neuroscientific approaches offer designers and architects the opportunity to objectively observe the physiological and cognitive processes of the brain and see how spatial features of an architectural environment influence the brain's perceptual mechanism (Paiva, 2018; Papale *et al.,* 2016; Wiesmann & Ishai, 2011; Eberhard, 2009). For instance, Djebbara *et al.* (2022) used a neuroscientific method to monitor environmental characteristics and sensorimotor responses in the brain and body. They demonstrated how the built environment fundamentally contributes to the neurodynamic and behavior of individuals. Gregorians *et al.* (2022) developed a novel dataset of videos of trajectories through built environments and used it to explore the connections between emotions and the psychological dimensions of architectural experience. They proposed that parameters central to spatial mapping and navigation (spatial complexity) are embedded in the affective and aesthetic processing of built environments. Bowera *et al.* (2019) have shown that brain and body activity can occur in response to design features without conscious perception. Thus, knowledge and measurability of these effects could lead to a new standard for evaluating built environments. Gepshtein and Snider (2019) believe that neuroscientific methods have evolved to a degree of sophistication that allows researchers to test hypotheses about perception and action in realistically complex environments. Therefore, we can methodologically apply neurological

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

techniques such as fMRI, EEG, PET, or MEG to objectively investigate the neurophysiological impacts of architecture on the individual's emotion and perception.

The present study, based on the experimental approaches of neuroscience and cognitive psychology, aims to objectively investigate the effects of architectural components on the emotional-perceptual experience of users. To this end, two questions will be answered: 1) Is there a relationship between the emotional-perceptual experience of architecture and the regional response of the brain? 2) To what extent do the sensory and perceptual components of architecture contribute to such an experience? Then, to answer these questions, two experiments were conducted. Firstly, to objectify the effects of architecture on brain emotional-perceptual and sensorimotor functions, the most effective method of cognitive methods such as functional magnetic resonance imaging (fMRI) technique was applied when users experience architectural spaces. In this context, users were shown the images of four different architectural spaces (office, polyclinic, educational institution, and traditional space) as stimuli. Secondly, to measure the contribution of each sensory and perceptual component, a survey including questions about sensory and physical factors was distributed to the users. The questioning test was indeed an approach to support and strengthen the neuroimaging results regarding the recognition of brain areas involved in emotions since functional brain imaging does not provide data on the contribution of architectural components. Ultimately, the results of the neuroimaging and survey experiments were compared.

METHODOLOGY

EXPERIMENT 1

This experiment aims to identify the regional activations of the brain during an architectural experience. In this context, architectural features are expected to engage brain areas involved in emotion and perception.

Participants

36 volunteers (18 males, mean age = 25.3 ± 4.7 & 18 females, mean age = 31.7 ± 3.2) participated in the brain imaging process. All the participants had normal color vision and were informed about the experimental procedure in detail.

Materials

In this experiment, participants were shown pictures of four different architectural buildings to image and observe the brain's emotional-perceptual response to architectural environments. In a previous test, 280 colored images representing the outdoor and indoor spaces of four office, polyclinic, educational institution, and traditional buildings were rated as pleasant and unpleasant spaces by 280 participants based on the emotional rating model of pleasure-arousal proposed by Mehrabian

DOI: 10.15320/ICONARP.2022.209

and Russell (1974). Accordingly, 40 most rated pictures were divided into two groups of 20 pleasant/positive spaces (10 pcs of traditional buildings & 10 pcs of office buildings) and 20 unpleasant/negative spaces (10 pcs of polyclinic & 10 pcs of educational buildings) and were shown to the participants in the MRI scanner separately. As an experimental paradigm, pictures of each file were adapted into three blocks: rest time slides, pleasant or unpleasant slides, and neutral slides. Firstly, the anatomical imaging (TR: 2400ms, TE: 3.54ms, FOV: 240mm) was acquired for 4 min & 42 sec. Then, for 4 min and 14 sec, the functional imaging of the brain (TR: 4000ms, TE: 50ms, FOV: 220 mm) started (Fig. 1).

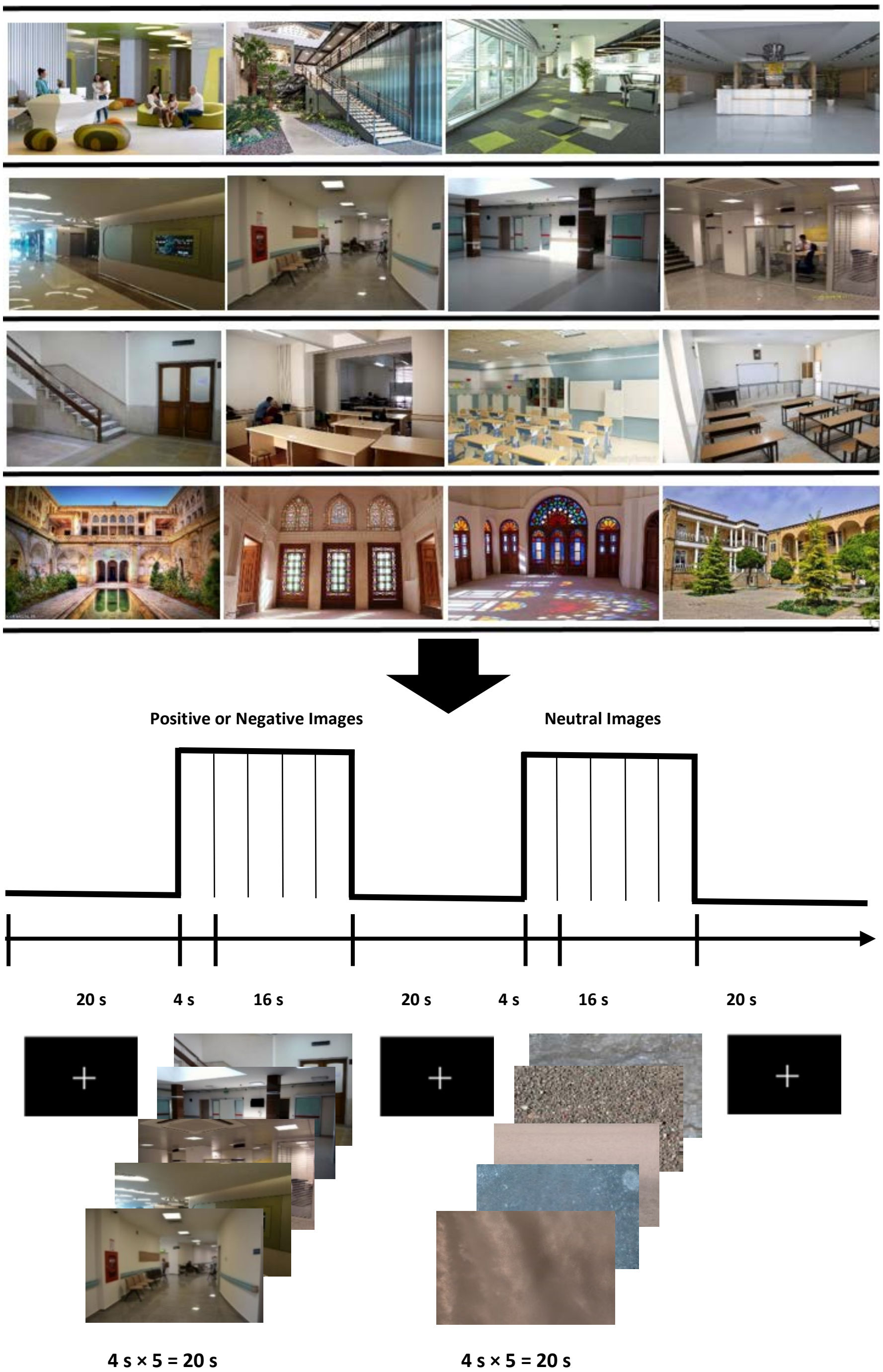


Figure 1. An example of experimental procedure involving different architectural stimuli used at the study (Provided by the Author, 2022).

fMRI analysis

Imaging data were preprocessed using SPM12 implemented in MATLAB 2018 with the Data Processing and Analysis of Brain Imaging extension software. A combination of voxel-level and cluster-size correction was used to control false positives. A t-statistical test was applied to evaluate the mean difference in signal intensity. A significance level of P values < 0.05 was considered for statistical correlation. The extent of activation in each area was calculated as the number of active voxels (determined by the t test).

EXPERIMENT 2

Since determining the regional activation of the brain does not provide a way to measure the contribution of each architectural components to the spatial evaluation, Experiment 2 aims to measure the contribution of each sensory and perceptual components to the users' architectural experience by means of a survey.

Participants

250 participants (125 men and 125 women) voluntarily completed the surveys. Ages ranged from 22 to 42 years old. Participants were informed about how to complete the survey. The questionnaires were answered in groups of 4 or 5. The time spent completing each survey ranged from 25 to 30 minutes.

Materials

Regarding assessing the impact of spatial components on architectural experience, the previous studies (Stokolos & Altman, 1987; Cohen & Areni, 1991; Cacioppo *et al.,* 2001; Radberg & Steffner, 2003; Eun Cho & Kim, 2017) have introduced color, light, texture (touch), sound, and odor as sensory measurements. In addition, they have introduced largeness, height, width, depth, geometry, order, proportion, and rhythm as perceptual measures (physical factors). Accordingly, the survey questions in this experiment were divided into a sensation part and a perception part. The questions in the sensation part included pleasant and unpleasant images of spaces, which were rated based on sensory components such as color, light, texture (touch), sound, and odor. The questions in the perceptual part included pleasant and unpleasant images of spaces evaluated by physical components such as size, height, width, depth, geometry, order, proportion, and rhythm. All images used in this experiment were the same as those used for brain imaging in Experiment 1 (Fig. 1; 15 images representing pleasant spaces and 15 images representing unpleasant spaces. While viewing the images, participants answered questions (Pleasant space: Rate the following criteria that lead to the following spaces being perceived as pleasant by giving the highest score; Unpleasant spaces: Rate the following criteria that lead to the following spaces being perceived as unpleasant by giving the highest score) on a five-point scale from '1, meagerly' to '5, extremely'.

DOI: 10.15320/ICONARP.2022.209

Data analysis

Data analysis was performed with SPSS 20 using the t test for independent samples. The variables used for the t-test were p-value and sig. (2-tailed). The 'confidence level' of the test is reported as 95% and the magnitude of the p-value.

RESULTS

Figures 2 and 3 show the more activated brain areas when participants saw pleasant and unpleasant spaces. The corresponding brain imaging figures represent the midsagittal slice, coronal slice, and horizontal slice. As a result of the fMRI analysis regarding pleasant spaces (office buildings and traditional buildings), a total of 31312 active voxels were detected in 38 clusters. Accordingly, the most significant regional activations were identified in cluster 14 (T=6.37, p= 0.000 < 0.05, x=28, y=62, z=-11, K=27908). In this context, areas such as the occipital lobe, temporal lobe, parietal lobe, cuneus, precuneus, frontal lobe, fusiform, middle occipital lobe, parahippocampal, middle temporal lobe, superior temporal lobe, middle frontal lobe, and superior frontal lobe were activated (see Figure 2 and Table 1).

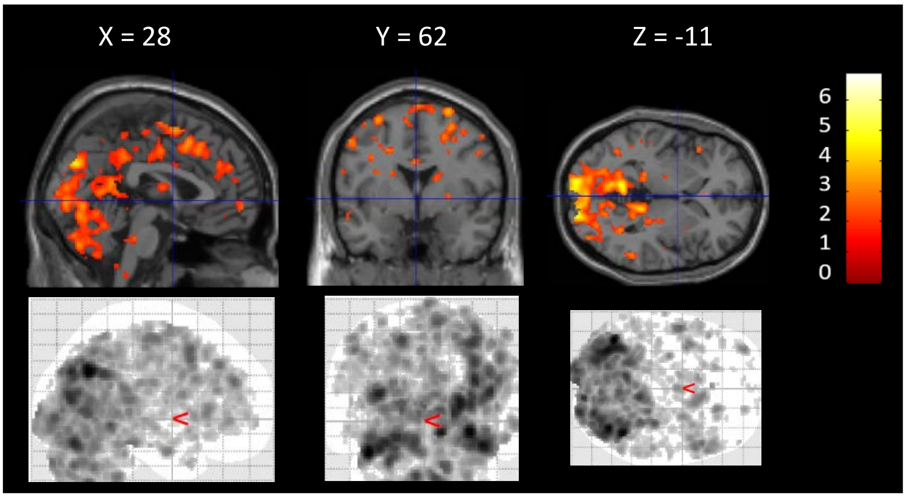


Figure 2. The main areas activated in experiencing pleasant architectural spaces (Provided by the Author, 2022).

Table 1: Activated brain areas when experiencing pleasant spaces. The activations are *p-FWE*-uncorrected at the voxel and cluster level (p<0.05).

Cluster	Total Voxels Number	Brain Area	KE	Peak MNI Coordinate X Y Z	t	p
14	*27908*	Occipital Lobe	7122	28 62 -11	6.37	0.000
		Temporal Lobe	3411			
		Parietal Lobe	3029			
		Cuneus	2147			
		Precuneus	2002			
		Frontal Lobe	1639			
		Fusiform	1010			
		Middle Occipital	856			
		Parahippocampal	811			
		Middle Temporal	699			
		Superior Temporal	648			
		Middle Frontal	182			
		Superior Frontal	130			

As for the results of the survey, a descriptive statistical analysis, the arithmetic mean, and the standard deviation of the distribution of the users' measurement data about pleasant spaces were studied. Accordingly, the individual measurement data were determined as follows: Light 22.63/3.21±4.11, Texture 25.33/4.24±4.26, Color 23.13/3.41±4.16, Sound 14.13/3.01±5.89 and Odor 11.81/2.16±3.66. It was found that the measurement of texture (touch) has the highest score and is considered the most effective sensory factor to perceive the spaces in question as pleasant. The measurement of odor has the lowest score in this regard. Likewise, the scores for color and light are also close to each other.

Table 2: Users sensation measurement data related to pleasant spaces

Sub-Component	Mean ($\overline{X}$)		SD
Light	22.63	3.21	4.11
Texture (Touch)	25.33	4.24	4.26
Color	23.13	3.41	4.16
Sound	14.13	3.01	5.89
Odor	11.81	2.16	3.66

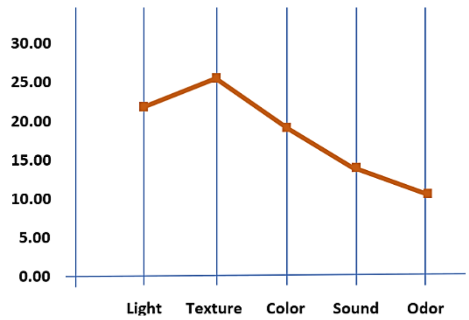


Diagram 1: Sensation measurement data of participants in relation to pleasant spaces (Provided by the Author, 2022).

Analysis of user perception data related to pleasant spaces revealed that geometry (25.41/3.23±4.64) was the most effective physical factor for the pleasantness of the spaces in question.

Table 3. Users perception measurement data related to pleasant spaces

Sub-Component	Mean ($\overline{X}$)		SD
Proportion	22.17	3.71	4.22
Order	23.36	3.26	5.16
Rhythm	20.26	3.15	5.61
Geometry	25.11	3.23	4.64
Width	21.41	3.33	4.29
Height	20.83	3.14	4.33
Depth	19.28	3.01	4.10
Largeness	21.81	3.66	4.28

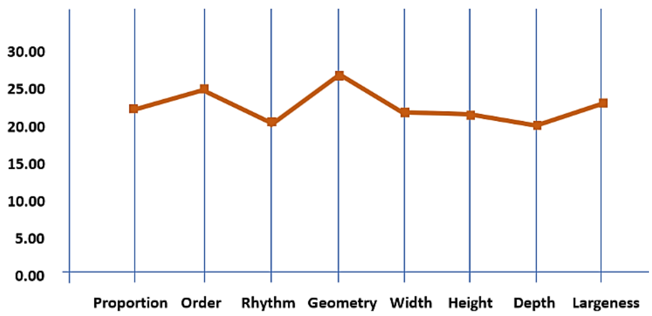


Diagram 2: Measurement data on users' perception of pleasant spaces (Provided by the Author, 2022).

DOI: 10.15320/ICONARP.2022.209

For the experience of unpleasant architectural spaces, a total of 22643 active voxels were detected in 50 different clusters. In this context, in cluster 8 (T=5.15, p= 0.000 < 0.05, x=44, y=-52, z=-31, K=14178) the activation of brain areas such as the occipital lobe, temporal lobe, parietal lobe, cuneus, fusiform, left fusiform, parahippocampal, middle occipital lobe, precuneus, middle temporal lobe, frontal lobe, cingulate, and left precuneus was detected (Figure 3 and Table 4).

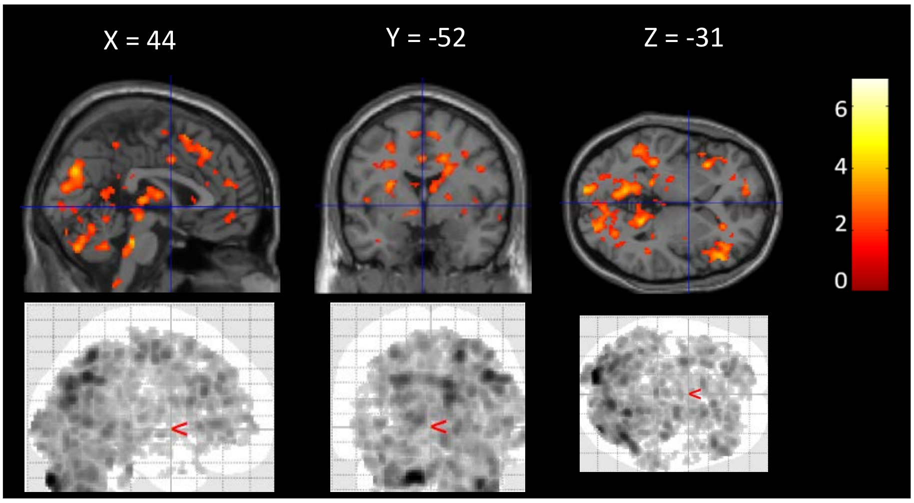


Figure 3. The main areas activated in experiencing unpleasant architectural spaces (Provided by the Author, 2022).

Table 4: Activated brain areas for participants when experiencing unpleasant spaces. The activations are *p-FWE*-uncorrected at the voxel level and cluster level (p<0.05).

Cluster	Total Voxels Number	Brain Area	KE	Peak MNI Coordinate X Y Z	t	p
8	***14178***	Occipital Lobe	3232	44 -52 -31	5.15	0.000
		Temporal Lobe	1614			
		Parietal Lobe	1147			
		Cuneus	1004			
		Fusiform	869			
		Left Fusiform	733			
		Parahippocampal	511			
		Middle Occipital	455			
		Precuneus	412			
		Middle Temporal	369			
		Frontal Lobe	337			
		Cingulate	121			
		Left Precuneus	78			

Descriptive statistical analysis of sensations measured by users in relation to unpleasant spaces showed that texture (touch) measurement (34.58/4.64±4.16) was the most effective sensory factor in eliciting unpleasant feelings.

Table 5: Data measuring participants' perceptions of uncomfortable spaces

Sub-Component	Mean ($\bar{X}$)		SD
Light	24.13	3.11	3.91
Texture (Touch)	34.58	4.64	4.16
Color	30.03	3.81	4.66
Sound	8.13	3.11	5.29
Odor	2.81	3.16	3.06

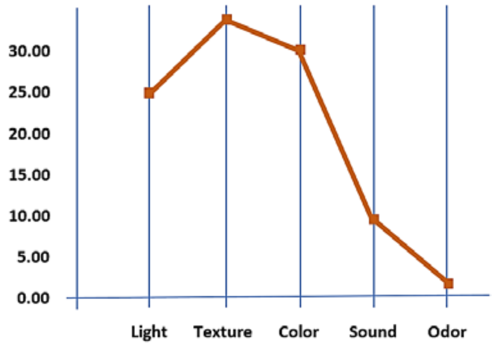


Diagram 3: Users sensation measurement data in related to unpleasant spaces (Provided by the Author, 2022).

Data on users' perceptual measures of unpleasant spaces showed that geometry (34.04/3.13±4.11) and proportion (32.17/3.21±4.61) were the most important physical factors that made the spaces in question unpleasant.

Table 6: Users perception measurement data related to unpleasant spaces

Sub-Component	Mean ($\bar{X}$)	SD
Proportion	32.17 3.21	4.61
Order	21.36 3.22	4.36
Rhythm	24.21 3.65	5.01
Geometry	34.04 3.13	4.11
Width	27.01 3.73	4.19
Height	28.85 4.14	5.03
Depth	29.12 3.21	4.00
Rhythm	22.26 4.15	3.41
Largeness	28.81 3.56	4.18

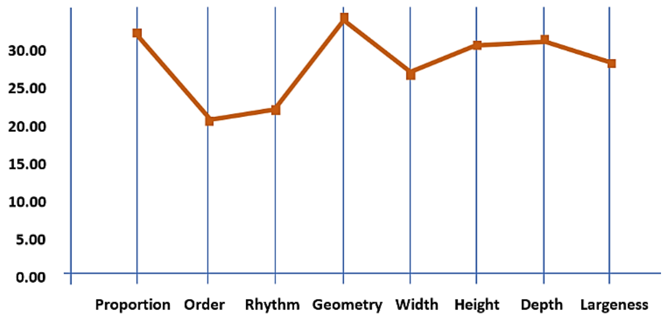


Diagram 4: Users perception measurement data in related to unpleasant spaces (Provided by the Author, 2022).

DISCUSSION

This study was conducted to observe the effects of architectural components on the perceptual processing of users' brains when encountering architectural spaces. Regarding the first research question of the study, the results showed the relationship between the emotional-perceptual experience of architecture and the regional response of the brain. In this regard, for both pleasant and unpleasant spaces, the results showed significant activation in the occipital lobe, temporal lobe, middle temporal lobe, and parietal lobe, which are involved in visual perception (form, color, and recognition of objects) and spatial perception (height, depth, geometry). In this case, Zhang *et al.* (2019) have demonstrated that experiencing architectural parameters is associated with activation of the occipital lobe (responding to perceptual information about architecture).

DOI: 10.15320/ICONARP.2022.209

Furthermore, it has been shown that brain activations associated with the perception of height, depth, geometry, and shape have been shown to be associated with the occipital, parietal, and temporal lobes (Arellano, 2015; Mallgrave, 2011; Costa *et al.,* 2010). Results also showed greater activation of the precuneus, middle occipital, and frontal lobes, which are involved in esthetic evaluation, reward, and beauty judgments (Zhang *et al.,* 2019; Vartanian *et al.,* 2013). Parahippocampal activity may support the findings of the Vartanian *et al.* (2015) study that the parahippocampus responds selectively to spaces and is involved in scene perception, perceived seclusion, and beauty judgments of spaces. In addition, greater activation was detected in the cuneus and fusiform area. According to previous studies, activation of the fusiform area is consistent with its role in neural representation of architectural styles and object recognition (Choo *et al.,* 2017), and activation of the cuneus is related to appreciation of representational materials (Mizokami *et al.,* 2014). Based on the fMRI results of this study, pleasant spaces were also found to increase activation in the middle and superior frontal areas. Consistent with recent studies (Zhang *et al.,* 2019; Vartanian *et al.,* 2013), activation of these areas is related to the brain mechanism for pleasantness, esthetic judgment, and approach behavior. Therefore, this may support the role of pleasant spaces in arousing approach decisions. Moreover, regarding unpleasant spaces, activation was detected in the cingulate area. In this regard, previous studies have claimed that the activation of the cingulate cortex is associated with avoidance behavior (Zhang *et l.,* 2019; Vartanian *et al.,* 2015; Vartanian *et al.,* 2013; Barrett & Wager, 2006). It means that unpleasant spaces may elicit the avoidance decision.

It means that unpleasant spaces may evoke the avoidance decision. As shown, significant brain activations were detected in relation to the emotional-perceptual evaluation of architectural spaces. Pleasant spaces were exclusively associated with strong activations, and the highest value of voxels was found (31312) compared to unpleasant spaces (22643). Such a difference provides evidence that pleasant spaces elicit emotions to a greater extent than unpleasant spaces when spatial and architectural qualities are used, so that brain areas concerned with emotions and perception respond more effectively and strongly to pleasant spaces than to unpleasant ones. These results show that areas associated with pleasantness and reward processing are involved in preferences involving good (pleasant) or bad (unpleasant) designs. In other words, due to greatly increased activity in visual areas of the occipital lobe (v=7122), in areas of visuospatial perception (form, color, and recognition of objects) of the temporal lobe (v=3411), in areas of spatial orientation, touch, and perception (motion, depth, height, width, geometry) of the parietal lobe (v=3029), appreciation of materials areas of the cuneus (v=2147), esthetic evaluation areas of the precuneus (v=2002), beauty judgment areas of the frontal lobe (v=1639), representation of architectural styles areas of the fusiform (1010), esthetic and beauty judgments areas of the middle occipital (v=856), architectural experience of large spaces and landscapes areas of the parahippocampal (v=811), and perception of movement in architectural space areas of the middle temporal lobe (v=699) related to pleasant spaces rather than the same areas for unpleasant spaces [occipital lobe (v=3232), temporal lobe (v=1614), parietal lobe (v=1147), cuneus (v=1004), precuneus (412), frontal lobe (v=337), fusiform (v=869), middle occipital lobe (v=455), parahippocampal (v=511), middle temporal lobe (v=369)], it is hypothesized that positive spaces in terms of providing architectural qualities may attract more attention to design. Regarding the second question of the study, it was concluded that the sub-component of "texture" had the highest score; and the "odor" had the lowest score from the users' point of view. The results have been quite similar in two rerspects, both for pleasant spaces (texture; M=4.24; odor; M=2.16) and for unpleasant spaces (texture; M=4.64; odor; M=3.16). Therefore, the texture sub-component was the most effective item in creating a pleasant or unpleasant feeling for a space, and the odor sub-component was the least effective item. A more refined examination of the numerical results of the sensation component in the users' emotional-perceptual experience in both pleasant and unpleasant conditions shows that the 'odor' and 'sound' subcomponents differ significantly from the other items. It can be suggested that the four subcomponents of 'texture', 'material', 'light' and 'color' are recognized as the most important subcomponents of the emotional perceptual experience of spaces and are different from the subcomponents of 'odor' and 'sound'.

Given the direct relationship of the four main subcomponents of the sensation component of the emotional-perceptual experience of space (texture, materials, light, and color) to the senses of 'vision' and 'touch,' the primary role of these senses in producing a pleasant or unpleasant feeling of space is emphasized. In this respect, the results obtained are consistent with an important part of postmodern theorists and architects such as Johannes Pallasma, Peter Zumthor and Steven Hall, who emphasize the visually oriented and multisensory architectural experience. These views emphasize that the architectural work is not experienced as a series of isolated visual images, but rather offers a specific experience of the surrounding world within the framework of a body-oriented approach that takes into account the senses of the body - the physical and the tactile. Thus, along with the tactual components such as touch and material, visual components such as light and color also ensure that a space is perceived as pleasant or unpleasant. Based on the data analysis of the perception component in the survey experiment, the results showed a trivial difference between the subcomponents (the highest score of M=3.23 for geometry and the lowest score of M=3.01 for depth) for pleasant spaces and the highest score of M=3.13 (for geometry) and the lowest score of M=3.22 (for order) for unpleasant spaces. The expressions of the other components in the pleasant and

DOI: 10.15320/ICONARP.2022.209

unpleasant conditions were different. This shows that in contrast to the 'sensation components', which were similarly expressed under both pleasant and unpleasant conditions, the 'perception components' were different. This suggests that the perceptual subcomponents vary greatly depending on the characteristics of the user. Numerical analysis of the perceptual data showed that the 'largeness' and 'depth' subcomponents had the least influence on the pleasant feeling. In other words, the sense of pleasantness of a space may not depend significantly on its depth or size. Other data also suggest that the unpleasant feeling of a space does not depend significantly on its size or height. The importance of the three subcomponents of geometry, order, and proportion to the pleasurable perception of space underscores the impact of ''formal properties,'' ''mathematical relationships of physical elements,'' and ''visual clutter rate'' on the architectural experience of users.

CONCLUSION

The emotional-perceptual experience of space is one of the most important factors in evaluating the relationship between the individual and the environment in creating qualified environments. In this study, as a result of neurological and quantitative experiments on the evaluation of the emotional-perceptual experience of architecture through the involvement of brain regions, the hypothesis was supported that the perceptual and emotional evaluation of an architectural space depends on the specific neural areas that are active when people see or experience pleasant (positive) or unpleasant (negative) scenes. Moreover, the corresponding results support the cognitive basis of the experience of amenity on the neuroscience underlying users' perception and appreciation of architecture. In this context, the neural responses indicated that the emotional-perceptual experience of a space is specifically associated with the activation of brain areas responsible for emotion and perception, architectural experience, approach/avoidance decisions, and beauty judgments. As a contribution to future studies, it is worth mentioning that the results of this study objectively show why users prefer spaces and which components of an architectural environment increase user satisfaction. The methodological approach of the current study could potentially improve the reliability and validity of determining specific brain areas involved in positive and negative emotions when experiencing an architectural space. Also, it is anticipated that future neuroimaging studies will add to the current findings, but the patterns identified in this study are important components of the emotional-perceptual experience of architecture.

ACKNOWLEDGEMENTS/NOTES

I offer my endless gratitude to all voluntarily participants who supported me in conducting surveys and functional magnetic resonance imaging experiments. I believe that without their participation, this study would be impossible.

REFERENCES

Abdollahi, R. (2021). Design of lighting system for sacred places with the approach of improving technical and economic conditions, *Ain Shams Engineering Journal, 12(33),* 2899-2905.

Arellano, M. R. (2015). Hawaiian Healing Center: A Weaving of Neuro-Architecture and Cultural Practices, Ph.D Thesis. University of Hawaii.

Bakker, I., van der Voordt, T., Vink, P. & de Boon, J. (2014). Pleasure, Arousal, Dominance: Mehrabian and Russell revisited, *Journal of Current Psychology, 33(3),* 405-421.

Barati, N. & Soleymannejad, M. (2011). Perception of Stimuli in Controlled Environment and Gender Impact on It. Case Study: Faculty of Architecture and Urbanism Students at the International University of Imam Khomeini, *Journal of Bagh-e Nazar, 8(17),* 19-30.

Barker, T. V., Buzzell, G. A. & Fox, N. A. (2019). Approach, Avoidance, and the Detection of Conflict in the Development of Behavioral Inhibition, *New Ideas in Psychology, 53*, 2-12.

Barrett, L. F. & Wager, T. D. (2006). The Structure of Emotion; Evidence from Neuroimaging Studies. *Journal of Current Directions in Psychological Science*, *15(2),* 79-83.

Bigne, J. E., Andreu, L. & Gnoth, J. (2005). The theme park experience: An analysis of pleasure, arousal, and satisfaction. *Journal of Tourism Management, 26*(6), 833-844.

Bowera, I., Tuckera, R. & Enticott, P. G. (2019). Impact of built environment design on emotion measured via neurophysiological correlates and subjective indicators: A systematic review, *Journal of Environmental Psychology, 66*, 1-11.

Cacioppo, J.T., Berntson, G.G., Larsen, J.T., Poehlmann, K.M. & Ito, T.A. (2001). The psychophysiology of emotion. In M. Lewis & J.M. Haviland-Jones (Eds.), *Handbook of Emotions* (2st ed., pp. 173-191), The Guilford Press, New York.

Choo, H., Nasar, J. L., Nikrahei, B. & Walther, D. B. (2017). Neural codes of seeing architectural styles, *Scientific Reports*, *7*, 40201.

Coburn, A., Vartanian, O. & Chatterjee, A. (2017). Buildings, Beauty, and the Brain: A Neuroscience of Architectural Experience, *Journal of Cognitive Neuroscience, 29(9), 1521-1531.*

Cohen, J. B. and Areni, C. S. (1991). Affect and consumer behavior. In T. S. Robertson & H. H. Kassarjian (Eds.), *Handbook of consumer theory and research* (pp. 188-240). Englewood Cliffs, NJ: Prentice-Hall.

Costa, V. D., Lang, P. J., Sabatinelli, D., Versace, F. & Bradley, M. M. (2010). Emotional Imagery: Assessing Pleasure and Arousal in the Brain's Reward Circuitry, *Human Brain Mapping*, *31*, 1446–1457.

Djebbara, Z., Fich, L.B., Petrini, L. & Gramann, K. (2019). Sensorimotor brain dynamics reflect architectural affordances, *PNAS*, *116(29),* 14769–14778.

Djebbara, Z., Jensen, O.B., Parada, F.J. & Gramann, K. (2022). Neuroscience and architecture: Modulating behavior through sensorimotor responses to the built environment, *Neuroscience & Biobehavioral Reviews*, *138(104715),* 2-13.

Eberhard, J. P. (2009). Applying Neuroscience to Architecture, *Neuron*, *62(6),* 753-756.

Elbaiuomy, E., Hegazy, I. & Sheta, S. (2019). The impact of architectural spaces' geometric forms and construction materials on the users' brainwaves and consciousness status, *International Journal of Low-Carbon Technologies*, *14(3),* 326–334.

DOI: 10.15320/ICONARP.2022.209

Ellsworth, P.C. & Scherer, K.R. (2003). Appraisal processes in emotion. In R.J. Davidson, K.R., Scherer, & H.H. Goldsmith (Eds.), Handbook of affective sciences, New York: Oxford University Press, 572-595.

Eun Cho, M. & Kim, M. J. (2017). Measurement of User Emotion and Experience in Interaction with Space, *Journal of Asian Architecture and Building Engineering*, *16 (1),* 99-106.

Gepshtein, S. & Snider, J. (2019). Neuroscience for architecture: The evolving science of perceptual meaning, *PNAS*, *116(29),* 14404–14406.

Galindo, M. P. G. & Rodriguez, J. A. C. (2000). Environmental aesthetics and psychological wellbeing: Relationships between preference judgements for urban landscapes and other relevant affective responses, *Psychology in Spain, 4(1),* 13–27.

Gogoi, B.J. (2017). Effect of store design on perceived crowding and impulse buying behavior, *International Review of Management and Marketing*, *7(2),* 180-186.

Gregorians, L., Velasco, P.F., Zisch, F. & Spiers, H.J. (2022). Architectural experience: Clarifying its central components and their relation to core affect with a set of first-person-view videos, *Journal of Environmental Psychology*, *82,* 1-20.

Holl, S., Pallasmaa, J. and Gomez, A. P. (2007). *Questions of Perception: Phenomenology of Architecture*. William Stout Publishers, San Francisco.

Iraji, A.A. & Zolfagharzadeh, H. (2020). Comparative study of Daylight Design in Safavid Mosque and Renaissance Church ase studies: Jame Abbasi Mosque in Isfahan and St. Peter Church in Rome, *Maremat & Me'mari-e Iran*, *10(21),* 77–89.

Kirk, U., Skov, M., Christensen, M. S. & Nygaard, N. (2009). Brain correlates of aesthetic expertise: A parametric fMRI study, *Brain and Cognition*, *69*, 306-315.

Lowe, M. X., Rajsic, J., Gallivan, J. P., Ferber, S. & Cant, J. S. (2017). Neural representation of geometry and surface properties in object and scene perception, *Neuroimage, 157*, 586–597.

Ma, K. W., Wong, H. M. & Mak, C. M. (2018). A systematic review of human perceptual dimensions of sound: Meta-analysis of semantic differential method applications to indoor and outdoor sounds, *Building and Environment*, *133*, 123–150.

Mallgrave, H. F. (2011). *The Architect's Brain: Neuroscience, Creativity, and Architecture*. Chichester: Wiley-Blackwell.

Maroofi, S., Taghvaie, A.A. & Pourjafar, M.R. (2019). Evaluation of the Effects of Religious Spaces on Citizen's Behaviors with Particular Reference to the Selected Tehran Mosques, *Naqshejahan- Basic studies and New Technologies of Architecture and Planning*, *8(4),* 205-211.

Mehrabian, A. & Russell, A. (1974). *An approach to environmental psychology*. Cambridge, Mass: MIT Press.

Mizokami, Y., Terao, T., Hatano, K., Hoaki, N., Kohno, K., Araki, Y. & Kochiyama, T. (2014). Difference in brain activations during appreciating paintings and photographic analogs, Frontiers in Human Neuroscience, *8(478),* 1-8.

Paiva, A. (2018). Neuroscience for Architecture: How Building Design Can Influence Behaviors and Performance, *Journal of Civil Engineering and Architecture*, *12*, 132-138.

Pakzad, J. and Bozorg, H. (2012). *Alefba-e-Mohit Baraye Tarahan*, Armanshahr, Tehran.

Pallasmaa, J. (Eds.). (2012). *The Eyes of the Skin, Architecture and the Senses* (3th Ed.). John Wiley and Sons Ltd, United Kingdom.

Papale, P., Chiesi, L., Rampinini, A. C., Pietrini, P. & Ricciardi, E. (2016). When Neuroscience "Touches" Architecture: From Hapticity to a Supramodal Functioning of the Human Brain, *Frontiers in Psychology*, *7(866),* 1-8.

Radberg, J. Steffner, L. (2003). Affective appraisals as indicators of aesthetic qualities in urban places, 1th Nordic symposium, Local Planning in Change, New Possibilities and Roles, 14-16 August 2019, pp. 14-16. Lillehammer.

Reghukumar, A. (2019). Sense and sensitivity in architecture-the use of five senses in space making, *International Research Journal of Architecture and Planning*, *4(3),* 97-101.

Russell, J. (2003). Core Affect and the Psychological Construction of Emotion, *Journal of Psychological Review*, *110(1),* 145-172.

Ryu, K. & Jang, S. C. (2008). Influence of restaurants' physical environments on emotion and behavioral intention, *The Service Industies Journal, 28(8),* 1151-1165.

Shemesh, A., Talmon, R., Karp, O., Amir, I., Bar, M. & Grobman, Y.J. (2017). Affective response to architecture – investigating human reaction to spaces with different geometry, *Architectural Science Review*, *60(2),* 116-125.

Stokolos, D. & Altman, I. (1987). *Handbook of environmental psychology*. Wiley, New York.

Teh, E.J., Yap, M.J. & Liow, S.J.R. (2018). PiSCES: Pictures with social context and emotional scenes with norms for emotional valence, intensity, and social engagement, *Behavior Research Methods*, *50(5),* 1793-1805.

Vartanian, O., Navarrete, G., Chatterjee, A., Fich, L. B., Leder, H., Modrono, C., Nadal, M., Rostrup, N. & Skov, M. (2013). Impact of contour on aesthetic judgments and approach-avoidance decisions in architecture, *Proceedings of the National Academy of Sciences*, *110*, 10446-10453.

Vartanian, O., Navarrete, G., Chatterjee, A., Fich, L. B., Gonzalez-Mora, J. L., Leder, H., Modrono, C., Nadal, M., Rostrup, N. & Skov, M. (2015). Architectural design and the brain: Effects of ceiling height and perceived enclosure on beauty judgments and approach-avoidance decisions, *Journal of Environmental Psychology*, *41*, 10-18.

Vogels, I. M. (2008). Atmosphere metrics. In J. H. Westerink, M. Ouwerkerk, T. J. Overbeek, W. F. Pasveer, B. F. de Ruyter (Eds.). *Probing experience: From assessment of user emotions and behaviour to development of products* (pp. 25-41). Dordrecht: Springer.

Wiesmann, M. & Ishai, A. (2011). Expertise reduces neural cost but does not modulate repetition suppression, *Cognitive Neuroscience*, *2(1),* 57-65.

Zaredar, A. (2015). Considering the five senses in architecture, *Curr World Environ*, *10(special issue),* 138-143.

Zhang, W., He, X., Liu, S., Li, T., Li, J., Tang, X. & Lai, S. (2019). Neural correlates of appreciating natural landscape and landscape garden: Evidence from an fMRI study, *Brain and behavior*, *9(7),* 1-10.

Resume

Navid Khaleghimoghaddam works on key topics in architecture and neuroscience with psychological and physiological approaches, such as the study of the brain's perceptual mechanism and emotional behavior, neuroarchitecture, cognitive and environmental psychology.

DOI: 10.15320/ICONARP.2022.209

Research Article

ICONARP
International Journal of Architecture and Planning
Received: 20.02.2022 Accepted: 04.10.2022
Volume 10, Issue 2/ Published: 20.12.2022
DOI: 10.15320 /ICONARP.2022.210 E- ISSN:2147-9380

ICONARP

Determining Female Housing Users' Housing Needs and Satisfaction Levels During the Pandemic

Özge İslamoğlu*

Abstract

This study hypothesizes that the COVID-19 pandemic has changed housing users' physical and psychosocial needs, and thus, their expectations of their residences. The study aims to determine what new needs housing users have and how satisfied they are with their residences. First, a literature search was conducted on residences and user needs and satisfaction. Second, surveys were conducted to identify the residential problems and needs of female users from Rize during the pandemic when people have been spending more time indoors since the preventive measures. The data were analyzed using the Statistical Package for Social Sciences and the results were expressed in figures and tables. The questionnaires were administered to female users, who are believed to be more responsible for household tasks than male users. Findings on users' residential use and satisfaction levels before and during the pandemic are presented in detail. In the last stage, the study made recommendations regarding the design of current residences and future ones based on the results. The survey results showed that participants had spent more time in their residences, used the rooms more often, performed different activities in the rooms, attached different meanings to their residences, and changed the norms regarding the use of the rooms since the pandemic. Depending on these changes, participants had new needs, made or considered making modifications, and encountered some problems during the process. The study aimed to develop design proposals for future residences by determining how the pandemic had affected current users and what new residential needs they had had since the pandemic began. In this study, the effects of this newly encountered process on residential spaces are revealed. In addition the results will contribute to the plans of new projects or existing residences.

Keywords:
COVID-19, housing design, female housing user, user satisfaction, user needs

*Faculty of Architecture, Karadeniz Technical University, Trabzon, Turkey.

Email: ozgesever@hotmail.com

To cite this article: İslamoğlu, Ö. (2022). Determining female housing users' housing needs and satisfaction levels during the pandemic. *ICONARP International Journal of Architecture and Planning,* 10 (2),444-464. DOI: 10.15320 /ICONARP.2022.210

INTRODUCTION

The novel coronavirus disease 2019 (COVID-19) that broke out in Wuhan, China, at the end of 2019 has been declared a pandemic by the World Health Organization. The pandemic has taken hold of the whole world and led to significant changes in behaviors, lifestyles, and habits. Almost all countries have taken several measures to prevent the spread of the virus, such as social distancing, quarantine, curfews, travel restrictions, flexibility in working hours, distance learning, working from home, etc. In other words, the pandemic has affected every sphere of life (healthcare, education, culture, economy, social life, etc.). It has also changed how we use our apartments/houses (residences) and even what meaning we attach to them. In other words, there has been a dramatic change in the physical reality and psychosocial meaning of our residences. We did not think much about what our residences meant to us in the hustle and bustle of everyday life before the pandemic. However, they have been places where we spend our whole lives since the onset of the pandemic. Before the pandemic, our residences were our private spaces. However, they have turned into workspaces and studies where we have ended up spending a large portion of the day since the pandemic began. In line with this, there have been significant changes in housing planning and indoor and outdoor relations. Users whose new residential needs are not met are more likely to be dissatisfied with their residences. This paradigm change has drawn researchers' attention to residential factors affecting users' everyday lives. There has been a growing body of research on residence use during the pandemic (Origoni & Origoni, 2020; Ak, 2020; Taşçı,2020; Yalçın, 2021; Soykan Berber, 2021; Ekenyazıcı Güney &Tulum, H. 2021; Turna&Usta, 2021; Tayanç; 2022; Adıgüzel Özbek& Melikoğlu Eke, 2022). Research on housing is critical because it gives us clues as to whether users are physically, socially, and psychologically satisfied with the way they live in their residences. The short-term benefit of research on housing is that it allows us to solve the problems of current projects as soon as possible. Its medium-term benefit is providing information for the building cycle in future projects. Its long-term benefit is that it provides feedback to develop new design criteria for future projects (Liu, 1999).

This study hypothesized that the COVID 19 pandemic had transformed housing users' physical and psychosocial needs, and thus, their expectations of their residences. The study aimed to develop design proposals for future residences by determining how the pandemic had affected current users and what new residential needs they had had since the pandemic began. First, a literature review was conducted on users' residential needs and satisfaction levels. Second, surveys were conducted to identify the residential problems and needs of female users from Rize during the pandemic. The data were analyzed using the Statistical Package for Social Sciences (SPSS).

DOI: 10.15320/ICONARP.2022.210

HOUSING AND PANDEMIC

Having a shelter is one of the basic needs, like food and clothes. Residences are safe environments expected to meet accommodation needs (Özkan, 1981). According to Gür (2000), housing is a phenomenon interlocked with human life and is an organized pattern of communication, interaction, space, time, and meaning. According to Dostoğlu (2000), housing is a shelter that meets one of the basic needs of humans and families, while it is also a social phenomenon with economic and spatial meanings. Home is our corner on earth; it is our first universe, a true cosmos in the truest sense of the word (Bachelard, 1996). Francescato (1998) defines one's home as an everyday-life sanctuary that symbolizes one's socioeconomic status and describes the relationship one has with one's environment. Sommerville (1997) argues that home has a physical reality and an intellectual dimension.

As a type of building that meets accommodation needs, the housing includes many different actions. These actions depend on many factors, such as users' characteristics, needs, lifestyles, socioeconomic characteristics, etc. (Zorlu, 2004). Some actions performed in houses are sitting, resting, working, engaging in hobbies, eating, cleaning, and sleeping.

Housing has a social connotation as well because it is where the family takes shape. According to Rapoport (1969), although the passive purpose of housing is to provide shelter, its primary purpose is to create the most suitable environment for human life. In other words, housing is a sociospatial unit. Housing is where one functions physically and visibly, but it is also a structure that fulfills one's values and meets one's needs that develop through cultural and social conditioning (Ersoy, 2002).

The concept of housing has transitioned from a simple shelter mechanism to a complex system as a result of the changes in physical and social structure. Therefore, housing has become the subject of many disciplines (physics, sociology, psychology, etc.) (Eyüce, 1991).

The pandemic has introduced many concepts into our lives, such as social distancing, isolation, flexible working, distance learning, quarantine, etc. These preventive measures have changed our daily lives and routines. Since the pandemic, people have ended up spending much more time at home, trying to live their lives within four walls. However, this has urged them to question whether they can really fit their lives into the confines of their residences. The new normal has given birth to new spatial and functional needs. However, people have started questioning whether their residences can meet their new needs. The pandemic has turned residences into schools and offices. Due to the pandemic, people try to adapt to living within the limits of their residences. However, there has been a considerable change in people's residential needs and expectations. The primary objective of a design is to meet user needs. Therefore, it is critical to identify all needs that change with time. Individual and social welfare is possible as long as new needs are met within the framework of those norms (Eyüce, 1991). This shows that residential needs should be reconsidered in the face of changing conditions.

HOUSING USERS' NEEDS

According to Ünügür (1973), the environment should meet some conditions for users to perform certain actions. People whose needs are met can effectively perform their actions in society. This points to a necessity and an obligation (Atasoy, 1973). Meeting user needs is necessary for the most effective performance of individual and social actions.

The spatial setup of a residence depends on its users' needs, lifestyles, and expectations (Zorlu&Sağsöz, 2010). Therefore, housing users' needs should be identified to contribute to personal and social welfare.

A need indicates a necessity. Favorable residential conditions are a prerequisite for user satisfaction. A design should focus on needs depending on users' wants, expectations, futures, possibilities, and cultural codes (Bektaş, 1995).

User needs are classified differently, but what they have in common is that needs have physiological, social, and psychological aspects. Maslow (1954) was the first to address user needs. He developed a Hierarchy of Needs to explain the five levels every human being must progress through to self-actualization. Those levels were physiological needs, safety needs, love and belonging, esteem, and self-actualization. Ünügür classifies user needs as physical and psychosocial (Zorlu, 1996). Physical user needs refer to situations that provide shelter and comfort conditions at a minimum level. Psychosocial user needs refer to the environmental conditions required to act without discomfort. Depending on the subject of the present study, the most important physical user needs are spatial and auditory user needs, while the most important psychosocial user needs are visual privacy needs.

HOUSING USER SATISFACTION

User satisfaction is about evaluating users' perceived feelings for a resident and its environment (Ogu, 2002). Residential satisfaction is affected by numerous parameters, such as privacy, personalization, identity, social status, personal/social space, sense of place, freedom of choice, etc. (Özsoy, 1995). Ergenoğlu and Çağdaş (2003) classify the parameters affecting residential satisfaction as user-related parameters, environmental parameters, building-related parameters, residential parameters, and parameters related to housing and interior spaces and user needs.

Housing user satisfaction changes with time because it is affected by different factors. The demographic characteristics of users and the features of the residence and its immediate surroundings affect housing user satisfaction. In line with this, it is an important problem for users' inability to meet their residential needs. Therefore, we should consider residential environments and remove the reasons that make users

DOI: 10.15320/ICONARP.2022.210

dissatisfied in those environments (Eyüce, 1991). Users have high residential satisfaction if they live in suitable places for their lifestyles and meet their needs and expectations. Housing user satisfaction is also associated with physical and mental health. This is particularly important today because people have been spending much more time indoors and attributing different roles to their residences since the pandemic began. What meaning people attach to where they live depends on how much time they spend there (Özsoy, 1994).

A residence is successful if it is located at the right spot at the right time for the right people with the right organization (Gür, 2000). Residential satisfaction is related to the extent to which a residence meets its users' needs. In this context, users' evaluation of a residence is critical to realizing the right design.

METHOD

We need to identify users' wants and needs and design residences that can fulfill them to increase user satisfaction. Post-use evaluation and user involvement in the housing production process are two methods used to determine users' wants and needs (Der, 2005). According to Özsoy et al. (1995), post-use evaluation is an assessment method used to ascertain how satisfied housing users are with the physical environment. The purpose of the post-use evaluation is to identify the reasons for dissatisfaction during use and to recreate building programs for new designs in accordance with users' needs (Altaş, 2003). Post-use evaluation allows us to determine residential shortcomings and create better places that satisfy users' needs and wants. Post-use evaluation is user-focused.

Residential needs depend on the changes during use. This study aimed to determine users' residential needs and satisfaction levels during the pandemic to make revisions or suggestions for current or new residences. The sample consisted of 188 female housing users aged 22-61 living in Rize, Turkey. Data were collected using an online survey, which is a quantitative research technique.

The sample consisted of women for two reasons. First, women are considered more responsible for domestic activities than men in Turkey. Second, the pandemic is believed to have taken a greater toll on women because they have had to take on different roles at the same time. In other words, they have had to function as wives, mothers, and workers at the same time.

The research setting was the city of Rize for various reasons. First, there is research on the residential satisfaction levels and needs of users during the COVID-19 pandemic. However, there is no research on this topic in Rize despite its vegetation, built environment features, and socioeconomic and sociocultural characteristics. Second, the city has been undergoing rapid construction and spatial transformation in recent years. Third, there has been an average of 44 percent increase in house sales in the Eastern Black Sea Region, according to the Turkish Statistical Institute (TUIK) (URL 1).

This study addressed satisfaction at the residence scale. The questionnaire form had two stages to reach appropriate and sufficient data on demographics, residential information, and pre- and post-pandemic residential satisfaction.

The first stage consisted of items on user characteristics (age, occupation, education, living arrangement, ownership status, etc.) and residential information (resident type, the number of rooms, total meter square, etc.).

The second stage consisted of items on residential use and satisfaction levels before the pandemic. It also asked participants what room they used most, except the bedroom, how many hours they spent in which room, how satisfied they were with their residences, and the reasons for their dissatisfaction with their residences, if any.

Afterward, participants were asked how satisfied they had been with their residences since the pandemic began. The other questions elicited information on (1) what their working arrangements were, (2) how their residences affected their productivity, (3) what problems they faced during distance learning, (4) which room they used most for work, (5) how many hours they spent indoors, (6) how satisfied they were with their residences, (7) the reasons for their dissatisfaction if their satisfaction level was moderate, low or very low, (8) what they did in their free time, (9) what modifications they made to their residences and why, and (10) what kind of spaces they needed most.

The data were analyzed using the Statistical Package for Social Sciences (SPSS). Frequency distributions were calculated using frequency analysis. The relationship between the variables was determined using the correlation test. The "Crosstabs" tab was used for the tables to show the relationship between the variables (significant results according to the p-value).

All parts of the questionnaire were analyzed and evaluated within themselves and in relation to each other.

RESULTS AND DISCUSSION

User Characteristics and Residential Results

Table 1 shows the participants' characteristics and ownership status. Most participants were married (82.4%). More than half the participants had bachelor's degrees (58.5%). Half the participants lived with three more people (50.5%), while more than a quarter lived with two other people (21.8%). More than half the participants owned the residences they lived in (61.7%). More than a quarter of the participants were tenants (28.1%). Ten participants lived in the family property (5.3%), while nine lived in public housing (4.7%).

DOI: 10.15320/ICONARP.2022.210

Table 1. Participants' Characteristics and Ownership Status

Marital Status			Education (Degree)			Number of Residents			Ownership Status		
	N	%		N	%		N	%		N	%
Married	155	82.4	Primary School	3	1.5	1	12	6.3	Owner	116	61.7
Single	33	17.5	Middle School	3	1.5	2	11	5.8	Tenant	53	28.1
			High School	21	11.1	3	41	21.8	Family Property	10	5.3
			Vocational School	14	7.4	4	95	50.5	Public housing	9	4.7
			Bachelor's	110	58.5	5	26	13.8			
			Master's	25	13.2	6	2	1.06			
			PhD	12	6.3	7	1	0.5			

Tables 2 and 3 show the properties of the residences. One hundred and one participants lived in apartments (53.4%). Seventy-one participants lived in apartment complexes (38.1%). Eight participants lived in public housing (4.2%). Six participants lived in houses (3.2%). More than half the participants lived in 101-150 m^2 residences (54.7%). Fifty participants lived in 151-200 m2 residences (26.5%). Seventeen participants lived in 51-100 m2 residences (9.04%). Nine participants lived in 201-250 m2 residences (4.7%). Nine participants lived in >250m2 residences (4.7%). Most residences had three rooms (71.2%). Less than a quarter of the residences had more than three rooms (18.6%). Eighteen residences had two rooms (9.5%). Most residences had one living room (93.6) and one kitchen (96.2%). Half the residences had one bathroom (51.2%), while more than a quarter had two bathrooms (36.1%). Half the residences had two balconies (49.4%), a quarter of the residences had one balcony (26.5%), and less than a quarter of the residences had three balconies (21.2%). 450

Table 2. Residential Properties

	N	%		N	%		N	%
Residence type			m2			Number of rooms		
House	6	3.2	51-100	17	9.04	1	-	
Apartment	101	53.4	101-150	103	54.7	2	18	9.5
Apartment complex	71	38.1	151-200	50	26.5	3	134	71.2
Housing complex	2	1.1	201-250	9	4.7	>3	35	18.6
Public housing	8	4.2	>250	9	4.7			

Table 3. Residential Properties

	N	%		N	%		N	%		N	%
Number of living rooms			Number of kitchens			Number of bathrooms			Number of balconies		
1	176	93.6	1	181	96.2	1	96	51.2	1	50	26.5
2	8	4.2	2	4	2.1	2	68	36.1	2	93	49.4
3	2	1.06	3	1	0.5	3	21	11.1	3	40	21.2
>3	2	1.06	4	2	1.06	>3	3	1.5	>3	5	2.6

Residential Use and Satisfaction Levels before and during the Pandemic

Participants were asked, "What is your working arrangement during the pandemic?" Fifty-five participants stated that they worked in their offices during the pandemic (29%). Forty-eight participants noted that they worked from home during the pandemic (26%). Fifty-two participants remarked that they did not work during the pandemic (28%). Thirty-three participants expressed that they worked in their offices for a short while during the pandemic (17%) (Figure 1). The figures show an almost homogenous distribution regarding working systems during the pandemic. However, they also show that people have been spending much more time indoors since the onset of the pandemic.

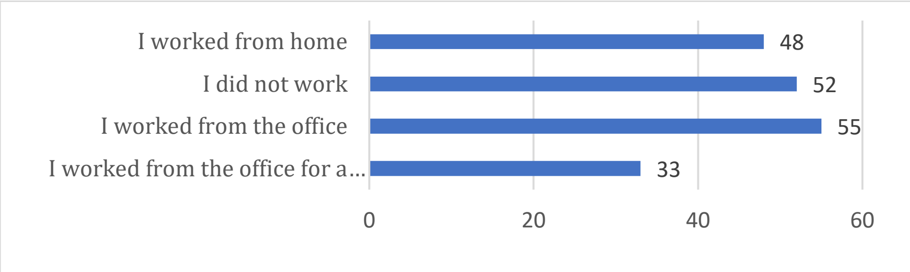


Figure 1. Work during the Pandemic

Participants were asked, "If you are working from home during the pandemic, how is that affecting your productivity?" The results showed that marital status affected how participants believed working from home impacted their productivity. Half the married participants (51%) and the majority of the single participants (85.3%) stated that they had been working from home since the pandemic. More than a quarter of the married participants noted that working from home positively affected their productivity, whereas less than a quarter of the married participants remarked that working from home negatively affected their productivity. More than a quarter of the single participants noted that working from home positively affected their productivity, whereas less than a quarter of the single participants remarked that working from home negatively affected their productivity.

Participants were asked the open-ended question, "If you have a child receiving distance education during the pandemic, can you tell us about the residential problems you are facing during the process?" The greatest difficulty participants experienced during distance education was too much noise/lack of sound insulation. Participants stated that they were disturbed by too much noise indoors and outdoors because their buildings lacked proper sound insulation. Constructions and neighbors caused the outdoor noise. The indoor noise was caused by the doorbell ringing or siblings being too loud during distance education. Participants with more than one child also noted that their children sometimes had to be online for distance education at the same time, which caused a cacophony of noise. They added that they sometimes had to change the

DOI: 10.15320/ICONARP.2022.210

hours of classes because they had to clean their residences, which caused their children to lose concentration.

Another residential challenge was related to the number and size of rooms. Mothers who worked from home and/or had more than one child stated that they had to set up more than one work/study space at home. They noted that their children sometimes logged into online classes from their bedrooms, which was problematic in terms of privacy because their classmates could see their bedrooms in the background. They added that they had difficulty adjusting their residences for their children's distance education because they needed to organize their books, but they did not have enough space. They remarked that they did not have enough space at home for their children's gym classes, and therefore, they were worried that their children were becoming more and more sedentary. Participants stated that they had difficulty providing their children with a classroom-like environment because they either had too small rooms or had no extra rooms at all. They also noted that their children had difficulty attending online classes because they either had bad Internet connections or inadequate materials, such as computers and smartphones.

Participants were asked, "How much do you use the rooms as your workspace? Can you rank them from most to least often, please?" Participants stated that they mostly worked in the living room, followed by the kitchen, bedroom, anteroom, and balcony (based on those who marked "1") (Table 4).

Table 4. Rooms as Workspaces during the Pandemic

Rooms as Workspaces during the Pandemic						Total
	1	2	3	4	5	
Living room (f) (%)	85 45.9%	47 25.4%	16 8.6%	19 10.3%	18 9.7%	185 100%
Kitchen (f) (%)	69 37.5%	54 29.3%	29 15.8%	17 9.2%	15 8.2%	184 100%
Bedroom (f) (%)	35 19.0%	27 14.7%	73 39.7%	29 15.8%	20 10.9%	184 100%
Anteroom (f) (%)	30 16.4%	14 7.7%	22 12.0%	51 27.9%	66 36.1%	183 100%
Balcony (f) (%)	28 15.2%	18 9.8%	26 14.1%	70 38.0%	42 22.8%	184 100%

Participants were asked, "How often did/do you use the rooms before/during the pandemic, except for the bedroom to sleep in? Can you rank them from most to least often, please? The living room was the room they spent most of their time in before the pandemic. They spent more than 3-6 hours on average in the living room before the pandemic. However, the kitchen was the room they spent most of their time in during the pandemic. They spent more time in the living room during the pandemic than before the pandemic. They spent 3-6 hours in the living room before the pandemic, but they spent more than six hours in the living room during the pandemic. They also spent more time in the kitchen during the pandemic than before. However, they spent less time in the bedroom during the pandemic than before the pandemic. Participants used the balcony and anteroom during the pandemic as much as they did before the pandemic. They spent more time in the bathroom during the pandemic than before the pandemic (Table 5). Participants spent most of their time in the living room, followed by the kitchen, bedroom/balcony/anteroom, and bathroom (Table 6). Ninety participants spent most of their time in the living room before the pandemic (47.9%), whereas 84 participants spent most of their time in the living room during the pandemic (44.7%). Thirty-one participants spent most of their time in the bedroom before the pandemic (16.5%), whereas 29 participants spent most of their time in the bedroom during the pandemic (15.4%). Thirty-one participants spent most of their time in the anteroom before the pandemic (16.5%), whereas 29 participants spent most of their time in the anteroom during the pandemic (15.4%). Twenty-three participants spent most of their time in the bathroom before the pandemic (12.2%), whereas 20 participants spent most of their time in the bathroom during the pandemic (10.6%). Seventy-two participants spent most of their time in the kitchen before the pandemic (38.3%), whereas 80 participants spent most of their time in the kitchen during the pandemic (42.6%). Twenty-seven participants spent most of their time in the balcony before the pandemic (14.4%), whereas 29 participants spent most of their time in the balcony during the pandemic (15.4%).

Participants mostly used the living room before the pandemic, but they mostly used the kitchen during the pandemic. They spent more time in the living room during the pandemic than before the pandemic. They spent less time in the bedroom during the pandemic than before the pandemic. They used the balcony and anteroom during the pandemic as much as they did before the pandemic. They spent more time in the bathroom during the pandemic than before the pandemic. They spent more time in the kitchen during the pandemic, suggesting that they cooked more and had more meals at home during the pandemic. Participants who spent more time at home devoted more time to kitchen chores. In addition, participants and their children turned the kitchen into a study and office during the pandemic. Participants and their children used the bathroom more often for hygiene reasons. The results also showed that the higher the number of residents at home, the more time they spent in the kitchen. This is probably because participants and their children use the kitchen not only to cook and eat but also to study and work.

DOI: 10.15320/ICONARP.2022.210

Table 5. Average Hours of Space Use per Day before and during the Pandemic

Average Hours of Space Use per Day before the Pandemic (except for the bedroom)						Total
	Never	0-1 hours	1-3 hours	3-6 hours	+6 hours	
Living room(f) %)	11 5.9%	12 6.4%	43 22.9%	68 36.2%	54 28.7%	188 100%
Kitchen (f) (%)	7 3.7%	25 13.3%	95 50.5%	52 27.7%	9 4.8%	188 100%
Bedroom (f) (%)	12 6.4%	56 29.9%	15 8.0%	27 14.4%	77 41.2%	187 100%
Balcony (f) (%)	57 30.5%	76 40.6%	36 19.3%	15 8.0%	3 1.6%	187 100%
Anteroom (f) (%)	84 44.9%	76 40.6%	14 7.5%	11 5.9%	2 1.1%	187 100%
Bathroom (f) (%)	14 7.5%	125 66.8%	41 21.9%	5 2.7%	2 1.1%	187 100%
Average Hours of Space Use per Day during the Pandemic (except for the bedroom)						Total
	Never	0-1 hours	1-3 hours	3-6 hours	+6 hours	
Living room (f) (%)	7 3.7%	14 7.4%	46 24.5%	57 %30.3	64 %34.0	188 100%
Kitchen (f) (%)	7 3.7%	25 13.3%	79 42.0%	67 %35.6	10 %5.3	188 100%
Bedroom (f) (%)	15 8.0%	46 24.6%	31 16.6%	29 %15.5	66 %35.3	187 100%
Balcony (f) (%)	54 38.7%	81 43.1%	36 19.1%	13 %6.9	4 %2.1	187 100%
Anteroom (f) (%)	82 43.9%	79 42.2%	13 7.0%	9 %4.8	4 %2.1	187 100%
Bathroom (f) (%)	19 10.2%	111 59.4%	48 25.7%	6 %3.2	3 %1.6	187 100%

Table 6. Most Used Room before and during the Pandemic

Most Used Room before the Pandemic							Total
	1	2	3	4	5	6	
Living room (f) (%)	90 47.9%	50 26.6%	8 4.3%	15 8.0%	10 5.3%	15 8.0%	188 100%
Kitchen (f) (%)	72 38.3%	69 36.7%	19 10.1%	8 4.3%	9 4.8%	11 5.9%	188 100%
Bedroom (f)(%)	31 16.5%	18 9.6%	89 47.3%	32 17.0%	13 6.9%	5 2.7%	187 100%
Anteroom (f) (%)	31 16.5%	9 4.8%	8 4.3%	47 25.0%	47 25.0%	46 24.5%	187 100%
Balcony (f) (%)	27 14.4%	14 7.4%	32 17.0%	54 28.7%	31 16.5%	30 16.0%	187 100%
Bathroom (f) (%)	23 12.2%	21 11.2%	35 18.6%	58 30.9%	35 18.6%	16 8.5%	187 100%
Most Used Room during the Pandemic							Total
	1	2	3	4	5	6	
Living room (f)(%)	84 44.7%	56 29.8%	13 6.9%	11 5.9%	9 4.8%	15 8.0%	188 100%
Kitchen (f) (%)	80 42.6%	60 31.9%	17 9.0%	9 4.8%	13 6.9%	9 4.8%	188 100%
Bedroom (f) (%)	29 15.4%	20 10.6%	89 47.3%	27 14.4%	13 6.9%	10 5.3%	187 100%
Balcony (f) (%)	29 15.4%	16 8.5%	24 12.8%	46 24.5%	42 22.3%	31 16.5%	187 100%
Anteroom (f)(%)	29 15.4%	10 5.3%	14 7.4%	42 22.3%	52 27.7%	41 21.8%	187 100%
Bathroom (f)(%)	20 10.6%	20 10.6%	33 17.6%	63 33.5%	32 17.0%	20 10.6%	187 100%

Participants were asked to evaluate how satisfied they were with their residences before and during the pandemic. Eighty participants were satisfied with their residences before the pandemic (43%). Fifty-two participants were very satisfied with their residences before the pandemic (28%). Forty-eight participants were moderately satisfied with their residences before the pandemic (25%). Four participants were dissatisfied with their residences before the pandemic (2%). Four participants were very dissatisfied with their residences before the pandemic (2%). The results show that participants were, in general, satisfied with their residences before the pandemic. Eighty-seven participants were satisfied with their residences during the pandemic (46%). Fifty-four participants were moderately satisfied with their residences during the pandemic (29%). Thirty-seven participants were very satisfied with their residences during the pandemic (20%). Three participants were dissatisfied with their residences during the pandemic (1%). Seven participants were very dissatisfied with their residences during the pandemic (4%) (Figure 2). The results show that participants are as satisfied with their residences during the pandemic as they were before the pandemic. However, fifty-two participants were very satisfied with their residences before the pandemic (28%), whereas thirty-seven participants were very satisfied with their residences during the pandemic (20%). The majority of the participants who were satisfied with their residences before the pandemic are also satisfied with their residences during the pandemic (91%). Only eight percent of the participants who were satisfied with their residences before the pandemic are moderately satisfied with their residences during the pandemic. Only one percent of the participants who were satisfied with their residences before the pandemic are dissatisfied with their residences during the pandemic.

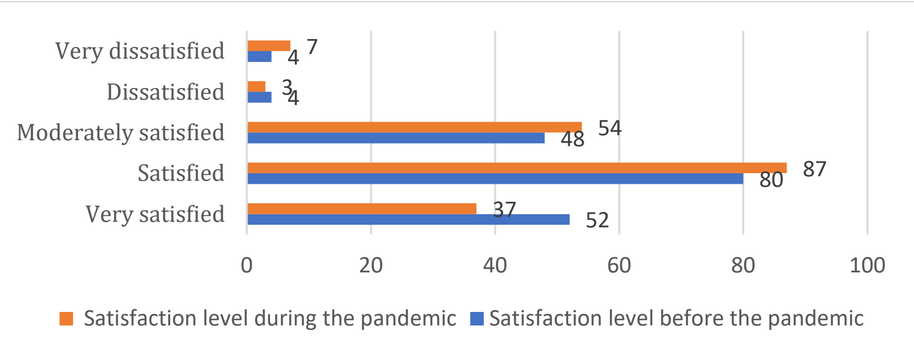


Figure 2. Residential satisfaction before and during the Pandemic

The “ownership status” affected participants’ residential satisfaction levels before and during the pandemic. Thirty-one tenants were satisfied with their residences before the pandemic (59.6%; n=52), whereas 18 tenants were satisfied with their residences during the pandemic (54.6%; n=33). Eighty-eight homeowners were satisfied with their residences before the pandemic (75.9%; n=116), whereas 58 homeowners were satisfied with their residences during the pandemic (81.6%; n=71). Six

DOI: 10.15320/ICONARP.2022.210

participants living in family property were satisfied with their residences before the pandemic (60%; n=10), whereas five participants living in family property were satisfied with their residences during the pandemic (71.4%; n=7). Seven participants living in public housing were satisfied with their residences before the pandemic (70%; n=10), whereas six participants living in public housing were satisfied with their residences during the pandemic (85.7%; n=7) (percentages are based on "very satisfied" and "satisfied" responses) (Table 7). The "total square meter" affected participants' residential satisfaction levels before and during the pandemic. The bigger the residences, the more satisfied the participants were with them. The bigger the kitchen, the more satisfied the participants were with it (Table 8).

Table 7. The Effect of Ownership Status on Residential Satisfaction before and during the Pandemic

Residential Satisfaction before the Pandemic						
Ownership Status	Very Satisfied	Satisfied	Moderately Satisfied	Dissatisfied	Very Dissatisfied	Total
Homeowner	40 34.5%	48 41.4%	25 21.6%	2 1.7%	1 %0.9	116 100%
Tenant	9 17.3%	22 42.3%	16 30.8%	2 3.8%	3 %5.8	52 100%
Family Property	1 10.0%	5 50.0%	4 40.0%	0 0.0%	0 %0.0	10 100%
Public Housing	2 20.0%	5 50.0%	3 30.0%	0 0.0%	0 %0.0	10 100%
Residential Satisfaction during the Pandemic						
Ownership Status	Very Satisfied	Satisfied	Moderately Satisfied	Dissatisfied	Very Dissatisfied	Total
Homeowner	17 23.9%	41 57.7%	12 16.9%	0 0.0%	1 1.4%	71 100%
Tenant	6 18.2%	12 36.4%	12 36.4%	1 3.0%	2 6.1%	33 100%
Family Property	1 14.3%	4 57.1%	2 28.6%	0 0.0%	0 0.0%	7 100%
Public Housing	0 0.0%	6 85.7%	1 14.3%	0 0.0%	0 0.0%	7 100%

Table 8. The Effect of Total Meter Square on Residential Satisfaction before and during the Pandemic

Residential Satisfaction before the Pandemic						
Total Meter Square	Very Satisfied	Satisfied	Moderately Satisfied	Dissatisfied	Very Dissatisfied	Total
51-100 m2	0 0.0%	6 35.3%	6 35.3%	2 11.8%	3 17.6%	17 100%
101-150 m2	23 22.3%	47 45.6%	30 29.1%	2 1.9%	1 1.0%	103 100%
151-200 m2	19 38.0%	21 42.0%	10 20.0%	0 0.0%	0 0.0%	50 100%
201-250 m2	3 33.3%	4 44.4%	2 22.2%	0 0.0%	0 0.0%	9 100%
+250 m2	7 77.8%	2 22.2%	0 0.0%	0 0.0%	0 0.0%	9 100%

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

Residential Satisfaction during the Pandemic						
Total Meter Square	Very Satisfied	Satisfied	Moderately Satisfied	Dissatisfied	Very Dissatisfied	Total
51-100 m2	0 0.0%	2 28.6%	2 28.6%	0 0.0%	3 42.9%	17 100%
101-150 m2	11 15.3%	40 55.6%	20 27.8%	2 1.4%	0 0.0%	72 100%
151-200 m2	8 27.6%	17 58.6%	4 13.8%	0 0.0%	0 0.0%	29 100%
201-250 m2	3 50.0%	2 33.3%	1 16.7%	0 0.0%	0 0.0%	6 100%
+250 m2	2 50%	2 50%	0 0.0%	0 0.0%	0 0.0%	4 100%

Participants were asked why they were moderately satisfied, dissatisfied, or very dissatisfied with their residences before and during the pandemic. Figure 3 shows the results. Participants' residential satisfaction levels were adversely affected by various factors: the relationship level of the rooms, the need for a garden, the lack of a view, the number and size of the balcony/patio, the number of living rooms and bathrooms, and the size of the rooms. Participants were dissatisfied with their residences also because their residences needed repair and were unhappy with their neighborhoods. The lack of adequate storage area and connection with the outdoors did not affect participants' residential satisfaction levels. Participants were highly dissatisfied with poor housing planning and the lack of noise isolation, ventilation, daylight, and flexible space and equipment. However, they were less dissatisfied with these problems during the pandemic than before the pandemic.

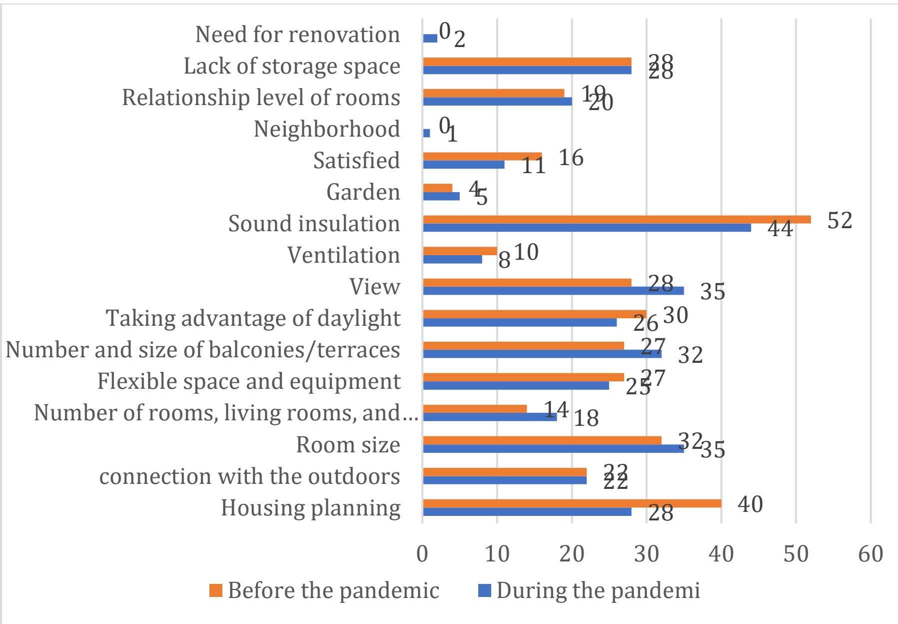


Figure 3. The reasons why participants are dissatisfied with their residences during the pandemic

The results showed that participants were less satisfied with their residences during the pandemic than they were before the pandemic. Of the participants who were very satisfied with their residences before the pandemic, 35.9% were satisfied, and 5.1% were moderately satisfied with their residences during the pandemic. Of the participants who were

DOI: 10.15320/ICONARP.2022.210

satisfied with their residences before the pandemic, 12.1% were moderately satisfied, and 1.7% were dissatisfied with their residences during the pandemic (Table 9).

Table 9. Residential Satisfaction Levels before and during the Pandemic

Residential Satisfaction Levels before the Pandemic		Residential Satisfaction Levels during the Pandemic					
		Very satisfied	Satisfied	Moderately Satisfied	Dissatisfied	Very Dissatisfied	Total
	Very satisfied	23 59.0%	14 35.9%	2 5.1%	0 0%	0 0%	39 100%
	Satisfied	1 1.7%	49 84.5%	7 12.1%	1 1.7%	0 0%	58 100%
	Moderately Satisfied	0 0%	0 0%	17 100%	0 0.0%	0 0.0%	17 100%
	Very Dissatisfied	0 0%	0 0%	1 25.0%	0 0.0%	3 75.0%	4 100%
	Total	24 20.3%	63 53.4%	27 22.9%	1 0.8%	3 2.5%	118 100%

Participants were asked how they spent their time indoors, except working, during the pandemic. Most participants stated that they cooked during the pandemic (83%), indicating that they use the kitchen very often during the pandemic. The second most common action performed by participants was cleaning (70.9%), suggesting that they pay more attention to their hygiene and therefore devote more time to cleaning. These findings support the results regarding the most commonly used rooms. The marital status affected participants' leisure time activities. Most single participants spent their time on self-care (71%), whereas only 30% of the married participants spent their time on self-care. More than half the married participants spent their time cooking (53.8%). However, only six percent of the single participants spent their time cooking.

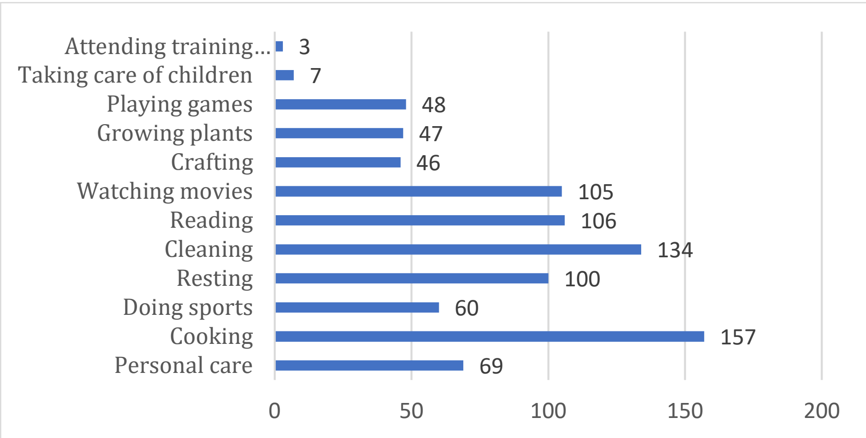


Figure 4. Most Common Activities during the Pandemic

Participants were asked what modifications they needed to make to their residences during the pandemic. Less than half the participants stated that they did not need to modify their residences (45%). However, participants noted that they needed to move the furniture around

(35.4%), use the rooms for other purposes (31.2%), buy new furniture (16.4%), use furniture for other purposes (15.3%), or merge/separate spaces (9%). Very few participants remarked that they were considering buying another modem, growing plants, painting the walls, replacing the wallpaper, and decorating.

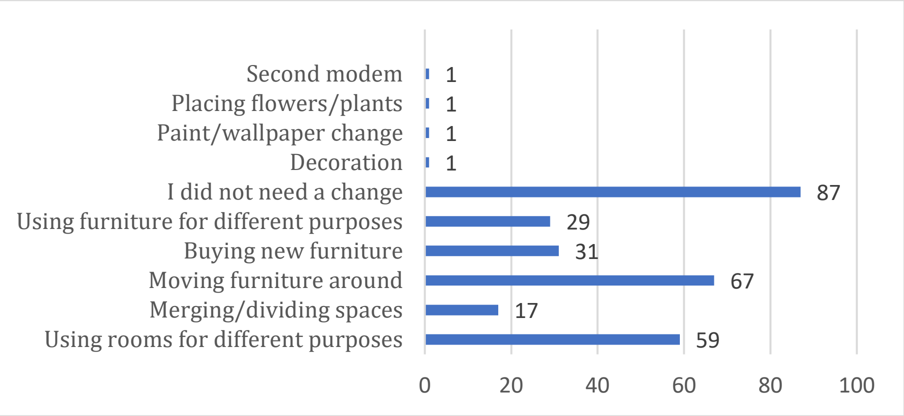


Figure 5. Indoor Modifications

Participants were asked, "Can you state the reasons for the modifications you have made to your residence, please?" The most common reason for the modifications was creating a study or a workspace. Especially those who had more than one child and/or worked from home needed multiple studies/workspaces in their residences. Some participants stated that they needed to repurpose some rooms and move the furniture around to create a classroom-like environment for their children receiving distance education. Those who had more than one child repurposed their kitchens, living rooms, and bedrooms to provide each family member an independent study or workspace.

Some participants made modifications to their residences to have better Internet access. For example, they either moved the furniture around or bought new ones.

Participants noted that they made modifications to their residences for other reasons. For example, the pandemic identified new needs and priorities. They were bothered by the furniture they did not use. Their residences were too small, or their furniture was too old. They stated that they moved their furniture around or bought new ones to maximize the space in their residences.

Some participants remarked that they made modifications to their residences for a change because they were bored. Some others made modifications because they wanted to feel good or turn their studies into fun settings for their children receiving distance education. Some participants noted that they modified their residences even before the pandemic because it made them happy.

Participants were asked, "What are the space and building elements that you have needed most in your residence since the pandemic began?" They were allowed to choose more than one option. Participants needed gardens (43.9%), spaces for sports (40.2%), studies/workspaces (38.6%), hobby rooms (27.5%), balconies (25.4%), cellars (17.5%),

DOI: 10.15320/ICONARP.2022.210

patios (16.4%), flexible space and equipment (14.8%), or windows (9%). Participants mostly needed gardens, balconies, patios, and windows to contact the outside world during the pandemic. Secondly, they needed spaces for sports because they wanted to lead more active lives during the pandemic. Thirdly, they needed studies/workspaces and hobby rooms because they ended up spending much time indoors during the pandemic. The homeowners needed gardens the most (65%), while the tenants needed studies (37.5%) and hobby rooms (25%) the most.

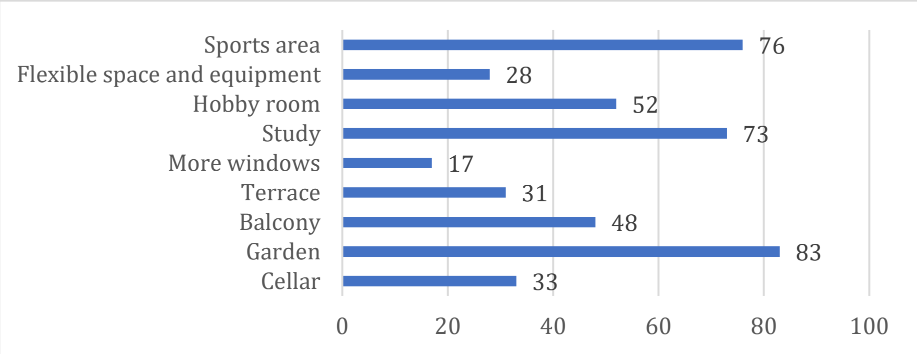


Figure 6. Space and Building Elements

Participants were asked why they needed those spaces and building elements. Participants stated that they needed gardens because they spent much time indoors during the pandemic, and therefore, wanted to have some sort of contact with the outside world. They also noted that their children wanted to go out and take walks. They also needed to get enough sunlight, work the land, socialize, and have fresh air. Secondly, participants needed spaces for sports because they wanted to have fun at home and stop gaining weight. Thirdly, they needed studies/workspaces because parents ended up working from home while children ended up receiving distance education. Participants remarked that they needed quiet spaces to study or work because their dinner tables were full of stuff (laptops, pencil boxes, books, notebooks, etc.), which demotivated them. They noted that they needed extra studies/workspaces in their residences because both they and their children had to use the Internet at the same time, and therefore, the current studies/workspaces were not enough. In addition, they felt uncomfortable because they sometimes had to turn on their cameras, resulting in others seeing their rooms, which was a privacy concern. These results show that residences need studies. Participants also stated that they needed hobby rooms. Therefore, residences should have hobby rooms to enjoy their time and feel mentally relaxed during the pandemic. Participants noted that they needed more balconies, patios, and windows because they wanted to enjoy their time watching outside and relaxing. They needed balconies also because they wanted to disinfect their clothes and groceries there. They also needed cellars because they went shopping less often and bought in bulks when they did during the pandemic. Moreover, they also wanted to keep hygiene products in the cellar.

Participants needed flexible spaces and accessories to create more space for themselves because they had small residences with too many people living in at the same time.

EVALUATION AND CONCLUSION

The results show that lockdowns, distance education, and flexible working conditions have changed the way housing users have lived in their residences. Since the pandemic began, they have spent more time indoors, used the rooms longer, and performed different activities in different rooms. All these changes have brought about new needs. Housing users have made or considered making some modifications to their residences and encountered some problems during the process. The following are results and recommendations regarding residential designs:

Since the pandemic, housing users have been using and repurposing their residential spaces more often. They spent most of their time in their living rooms before the pandemic. However, they have been spending most of their time in their kitchens since the pandemic. They have repurposed their kitchens and used them for purposes other than eating and cooking. Therefore, kitchens should be designed so that they should be big enough to allow residents to perform different tasks in them.

Since the pandemic, housing users have been using and repurposing their living rooms more often. Therefore, living rooms should be designed so that they should allow both parents and children to perform different tasks in them at the same time.

Since the onset of the pandemic, housing users have been using their bathrooms and toilets more often for hygiene reasons. Therefore, residences should have more than one bathroom and toilet, which should be large enough to allow users to store hygiene products in.

The more time housing users spend in their residences, the more they need to contact the outside world. Therefore, they need gardens, patios, and balconies. Therefore, residences should have spatial constructs, such as gardens, patios, and balconies, which provide indoor-outdoor interactions.

Housing users need studies/workspaces the most because both parents and children spend much time indoors working and studying at the same time, causing a cacophony of noise. Outside noises are also a problem for people because they distract them. Therefore, noise control is a parameter that should be addressed in housing designs.

Housing users have repurposed their living rooms, kitchens, and bedrooms and turned them into quiet and comfortable studies/workspaces for each family member since the onset of the pandemic. Therefore, architects and interior architects should design more workspaces for residences or design living rooms, kitchens, and bedrooms so that residents can use them for other purposes.

Housing users need new accessories in their residences because they have been spending more time indoors since the pandemic, and

DOI: 10.15320/ICONARP.2022.210

therefore, they want to be happy and comfortable and want to change their rooms into fun and attractive spaces for family members. Furniture should be designed so that it can be used for different purposes.

Housing users need to exercise and pursue their hobbies because they spend much time indoors during the pandemic. Therefore, architects and interior architects should design sports areas and hobby rooms for residences.

The results show that housing users have needed more rooms or larger rooms in their residences because they have encountered problems in terms of auditory and visual privacy since the onset of the pandemic. These results indicate that architects and interior architects should adopt flexible design approaches to respond to housing users' needs and problems. Providing the relationship between the user, the action, and the space without major changes is only possible with design flexibility. Users should be provided with simple and efficient spatial setups and solutions that meet their needs with little intervention.

Residences should consist of removable or movable partition elements that allow users to divide, enclose, and modify spaces that serve different functions that users intend to perform indoors during the pandemic. In addition, multi-purpose modular system equipment allows different spatial setups and facilitates flexible planning.

New residences should be based on flexible and adaptable housing plans. Architects and interior architects should prefer structural elements to create flexible spaces that serve different purposes. Architects and interior architects should correctly determine spatial organization characters, spatial dimensions, and carrier system characteristics at the design stage. They should design modifiable and immutable spaces. Flexible planning can be possible with an approach that separates those spaces from each other. In addition, creating neutral spaces that residents can use according to their needs is extremely important for flexibility.

Therefore, architects and interior architects should consider these conditions in new housing designs and adopt flexible approaches to design larger residences. Using flexible building elements and reinforcements helps existing residences to adapt to changes. In this way, users can create studies/workspaces, personal spaces, and hobby rooms in their residences.

The pandemic is reshaping the needs of housing users. The results of the present study will contribute to the plans of new projects or existing residences.

REFERENCES

Adıgüzel Özbek D. & Melikoğlu Eke AS. (2022) Life at home with the pandemic design strategies of housing, for during and after the COVID-19. *Megaron*;17(2): 371–388.

Ak, Ö. (2020). Pandemi Mimarisi – Yeni Normal Evler, Ofisler. *Bilim ve Teknik,* (633), 32-45.

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

Altaş, N. E. (2003). Mimarlık bürolarında kalite yönetimine doğru. *YEM e-Yayını.* Web Sitesi: http://www. yapi. com. tr/V_Images/arastirma/nuresinaltas. pdf, Erişim Tarihi, 28, 2014.

Atasoy, A. (1973). *Değişen ihtiyaçlar karşısında konut tasarlamasının mevcut konutların değerlendirilmesi yolu ile geliştirilmesi*. (Doktora tezi). İstanbul Teknik Üniversitesi, Fen Bilimleri Enstitüsü, İstanbul.

Bachelard, G. (1996). *Mekânın Poetikası* (A. Derman, Çev.). İstanbul: Kesit Yayıncılık.

Bektaş, C. (2016*). Türk Evi*. İstanbul: YEM Yayınları

Der, V. (2005). *Konut uygulamalarında kaliteyi arttırıcı bir yöntem olarak tasarımda kullanıcı katılımı: Düzce-Beyciler Evleri örneği*. (Yüksek Lisans Tezi). Yıldız Teknik Üniversitesi Fen Bilimleri Enstitüsü, İstanbul.

Dostoğlu, N. (2000). *Bursa'da Farklı Konut Alanlarında Çevresel Anlam.* Yapı Dergisi, 221, 62-63.

Ekenyazıcı Güney, E., & Tulum, H. (2021). 19. Yüzyıldan 2020'ye İdeal Ev Kavramı: Covid-19 Sürecinin Etkilerine İlişkin Bir Okuma, *Türk İslâm Medeniyeti Akademik Araştırmalar Dergisi*, 16,32, 337-360.

Ergenoğlu, S.A., & Çağdaş, G. (2003). *Morphology and User Satısfactıon As Components of Housıng Qualıty.* The International Conference on 'Quality of Urban Life Policy versus Practice, 3 - 05 Aralık 2003.

Ersoy, Z.A., (2002). *Konut ve ev kavramlarının karşılaştırmalı analizi* (Doktora tezi). Dokuz Eylül Üniversitesi, Fen Bilimleri Enstitüsü. İzmir.

Eyüce, Ö. (1991*). Toplu Konut; Sorunlar ve Nedenleri, Konut Çevrelerinin Mekansal Gerekliliklerine Bireyin Tatmini Açısından Psikolojik Bir Yaklaşım*. (Doktora tezi). Fen Bilimleri Enstitüsü, İzmir.

Francescato, G. (1998). *Residential satisfaction*. Encyclopedia of Housing, ed: Vliet WV, Sage, London, 484-486.

Gali Taşçı, G., (2020). *Rezidanslarda Konfor Koşullarının Pandemi Dönemi Etkisinde Analizi.* Kent Akademisi, 13,4, 701-721.

Gür, Ş. Ö. (2000). *Doğu Karadeniz örneğinde konut kültürü*. Yapı-Endüstri Merkezi Yayınları.

Liu, A. M. M. (1999). *Residential satisfaction in housing estates: a Hong Kong perspective.* Automation in construction, 8(4), 511-524.

Maslow, A., H. 1954. *Motivation and Personality*. HarperCollins Publishers

Ogu, V. I. (2002). Urban residential satisfaction and the planning implications in a developing world context: The example of Benin City, Nigeria. *International planning studies*, 7(1), 37-53.

Origoni C., & Origoni M. (2020). A Brief History of the Balcony, From Ancient Persia to the COVID-19 pandemic. *Domus.* https://www.domusweb.it/en/architecture/2020/04/03/a-brief-history-of-the-balcony-from-ancient-persia-to-the-covid-19-pandemic.html Son erişim tarihi: 17 Ekim 2021.

Özkan, E. (1981). *Türkiye'de konut sorunu ve ekonomik sınırlamalar içinde konut üretimi'ni finanslama olanakları.* Karadeniz Teknik Üniversitesi İnşaat ve Mimarlık Fakültesi.

Özsoy, A., (1994). *Konut Tasarım ve Değerlendirmesinde Davranışsal Veriler*, İTÜ, İstanbul.

Özsoy, A., Esin, N. Ok. V. & Pulat, G. (1995). *Toplu Konutlarda Davranışsal Verilere Dayalı Nitelik Değerlendirmesi*. TÜBİTAK Araştırma Projesi, INTAG, Proje No.102, İstanbul.

Rapoport, A. (1969). *House Form and Culture*. New Jersey: Prenrice Hall. Inc. Englewood Cliffs. 969,s.46,

DOI: 10.15320/ICONARP.2022.210

Somerville, P. (1997). The social construction of home. *Journal of architectural and planning research*, 226-245.

Soykan Berber, B. (2021). *Revisiting Domesticity In Suburban Housing During Covid19 Pandemic*, (Yüksek Lisans Tezi), İzmir Ekonomi Üniversitesi, İzmir.

Tayanç, M. (2022). Mekân ve Pandemi: Değişen Roller ve Dönüşen Evin Halleri. *Habitus Toplum bilim Dergisi*, 3,3, 71-96.

Turna, E. A., & Usta, G., 2021. Covid-19 Pandemisi'nde Evin Değişimi ve Evde Çalışma Ortamları. *YDÜ Mimarlık Fakültesi Dergisi*, 3,2, 115-128.

Ünügür, M. (1973). *Kültür Farklarının Mutfaklarda Mekan Gereksinmelerine Etkilerinin Saptanmasında Kullanılabilecek Bir Ergonomik Metod*, (Doktora Tezi), İ.T.Ü. Mimarlık Fakültesi, İstanbul.

Yalçın, M. B., (2021). *Kullanıcıların Konut Tercihlerindeki Değişime Covıd-19 Pandemisinin Etkileri*,(Yüksek Lisans Tezi), Akdeniz Üniversitesi, Fen Bilimleri Enstitüsü, Antalya.

Zorlu, T. (2004). *Müstakil konut sitelerinde değişim, dönüşüm sorunsali ve kimlik: trabzon örneği* (Doktora Tezi), Karadeniz Teknik Üniversitesi, Fen Bilimleri Enstitüsü, Trabzon.

Zorlu, T., & Sağsöz, A. (2010). Müstakil Konut Sitelerinde Kullanıcı Tercihlerine Bağlı Fiziki Müdahaleler: Trabzon Örneği. *METU Journal of the Faculty of Architecture*, 27(2). 189-206.

Zorlu, T. (1996). *Trabzon kent ölçeğinde kullanıcı ihtiyaçlarıne bağlı olarak mutfak mekânı ve tipleri üzerine bir araştırma*. (Yüksek Lisans Tezi). Karadeniz Teknik Üniversitesi, Fen Bilimleri Enstitüsü, Trabzon.

(URL 1) https://www.milliyet.com.tr/emlak/karadenizde-pandemide-tersine-gocle-konut-satislari-artti-6694720

Resume

Özge İslamoğlu, Assoc. Prof. Dr. Karadeniz Technical University, Department of Interior Architecture, Trabzon, Turkey. Received her B. I. Arch and MSc. in Interior Architecture from Karadeniz Technical University, Faculty of Architecture (2004-2008). Earned her PhD. degree in architecture from the Karadeniz Technical University, Faculty of Architecture (2014). Major research interests include Awareness of Protection, Cultural heritage, Education, spatial and functional analysis.

Research Article

ICONARP
International Journal of Architecture and Planning
Received: 01.12.2021 Accepted: 04.10.2022
Volume 10, Issue 2/ Published: 20.12.2022
DOI: 10.15320/ICONARP.2022.211 E- ISSN:2147-9380

ICONARP

Energy Saving Opportunities through Glazing and Shading Alternatives

Arzu Cilasun Kunduracı*
Süleyman İvgin**

Abstract

Windows are the weakest elements due to their high heat transfer coefficient and are responsible for 60% energy heat/gain loss. Healthcare buildings are one of the biggest consumers of energy due to continuous occupation hours and medical requirements, providing comfortable conditions for people in need of care and staff; yet recently less attention was given to healthcare buildings due to their unique operational requirements and advanced medical equipment. Thus, the main purpose of this study was to evaluate energy saving potentials of windows through glazing and shading alternatives over a case study. Within this study, a single patient room in Izmir Turkey has been chosen as a case study, and the room was simulated for sixteen scenarios generated by using four different glazing and shading systems. Each design scenario was simulated using DALEC for their lighting, heating, cooling, and total energy consumption. Results showed that lighting energy consumption constitutes the highest energy demand (up to 52%) and high transmitting glazing usage can reduce lighting loads. Finally, up to 16.3%, energy saving is possible only by changing shading and glazing types. Though there is a great diversity of glazing and shading types, this study's outputs only reflect the selected four glazing and four shading system types that are offered by DALEC. Healthcare buildings spend a vast amount of energy to provide thermal and visual comfort for various user profiles. Considering the large number of patient rooms in healthcare facilities, only careful consideration of glazing or shadings can significantly contribute to energy savings. This study focuses on shading and glazing alternatives as an energy-saving strategy. For simulation, an underrecognized BES tool DALEC was hyped to show integrated thermal and visual energy consumption. The findings highlight that energy savings of up to 16.3% is possible.

Keywords: *Glazing, shading, healthcare buildings, energy consumption, DALEC*

*Faculty of Architecture, Department of Architecture Yaşar University, İzmir, Turkey. (*Corresponding author*)

Email: arzu.cilasun@yasar.edu.tr

** Faculty of Architecture, Department of Interior Architecture and Environmental Design, Yaşar University, İzmir, Turkey

Email: suleyman.ivgin@gmail.com

To cite this article: Cilasun Kunduracı, A., & İvgin, S. (2022). Energy Saving Opportunities Through Glazing and Shading Alternatives. *ICONARP International Journal of Architecture and Planning,* 10 (2), 465-481. DOI: 10.15320/ICONARP.2022.211

INTRODUCTION

In terms of energy consumption, it is predicted that buildings constitute the second largest sector and the current consumption will increase further in the future (Özbalta et al., 2012). The energy used in buildings accounts for more than one-third of the total energy consumed (Lei et al., 2021; Yu & Su, 2015). In the last decade, the environmental consequences of energy usage in buildings are recognized, and embracing a more sustainable design approach was agreed upon(Wu, 2011). Interestingly, for a long-time healthcare building were out of sight in terms of energy-saving concerns, and energy conservation practices were not widespread in these buildings. Due to that, comprehensive investigations to reduce the energy consumption of healthcare are limited in literature(Ji & Qu, 2019). Among various building types, healthcare buildings are responsible for a significant portion of energy consumption due to continuous occupation hours, medical requirements, and providing high standard requirements for indoor environmental comfort conditions. They consume approximately 10% of total energy consumption (Alshayeb et al., 2015; Englezou & Michael, 2020; Wang et al., 2016) and this is more than twice of other public buildings' energy consumption (Ji & Qu, 2019). Healthcare spaces spend a vast amount of energy to provide thermal comfort (50%), visual comfort (30%), equipment (12%), and hot water usage(8%) (Bawaneh et al., 2019; Fifield et al., 2018; García-Sanz-Calcedo, 2014).

Windows have a significant role in energy consumption in buildings since they work as a barrier between indoor and exterior environments. However, they are the weakest component of buildings due to their high heat transfer coefficient (Vanhoutteghem & Svendsen, 2014) and responsible for the majority of heat gain/loss(Dutta et al., 2017). When compared with other building components, windows have the highest heat gain/loss by 60% while flooring by 9%, walls by 8%, and roof by 8% (Dutta et al., 2017; Jelle et al., 2012).

Energy-efficient design for windows requires careful consideration of climate, orientation, window design, and its components (Eisazadeh et al., 2021). The influence of variations for window design is diverse in various climates. For instance in hot-arid climate dominated regions, such as Egypt, increasing window area may result in excessive heat gains and cooling loads (Sadek & Mahrous, 2018) while in cold climate dominated regions it may increase energy loss and heating loads (Altomonte, 2015). Modifying windows (such as ratios, glazing and, shading type) can make meaningful savings. For instance, changing the window-to-wall ratio (WWR) of an office building from 13,3% to 53,3% in India resulted in a 53,33% increase in total energy consumption (Ghosh & Neogi, 2018). While, in Hassouneh et al.'s study (2010) using solar-e glass instead of clear glass in an apartment block saved energy by up to 160% (Hassouneh et al., 2010). Similar effects can be observed also in patient rooms since they are one of the most significant spaces in healthcare facilities in terms of both energy consumption and users' well-being. For

DOI: 10.15320/ICONARP.2022.211

instance, according to Sherif & Sabry's study in a healthcare building, modification of glazing and shading elements can cause significant energy savings that can reach up to 30% (Sherif & Sabry, 2014). Thus when windows are carefully designed, energy savings can be achieved while preventing glare, excessive heat gains, and adaptation problems (Stevanovi & Stevanović, 2013; Zhang et al., 2017).

To adopt energy-efficient daylight strategies, all window components such as glazing, frame (panes, rails, sill, etc.), and shadings (interior or exterior) should be considered. Among the given window components, mainly shading and glazing materials determine thermal transmittance and solar radiation since they are the two most energy-effective components of windows (Mohammad Yusoff, 2021; Raji et al., 2015). Shading systems (either present outside or inside the building) directly affect the amount of daylight entering interiors as well as the heat gain and privacy (Gomes et al., 2014). Through various glazing and shading combinations, daylight illumination can be increased in non-light areas of the building, while total energy consumption can be reduced (Alhazzaa, 2020; Do & Chan, 2020; Huo et al., 2021; Raheem et al., 2015).

Building Energy Simulation (BES) tools are quite helpful for predicting and optimizing building energy performance during the design phase (Magni et al., 2021). However, they require both several detailed input data for building characteristics and advanced computer skills which can be very time-consuming. Although the number of BES tools is increasing, aspects such as simulation flexibility, user-friendly interface, efficient runtime while preserving detailed results and free access are still rare. For daylight simulation, several BES tools that are capable of supporting both thermal and visual performance evaluation of façade systems such as; EnergyPlus, TRNSYS, IES VE, IDA ICE v4.8, ESP-r and DALEC (Hauer M., De Michele G., Demanega I., Avesani S., 2019). Among the listed BES, DALEC is the only free online tool for the evaluation of building facades in terms of visual and thermal aspects within seconds. DALEC is provided by Zumtobel due to its rapid runtime, user-friendly interface, and free access; it can be quite helpful for people without deep expert knowledge(Ebert et al., 2018).

The number of studies that predict and evaluate the impacts of architectural design and material usage on the energy performance of buildings through BES has increased significantly over the last 20 years. Having diversity in conducted studies, in terms of climate, architectural properties, and parameters may be quite helpful for future designers. Within this study a case study building located in Izmir, Turkey was simulated using DALEC. Previous studies which were carried out in Izmir focused on natural illumination levels and total energy consumption concerning window dimensions (Gündoğdu & Cilasun Kunduraci, 2019; İnan, 2013; Yildiz et al., 2011)(Yildiz et al., 2011) in educational buildings. Also, some other studies focused on the window to wall ratio (WWR) and daylight's influence in offices(Baş & Kazanasmaz, 2020; Kazanasmaz, 2013), nevertheless, the impact of window components in healthcare

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

buildings has not been focused on. Healthcare buildings are complex facilities that should provide a safe and healthy environment for all of their users who are vulnerable or have differing and sensitive needs. Achieving energy-efficient window design decisions made for patient rooms is not an easy task due to the high market diversity for glazing and shading options. The wide range of alternatives should be examined in terms of both thermal (transferring solar heat) and visual (providing natural light) aspects to reduce energy consumption (Eisazadeh et al., 2021; Shahbazi et al., 2019). Despite that, generally, window design is treated like a black box where their combined effects of energy efficiency are limited with assumptions, and decisions are left to building engineers and architects (Bülow-hübe, 2001).

Within this study, a sample patient room was simulated by using DALEC to evaluate energy saving potentials of various glazing and shading configurations. Results were compared in terms of lighting, heating, cooling, and total energy consumption. The main objectives of this study were to evaluate potential energy savings due to *(1) glazing alternatives, (2) various shading types, and (3) estimate the total energy (heating, lighting, and cooling) changes of each scenario.* The larger aim was to highlight how glazing and shading type decisions influence energy consumption aspects (lighting, heating, and cooling) and how the DALEC online tool can help researchers for future projects and research.

METHODOLOGY

The method describing the followed processed was explained step by step. First, DALEC software was acquainted with its significance and limitations. Later the alternative sets of glazing and shadings were introduced and finally, the patient room that was used as a baseline scenario was introduced with its characteristics.

Simulation Tool: DALEC

Architects and building engineers can use simulation tools for accurate and rapid evaluation of alternatives yet the number of software that allows simulating daylight both in terms of visual and thermal performance were limited. DALEC software, which was used in this study, can help architects through window design, with its thermal-visual integrated friendly interface and rapid simulations. The case study room was simulated using DALEC (Day and Artificial Light with Energy Calculation) which is a web-based free and user-friendly online tool that combines visual and thermal simulations at once(Miller et al., 2020). It has been developed by Bartenbach Zumtobel Lighting and the University of Innsbruck (Ebert et al., 2018). DALEC allows designers to achieve thermal and visual comfort goals together and helps to examine the impact of various factors on energy consumption.

For simulation, DALEC online tool uses already determined input factors that affect building energy consumption. The mentioned input values are; material properties, reflectivity values of surfaces, window

DOI: 10.15320/ICONARP.2022.211

wall ratio, shading systems, orientation, window type, window permeability rate, heating and cooling data, natural and artificial lighting amount, and heat permeability rate of interior and exterior walls. A screenshot of the DALEC interface can be seen in Figure 1 and detailed input values of general, visual and thermal can be summarized in Figure 2.

Figure 1. Opening interface of DALEC

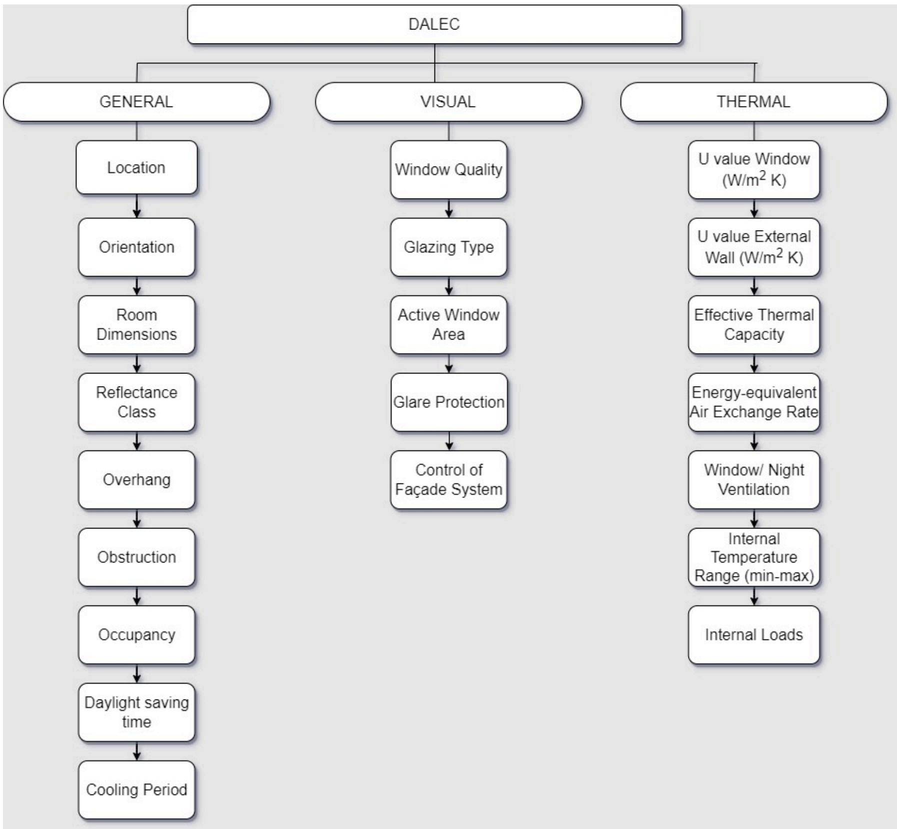


Figure 2. DALEC input parameters.

DALEC can simulate various façade systems in more than 2000 locations worldwide. Complex thermal and visual simulations of daylight can be simply evaluated for heating, cooling, and lighting loads either separately or combined. Besides artificial lighting loads, user behavior and various control strategies such as dimming or daylight-dependent controls are considered in simulations(Ebert et al., 2018; Hauer M., De Michele G., Demanega I., Avesani S., 2019). DALEC provides calculation of lighting metrics such as continuous daylight autonomy cDA (continuous daylight autonomy), luminance limit [cd/m^2] as well as overheating frequency, and annual energy need kWh / (m^2 a).

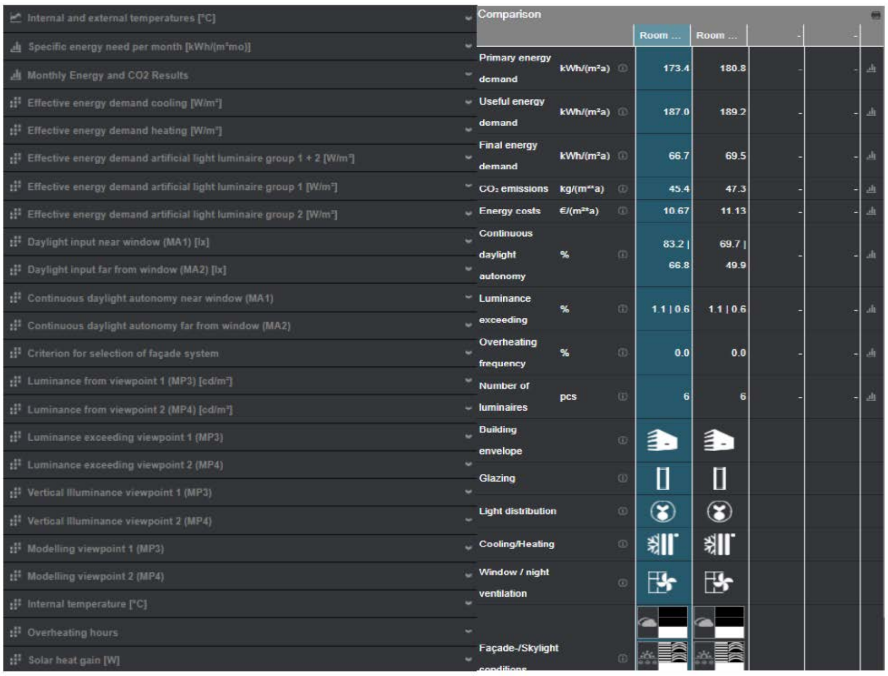


Figure 3. DALEC's results interface.

By selecting locational, constructional properties and occupation type from the given list of options, DALEC is capable of calculating artificial lighting, heating, and cooling consumptions for hourly-based scenarios in less than a second (Miller et al., 2020; Werner et al., 2017). DALEC provides comparison tables of various scenarios at the same interface (Figure 3) and also offers individual graphs of the below-listed aspects.

- Internal and external temperatures,
- specific energy need per month,
- the monthly energy and CO_2,
- effective energy demand for cooling, heating, and artificial lighting,
- daylight input near and far from the window,
- continuous daylight autonomy near and far from the window,
- the criterion for the selection of the façade system,
- luminance from the viewpoint,
- luminance exceeding viewpoint,
- vertical illuminance viewpoint,
- modeling viewpoint,

DOI: 10.15320/ICONARP.2022.211

- internal temperature,
- overheating hours and
- solar heat gain

Though the DALEC is available since 2017, it is not a commonly used or well-known software in literature. DALEC has some limitations as well; for instance, it does not give the opportunity to manually type in the building components or materials, instead, users have to choose among the given alternatives because different calculations and integration of each of these components require considerable computation and time (Werner et al., 2017). Non-linear room geometry, organic forms, and special architectural features can not be simulated in the DALEC web interface yet an integration into Building Integrated Modelling (BIM) environment such as a plug-in for Revit is also developed which could diminish these limitations (Hauer M., De Michele G., Demanega I., Avesani S., 2019).

Case Study Description

A private hospital located in İzmir, Turkey (38° 24′ 45″ N 27° 8′ 18″ E) was selected as a case study. Izmir experiences a warm Mediterranean climate which is hot-humid and categorized as Csa (Cs for dry summer and a for hot summer) in Köppen - Geiger climate categorization (Gercek & Arsan, 2015). A single patient room of dimension 3,66 m × 6,99 m × 3 m located on a ground floor level of a healthcare building (due to the preference of the authorities of the institution, the name of the hospital was not shared) had been chosen for the present study. The layout and dimensions are shown in Figure 4 while a detailed description of the building materials was provided in Table 1.

The case study patient room was selected as a south-facing room without any protrusion (canopy) or exterior shading devices to assess the most critical conditions in terms of solar control. The heat transmission coefficient (U-value) of the building's exterior walls was 1.44 [W / (m^2 K)]. Inner walls were considered adiabatic and have no external connection with the roof or floor. It is assumed that window/night ventilation is active and windows were opened by users when the outside temperature is lower than the indoor temperature. It has been considered that the windows and doors were closed most of the day and the air exchange rate is 0.3. The room interior temperature is set as 24 °C. When this value is exceeded, it is simulated that window/light ventilation is activated. The set points of the range (minimal and maximal) of inner room temperature were 20 – 26 °C. When the temperature is above or lower than the setpoints, the heating or conversely cooling is activated. It is thought that active cooling and heating systems were targeting the determined values. The reduction factor used to account for the reduction of the glass's permeability due to the dirt ratio was considered to be 0.9. The described case study was simulated for 16 scenarios consisting of 4 glazing types and 4 shading system alternatives that were given as options in DALEC (Table 4).

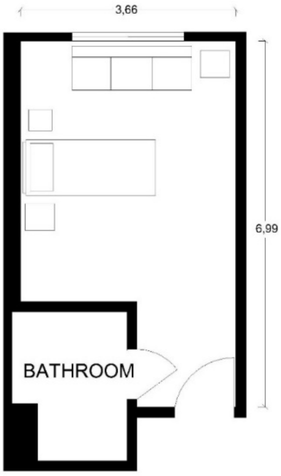


Figure 4. Plan layout of case study single patient room.

Table 1. The details of the case study

Location	38° 24′ 45″ N 27° 8′ 18″ E in İzmir, Turkey
Room Dimensions	3.66 m x 6.99 m x 3 m
Protrusion (canopy)	0 m
Horizontal obstruction	0 °
Orientation	270 ° (South)
Occupancy time	0 - 24h
Number of working days per week	7
Interior reflectance values (ceiling, wall, floor)	70 % - 50 % - 20 %
U-value outer wall	1.44 [W / (m^2 K)]
U-value inner wall	adiabatic
Effective thermal capacity	165000 J / (m^2*K).
Energy equivalent air exchange rate	0.62
Window / night ventilation	Active
Air exchange rate	0.3
Limit temperature window ventilation	24 °C
Internal temperature (min–max)	20 °C – 26 °C
Other internal loads	7 W / m^2
Cooling and Heating Systems	Active
Reduction factor	0.9
Artificial Lighting	Zumtobel 42932522 LF3 A 1600-940 MINI LDE BK
Maintenance factor	0.67
Mounting type	Surface Mounted
Flux per luminaire	1552 lm
Direct light ratio	0.95
Power per luminaire	17.5 W
Lamp dimming characteristic	LinearLed
Switching status	Dimmable

Description of Alternative Materials

To see the effect of various glazing types on energy consumption, four glazing types were selected among the given options of DALEC; heat control glass (HCG), solar control glass (SCG), heat and solar control glass (HSCG), and reflective solar glass (RSG). Double glazing has been applied

DOI: 10.15320/ICONARP.2022.211

for all glazing types. The space between the glasses was chosen as air because it affects the heat transmission values. Selected glazings' light transmittance for normal incidence (Tau-value), heat gain from sun (g-value), and heat transfer coefficient (U-value) values were given in Table 2.

Table 2. Glazing type alternatives and their properties

	Glazing Type	Tau-value	g-value	U-value
Heat Control Glass (HCG)	4 mm Low-E Glass	79 %	55 %	1.3
Heat Solar Control Glass (HSCG)	4 mm Solar Low-E Glass	72 %	44 %	1.3
Solar Control Glass (SCG)	6 mm Green Float Glass	66 %	45 %	2.7
Reflective Solar Glass (RSG)	6 mm Green Tentesol	29 %	27 %	2.7

Shading System Types

Four types of shading systems were selected from ten different shading systems offered by DALEC and those were; No shading (NS), film roller blind (FRB), external Venetian blinds 0° (EVB 0°) and external Venetian blinds 45° (EVB 45°) (*Table 3*). All 16 scenarios were simulated and results can be seen with a comparative interface in DALEC (Figure 3).

Table 3. Shading Systems and Features

Shading System	Shading feature
No shading (NS)	Glazing only
Film Roller blind (FRB)	Clear Screen
External Venetian blinds (EVB 0°)	0 °
External Venetian blinds (EVB 45°)	45 °

Table 4. Scenario and material lists

Scenario	Glazing	Shading
1	Heat Control Glass (HCG) (4 mm Low-E glass)	No Shading (NS)
2	Heat Control Glass (HCG) (4 mm Low-E glass)	Film Roller Blind (FRB)
3	Heat Control Glass (HCG) (4 mm Low-E glass)	External Venetian Blind 0° (EVB 0°)
4	Heat Control Glass (HCG) (4 mm Low-E glass)	External Venetian Blind 45° (EVB 45°)
5	Heat Solar Control Glass (HSCG) (4 mm Solar Low-E Glass)	No Shading (NS)
6	Heat Solar Control Glass (HSCG) (4 mm Solar Low-E Glass)	Film Roller Blind (FRB)
7	Heat Solar Control Glass (HSCG) (4 mm Solar Low-E Glass)	External Venetian Blind 0° (EVB 0°)

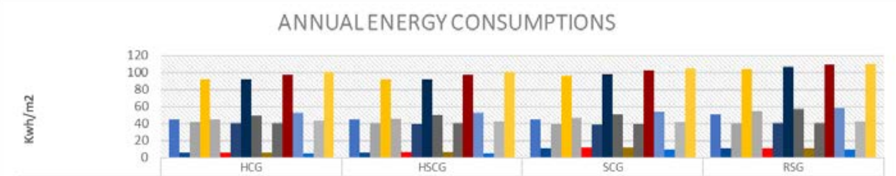
8	Heat Solar Control Glass (HSCG) (4 mm Solar Low-E Glass)	External Venetian Blind 45° (EVB 45°)
9	Solar Control Glass (SCG) (6 mm Green Float Glass)	No Shading (NS)
10	Solar Control Glass (SCG) (6 mm Green Float Glass)	Film Roller Blind (FRB)
11	Solar Control Glass (SCG) (6 mm Green Float Glass)	External Venetian Blind 0° (EVB 0°)
12	Solar Control Glass (SCG) (6 mm Green Float Glass)	External Venetian Blind 45° (EVB 45°)
13	Reflective Solar Glass (RSG) (6 mm Green Tentesol)	No Shading (NS)
14	Reflective Solar Glass (RSG) (6 mm Green Tentesol)	Film Roller Blind (FRB)
15	Reflective Solar Glass (RSG) (6 mm Green Tentesol)	External Venetian Blind 0° (EVB 0°)
16	Reflective Solar Glass (RSG) (6 mm Green Tentesol)	External Venetian Blind 45° (EVB 45°)

RESULTS

Considering the combinations between glazing and shading types, 16 scenarios were simulated for the single patient room by using DALEC software.

Table 5 illustrates a comparative graph of simulation results of a single patient room and each scenario was discussed individually in terms of lighting, heating, cooling, and total energy consumption in detail.

Table 5. Lighting, heating, cooling, and total energy consumption results of all glazing and shading types



	HCG	HSCG	SCG	RSG
NS LIGHTING	44.70	45.00	45.40	51.50
NS HEATING	5.90	6.20	11.40	11.50
NS COOLING	41.40	40.40	39.80	40.80
NS TOTAL ENERGY C.	92.00	91.60	96.60	103.80
EVB0 LIGHTING	45.00	45.70	46.60	54.20
EVB0 HEATING	6.30	6.60	11.90	11.40
EVB0 COOLING	40.90	39.90	39.20	41.00
EVB0 TOTAL ENERGY C.	92.20	92.20	97.70	106.60
EVB45 LIGHTING	49.80	50.60	51.40	57.00
EVB45 HEATING	6.30	6.40	11.70	11.40
EVB45 COOLING	40.90	40.30	39.50	41.00
EVB45 TOTAL ENERGY C.	97.00	97.30	102.60	109.40
FRB LIGHTING	52.60	53.20	53.80	58.20
FRB HEATING	5.10	5.00	9.70	9.30
FRB COOLING	43.10	42.70	41.50	42.60
FRB TOTAL ENERGY C.	100.80	100.90	105.00	110.10

Lighting Energy

In terms of lighting energy consumption, among the four glazing types, the highest energy is consumed by RSG, while HCG is the most energy-efficient glazing type. Using HCG saved up to 20.4% (with EVB 0°) energy compared to alternatives using RSG. This saving can be explained by the transmission coefficient (tau) difference. The Tau value of HCG is 79% while it is 29% for RSG (*Table 2*) therefore this difference reflects the

DOI: 10.15320/ICONARP.2022.211

amount of light transmitted to interiors. Lighting energy consumptions of HSCG and SCG were close to each other yet HSCG consumes 0.6 % to 1.6 % and SCG consumes 1.6 % to 3.6 % more energy compared to HCG.

The usage of all three shading types increased the energy consumption for lighting. This increase is most visible on FRB with 30.2 % compared to NS (with RSG), while the difference is less significant between EVB 45° and EVB 0° shadings. For instance, EVB 45° consumes only 5.2 % (with RSG) to 10.7 % (with HCG) more lighting energy compared to EVB 0°. Results show that using shading (all three types) has increased lighting energy consumption compared to the alternative without shading (NS). Though it seems like not using a shading device can be an energy-efficient solution, without shading discomfort problems might occur. Within this study daylight related comfort parameters (such as daylight glare probability and daylight glare index) were not taken into consideration.

Heating Energy

In terms of heating energy consumption, among the four glazing types, the highest energy was consumed by SCG and RSG. When RSG is used, the energy required for heating has increased by 94.9 % compared to HCG (with NS). Similarly, the heating demand of SCG is 85.7 % to 93.2 % more than HCG. The heating energy demands vary significantly among glazing types depending on their U and g values. To minimize the energy consumption for heating, both U and g values were quite important.

Using a shading system decreased heating energy demand in some cases. For all four glazing types when FRB shading is used the heating demand reduces up to 19.4 % (compared to HSCG with NS). However, using EVB 0° and EVB 45° as shading, increased heating energy consumption for each glazing type. The difference between EVB 0° and EVB 45° shading types is closer, however, EVB 0° consumes 3.1 % (with RSG) more energy compared to EVB 45°. As an alternative set, SCG with EVB 0° has the highest, while HSCG with FRB has the lowest heating energy demand.

Cooling Energy

Among each type of energy demand, the least difference was observed in cooling energy demand comparisons; both in terms of glazing and shading systems. The differences between the alternatives were significantly close to each other, yet SCG has the lowest cooling energy consumption despite its high heating demand of it. For shading devices, the usage of EVB 0° and EVB 45° shadings (with all four glazing types) have the least energy consumption compared to the others. For instance, when FRB is used as a shading system, the cooling energy demand increases up to 7 % (in HSCG). The lowest energy demand is observed when SCG is used with EVB 0° while the highest is observed with HCG is used with FRB and the possible cooling energy savings can be 9 % between these two alternatives.

Total Energy Consumption

When results were compared, using different glazing types can save energy up to 15.6 %. Among the four glazing types, HCG and HSCG have the lowest energy consumptions and their consumption values were very similar to each other (for all four shading options). On the other hand, RSG and SCG have higher total energy consumption, particularly, RSG has the highest total energy consumption and it consumes 15.6 % more energy compared to HCG. This energy consumption increase is a total of lighting, heating, and cooling, therefore some of the glazings have better performance in terms of lighting (such as HCG), while another has a better performance for cooling (such as SCG) (Figure 5).

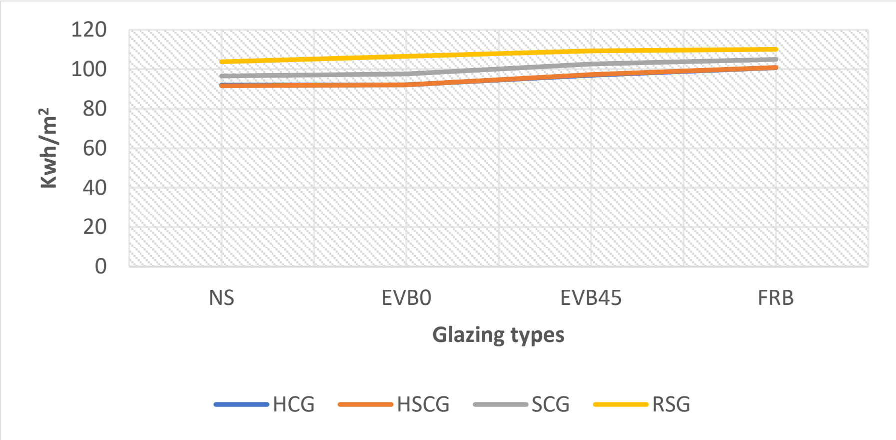


Figure 5. Annual total energy consumption according to glazing types

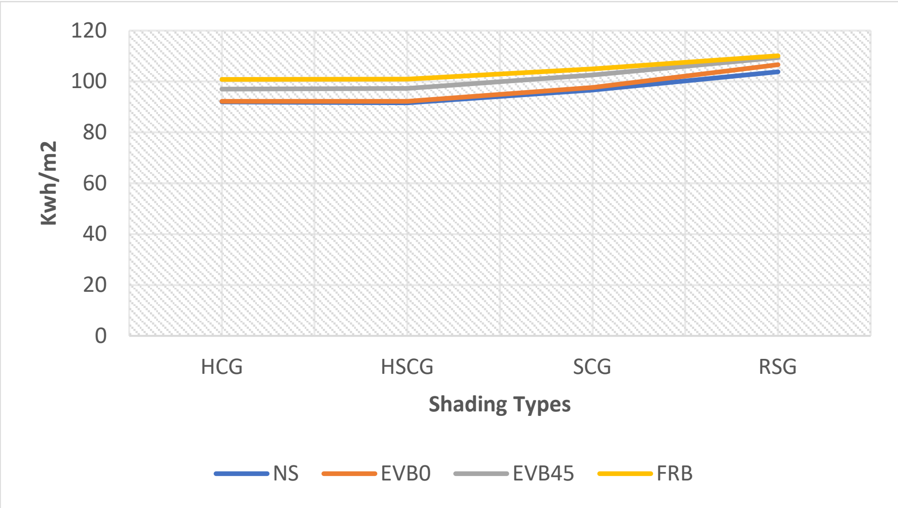


Figure 6. Annual total energy consumptions according to shading types

In terms of shading systems, it was found that compared to the alternatives without shading system (NS), using any of the three selected shading systems (FRB, EVB 0°, and EVB 45°) increased total energy consumption for each glazing type. Especially FRB shading increased it up to 10.2 % compared to NS (with HSCG). The total energy consumptions of EVB 0° and EVB 45° shading types were close to each other, however, EVB 0° consumes 2.6 % (with RSG) to 5.5 % (with HSCG) less energy compared to EVB 45°. As a result, HSCG without any shading (NS) has the lowest, while RSG with EVB 45° shadings has the highest total energy

DOI: 10.15320/ICONARP.2022.211

consumption among all 16 alternatives. When those two values were compared 16.3 % saving is possible Figure 6.

CONCLUSION

In the present study, a single patient room in Izmir with 16 different glazing and shading alternatives was simulated using DALEC. Results were compared and tested to explore how daylight and energy consumption are precisely balanced by glazing components. Although the outcome was an energy consumption comparison, the focus was based much on the change of heating, cooling and lighting consumption over glazing-shading options. Conclusions to be derived from this study can be viewed to see the energy-saving potentials through window components. The findings of the simulations are briefly listed:

- Among the three energy demands, lighting is the biggest energy consumer (48.6 % to 52.2 %) thus, to have an energy-efficient patient room, lighting demand should be minimized.
- The most energy-efficient scenario was NS with HCG and SHCG (Low-E glasses with high tau values). HCG and SHCG without any shading allow more daylight penetration which reduces artificial lighting usage, yet the possibility of glare should also be considered.
- As daylight availability increases, cooling energy demand also increases and it's the second biggest energy consumer (38.5 % to 41.2 %).
- Heating energy demand constitutes the smallest part of total energy consumption for the selected case study and scenarios (9.2 % to 12.2 %).
- Using alternative glazing and shading combinations affected total energy consumption by up to 16.3 %.

Several limitations were considered noteworthy. The first limitation concerns the selection of DALEC which also limits the glazing and shading alternatives that were used in simulations. DALEC does not allow the manual import of glazing or shading materials, so if a designer wants to check a different alternative, the interface does not enable such an option. Therefore, simulated scenarios were determined according to DALEC's material library, luckily, they are common products that can be easily found in the market. The second limitation is related to the total model scale. The simulation results fall short of representing the whole building's energy performance but only a room can be modelled with given locational and architectural features. However, the impact of different alternatives and various room types (such as circulation, polyclinic, and care areas) was eliminated. To predict a healthcare facility's total energy consumption all should be taken into consideration. Daylight is vital for humans yet it also requires optimization between various design aspects (such as facade design, internal finishes, space layout, glazing, shadings, views, glare, solar gains, etc.) in the early stages of design. Compared to other building types, healthcare buildings are more complicated and energy-saving strategies that should be applied

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

are more layered (Ji & Qu, 2019). To design an energy-efficient healthcare building, all these variables have to be related to biological, behavioural, and comfort factors with a multidisciplinary approach and detailed evaluation. Researchers and designers can benefit from this study's findings during healthcare design and decision-making processes. This study is only a first step of a more in-depth analysis where exclusive optimization of energy performance and focus on patients' visual and thermal comforts in terms of glazing and shading preferences.

REFERENCES

Alhazzaa, K. (2020). Energy Reduction, Daylight and View Quality Assessment of a Passive Dynamic Facade in Hot Arid Climate. *Iconarp International J. of Architecture and Planning*, *8*(2), 518–544. https://doi.org/10.15320/iconarp.2020.125

Alshayeb, M., Mohamed, H., & Chang, J. D. (2015). Energy Analysis of Health Center Facilities in Saudi Arabia: Influence of Building Orientation, Shading Devices, and Roof Solar Reflectance. *Procedia Engineering*, *118*, 827–832. https://doi.org/10.1016/j.proeng.2015.08.520

Altomonte, S. (2015). *Daylight for Energy Savings and Psycho-Physiological Well-Being in Daylight for Energy Savings and Psycho-Physiological Well-Being in Sustainable Built Environments*. *February 2009*. https://doi.org/10.5539/jsd.v1n3p3

Baş, H., & Kazanasmaz, T. (2020). Hybrid-model simulations to equilibrate the energy demand and daylight autonomy as a function of window-to-wall ratio and orientation for a perimeter office in Izmir. *MEGARON / Yıldız Technical University, Faculty of Architecture E-Journal*, *15*(4), 537–552. https://doi.org/10.14744/megaron.2020.42223

Bawaneh, K., Nezami, F. G., Rasheduzzaman, M., & Deken, B. (2019). Energy consumption analysis and characterization of healthcare facilities in the United States. *Energies*, *12*(19). https://doi.org/10.3390/en12193775

Bülow-hübe, H. (2001). *Energy-Efficient Window Systems in Buildings*. Department of Construction and Architecture.

Do, C. T., & Chan, Y. C. (2020). Evaluation of the effectiveness of a multi-sectional facade with Venetian blinds and roller shades with automated shading control strategies. *Solar Energy*, *212*(September), 241–257. https://doi.org/10.1016/j.solener.2020.11.003

Dutta, A., Samanta, A., & Neogi, S. (2017). Influence of orientation and the impact of external window shading on building thermal performance in tropical climate. *Energy and Buildings*, *139*, 680–689. https://doi.org/10.1016/j.enbuild.2017.01.018

Ebert, O., Junghans, B., Geisler-Moroder, D., Pohl, W., Werner, M., & Pfluger, R. (2018). *Day and Artificial Light with Energy Calculation*.

Eisazadeh, N., Allacker, K., & De Troyer, F. (2021). Integrated energy, daylighting and visual comfort analysis of window systems in patient rooms. *Science and Technology for the Built Environment*, *27*(8), 1040–1055. https://doi.org/10.1080/23744731.2021.1912512

Englezou, M., & Michael, A. (2020). Assessment of daylight performance and the impact of shading devices for typical in-patient rooms in healthcare facilities in Cyprus. *Procedia Manufacturing*, *44*, 277–285. https://doi.org/10.1016/j.promfg.2020.02.232

Fifield, L. J., Lomas, K. J., Giridharan, R., & Allinson, D. (2018). Hospital wards and

DOI: 10.15320/ICONARP.2022.211

modular construction: Summertime overheating and energy efficiency. *Building and Environment*, *141*(May), 28–44. https://doi.org/10.1016/j.buildenv.2018.05.041

García-Sanz-Calcedo, J. (2014). Analysis on energy efficiency in healthcare buildings. *Journal of Healthcare Engineering*, *5*(3), 361–374. https://doi.org/10.1260/2040-2295.5.3.361

Gercek, M., & Arsan, Z. D. (2015). Impact of Thermal Mass Oriented Measures Over CO2 Emissions Of a Thermally Insulated Low-rise Apartment Building in Izmir, Turkey. *Iconarp International Journal of Architecture and Planning*, *2*(2), 59–72.

Ghosh, A., & Neogi, S. (2018). Effect of fenestration geometrical factors on building energy consumption and performance evaluation of a new external solar shading device in warm and humid climatic condition. *Solar Energy*, *169*(March 2017), 94–104. https://doi.org/10.1016/j.solener.2018.04.025

Gomes, M. G., Santos, A. J., & Rodrigues, A. M. (2014). Solar and visible optical properties of glazing systems with venetian blinds: Numerical, experimental and blind control study. *Building and Environment*, *71*, 47–59. https://doi.org/10.1016/j.buildenv.2013.09.003

Gündoğdu, E., & Cilasun Kunduraci, A. (2019). Effect of Window Glazings' Visible Transmittance to Daylight Factor and Energy Efficiency in An Architecture Studio. *7th International Conference on Embracing Capacity Building Opportunities in the Modern Day Dispensation*, *26*(3), 1–4. https://doi.org/10.1007/s11273-020-09706-3%0Ahttp://dx.doi.org/10.1016/j.jweia.2017.09.008%0Ahttps://doi.org/10.1016/j.energy.2020.117919%0Ahttps://doi.org/10.1016/j.coldregions.2020.103116%0Ahttp://dx.doi.org/10.1016/j.jweia.2010.12.004%0Ahttp://dx.doi.o

Hassouneh, K., Alshboul, A., & Al-Salaymeh, A. (2010). Influence of windows on the energy balance of apartment buildings in Amman. *Energy Conversion and Management*, *51*(8), 1583–1591. https://doi.org/10.1016/j.enconman.2009.08.037

Hauer M., De Michele G., Demanega I., Avesani S., P. D. (2019). Analysis of calculation approaches for complex fenestration systems. In *FACEcamp*. https://www.semanticscholar.org/paper/M4.1-Analysis-of-calculation-approaches-for-complex/17902bbe14a0ad78af17b6d50f88e0d6a0025695

Huo, H., Xu, W., Li, A., Chu, J., & Lv, Y. (2021). Sensitivity analysis and prediction of shading effect of external Venetian blind for nearly zero-energy buildings in China. *Journal of Building Engineering*, *41*, 135907. https://doi.org/10.1016/j.jobe.2021.102401

İnan, T. (2013). An investigation on daylighting performance in educational institutions. *Structural Survey*, *31*(2), 121–138. https://doi.org/10.1108/02630801311317536

Jelle, B. P., Hynd, A., Gustavsen, A., Arasteh, D., Goudey, H., & Hart, R. (2012). Fenestration of Today and Tomorrow : A State-of- the-Art Review and Future Opportunities. *Solar Energy Materials and Solar Cells*, *96*(October), 1–28.

Ji, R., & Qu, S. (2019). Investigation and evaluation of energy consumption performance for hospital buildings in China. *Sustainability (Switzerland)*, *11*(6). https://doi.org/10.3390/su11061724

Kazanasmaz, T. (2013). Fuzzy logic model to classify effectiveness of daylighting in an office with a movable blind system. *Building and Environment*, *69*, 22–34. https://doi.org/10.1016/j.buildenv.2013.07.011

Lei, L., Chen, W., Wu, B., Chen, C., & Liu, W. (2021). A building energy consumption prediction model based on rough set theory and deep learning algorithms. *Energy and Buildings*, *240*, 110886. https://doi.org/10.1016/j.enbuild.2021.110886

Magni, M., Ochs, F., de Vries, S., Maccarini, A., & Sigg, F. (2021). Detailed cross comparison of building energy simulation tools results using a reference office building as a case study. *Energy and Buildings*, *250*, 111260. https://doi.org/10.1016/j.enbuild.2021.111260

Miller, J., Moser, F., Stumpf, J. P., & Pfluger, R. (2020). REVIT2DALEC : A BIM2BEM COMBINED THERMAL AND DAY-AND ARTIFICIAL LIGHT ENERGY CALCULATION WITH DALEC USING THE MVD. *BauSIM 2020 TU Graz, October*.

Mohammad Yusoff, W. F. (2021). Indoor Thermal Comfort in Modern Mosque of Tropical Climate. *Iconarp International J. of Architecture and Planning*, *9*(2), 720–741. https://doi.org/10.15320/iconarp.2021.178

Özbalta, T. G., Sezer, A., & Yildiz, Y. (2012). Models for prediction of daily mean indoor temperature and relative humidity: Education building in Izmir, Turkey. *Indoor and Built Environment*, *21*(6), 772–781. https://doi.org/10.1177/1420326X11422163

Raheem, A. A., Issa, R. R. A., & Olbina, S. (2015). Energy and indoor comfort analysis of various window-shading assemblies INA hot and humid climate. *Proceedings - Winter Simulation Conference*, *2015-Janua*, 3200–3211. https://doi.org/10.1109/WSC.2014.7020156

Raji, B., Tenpierik, M. J., & van den Dobbelsteen, A. (2015). An assessment of energy-saving solutions for the envelope design of high-rise buildings in temperate climates: A case study in the Netherlands. *Energy and Buildings*, *124*, 210–221. https://doi.org/10.1016/j.enbuild.2015.10.049

Sadek, A. H., & Mahrous, R. (2018). Adaptive glazing technologies: Balancing the benefits of outdoor views in healthcare environments. *Solar Energy*, *174*(September), 719–727. https://doi.org/10.1016/j.solener.2018.09.032

Shahbazi, Y., Heydari, M., & Haghparast, F. (2019). An early-stage design optimization for office buildings' façade providing high-energy performance and daylight. *Indoor and Built Environment*, *28*(10), 1350–1367. https://doi.org/10.1177/1420326X19840761

Sherif, A., & Sabry, H. (2014). Energy Efficient Hospital Patient Room Design : Effect of Room Shape on Window- to-Wall Ratio in a Desert Climate. *30th International Plea Conference, December 2014*.

Stevanovi, S., & Stevanović, S. (2013). Optimization of passive solar design strategies : A review $. *Renewable and Sustainable Energy Reviews*, *25*, 177–196. https://doi.org/10.1016/j.rser.2013.04.028

Vanhoutteghem, L., & Svendsen, S. (2014). Modern insulation requirements change the rules of architectural design in low-energy homes. *Renewable Energy*, *72*, 301–310. https://doi.org/10.1016/j.renene.2014.07.005

Wang, T., Li, X., Liao, P. C., & Fang, D. (2016). Building energy efficiency for public hospitals and healthcare facilities in China: Barriers and drivers. *Energy*, *103*, 588–597. https://doi.org/10.1016/j.energy.2016.03.039

Werner, M., Geisler-Moroder, D., Junghans, B., Ebert, O., & Feist, W. (2017). DALEC–a novel web tool for integrated day- and artificial light and energy calculation. *Journal of Building Performance Simulation*, *10*(3), 344–363. https://doi.org/10.1080/19401493.2016.1259352

Wu, Z. (2011). *Evaluation of a Sustainable Hospital Design Based on Its Social and* (Issue May) [Cornell University]. http://iwsp.human.cornell.edu/files/2013/09/Ziqi-Wu-2011-19cxn60.pdf

DOI: 10.15320/ICONARP.2022.211

Yildiz, Y., Göksal Özbalta, T., & Durmuş Arsan, Z. (2011). Farklı Cam Türleri ve Yönlere Göre Pencere/Duvar Alanı Oranının Bina Enerji Performansına Etkisi: Eğitim Binası, İzmir. *Megaron*, *6*, 30–38. http://search.ebscohost.com/login.aspx?direct=true&profile=ehost&scope=site&authtype=crawler&jrnl=13096915&AN=69832767&h=ZlUwcBJ7oWRTQJVqbVY7TTf6j5gWSMSHzRp8WYT9MqxHHYvrlqzM3LmTi3fTweL%2BGZxF9E%2B1INE2S60cfXvaMg%3D%3D&crl=c

Yu, X., & Su, Y. (2015). Daylight availability assessment and its potential energy saving estimation –A literature review. *Renewable and Sustainable Energy Reviews*, *52*, 494–503. https://doi.org/10.1016/j.rser.2015.07.142

Zhang, A., Bokel, R., van den Dobbelsteen, A., Sun, Y., Huang, Q., & Zhang, Q. (2017). Optimization of thermal and daylight performance of school buildings based on a multi-objective genetic algorithm in the cold climate of China. *Energy and Buildings*, *139*, 371–384. https://doi.org/10.1016/j.enbuild.2017.01.048

Resume

Arzu Cilasun Kunduracı, held a Doctor of Philosophy in Architecture from Izmir Institute of Technology. She received her B.Arch and M.Arch from Yıldız Technical University in the major of Architecture.

Süleyman İvgin, received his B. Int. Architecture and M. Int. Architecture from Yaşar University. He currently works at S8 Interior Architecture as company manager.

Research Article

ICONARP
International Journal of Architecture and Planning
Received: 04.02.2022 Accepted: 30.10.2022
Volume 10, Issue 2/ Published: 20.12.2022
DOI: 10.15320/ICONARP.2022.212 E- ISSN:2147-9380

ICONARP

Evaluation of the Lighting Energy Performance of Educational Buildings with BEP-TR Methodology: The Case of ERU Faculty of Architecture

Ahmet Afşin Küçük*
Özlem Sümengen **

Keywords:
BEP-TR, energy efficient lighting, educational buildings, artificial lighting

*Erciyes University, Graduate School of Natural and Applied Sciences (Architecture Program) Kayseri-Turkey.
E-mail: ahmetafsinkucuk@gmail.com

**Erciyes University, Faculty of Architecture, Department of Architecture, Kayseri- Turkey.
(Corresponding author)
E-mail: osumengen@erciyes.edu.tr

Abstract

As part of energy efficiency and conservation measures, central and local governments have developed various action plans, international commitments, calculation models, regulations, standards, and certificates and arrangements. Building Energy Performance (BEP-TR), a national calculation method developed according to the conditions of Turkey, is one of them. With BEP-TR, the energy efficiency of the building is measured in existing or alternative situations. In public buildings, the issue of energy efficiency is vital in terms of being an example. In the framework of this study, the Faculty of Architecture of Erciyes University as an educational and public structure was selected as the study area. Lighting is essential in electricity consumption in public buildings, especially educational establishments. This study aims to guide the energy efficiency principles and lighting design on the axis of comfort-cost and consumption for all public buildings, especially educational buildings, by emphasizing that the concept of energy efficiency should be handled multi-dimensionally with its various layers. Current state data to measure using the BEP-TR will be assessed if the lighting is energy efficient, according to visual comfort needs. Lighting energy consumption values were recalculated by checking the alternatives, simulations, and visual comfort criteria developed concerning energy efficiency. With the revision of the lighting design, the amount of savings to be realized by the system that meets the requirements for visual comfort was calculated. While the improvements proposed in the study were handled under the title of the artificial lighting system, other parameters were kept constant. In improvements alternatives, while offering a physical and psychological enhancement for users, it also saves energy in public buildings and bring an ecological proposition to reduce the carbon footprint for nature. Considering the proposal in the context of comfort-consumption-cost and amortization. The calculation of how long the initial investment cost will be amortized with the amount of savings has been made using three different methods. The study shows originality in responding to the designer's aesthetic concerns with the multi-dimensional inputs of energy efficiency.

To cite this article: Küçük, A.A. & Sümengen, Ö. (2022) Evaluation of the Lighting Energy Performance of Educational Buildings with BEP-TR Methodology: The Case of ERU Faculty of Architecture. *ICONARP International Journal of Architecture and Planning,* 10 (2), 482-502. DOI: 10.15320/ICONARP.2022.212

INTRODUCTION

The protection of natural and cultural heritage, urban and environmental values, and observance of the principle of priority of public and public interest are the necessity of the obligations of scientists, especially architects, to society and the essential parts of professional ethics. In our world, where resources are rapidly running out, the energy needed and used is rapidly increasing. Accordingly, the deterioration of the ecosystem balance and the economic dimension of energy costs have also led to new approaches to both the conservation of environmental values and the efficiency of energy use. Terms such as sustainability, energy efficiency, green energy, and green buildings appear in both practice and legal regulations as the results of the processes mentioned [Ozyurt and Kutluay, 2009].

Energy consumption is a significant problem with its cost and environmental impact on a global scale. In order to prevent this problem, it is imperative that energy is consumed as little as possible and that the consumed energy is obtained from renewable sources. A system proposal is needed for the supply of this supply. In particular, studies on the efficient use of electrical energy have gained importance in recent years. Therefore, regulations, standards, and energy performance certification systems are being developed to determine energy performance in countries [Kucuk, 2019], such as the Rio Protocole, the Kyoto Protocole, the Paris Agreement, the European Union Green Deal, and test tubes. The Paris Agreement has been an indicator and the most concrete initiative of the effort of a global climate change fight with Intended Nationally Determined Contributions - INDC of 189 countries responsible for approximately 98% of greenhouse gas emissions [UNEP, 1972]. In order to reduce climate change, INDCs have been determined for each state by international agreements [Hamilton et al., 2021]. The steps of the European Union to combat climate change continue with the European Green Deal (EGD) after the Paris Agreement [Sahin and Onder, 2021]. EGD aims to transform European Union countries and citizens into a fair and competitive environment with zero greenhouse gas emissions by 2050 [Cayiragası and Sakacı, 2021]. These targets have been shaped toward the United Nations Sustainable Development Goals, covering 2015 – 2030 [United Nations, 2015a]. Sustainable Development Goals (SDGs) were adopted as an international action plan at the General Assembly of the Nations held in September 2015. For a comprehensive future vision, 17 SDGs and 169 associated targets have been identified [Europe Sustainable Development Report, 2020]. The SDGs for Europe are expressed as a commitment to guide sustainable development [Europe Sustainable Development Report, 2020]. The common theme in all these agreements is energy-efficient sustainable development [Idowu, Schmidpeter & Zu, 2020; Barbier, 2019]. The European Green Consensus has emerged to meet the European Union's vision of a typical "green growth" strategy;

DOI: 10.15320/ICONARP.2022.212

the definition of "reaching climate neutrality at the continental scale" was used for this agreement [Desouza, 2020; Storm, 2020].

However, central and local governments put forward various action plans and agreements within the scope of energy efficiency and saving measures. For example, following the 2002/91/EC regulation for the calculation of lighting energy by the EU, EN 15193 Energy Performance in Buildings-Lighting Energy Requirements standard has been published [DEPB, 2002/91/EC] because lighting energy needs are also components that significantly affect the electrical energy consumption of buildings [Sumengen, 2015].

The economic dimension of saving measures in energy consumption is essential for local governments. Promulgated in the official gazette on the date of August 16, 2019, according to the Presidential Circular, in order to use public resources efficiently and to reduce the burden of energy costs on the public sector of public buildings by the end of 2023 seems targeted to 15 percent energy saving [Energy Saving in Public Buildings, 2019]. One of these savings measures is undoubtedly lighting energy.

In 2018, the Ministry of Energy and Natural Resources, General Directorate of Renewable Energy, published the Energy Efficiency Survey Implementation Monitoring Report in Public Buildings. In this report, within the scope of savings potential, structures such as schools, student dormitories, teachers' houses, universities, hospitals, administrative buildings, airports, and prisons, which are affiliated with the Republic of Turkey Ministry of National Education(MNE), which cover the majority of public buildings, are discussed under seven headings [Energy Efficiency Survey Implementation Monitoring Report in Public Buildings – I, 2018]. In order to show the quantity of the savings measures to be taken, there are more than one hundred thousand educational institutions in Turkey as of 2020, serving only institutions and organizations affiliated with YOK and MEB [MEB, 2020]. However, within the scope of the research, only 72 schools affiliated with MEB, 359 buildings affiliated with these schools, nine universities, and 180 buildings affiliated with universities were examined. Lighting is the essential energy consumption item in universities, MNE-affiliated schools, student dormitories, teachers' houses, and prisons. It is the second most crucial item in Administrative Buildings [BEP-TR, 2010].

Erciyes University (ERU) Faculty of Architecture, education, and public structure were chosen as the study area in this paper. The study is a quantitative research subject, and a causal-comparative method was followed. Within the scope of the study, it was desired to examine the current working area in terms of energy efficiency with the BEP-TR calculation model. For this, it is necessary to examine whether the lighting of the current situation provides visual comfort requirements.

Visual comfort requirements are the essential requirement for lighting energy performance when measuring lighting energy performance. Visual comfort conditions are required to improve visual and spiritual performance in educational structures, keep learning performance high and increase motivation and working productivity. In this context, determining lighting performance is a comprehensive and detailed method that allows one to examine the behavior of lighting in the interior space and the lighting of the building in a quantitative and qualitative context [Kucuk, 2019]. Therefore, in the scope of the study, the visual comfort conditions provided by the existing lighting system were determined, and the annual lighting energy consumed was calculated based on the BEP-TR method. In order to provide visual comfort conditions, the current situation with the standards was evaluated, and alternative lighting system suggestions were developed by making revisions according to energy-efficient lighting principles to reduce lighting energy consumption. By making cost analyzes of the proposed revisions, the importance of multidimensional handling of the concept of energy efficiency has been revealed in the context of comfort-consumption-cost. Suggested improvements; within the scope of the artificial lighting system, other parameters such as daylight factor, geographical location, orientation, control systems, usage hours, and spatial features are kept constant in the study.

The study includes general information and literature studies; lighting was examined within the scope of concept studies and energy efficiency principles. There is a field study, and the current levels of illumination in the spaces were calculated using simulations using the DiaLux program, depending on the lighting elements in the spaces in the selected area, the colors of the materials selected in the spaces, and the preferred colors on the surfaces. At the same time, lighting energy consumption was determined by the BEP-TR method, and all aspects of the current situation were considered by evaluating whether the data of the current situation met the visual comfort requirements according to the standards.

This assessment utilizes energy-efficient and cost-efficient lighting system designs for energy-efficient light sources to determine the selection of lighting fixtures typology, mounting methods, visual comfort conditions and psychological design alternatives have been developed. Following a similar method in this alternative lighting design proposal, the visual comfort criteria were checked with the help of simulations, the lighting energy consumption was determined with the BEP-TR method, and the values were calculated. Also, the cost-performance analysis of these calculations' energy-efficient improvement proposals is examined. As a result, the lighting design revision was implemented in real terms, and the process was documented with the help of visuals. As a result of these calculations and evaluations, this study; underlines that the concept of multidimensional efficiency should be handled with its various layers; it is aimed to be a guide for all public structures, especially educational ones.

DOI: 10.15320/ICONARP.2022.212

CURRENT SITUATION ANALYSIS OF LIGHTING DATA IN RELEVANT SPACES

The structure chosen as the study area in order to evaluate the efficiency of lighting performance data in educational buildings is the Erciyes University Faculty of Architecture. Shown in Figure 1, there is the site plan of Erciyes University Faculty of Architecture. The Faculty of Architecture is located at 38.711013 North Latitudes and 35.537286 East Longitudes at an altitude of 1092 m.

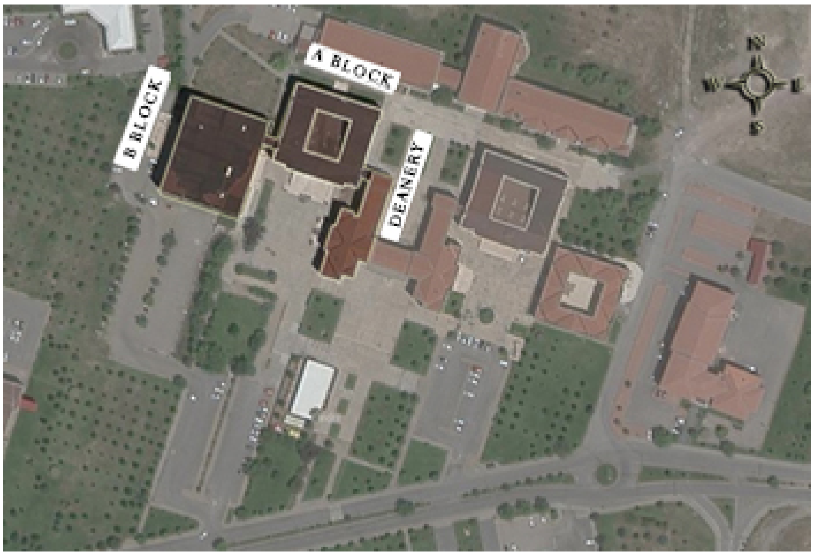


Figure 1. Erciyes University Faculty of Architecture Satellite Figure

It was designed as a complex with the transitions established on the first floor of three separate buildings, A Block, B Block, and Dean's Office, to surround the ceremonial area in the southwest of the Faculty of Architecture and is located in the northeast of Erciyes University Melikgazi campus, in the west of the Faculty of Fine Arts, again with the transition to the Faculty of Fine Arts. Within the scope of our study, the Dean's Office of the Faculty of Architecture was excluded from the scope, and the A and B Block buildings were discussed. The reason for choosing the A and B Blocks in the Faculty of Architecture building complex is that the courses that require attention, such as architectural education, are taught in the classrooms and studios of these blocks. There are educational spaces with lots of different functions within these blocks. Since the units in educational buildings are spaces used throughout the day, they should have adequate and uniform lighting. In order to obtain information about the general illuminance level of the building, spaces with different functions were selected. Along the relevant floors are classrooms, studios, seminar hall, archive rooms, library, rooms for teaching staff, specialized units, interior canteen, security room, club rooms, laboratories, exhibition rooms, and wet areas. Light colors are generally used on walls, floors, ceiling surfaces, and furniture in the work area. Except for the studios on the second floor of Block A, daylight is provided to the spaces through the window openings on only one wall, shown in Figure 2, views of Erciyes University Faculty of Architecture.

Figure 2. Views of Erciyes University Faculty of Architecture

It was designed as a complex, including two educational buildings and an administrative building. These three structures were designed to form a courtyard:

Administrative building: It was named the Dean's Office, its entrance was placed east of the courtyard, and its entrance was taken from the west side of the building.

Block A, the education building, is located north of the courtyard and has its entrance from the south side of the building.

Block B is located west of the courtyard and receives its entrance from the eastern part of the building in a controlled manner. This entrance, which is mostly closed due to security measures, is accessible from the first floor of Block A. The transition between Block A and the Dean's Office is also located on this floor.

As shown in Figure 3, There is a circulation area and archive rooms in the second basement (SB) floor plan of Block A, which has a floor area of 781 m2. There are 8 units on the floor with a floor height of 2.50 m. SB floor of Block B has a floor area of 756 m2, with a floor height of 2.50 m.

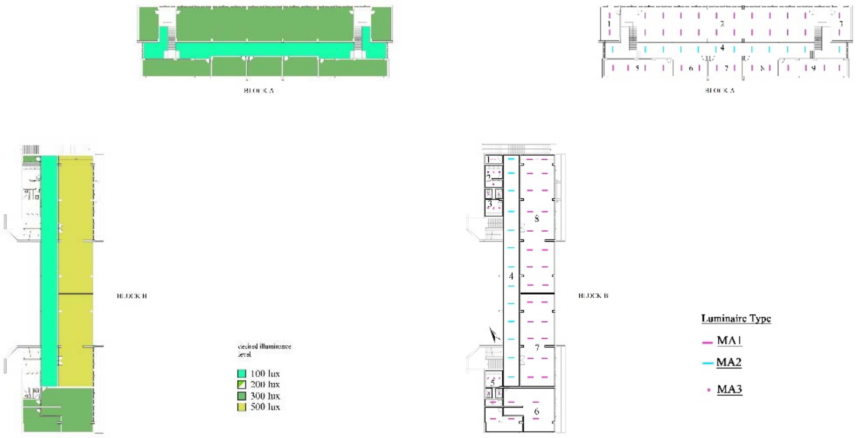


Figure 3. Second Basement Floor Plan and Existing Artificial Lighting Layout

Figure 4 shows studios located symmetrically around the basement(B) inner courtyard/hall of Block A with a floor area of 1793 m2. The studios have an area of 250 m2, and the space height is h=4.30 m. 17 ribbed beams are used along the ceiling, and artificial lighting is provided with the existing luminaire placed on the surface between the beams with a height of 60 cm. On the ground floor of Block A, there are

DOI: 10.15320/ICONARP.2022.212

two symmetrical wet areas and corridors leading to these areas. In the basement of Block B, which has a floor area of 2725 m2, studios are located symmetrically around the inner courtyard/hall. These studios have an area of 255 m2, and the space height is h=4.30 m. The floor heights in the corridor where the stairs to the west and east of the studio lead are 2.80 m. Classrooms are located in the east of Block B. In the west of Block B, the rooms between the wet areas and the stairs are used as storage areas.

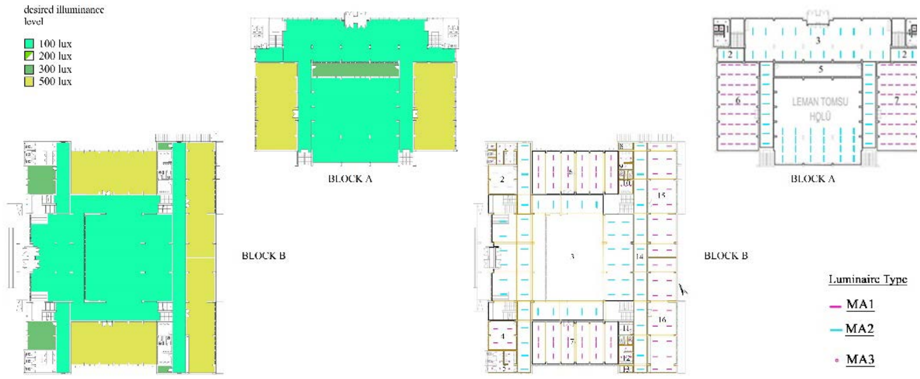


Figure 4. Block Basement Floor Plan and Existing Artificial Lighting Layout

Shown in Figure 5; at the ground floor level of Block A, which has a floor area of 703 m2. The floor height is 2.80 m. The ground floor area is 2280 m2. The floor height is 2.80 m, excluding studios and seminar halls. The studio's floor height is 4.30 m, and the maximum height is 4.30 m in the seminar hall.

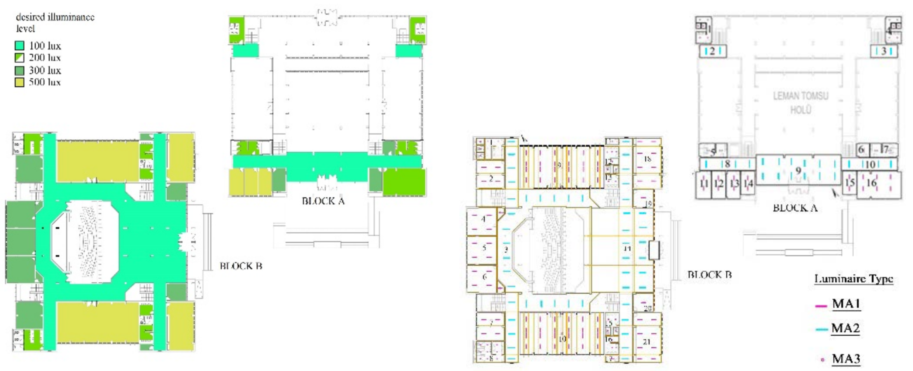


Figure 5. Ground Floor Plan and Existing Artificial Lighting Layout

It is shown in Figure 6, On the first floor level of Block A with a floor area of 2099 m2. The floor height is 4.30 m in the studios and the corridors between the atrium and the studios, while the floor height in other areas is 2.80 m on the first floor with a floor area of 1494 m2. The floor height is 2.80 m, excluding the seminar halls.

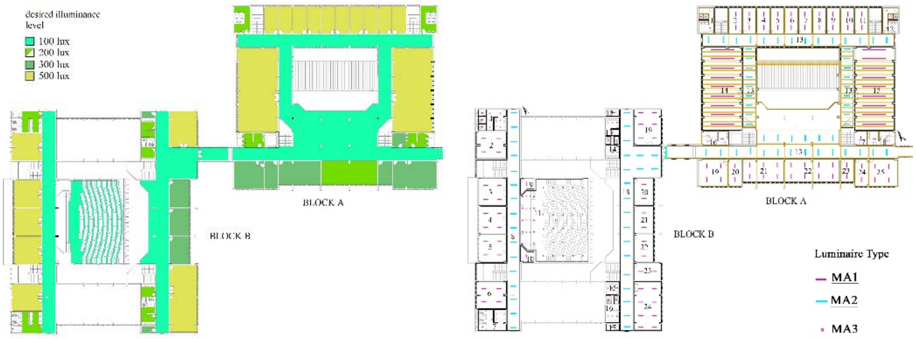


Figure 6. First Floor Plan and Existing Artificial Lighting Layout

On the second floor level of Block A, which has a floor area of 1884 m2. While the top floor height is 3.30 m in studios, it is 2.80 m in other areas. Shown in Figure 7; on the second floor with a floor area of 1962 m2. The top floor height is 3.30 m due to the roof. First of all, the spaces are handled separately in different blocks and on different floors, and the value of the illuminance level they need according to the quality of the units is shown.

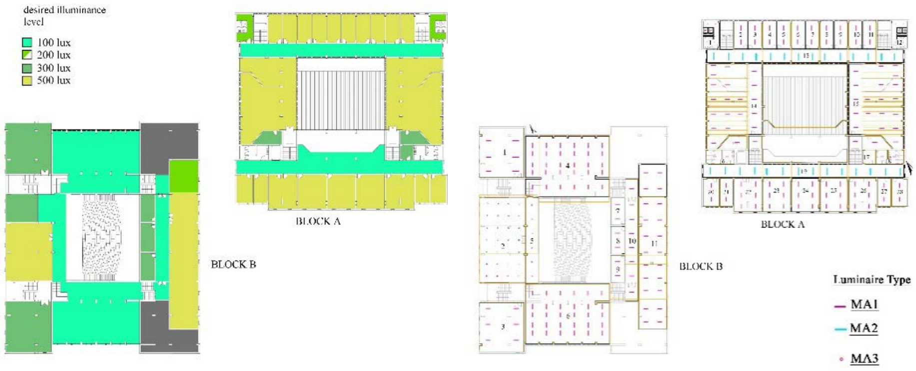


Figure 7. Second Floor Plan and Existing Artificial Lighting Layout

Some spaces in A and B Blocks are actively used during the months of September-June, as some spaces are used by administrative and academic staff throughout the year, and some spaces are reserved for the use of undergraduate and graduate students. Sufficient and uniform lighting is generally required for units in educational buildings. In this study, the data on the desired illuminance levels in the standards referenced within the scope of BEP-TR will be taken as a basis to meet the required visual comfort conditions in the spaces. As seen in Table 1, the building is designed at different elevations for different ceiling height requirements.

DOI: 10.15320/ICONARP.2022.212

Table 1. Block A General Information

Floor	Units – Rooms	Height (m)	Units	Height (m)	Total Area (m^2)
SB	Circulation area and archive	2.50	-	-	781
B.	Wet areas, corridors, passage and entrance	2.80	Studios, corridors	4.30	1793
Ground (G)	Entrance, wet areas, personal offices, cleaning, security, photocopy and stationery	2.80	-	-	703
First (F)	Personal offices, atrium, wet areas, cleaning, administrative, staff and canteen	2.80	Studios, corridors	4.30	2099
Second (S)	Personal offices, wet areas, cleaning, classrooms.	2.80	Studios (at Loft)	1.60-3.30	1884

In the proposal for the improvement of the A-Block lighting system, in units with a floor height of 2.80 m in general, surface-mounted(SM) LED luminaires were proposed instead of surface-mounted, ceiling-mounted(CM) luminaires. In order to reduce the distance between the working plane and the luminaire in the spaces with a ceiling height of 4.30 m, 1 m suspended LED luminaires are recommended. LED luminaires are also recommended in wet areas. The number of devices has been revised in accordance with visual comfort requirements.

As seen in Table 2, Block B is designed at different elevations for different ceiling height exigency.

Table 2. Block B General Information About Floors

Floor	Units - Rooms	Height (m)	Units	Height (m)	Total Area (m^2)
SB	Classrooms	2.50	-	-	756
B	Wet areas, corridors, passage and entrance	2.80	Studios,	4.30	2725
G	Entrance, club rooms, waiting, wet areas, administrative staff and classrooms.	2.80	Studios, seminar hall,	4.30	2280
F	Seminar hall seating areas, graduate classrooms, waiting, wet areas, administrative staff and classrooms.	2.80	-	-	1494
S	Library, technical, computer lab, blueprint and two unfunctional.	2.80	Studios (at Loft)	1.60-3.30	1962

SB: Second Basement, B: Basement, G: Ground, F: First, S: Second.

In the B Block lighting system improvement proposal, in units with a floor height of 2.80 m generally, SM LED luminaires were proposed instead of SM, CM luminaires. In order to reduce the distance between the working plane and the luminaire in the spaces with a ceiling height of 4.30 m, 1 m suspended LED luminaires are recommended. LED luminaires are also recommended in wet areas. The number of devices has been revised following visual comfort requirements [BEP-TR, 2010]. Educational Buildings require a different illuminance level and color rendering for each unit. As can be seen in Table 3, such as at corridors and circulation areas, an illuminance level of 100 lux and color rendering of 80 is required. For exhibition rooms, canteen, toilets, and shelf spaces of libraries illuminance level of 200 lux and color rendering of 80 are required; at the foyer, other living rooms, seminar audience areas, auxiliary spaces (archive, etc.), technical rooms, warehouses are required illuminance level 200 lux, color rendering 80 is required. At studios, classrooms, personal offices (single person), library reading rooms, and seminar presentation areas illuminance level of 500 lux and color rendering of 80 are required [BEP-TR, 2010]. The desired illumination level is high in places that require attention and in places where active lessons are held.

Table 3: The Required Illuminance Levels in Spaces on the Scope of BEP-TR

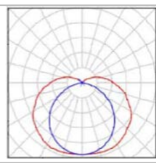
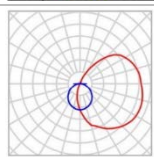
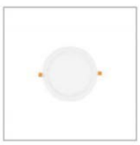
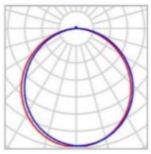
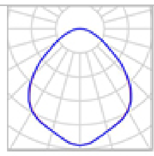
Spaces	Colour Rendering	Illuminance Level
Corridors and Circulation Areas	80	100
Exhibition Rooms, Canteen, Toilets, Shelf Spaces of Libraries	80	200
Foyer, Other Living Rooms, Seminar Audience Areas, Auxiliary Spaces (Archive etc.), Technical Rooms, Warehouses	80	300
Studios, Classrooms, Personal Offices (Single Person), Library Reading Rooms and Seminar Presentation Areas	80	500

Table 4: Existing Artificial Lighting Fixtures and Attributes in the Work Area

Name	Dimensions (m)	Power (W)	Luminous Flux (lm)	Type	Mounting Location
MA1	1,20 x 0,14 x 0,10	72	4095	SM	CM
MA2	1,20 x 0,056 x 0,06	36	2397	SM	CM
MA3	0,30 x 0,30 x 0,014	24	1706	SM	CM
MA4	0,307 x 0,307x 0,43	15	442	Stalactite	50 cm from the Ceiling

SM: Surface Mounted CM: Ceiling Mounted

Table 5: Characteristics and Luminous Intensity Distribution Diagram of Existing Artificial Lighting Fixtures

Luminaire Name	**Luminaire Figure**	**Type**	**Light Emission Curve**
MA1		T8 SM / Waterproof	
MA2		T8 SM	
MA3		Spiral Lamp in SM Download Spot	
MA4		Energy Saving Inside Conical Pendant Spiral Lamp	

DOI: 10.15320/ICONARP.2022.212

As can be seen, Table 4 includes data about the artificial lighting fixtures and their qualities available in the study area.

The luminaires used in the existing artificial lighting system are given in Table 5 with their luminous intensity disteibution and mounting method. MA1 type luminaire; It is used in classrooms, studios, living rooms, and technical rooms. MA2 type a luminaire; It is used in cleaning rooms and circulation areas. MA3 type armature; It is used in restrooms and seminar halls.

The MA4 type luminaire was used only on the second floor of Block B, in the computer laboratory, blueprint output room, and the corridor that leads to the computer laboratory. The MA4 type luminaire has a 50 cm pendant length. An energy-saving spiral lamp is used inside the cone surrounding the E27-type socket.

Table 6: Calculation of Usage Hours Based on Dates to ERU Faculty of Architecture

Date	Sun Rise Time	Sunset Time	Usage Type	Total Usage Times		
				t_D	t_N	t
23 Sept.	06:27	18:34	Official	660	0	660
			Education	726	0	726
21 Dec.	07:53	17:20	Official	590	70	660
			Education	616	110	726
21 March	06:40	18:51	Official	660	0	660
			Education	726	0	726
21 June	05:14	20:06	Official	612	0	612
			Education	242	0	242
Total			Official	2522	70	2592
			Education	2310	110	2420

Table 7: F_A Value and F_O Value Based on Space Types for the Study Building

Room Type	F_A Value	F_O Account Range	F_{OC}	F_O Value
Entrance hall, Waiting Halls, Library (read), Hallway (Not Dimmer)	0.00	1- [(1- F_{OC}) x F_A/0.2]		1.00
Activity Room, Office Room For 2 People	0.30			0.90
Office Room For 1 Person, Hallway, Staff Rooms, Copy Room	0.40	F_{OC} + 0.2 - F_A F_{OC} + 0.2 - F_A	1.00	0.80
General Use Rooms	0.50			0.70
Library (archive)	0.90			0.30
Technical Service Room	0.98	[7 -(10 x F_{OC})] x (F_A - 1)		0.06

Ref: BEP-TR, 2010, 36-39.

In the lighting part of the BEP-TR calculation method, a method prepared based on the EN 15193 standard and developed for the conditions of Turkey is presented. This calculation method introduces the calculation steps for evaluating the amount of energy consumed for interior lighting purposes in buildings and a numerical indicator that can be used for certification regarding the lighting energy requirement. This document also provides a method for calculating the lighting energy to be used in determining the total energy performance of the building [BEP-TR, 2010]. In Table 6, the total usage time is calculated as tD when there is daylight, tN when there is a lack of daylight, and the total usage time t is calculated. The calculation of March 21 represents March, April, and May. June 21 Calculation represents June, July, and August as the summer period. September 23 calculation is between September, October, and November as the autumn period. The calculation of December 21 represents the months; of December, January, and February in winter. Within the scope of our study, it is accepted that the education structures aren't available in July and August. The active training period was taken between September 1 and June 30. Half-hour extra working hours before and after the lesson and working hours are included.

In order to make these calculations in the relevant standards, the range of the FA value is checked first. Table 7, three different equations are used according to three different calculation intervals. With these equations, it is possible to calculate the factors related to usage (FO Value). Finally, the lighting control system factor (FOC Value), depending on the usage, should be known. Since the lighting control system of the spaces in Erciyes University is a manual on-off switch, the FOC value is calculated as 1.00.

In order to provide visual comfort and reduce the amount of power drawn from the network, an improvement proposal was made by using LED luminaires. It has been observed that the existing luminaires are mounted on the surface and are not sufficient to provide the illuminance level since they are located between the ribbed beams at the height of h=4.30. In the improvement proposal, between the beams, It is recommended to install pendant luminaires with a suspension length of 1 m. The distance between the working plane and the luminaires, which is 0.85 m, was fixed at 2.45 lower. Assembly alignments and fixture numbers remained the same. RA1, RA2, RA3, and RA4 coded LED luminaires that provide homogeneous light distribution are recommended instead of existing luminaires. Table 8 shows the data regarding the recommended luminaire in the improvement proposal.

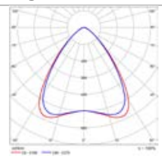
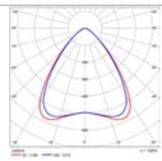
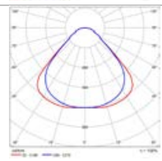
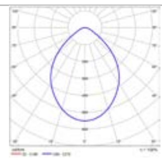
Table 8: Suggested Luminaires and Their Attributes

Luminaire Name	Dimensions (m)	Power (W)	Luminous Flux (lm)	Light Efficiency (lm/W)
RA1	1,20 x 0,20 x 0,05	22	2799	127.2
RA2	0,60 x 0,60 x 0,05	30,5	3698	121.3
RA3	1,20 x 0,30 x 0,05	35,5	4198	118.3
RA4	0,162 x 0,162 x 0,10	9,5	1100	115.8

DOI: 10.15320/ICONARP.2022.212

Attributes of luminaires in the improvement proposal and light emission curve shown in Table 9.

Table 9: Attributes of Luminaires in the Improvement Proposal

Name	Figure	Type	Information Leaflet	Light Emission Curve
RA1		SM LED Glare CCT : 3000K–4000K	Waterproof Polycarbonate Body Compatible CRI: 100	
RA2		SM LED Glare CCT : 3000K–4000K	Waterproof Polycarbonate Body CRI: 100	
RA3		Stalactite LED Glare CCT : 3000K–4000K	Waterproof Polycarbonate Body Compatible CRI: 100	
RA4		Recessed LED Glare CCT : 3000K–4000K	Polycarbonate Body CRI: 100 (Downlight)	

EFFECT OF IMPROVEMENT SUGGESTIONS ON LIGHTING CONSUMPTION

Regarding improvement suggestions, The approximate cost calculation items prepared according to the Ministry of Environment and Urbanization, Presidency of Higher Science Council, and Construction and Installation Unit Prices 2019 data and the exposure definitions defined are taken as the basis. While making improvement suggestions, luminaires with suitable luminous flux, luminous efficiency, and consumption values specified LED luminaires were selected, and cost calculations were made with the current unit prices of assembled. The sample luminaires used in Dialux Evo calculations were also selected within the framework of the definitions in accordance with the specified item numbers, and the selected luminaires were specified for comparison.

In the improvement suggestions made in Table 10, the RA1 type luminaire has a luminous flux of at least 2700 lm consumption value of at most 30 watts LED surface waterproof polycarbonate. The unit price of the body ceiling luminaire for 2021 is 230.00 ₺. A total of 186 RA1-type fixtures were used in the improvement proposals in Block A, and the assembled total cost of these fixtures is 42,780,00 ₺. RA2 type luminaire is 3300 lm light flux, maximum 36-watt consumption value, surface-mounted minimum 60x60 LED ceiling luminaire in 2021. The current assembled unit price is 286.00 ₺. A total of 73 RA2-type fixtures were used in the improvement proposals in Block A, and the assembled

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

total cost of these fixtures is 20,878.00 ₺. RA3 type luminaire was approved by the Ministry of Environment and Urbanization with a light flux of at least 3600 lm and a consumption value of at least 40 watts. The current assembled unit price is 269.00 ₺. A total of 144 RA3-type fixtures were used in the improvement proposals in Block A, and the assembled total cost of these fixtures is 38,736,00 ₺. RA4-type luminaire has a light flux of at least 800 lm and a consumption value of 12 watts at the most. The unit price of the ceiling fixture, part of which is cast aluminum, is 113,00 ₺ for 2021. 92 RA4-type fixtures were used in the improvement proposals in Block A, and the assembled total cost of these fixtures is 10.396,00 ₺. Clearly, to calculate the value in Table 10, in the improvement suggestions made, the total approximate cost in Block A was calculated as 112,790,00 ₺.

Table 10: Total Luminaire Numbers and Cost Calculation with A Block Improvement Proposal

Name	Total	Item Number	Power (W)	Luminous Flux (lm)	Assembled Prise (₺)	Total Prise (₺)
RA1	186	35.170.1602	22	2799	230	42.780
RA2	73	35.170.1105	30.5	3698	286	20.878
RA3	144	35.170.1603	35.5	4198	269	38.736
RA4	92	35.170.1501	9.5	1100	113	10.396
					Total	112.790

As can be seen in Table 11, in the improvement suggestions made, the RA1 type luminaire has a minimum luminous flux of 2700 lm and a consumption value of 30 watts at most. The unit price of the waterproof polycarbonate ceiling luminaire for 2021 is 230.00 ₺. A total of 272 RA1-type fixtures were used in the improvement proposals in Block B, and the total cost of these fixtures as assembled is 62,560,00 ₺. RA2 type luminaire, 3300 lm light flux, maximum 36-watt consumption value, surface-mounted minimum 60x60 LED ceiling luminaire in 2021. The current assembled unit price is 286.00 ₺. 89 RA2-type luminaires were used for improvement suggestions in Block B. The assembled total cost of these fixtures is 25,454.00 ₺. RA3 type luminaire, with a light flux of at least 3600 lm and consumption value of at least 40 watts. The current assembled unit price is 269.00 ₺. A total of 96 RA3-type luminaires were used in the improvement proposals in Block B, and the assembled total cost of these luminaires is 25.824.00 ₺. RA4-type luminaire has a light flux of at least 800 lm and a consumption value of 12 watts at the most. The unit price of the ceiling fixture, part of which is cast aluminum, is 113,00 ₺ for 2021. A total of 173 RA4-type fixtures were used in the improvement proposals in Block B, and the assembled total cost of these fixtures is 19,549.00 ₺. According to Table 11, in the improvement suggestions made, the total cost in Block B was calculated as 133,387.00 ₺.

With the improvement proposal, the amount of energy saving in Block A is 63,024%. And the amount of energy saving in B Block is 61,784%. In total, the annual lighting energy consumption of 105,272.73 kWh decreased to 39,628.42 kWh annual lighting energy consumption

DOI: 10.15320/ICONARP.2022.212

with the improvements applied. This is when the improvement proposal is compared with the current situation; It shows that a 62,356% reduction is achieved in the annual energy consumption calculations obtained according to the BEP-TR lighting calculation method.

Table 11: Total Number of Luminaires Proposed for B Block Improvement and Cost Calculation

Name	Total	Item Number	Power (W)	Luminous Flux (lm)	Assembled Prise (₺)	Total Price(₺)
RA1	272	35.170.1602	22.0	2799	230	62.560
RA2	89	35.170.1105	30.5	3698	286	25.454
RA3	96	35.170.1603	35.5	4198	269	25.824
RA4	173	35.170.1501	9.5	1100	113	19.549
					Total	133.387

Calculating the Lighting Energy Numeric Display

LENI is the numerical indicator of lighting energy, and its unit is kWh/m2.year. Calculations made according to the BEP-TR method are based on the hours of use in the classrooms and studios, except for summer months and weekends. As can be seen in Table 12, the annual lighting energy consumption in the current situation is quite high compared to the LED luminaire, although it does not meet the visual comfort conditions. As can be seen in Table 12, with the improvement proposal, a saving of 30,608,19 kWh is achieved in Block A, and the difference obtained in LENI is 4.01 kWh/m2.year. With the improvement proposal, the amount of energy saving in Block A is 63.02%.

Table 12: Total Amount of Energy Consumed in A Block Floors Available and Revision LENI Value

Floors	SB (kWh)	B (kWh)	G (kWh)	F (kWh)	S (kWh)	Total (kWh)
Current Total $W_{L,T}$	800,39	13034,18	3379,27	19164,63	12187,14	48565,61
Revision Total $W_{L,T}$	452,07	5140,27	1167,58	6673,66	4523,83	17957,41
Retrench of $W_{L,T}$	30608,19					
m^2 Total	780,97	1793,67	702,93	2099,21	1884,25	7261,03
m^2 Total Units of F_0 0,10 over	227,51	1793,67	702,93	2099,21	1884,25	6707,57
Current LENI	1,02	7,27	4,81	9,13	6,47	6,69
Revision LENI	1,99	2,87	1,66	3,18	2,40	2,68
Retrench of LENI	4,01					

SB: Second Basement, B: Basement, G: Ground, F: First, S: Second.

As seen in Table 13, the annual lighting energy consumption in the current situation is quite high compared to the LED luminaire, although it does not meet the visual comfort requirements. As seen in Table 13, 35,036.12 kWh savings are achieved in B Block with the improvement proposal, and the difference obtained in LENI is 3.74 kWh/ m2 year. With the improvement proposal, the amount of energy saving in B Block is 61.78%. Comparing the improvement proposal with the current situation, it is observed that a 62,356% reduction is achieved in the annual energy consumption calculations obtained according to the BEP-TR lighting calculation method.

Table 11: Total Amount of Energy Consumed in B Block Floors Available and Revision LENI Value

Floors	SB (kWh)	B (kWh)	G (kWh)	F (kWh)	S (kWh)	Total (kWh)
Current Total $W_{L,T}$	5456,30	15018,59	11535,13	9218,44	15478,67	56707,12
Revision Total $W_{L,T}$	3029,00	7218,93	4316,87	3158,50	3947,71	21671,00
Retrench of $W_{L,T}$	35036,12					
m² Total	756,23	2725,11	2280,28	1494,20	1962,44	9218,26
m² Total Units of F_0 0,10 over	622,11	2725,11	2280,28	1494,20	1879,10	9000,80
Current LENI	7,22	5,51	5,06	6,17	7,89	6,15
Revision LENI	4,87	2,65	1,89	2,11	2,10	2,41
Retrench of LENI	3,74					

SB: Second Basement, B: Basement, G: Ground, F: First, S: Second.

Refund Calculation

Erciyes University Faculty of Architecture as electricity user type Double Term Single Time Commercial House Type Medium Voltage Electricity Receiving from the End Source Tariff is Eligible Consumer. As seen in Table 14 the backward inflation difference in 4 years and 4 months is 82.60%.

Table 14: Refund period estimation over backward inflation difference

Date	March 2017	March 2018	March 2019	March 2020	March 2021	July 2021
Inflation Difference	%0.00	%10.23	%31.97	%47.61	%71.51	%82.60

Source: Central Bank of Turkish Rebuplic. Inflation Calculator.

It can be predicted that the future reflection of this on electricity prices will be as follows at Table 15.

Table 15: Forward-Looking Unit Price Forecast Based on Inflation Difference

Date / ₺	July 2021	July 2022	July 2023	July 2024	July 2025	Nov. 2025
Unit Price	0,879	0,969	1,160	1,298	1,508	1,605

In the forecast, against the possibility of retrospective inflation to occur in the same way in the future, it is foreseen that the tariff, which is 0,87841 ₺ at the end of 52 months, will continue to their tariff at 1,603 ₺. The initial investment cost in Table 16; Based on the current inflation difference, the current electricity price that will emerge when the same amount of inflation occurs prospectively, the amount of savings made according to years, and the repayment amount have been calculated. Accordingly, the improvements made at the end of the 4th year have expected to realize a savings of 36,568.11 ₺ by providing their depreciation.

DOI: 10.15320/ICONARP.2022.212

Table 16: Reimbursement of Initial Investment Based on Inflation Difference

	Electricity Price ₺(f+g) ₺	Total Difference kWh	Savings Amount ₺	Amount to be Reimbursed ₺
Cost	0,8793674	65.644,31	0.00	-246.177,00
1.Year	0,8793674	65.644,31	57.725,47	-188.453,53
2.Year	0,96932	65.644,31	63.630,78	-124.820,75
3.Year	1,160501	65.644,31	76.180,30	-48.640,45
4.Year	1,298034	65.644,31	85.208,56	+36.568,11 ₺

In Table 17, the kWh - electricity unit price final price usage fee of the Eligible Consumer group who receives electricity from the Double Term Single Time Commercial House Type Medium Voltage Final Source Tariff for the last 4 years is given retrospectively.

Table 17: Double Term Single Time Mv Activity Based Consumer Tariff Final Price By Year

Date/ ₺	2017 July	2018 Jan.	2019 Jan.	2020 Jan.	2021 Jan.	2021 July
Unit Price- ₺	0,297	0,322	0,512	0,679	0,763	0,879
Exchange Rate	100	108,43	172,42	228,69	256,85	295,80

Source: EPDK, Address: https://www.epdk.gov.tr/Detay/Icerik/3-0-1/tarifeler. Access Date: 15.07.2021.

Based on these values, the future electricity unit price estimation is given in as seen in Table 18. In case of the possibility that the retrospective electricity unit price difference may occur in the same way in the future, it has foreseen that the Eligible Consumer group who purchases electricity from the Double Term Single Time Commercial Center Type Medium Voltage Final Source Tariff, which is 0,87841 ₺, at the end of 3 years, will continue to its tariff at 2,03607 ₺.

Table 18: Forward Electricity Unit Price Forecast with Retrospective Electricity Price Difference

Date	July 2021	July 2022	July 2023	July 2024
Unit Price- ₺	0,879367	1,139138	1,309837	2,03674

Table 19: Reimbursement of Initial Investment Based On Change in Electricity Unit Difference

	Electricity Price ₺(f+g) ₺	Total Difference kWh	Savings ₺	Amount to be Repaid ₺
Cost	0,8793674	65.644,31	0.00	-246.177,00
1.Year	0,8793674		57.725,47	-188.453,53
2. Year	1,139138		74.777,96	-113.673,58
3.Year	1,309837		85.983,33	-27.690,25
4.Year	2,03674		133.700,40	+106.010,14 ₺

If this is the case, the new payback period of the initial investment cost has indicated in Table 19. The initial investment cost in Table 19; based on the current electricity unit price difference retrospectively, the current electricity price that will emerge when the same amount of inflation occurs prospectively, the amount of savings made according to years and the repayment amount have calculated. Accordingly, it has foreseen that the improvements made at the end of the 4th year will realize a savings of 106,010.14 ₺ approximately 5,863 € (1 € = 18,08 ₺) by providing their depreciation.

CONCLUSION

In educational buildings, energy-efficient lighting is essential. Moreover, visual comfort keeps learning performance high, motivation of employees and students, and essential working productivity. As in other existing structures, educational buildings aim to reach the values of international standards and ensure minimum energy consumption in this study area. In this context, in our study, the concept of energy efficiency is discussed in a multifaceted way. In addition, studies on energy efficiency in public buildings examined, especially the current situation in energy efficiency in lighting energy given in detail in our study.

The illuminance levels on the working plane of the spaces in Blocks A and B within the Erciyes University Faculty of Architecture have been calculated, and the findings were evaluated. In order to provide visual comfort conditions primarily, by the energy-efficient design principles and at the same time taking into account the spatial characteristics, the use of LED luminaires and the use of pendant luminaires considering the floor height has been deemed appropriate. Comparing the improvement proposal with the current situation, it provides a 62,356% reduction in the annual energy consumption calculations obtained according to the BEP-TR lighting calculation method. In addition, the improvements made calculated a 4.01 LENI decrease in AESG value in A Block and a 3.74 LENI decrease in B Block. That means a total annual saving of 65,644.31 kilowatt-hours for both blocks in the lighting energy consumption only.

The approximate cost of the luminaires used in the improvement proposals was calculated in three different ways with the savings amount. The first one is the repayment calculation with current electricity prices without any inflation difference, the second one is the forward-looking calculation based on the backward inflation difference, and the last one is the forward-looking calculation based on the year-to-year price changes in the tariff fees in electricity prices. With the simple calculation method, when the current electricity unit price is accepted as constant over the years without any inflation difference, it is calculated that the first investment cost will be paid back in 1557 days (52 months) with the electrical energy savings in lighting energy. With the improvement proposal made later, the system will bring profit.

In the second calculation method, in the calculation made based on the backward inflation difference, calculations were made on the change in the electricity unit fee that would occur in case of inflation with the same rates prospectively. As a result of these calculations, it has been calculated that the amount of energy consumption saved in the improvement proposals and the initial investment cost will be provided

DOI: 10.15320/ICONARP.2022.212

at the end of 1305 days, and the improvement proposal system will bring profit after 1305 days (43 months).

Finally, in the third calculation method, based on the backward electricity unit price difference, calculations are made in case of changes in electricity unit prices with the same forward-looking rates. As a result of these calculations, it has been calculated that the amount of energy consumption saved in the improvement proposals will provide the first investment cost at the end of 1171 days, and the improvement proposal system will bring profit after 1171 days (38 months).

In the basic calculation made without considering the inflation difference and the electricity unit price difference over the years, the savings made at the end of the fourth year and the initial investment costs could be repaid, and the system became profitable in the improvement proposals. In the calculations made for years by including inflation, the amount of savings made at the end of the third year and the initial investment costs could be repaid, and the system turned into profit in suggestions for improvement. In the calculation made by considering the change in the electricity unit price difference over the years, the amount of savings made at the end of the third year and the initial investment costs could be paid back, and the system turned to profit in the improvement proposals.

In investments with a payback period of more than five years in public buildings, the system's length prevents the system's efficiency and the system's preference in terms of applicability decreases as the period gets longer. Within the scope of our study, it is thought that the payback period of the initial investment cost in all three calculations is below five years, which will cause these improvement proposals to be preferred in terms of applicability for public buildings.

Simultaneously in the study, according to the multidimensional approach of the concept of energy efficiency, suggestions for improvement, and cost analysis. It was noted that initial investment, assembly, dismantling and repair costs are also considered in all these processes. Based on the need to obtain a holistic approach to improving the lighting energy performance of existing buildings, it will be aimed that this selected educational structure study will shed light on other studies and constitute an exemplary approach in the context of comfort-consumption-cost for improvement proposals of all existing buildings.

ACKNOWLEDGEMENTS/NOTES

This article was produced from the thesis named "Evaluation of the lighting energy performance of educational buildings in the context of comfort-consumption-cost with building energy performance calculation methodology of turkey; the case of ERU Architecture Faculty", which was accepted at Erciyes University Graduate School of Natural and Applied Sciences (Architecture Program) in 2021.

REFERENCES

Barbier, E. (2019), “How to Make the Next Green New Deal Work”, Nature, 565 - 6, Access address https://www.nature.com/articles/d41586-018-07845-5. https://doi.org/10.1038/d41586-018-07845-5

BEP-TR- National Calculation Method of Energy Performance in Buildings, Annex 05-Lighting, 07 December 2010 Thursday, Official Gazette, Issue: 27778, 2010. Table F.1.

Cayıragası, F., Sakacı, S. (2021). Avrupa Yesil Mutabakati (Green Deal) ve Birlesmis Milletler Surdurulebilir Kalkinma Hedefleri Perspektifinde Surdurulebilir Dijital Pazarlama Stratejileri. Gaziantep University Journal of Social Sciences, 20(4), 1916-1937.

Central Bank of Turkish Rebuplic. Inflation Calculator. Access Adress: http://www3.tcmb.gov.tr/enflasyoncalc/enflasyon_hesaplayici.html. Date of Access: 05.08.2021.

Desouza, D. (2020). “The Green New Deal Explained”, Access address https://www.investopedia.com/the-green-new-deal-explained-4588463#citation11

Directive on Energy Performance of Buildings, 2002/91/EC, Brüksel, 2002.

Energy Efficiency Survey Implementation Monitoring Report in Public Buildings - I. (2018). T.R. Ministry of Energy and Natural Resources, General Directorate of Renewable Energy.

Energy Savings in Public Buildings (2019, 16 August). Official Gazette (No: 30860). Access Address: https://www.resmigazete.gov.tr/eskiler/2019/08/20190816-10.pdf Access Date: 10.03.2020.

EPDK, Tarifeler Listesi. Access Address: https://www.epdk.gov.tr/Detay/Icerik/3-0-1/tarifeler. Access Date: 15.07.2021.

Europe Sustainable Development Report (2020). “Six SDG Transformations for the EU”, Part 3, Access address https://eu-dashboards.sdgindex.org/chapters/part-3-six-sdgtransformations-for-the-eu

Hamilton, I., Kennard, H., McGushin, A., Höglund-Isaksson, L., Kiesewetter, G., Lott, M., ... Watts, N. (2021). The Public Health Implications of the Paris Agreement: A Modelling Study. The Lancet Planetary Health, 5(2), e74-e83.

Idowu, S. O., Schmidpeter R., Zu, L. (2020), “The Future of the UN Sustainable Development Goals Business Perspectives for Global Development in 2030”, CSR, Sustainability, Ethics & Governance, ISBN 978-3-030-21153-0 ISBN 978-3-030-21154-7 (eBook), Springer Nature Switzerland AG 2020https://doi.org/10.1007/978-3-030-21154-7, 6, 12, 16, 101.

Kucuk, A. A. (2019). “Egitim Yapılarında Aydınlatma Performansının BEP-TR Yontemiyle Degerlendirilmesi- ERU Mimarlık Fakultesi Tasarım Atolyeleri Ornegi”. 12. Ulusal Aydınlatma Kongresi Programı. 18-19 September, 2019. Istanbul.

Milli Egitim Istatistikleri Orgün Egitim 2018-2019. Access Address: http://sgb.meb.gov.tr/www/icerik_goruntule.php?KNO=361. Access Date: 10.03.2020.

Ozyurt, G., Kutluay, K. (2009). "Enerji Verimliligi, Binalarin Enerji Performansı ve Türkiye’deki Durum". TMMOB, Insaat Muhendisleri Odası, Turkiye Muhendislik Haberleri 457.54: 32-34.

DOI: 10.15320/ICONARP.2022.212

Sahin, G. Onder, H. G. (2021). Atik Yonetimi, Sera Gazi Emisyonlari ve Türkiye: Avrupa Yesil Mutabakati Cercevesinde Bir Degerlendirme. The Journal of Academic Social Sciences. Year: 9, Vol: 9, p. 194-216.

Storm, S. (2020). "The EU's Green Deal: Bismarck's 'what is possible' versus Thunberg's 'what is imperative'", Workin Paper No.117, Institute for New Economic Thinking, https://doi.org/10.36687/inetwp117

Sümengen, O. (2015). Türkiye İçin Konut Binalarının Aydınlatma Enerjisi Gereksinimi Açısından Degerlendirilmesine İliskin Bir Yaklasım. Ph.D. Thesis.Istanbul Technical Univercity. Graduate School of Science Engineering and Technology. s. 1.

UNEP. (1972). MFA. Access Address: http://www.mfa.gov.tr/birlesmis-milletler-cevre-programi.tr.mfa#:~:text=Bunun%20%C3%BCzerine%2C%20BM%20Genel%20Kurulu,bir%20%E2%80%9Cprogram%E2%80%9D%20olarak%20olu%C5%9Fturulmu%C5%9Ftur. Access Date: 01.06.2021.

United Nations. (2015a). "Transforming Our World: The 2030 Agenda for Sustainable Development". Access Address: https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for %20Sustainable%20Development%20web.pdf. Access Date: 06.07.2021

Resume

Ahmet Afşin Küçük was born in 1991 in Izmir. He graduated from Izmır Institute of Technology, Faculty of Architecture in 2016. He received M. Arch degree from Erciyes University, Faculty of Architecture. His thesis of master is "Evaluation of the lighting energy performance of educational buildings in the context of comfort-consumption-cost with building energy performance calculation methodology of turkey; the case of ERU Architecture Faculty". He currently has been studying for Ph. D. In Architecture at Erciyes University.

Assoc. Prof. Dr. Özlem Sümengen is an Associate Professor at the Faculty of Architecture at Erciyes University in Kayseri. She graduated from Istanbul Technical University in 2000. She received her M.Sc. (2004) and Ph.D. degrees (2015) at Faculty of Architecture, Istanbul Technical University. Her special fields of interest and research are architectural lighting systems, energy performance in buildings, building evaluation systems, sustainability, energy performance in residences. She has many administrative duties and works of professional chamber.

ICONARP
International Journal of Architecture and Planning
Received: 19.06.2021 Accepted: 03.10.2022
Volume 10, Issue 2/ Published: 20.12.2022
Research Article *DOI: 10.15320/ICONARP.2022.213 E- ISSN:2147-9380*
ICONARP

An Archetype of Architecture

Asma Khalid*

Abstract

Architecture is the art, and science of the built environment, where a multidisciplinary approach is prevalent. The paper tends to clarify architecture and explain its etymological meaning for an architectural student, practicing professional architect, and academic person. The paper suggests an archetype model using a combination of various logical terminologies that lead to the design of exquisitely defined words in human history. The manuscript relates each principal keyword as self-expressive for ARCHITECTURE. The research is based on the literal analysis of diverse content that covers the wider scope and application of architecture in qualitative research design. The note-taking series from different manuscripts that identify key areas in the field of ARCHITECTURE and their corresponding connection with each acronym was studied. The emerging themes consist of various parameters and help make strong arguments for the archetype model. The twelve emerging themes have been mapped using the mind-mapping technique in network diagrams. In the end, an archetype is explained, linking the connection of all keywords that prioritize the link with different aspects of architecture. Each letter refers to a specific term as A- Anthropometry, R-Responsive, C-Construction, H-History, I-Inspiration, T-Technology, E-Environment, C-Culture, T-Transformation, U-Utility, R-Resources, E-Economy. The author took help from the literature to reinforce the concept. In the end, an archetype is explained, linking the connection of all keywords with different aspects of architecture. The views expressed in the manuscript are based on a review analysis of existing information in the architectural discipline. It was difficult to include expert opinions due to the limitation of time and cost, and a more rigorous study can be planned later. The paper is based on the framework to benefit architectural students, academic people, and practicing architects and professionals about the range of approaches in ARCHITECTURE. Besides many definitions to expound, elucidate and clarify Architecture, the paper is novel in the approach of explaining the word ARCHITECTURE from a diverse perspective. Each letter has been an acronym with a term covering all significant aspects.

Keywords:
Archetype, architecture, etymology, multidisciplinary, thematic classification

*Department of Product and Industrial Design, Faculty of Architecture and Planning, University of Engineering and Technology, Lahore, Pakistan

Email: asma.khalid@uet.edu.pk

To cite this article: Khalid, A. (2022). An Archetype of Architecture. *ICONARP International Journal of Architecture and Planning*, 10 (2), 503-529. DOI: 10.15320/ICONARP.2022.213

INTRODUCTION

The Encyclopaedia Britannica describes architecture as "the art and technique of designing the building, as distinguished from the skills associated with construction (Architecture | Definition, Techniques, & Theory | Britannica.Com, n.d.)." According to Merriam-Webster's Dictionary, "Architecture is the art or practice of designing, buildings, structures and especially habitable ones (Architecture | Definition of Architecture by Merriam-Webster, 2019)." The word analogy of architecture is based on the essential component as identified by Vitruvius, which includes "utilitas (utilities-function), firmitas (firm-structure) and venustas (beauty-form) (Kunze, n.d.)." The word is borrowed from French architecture, Latin architectūra. Goldschmidt has given a comprehensive explanation of architecture, "it's changing trends towards technological and computational developments, ever-enduring function and form with perfect environmental adaptation" (Goldschmidt, 2016). Jon Woronoff also summarizes in his book on the Historical Dictionary of Architecture, "it is a multifaceted approach towards technology, material usage, construction techniques, new technological application, exploring cost matters, aesthetics, socio-political expression and many more (Ellis-Barrett, 2017)." Another significant contribution to architectural academics is made in the Encyclopaedia of 20th-century architecture, where the history and theory of the profession are explained in the context of the world's most notable architecture. The book features the role of architects, firms, building styles, planning, materials, construction, and professional issues (Stephen, 2004). The changing building types have made complex relations between architectural parameters. Traditional and modernized materials and technologies have given a diversified approach to the architectural profession. The emerging pattern of architectural practices is unprecedented and requires a link with the philosophical meaning of the architectural profession. The interdisciplinary method taught at architectural schools or expressed by professionals still needs a convincible approach towards an explanation. Besides so much complexity in the interconnection of various architectural terminologies, the students need an archetypical system or model that states its story itself. A model is needed to reflect the underlying pattern of interdisciplinary approaches in architecture, joining them under one umbrella. This research is an attempt to develop an archetype. Archetype refers to a pure form, pattern, and behavior universally present. It appears in areas related to behavior, psychological, and literary analysis. Archetypes are closely similar analogies of nature-immersed and inherited traits (Saunders & Skar, 2001; Wolstenholme, 2003). Few studies prioritize the linking role of different terminologies, subjects, or points of exploration in architecture. Hence, there is a need for a universal archetypical model for architecture. John Nuttall has proved that archetypal expression of architecture explores socio-economic and symbolism as design characteristics (Nuttall, 2002). Jody has defined

DOI: 10.15320/ICONARP.2022.213

architecture from various perspectives and described it as a noun that values engineering, creativity, and professional integrity (Brown, 2011). Becky has collected the viewpoint of 121 famous professionals mostly architects (Quintal Becky, 2019).

Archetypes on Architectural Education

This section will highlight the development of archetypes that helps to inspire people over the years since its inception. Archetype was coined by C.G. Jung psychologist and then by Paul Zucker used it in architectural theory in his book Town and Square. The archetype theory kept on developing further in 1960 through Aldo Rossi's book, and Architecture of the Citvfrom from 1966 (Thomas Thiis-Evensen, n.d.). Mario Botta defines "Architecture as an artificial fact" (Dimitriu & Botta, 1983). Later 1970 marked the beginning of its practical application in the architectural discipline through the work of Michael Graves, Rob and Leon Krier, and Mario Botta. From the fictional notion of nature, it emerged as a naturalistic phenomenon within the practical field. Historically the archetypes are seen as the reflective involvement of Place and Placemaking with emphasis on historical, psychological, social, and anthropological meaning in objects and a plethora of expressions (Dovey, 1985). Thomas Thiis- Evensen's also describes archetypes as the most basic to its identity, a language for experience and communication between inside and outside, yet quantifiable through 5 scale variation between the bipolar design of questions (Thomas Thiis- Evensen ' s, 1989). More recently the archetypes are the physical environment shaping the discipline as losing boundaries with its sister disciplines with an envision for design for sharing economy (Jamadar, n.d.). The work of Louis I. Kahn has also been debated as the Archetypes of similar analogies, patterns, and behavior in buildings and their expression. The recent trends in Architecture have been shifted to the Phenomenology of sustainable living, manifested in the environment and human life, broad archetypal, dimensions of experience and meaning (Seamon, 2017). In contemporary practices, the archetypes are seen as the timeless reference of buildings of various typologies through their intellectual appraisal (Pieczara, 2019). The 21st century marked the beginning of new theoretical concepts of contrapuntal, deconstructivism, interdisciplinary approach, theory-practice relation, critical thinking, and the pursuit of open-ended and provisional investigations (Crysler et al., 2012).

OBJECTIVE

The research objective is to devise a convincible methodology for designers in generic, architects, and architecture students. Also, it aims to demonstrate how we can archetypically express the very relation of interdisciplinary terminology in one model, creating their linkage. Architectural education and academics are readily shifting towards diverse disciplines, where future professionals need to be trained in a multidisciplinary approach. The research can familiarize future professionals with the word architecture which is so anonymous and yet self-explainable without going into complexity.

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

METHODOLOGY

For this purpose, the content analysis technique was chosen, a well-established method for studying the pattern and connection in qualitative research (Nelson & Woods, 2013; Neuman, 2011; Wong, 2010). The content has been sorted in the form of notes, which help identify key points and ideas. Different themes emerge from the existing text, highlighting the importance of categorizing words in twelve different variations, each unique and synergic. The word clustering further helps in grouping the themes in each acronym of Architecture (Figure 1). The graphical expression was created using the mind mapping technique in network diagrams. Some reference documents have been cited and used in the discussion section to support the emerging themes.

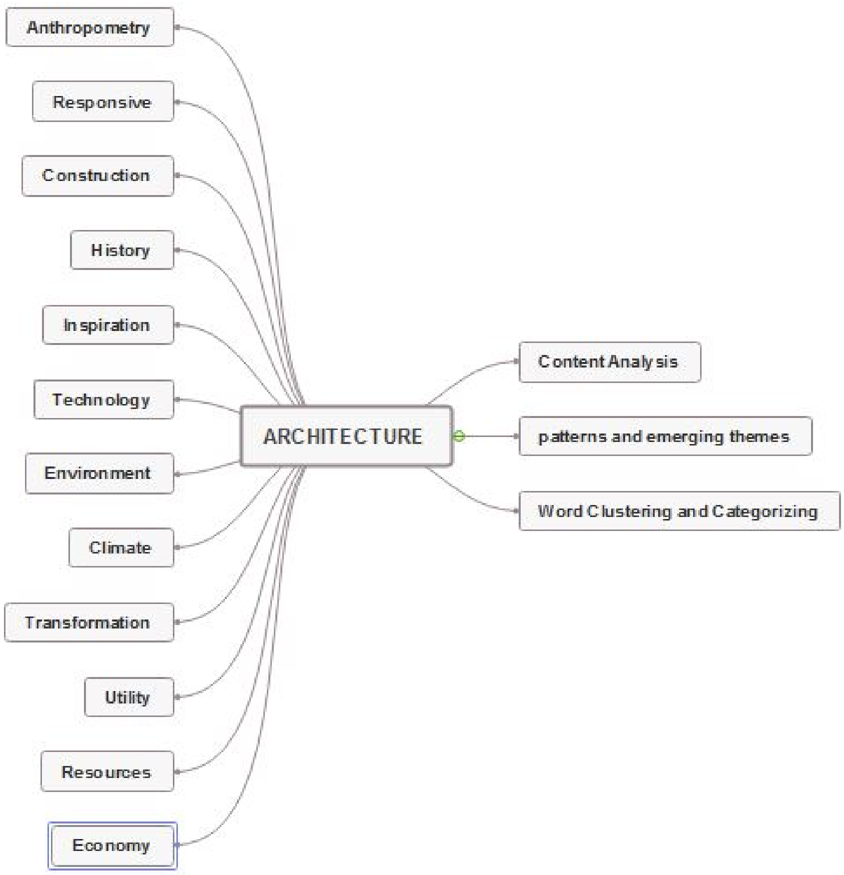


Figure 1. Thematic Methodology. Flowchart (Author Source but inspired from (Alex Milton, 2011))

A fluid, dynamic and expressive way was opted with a constraint to reduce and minimize the overlapping of key themes. However, despite being specific themes for each acronym, there has been a generic overlap in the discussion, which was unavoidable, as recent trends spot the application of multidisciplinary approaches. The Figures (2-13) below in the discussion section will show the graphical mind mapping of 12 emerged themes. However, the whole schematic theme has been combined in one framework at the end of the article (Figure 14).

The analogy of the word A.R.C.H.I.T.E.C.T.U.R.E as explained in (Figures 2-13) is a combination that brings every aspect on board and under one umbrella. For an architecture student, it encompasses diverse subjects and their applications. Academicians and Students can use this acronym to include in all Architectural, interior, and construction projects. By writing a single-word Architecture at one corner of the sheet,

DOI: 10.15320/ICONARP.2022.213

they will ensure that they do not miss out on a single approach in design. It will give students, academia, and practicing architects a paradigm to define their field using a multi-disciplinary approach. Table 1 shows the emerging themes from the content analysis, grouped and clustered under each acronym. The description columns grouped the key concepts related to the main theme.

Table 1. Thematic classification based on content analysis

No	Letter	Abbreviation	Description
1	A	Anthropometry (Figure 2)	Function, ergonomics, proportion, dimension, accuracy, inclusive
2	R	Responsive (Figure 3)	Form, aesthetics, technology, facade, appearance, affordance
3	C	Construction (Figure 4)	Structure, structure analysis, machinery, environment, 3D printing, resources, building life cycle, construction waste
4	H	History (Figure 5)	Historic, events, social, political, ancient civilization, diversity, archaeology, artifacts, vernacular, heritage, preservation
5	I	Inspiration (Figure 6)	Nature, aesthetics, innovation, creativity, biomimicry, organic, utopia, imagination, virtual reality, augmented reality
6	T	Technology (Figure 7)	Digitalization, sensors, Internet of Things (IoT), software, intelligent system, 3D lasers, construction, machine learning
7	E	Environment (Figure 8)	Nature, simulation, energy, GHG emissions, carbon footprints, passive, renewable energy, clean energy, ecosystem, HVAC, systems
8	C	Climate (Figure 9)	climate responsive, environment, classification system, weather, geography
9	T	Transformation (Figure 10)	Futuristic spaces, flexible design, function, nation, values, interiors
10	U	Utility (Figure 11)	Function, zones, commodity, services, anthropometry, space design
11	R	Resources (Figure 12)	Materials, workforce, innovative construction, resource management, sustainability, nature, 7R (waste management) principles
12	E	Economy (Figure 13)	Low cost, profit, business, life cycle, investment, payback, affordability, sustainable design

DISCUSSION AND RESULTS

Based on the results from the mentioned literature and model, each chosen acronym of Figure 2-13 has been explained. The grouped emerging themes have been discussed with the help of various examples, preferably contemporary and covering multi-contextual geography. Moreover, the archetype reflects a universal approach to the architectural profession.

Anthropometry

Anthropometry refers to the non-invasive (Casadei & Kiel, 2021) and scientific study of human measurements (Donald Watson, Michael J. Crosbie, 2004). Designers always in the need of an authenticated, contemporized, and usable reference for designing spaces, systems, and services (Pheasant Stephen, 2017). The very basic of the architectural project relates to the scientific consideration of human body measurements and their relative proportion. It explores the wider application of universally designed built environments. The functional boundaries are the major determinants of human sizes and proportions for designing a space. These dimensions are derived from the anthropometric measurement of various humans to accommodate the diverse needs of individuals inclusively. The optimized design of the building is also based on a comparative study of the measurement and capabilities of diverse individuals.

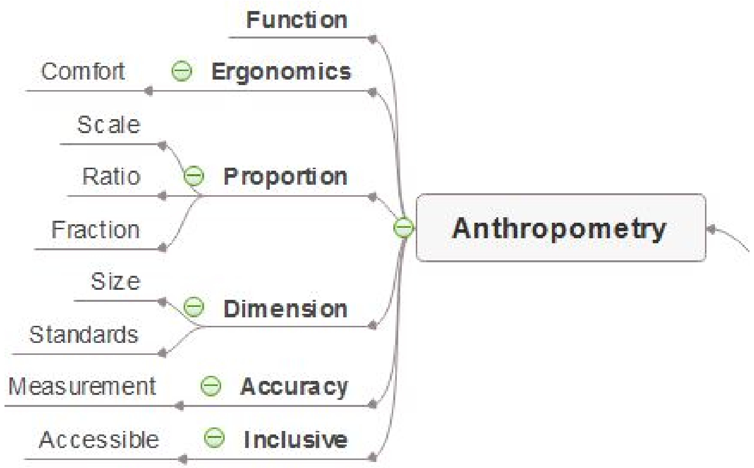


Figure 2. Mind map of A-Anthropometry. Flowchart (Author)

To achieve dimensional accuracy in the complex system of function, human physical dimensions work together with the interactive environment. For example, the design of the hospital is the collective formation of zones concerning its function. The function is lemmatized by the dimension of a particular space in a hospital (Figure 2). Each object placement, together with clearance and circulation will bring the design closer to a physically enclosed space. The interaction between objects required dimension, and their associated circulation will be done with the help of anthropometry. Anthropometry articulates all required information for the design of space by outlining the product and its interaction with the environment. Designers frequently apply standardization, while making choices about anthropometry and ergonomics. The use of time-saver standards and other ergonomic standards provides statistical data about the interaction of the human body in the built environment. The statistical information is based on data collection through a survey of the wider population using recent technologies. The database is based on anthropometric records of variability in genders, weights, geographic regions, ethnic groups, and socio-economic status.

Responsive

Sterk defines responsiveness as the ability of a structure to alter its form in response to changing conditions (Sterk, 2005). However, the approach is not limited to building aesthetics and outer shape but a comprehensive collaboration of computer-driven technologies. Meagher's approach is more comprehensive toward buildings. It is a changeable body regarding permeability, appearance, and affordances in response to the environment or user needs (Meagher, 2015).

Since nature is manifested in the structure's design, it has dynamically affected the responsive character of many building elements. For example, the building shades, blinds, vents, and mechanical facades are determinants of the building's external conditions (Figure 3). The bio-inspiration and reflection of responsive nature have been experienced by user behavior in buildings. Responsive architecture is an adaption of a natural system governed by the user's action as an external stimulus, and response occurs as a change in the system's state (Gronostajska & Berbesz, 2018). The kinetic facades allow the building envelope to be responsive to form and function, showing adaptability to a flexible design. The responsive design is controlled through environmental design, computer, and sensor technology. The exemplary design of Maison de

DOI: 10.15320/ICONARP.2022.213

Verre in Paris (Edwards & Gjertson, 2008) is a remarkable achievement in material innovation and cutting-edge technological development. The climatic adaptive building shells are also grouped into the responsive design of the building. The roof and facade adapt themselves to solar and wind by responding to improve their performance.

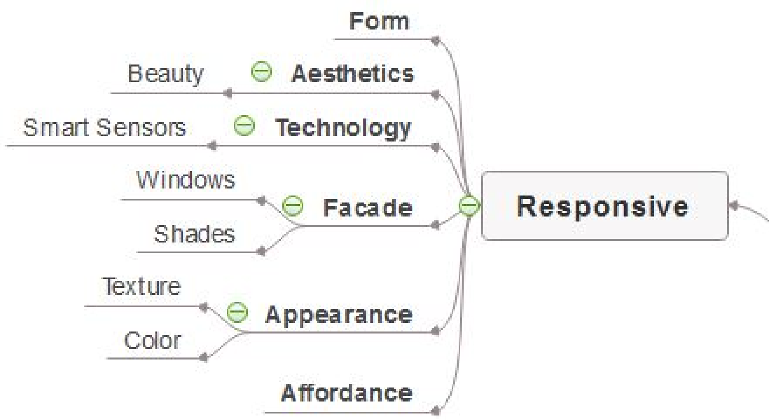


Figure 3. Mind map of R-Responsive. Flowchart (Author)

Furthermore, the building systems have also become intelligent, smart, and responses to human thermal comfort design conditions in the interior. The operation of security controls, openings, heating, ventilation, air conditioning, and lighting are sensor-driven. Many new buildings have smart technology and are connected and responsive to a smart power grid system (Daissaoui et al., 2020). In addition to the examples of responsive design in smart control systems, these technologies have equally been utilized in landscape and environmental design. The strategies like elucidate, compress, displace, connect, ambient, and modify also help integrate responsive technologies in landscape architecture (Cantrell & Holzman, 2016).

Construction

The Oxford dictionary defines construction as a synonym to structure. Construction refers to building a structure or infrastructure on-site using valuable resources. It includes its structural stability and how the building will be built. Construction is one major key component of architecture as it gives reality to a theoretical, philosophical, and drafted approach (Figure 4). A large variety of structural wonders have astonished the world from ancient times until today. The mystical construction of the Egyptian Pyramid, The Great Wall of China, Taj Mahal Monument, Eiffel Tower, Empire State Building, Petronas Tower, Palm Jumeirah Island, Shanghai Tower, Burj Khalifa, etc., and many other remarkable achievements are proven examples of structure and construction. The construction of architectural projects is done in different phases, starting from planning, designing, and executing. Depending on building typology, the structural system working is streamlined and ensured during the planning phase using different structural software like Autodesk AutoCAD, Revit, STAAD Pro, SAFE, RISA, Navisworks, ETABS, and SAP2000.

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

Various structural classifications and systems help in defining building form. The ropes, cables, struts, columns, beams, arches, Membranes, plates, slabs, shells, vaults, domes, synclastic, and anticlastic help achieve a form of the superstructure. The typical construction process involves machines like cranes, scaffolding, bulldozers, excavators, dump trucks, cement, concrete mixers, Forklift, Loader, pavers, compactors, etc. These are types of heavy machinery that work using hydraulics and reduce manual labor on construction sites. The construction industry is leading fast-track production and on-time completion of projects, tight schedules, reduced risk, etc.

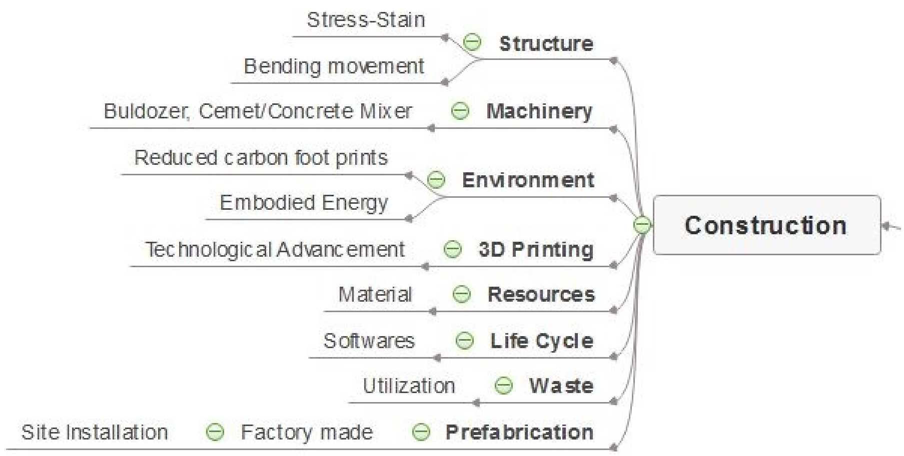


Figure 4. Mind map of C-Construction. Flowchart (Author)

Moreover, sustainable construction is also taking place as environmental concerns increases. Buildings are being considered for their whole life cycle, including the construction cycle, reducing construction waste, and recycling construction bulks. In addition to traditional construction techniques, futuristic construction technologies will change the world through robotic swarm construction, 3d printing, and Lego brick construction modules. The robotics machinery is programmed to perform complex construction functions, housed with sensors to work in synchronization. Construction robots have the potential to speed the completion of work with improved quality construction. To handle issues raised during the construction process, the building industry offers legal implementation. The Construction documents are governed by the legal obligations of the contract, procurement, and design-bid-build.

History

History is the record and interpretation of the past persisting events, human actions, and tangible work that existed through time and space till today (Helen Gardner, Horst De La Croix, 1980). It concerns the deep-rooted traditions of geography, climate, material availability, social and political challenges, and how these factors have helped shape the built environment (Figure 5).

The time-tested achievements in the history of architecture are commendable, celebrated, and appreciated while looking at the historical

DOI: 10.15320/ICONARP.2022.213

perspective of different civilizations. The exemplary work of ancient cultures like Egypt, Mesopotamia, Greek, Romans, Chinese, Persian, Islamic, Baroque, Renaissance, Art Nova, Modernism, And Postmodernism, etc. are just a few remarkable contributions ("Sir Banister Fletcher's Glob. Hist. Archit.," 2018). Architects always need to look back at the past to build the present, dream, and plan. The building history is based on the chronological classification of Stylistic, Physical, Visual, and Documentary shreds of evidence verified through multiple traces of evidence and historical context (Helen Gardner, Horst De La Croix, 1980).

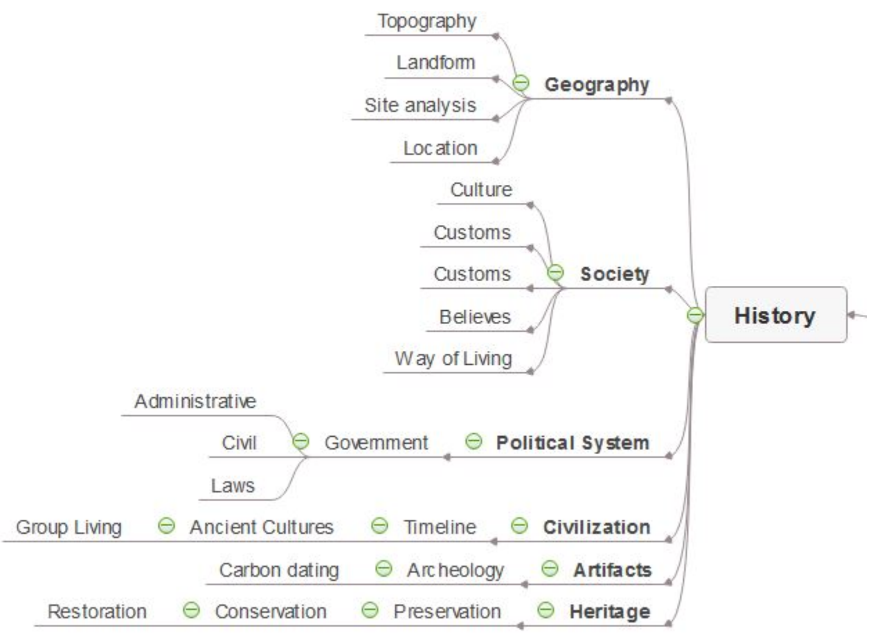


Figure 5. Mind map of H-History. Flowchart (Author)

The historical evolution of building design is a unique and unchanging skill that has manifested itself in different ways throughout time. History has led to the emergence of many radical concepts in architecture like Architectonic, thereomorphic, and anthropomorphic, etc. Culture characterizes architecture and the built environment, and the people reflect their intuition through the social grouping of culture.

Culture is the way of living, customs, beliefs, religion, and social practices of a particular group. The global contribution of a different culture to making advancements in architectural development has a far-reaching impact on people's lives. Architecture celebrates the deeply rooted tradition of cultural diversity. It is reflected in ancient civilization and upholds the identity of a particular area. The tangible and intangible historical and cultural values in architectural heritage and its preservation and conservation are necessary to achieve sustainable development goals. Historians and archaeologists unveil many of the ancient cultures that tell the story of the past, exploring how people lived before and how human civilization evolved. The existence of a vast majority of archaeological sites, historical monuments, artifacts, and objects significant to communities, nations, and humanity strongly depends on a particular culture. But tangible heritage is valued, appreciated, safeguarded, and illustrious globally. Culture is also communicated by the construction of public buildings. They are the reflection of religious belief that how a particular culture links its philosophies to the emergence of special architectural elements and features. The symbolic representation of ancient construction theories links with their beliefs and culture. Additionally, Architecture also tends to revive the cultural value in places to keep alive cultural practices. Social spaces are another way of increasing interaction among individuals. Historically, the old feature of public squares in the community is still practiced in many places. Greek Agora was the central place in their urban culture. Many European urban centers have preserved those historical public squares surrounded by shops and markets to celebrate cultural festivals. History and culture are also embedded in vernacular traditions of time-tested architecture. Vernacular buildings are considered part of regional culture. Many vernacular building practices are based on local needs, using indigenous materials and reflecting a particular area's local traditions and cultural practices.

Inspirational

Architecture is truly inspirational with the ability to connect with nature. Inspiration gives a philosophical meaning to beauty and function. Inspiration is not taken at random, but a building's functionality must be combined with its aesthetics. The role of intuitiveness becomes predominant in choosing inspiration that can be easily transformed into a more utilitarian approach and maintaining aesthetics (Figure 6).

The pragmatic and theoretical understanding of inspiration helps a designer design building form and function. Inspiration in design is a way of learning how nature has addressed the solution. It brings harmony to the choices available and unlocks creativity and innovation. The Parthenon is an enduring symbol of Ancient Greece, an inspiration for the golden ratio that has been considered the most pleasing to the eye. The falling water house by Frank Lloyd Wright is time tested inspiration of architecture with nature so close to a part of the design itself. Another intuitive inspiration is the bird's wing design of the Sydney Opera House in Australia.

Also, designers can inspire by music, painting, sculpture, or any art piece and bring it to reality as-built structures either two or three-dimensionally. A recent example is Biomimetic architecture, where designers find a sustainable solution by examining natural form, systems, and processes. Other inspirational philosophies that inspire designers seeking solutions to artificial problems are organic architecture, bio morphism, Metaphoric architecture, and Zoomorphic architecture. These natural inspirations add a deeper meaning to replicating natural phenomena and making them a reality in the built environment. The designers must understand the deep underlying pattern, layer by layer, and superimpose it with the prospective architectural solution.

DOI: 10.15320/ICONARP.2022.213

Utopic thought exists in theories of architecture (Johnson, 1994) and is a great inspiration for the future. Utopia is an imaginary world with social equity. It is the imaginary socio-economic order in a community aimed at public perfection (Giroux, 2003). The utopian society is based on social cohesion, equality, well-being, correctness, and reflection of a high level of order. The philosophy is reflected through the built environment, architecture, and urbanism. Utopian architecture is a close-to-perfection phenomenon practiced in decorating the interior of Roman buildings with 3rd and 4th styles of painting. A glimpse of an imaginary world, beautiful scenery, and vistas were created to address the fantasies. In the utopian approach, architecture is a world of fantasy and unimaginable thinking, and then try searching for its endlessness. Ideally and theoretically, architecture propagates social and economic equality in society, but its resonance is a paradigm shift toward excellence.

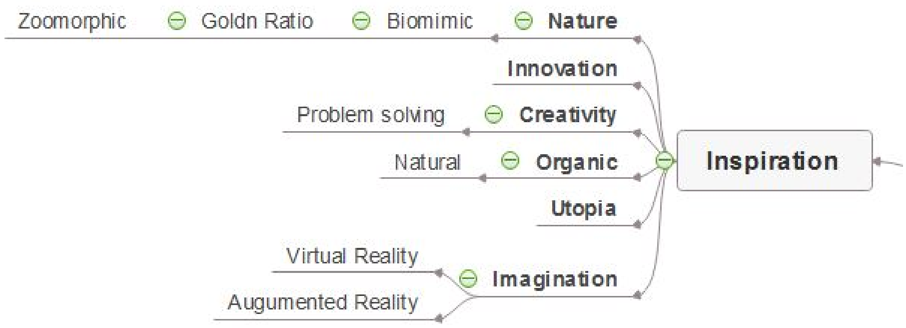


Figure 6. Mind map of I-Inspiration. Flowchart (Author)

The imaginary world is created through augmented reality, where architectural experience is digitalized. The augmented and virtual reality museum, IMAX Dome and theatre, Hollywood studio, and animation for cinema show the imaginary world and utopian architecture. In the world of architecture, it is an experience that takes the user beyond the level of imagination and dream world.

Technology

With the advent of the 21st century, the design realms cannot remain isolated from technology and its advancement. The futuristic way to design buildings that meet today's and tomorrow's needs will be achieved through technological advancement (Figure 7). The availability of new technology has revolutionized building construction, and the fast-communicated building information modeling has made designers more flexible in decision-making. The additive manufacturing and fabrication of 3D printing emerge as cutting-edge technology for the construction industry. Building applications using drones, Photogrammetry, 3-D laser scanner, and virtual and augmented reality have led designers to more reliably and quickly built solutions. The prefabricated construction of a hospital in Wuhan because of the Covid19 pandemic was an effort of six days that helped designers, the construction industry, and other stakeholders with quick fabrication and on-site assembly.

BIM-integrated design technology allows projects to capture the efficiencies gained by incorporating design, manufacturing, and construction processes without compromising function and aesthetics. This approach has resulted in a high-quality building delivered in a shorter time frame, with more predictable costs and fewer environmental impacts through reduced material use and waste. Compared to conventional construction, the benefits of recent technologies have made resource management easier, with reduced risks and optimized design, construction, and assembly.

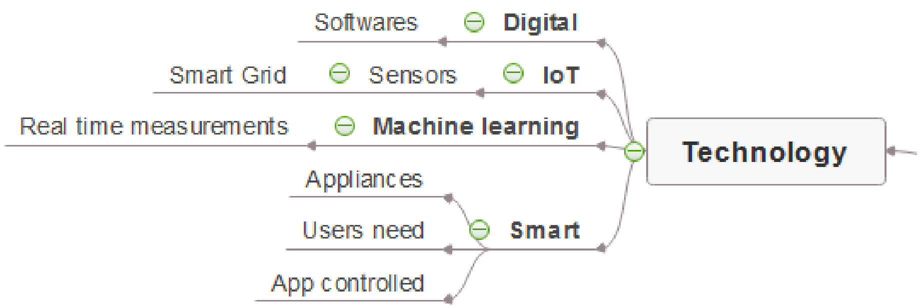


Figure 7. Mind map of T-Technology. Flowchart (Author)

Due to integrated technology, smart cities are necessary for sustainable development (Bibri & Krogstie, 2017). Intelligent buildings with the integration of smart technologies like smart meters, smart elevators, smart appliances, smart infrastructure, smart grid, smart parking, and traffic management are interpreting data to increase comfort and resilience. Future skyscrapers have waste-to-energy technologies, intelligent transportation, and mass transit systems to meet high-tech challenges. Along with the building itself, the concept of smart cities has also gained momentum. It has been named a Digital City, Information City, Intelligent City, Knowledge-based City, Ubiquitous City, and Wired City (Ismagilova et al., 2019) because of deep reliance on digitalization (Al-Saidi & Zaidan, 2020). The use of digital technologies and fast communication in infrastructure services, security, environmental control, and comfort is the priority of architects in the new era of technology. In the age of new challenges like the COVID-19 pandemic, the internet of things (IoT) will be a blessing without reliance on human-to-human or human-to-computer interaction. Technologically speaking, the convergence of multiple technologies, real-time analytics, machine learning, commodity sensors, and embedded systems will play a major role in transferring data. In this context the significant contribution of Google affiliate Sidewalk Labs to prototype a version of a smart city in Toronto, Canada (Goodman & Powles, 2019) is an praiseworthy approach and way forward to what technology can provide.

Environment

The environment includes both natural and built surroundings. Over the past few years, the environment has become highly thought-provoking. The urban ecosystem is putting up sustainable design challenges for the whole community of designers (Figure 8). Today

DOI: 10.15320/ICONARP.2022.213

buildings are expected to be designed with minimum impact on the environment, energy, and ecosystem. The recent agenda of green design, sustainable building challenges, air quality, passive standards, energy, and environmental policies have emerged as pollution issues, rise in earth temperature, climate change, etc., have gained momentum. The buildings are being designed for the entire life cycle and will give additional energy to grid infrastructure. The passive design, sustainable materials, use of renewable energy, rainwater collection, and wastewater treatment are being incorporated into building design. Compliance with energy codes, thermal comfort standards, and green certifications (LEED; BREAM) has enabled stakeholders to invest for greater payback in the longer run (S. Li et al., 2020). The availability of most building simulation software like Energy Plus, BLAST, DOE-2, HVACSIM+, and TRNSYS is helping architects to design eco-friendly, reduced carbon footprints, and zero energy buildings. Building performance simulation allows designers to take intelligent solutions for thermal design, acoustic design, ventilation design, and many other aspects of the primary concern of the environment. The validated process further helps in a more realistic solution that can be safely applied during the buildings' construction and operation.

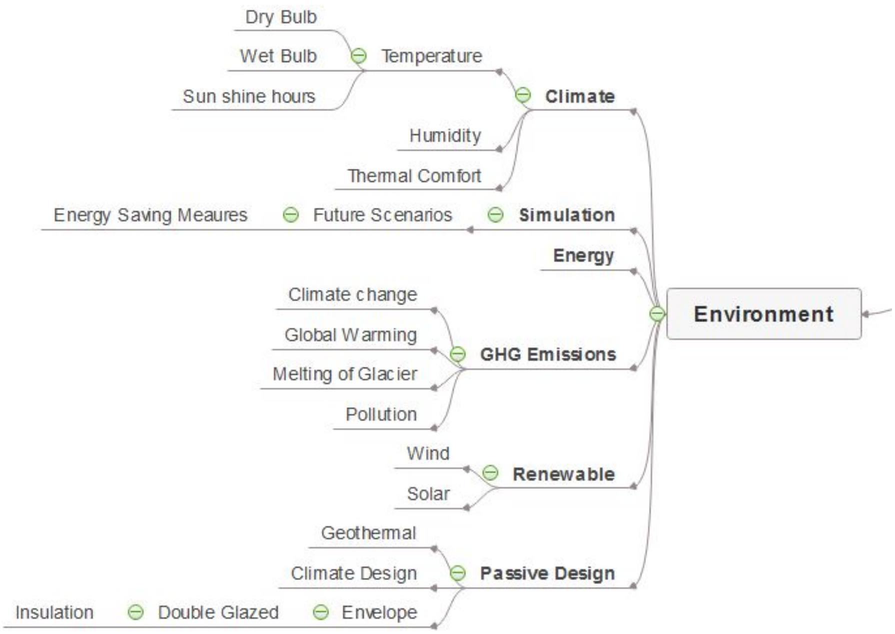


Figure 8. Mind map of E-Environment. Flowchart (Author)

A pivotal contribution of sustainability is to the environment and is ensured with the help of landscape design, ecological consideration, multifunctional landscapes, cleansing, environmental infrastructure, healthy landscapes-Food systems, and productive landscapes (Zeunert, 2017). The landscape design has made a total revolutionary impact on vertically farmed skyscrapers. Urban farming is being applied to various fruits, vegetables, and grains in buildings (L. Li et al., 2020). The natural landscape is utilizing renewable energy concepts to reduce the carbon footprints of an urban farm. The greenhouse technologies such as hydroponics, aeroponics, and aquaponics are a more sustainable way of producing food (Al-Kodmany, 2018).

Climate

Architecture is also driven by climate. Climate is the long-term weather conditions, often determined by the geographical conditions of an area (Werndl, 2016). The variance in climate influences how ancient cultures and civilizations construct shelters, houses, and buildings. Various environmental parameters of temperature, humidity, precipitation, solar radiations, topography, wind speed, direction, etc., are consistently considered in the design of buildings (Figure 9).

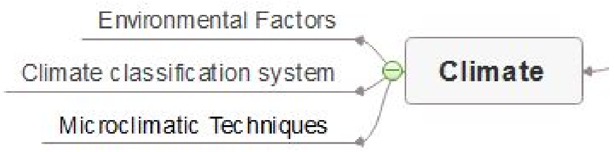


Figure 9. Mind map of C-Climate. Flowchart (Author)

The availability of world-renowned climate classification systems of Thornthwaite (Feddema, 2005) and Köppen (Chen & Chen, 2013) has made the understanding of climate easier for architects. The thermal performance of the building, like its heating, cooling, and ventilation requirements, is greatly influenced by climate and can be experienced in early design phases using simulation software. Climatic design significantly impacts architectural forms, patterns, and passive design considerations. Many initial stage design decisions like orientation, the percentage area of glazing, insulation, shading devices, and many more are based on climate challenges (Liu et al., 2020). The microclimatic site techniques like sun path diagram, sundial; the wind rose, wind square, air movement, etc., help in climate analysis and choosing the right design strategy and guidelines for the designed building. The climate is often combined with comfort for intelligent solutions in the architectural design process. For the use of the building, Givoni-Milne bioclimatic chart, *Mahoney tables*, and Olygyay chart identify the comfort zones for a particular climate and heating-cooling pattern for the buildings.

Transformation

Transformation is defined as an architectural concept or a structure that can be modified, transformed, or altered (Durmus, 2012). It is a change that occurs through manipulations, variations, and rearrangement of a previously existing concept. The change is brought in response to a specific context or a set of conditions that bring a new change without losing identity or concept. Transformation in architecture provides the flexibility to modify their original use for architects and building users (Figure 10). Flexibility is needed for function, layout, design, interior, ambiance, and form. Especially, space transformation is essential besides the original character of space, its social and historical connection, human perception, and experiment (Asefi, 2012). It's really about blurring the boundaries of art, design, landscape, interior, structure, and technology itself (Yi Li, 2017).

DOI: 10.15320/ICONARP.2022.213

Transformation is possible by applying conversion, makeovers, and alterations to basic elements and principles of design. Basic design elements like line, shape, form, color, and texture are combined with the principles like rhythm, movement, proportion, and symmetry in composition. The elements and principles tend to change, translate, rotate, and reflect in a new dimension. In addition to geometric transformation, natural analogies can also help in bringing a positive transformation (Celani et al., n.d.).

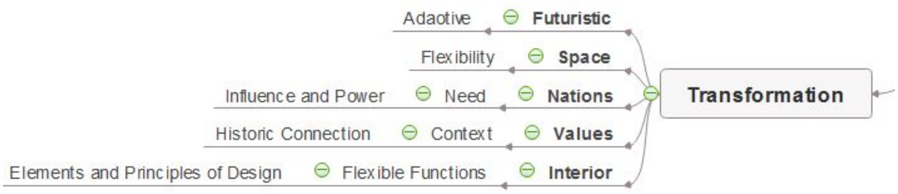


Figure 10. Mind map of T-Transformation. Flowchart (Author)

Urban transformation by applying the horizontal expansion analogy to the design of futuristic vertical cities is organic and isometric (Reinke, 2020)(Novikov & Gimazutdinova, 2021). The transformation is also widely practiced in modernism and contemporary interior design concepts through open floor plans, which provide flexibility to modify a space according to users' changing requirements and needs. The documentary evidence of Hagia Sophia shows the historical, functional, cultural, and social transformation at different times and places is remarkable. The building is still active, even though the work of architecture has been undergoing different transformations. It served as Byzantine Christian Cathedral (537–1204), then Roman Catholic Cathedral (1204–1261), Greek Orthodox Cathedral (1261–1453), Ottoman Mosque (1453–1931), and finally a museum (1935–present) at now. As another example of need-based transformation, London's ExCel Centre was rapidly transformed into the Nightingale Hospital for Covid19 patients after the global Pandemic crisis (Bushell et al., 2020). Many such examples have echoed in other countries, where both developing and developed nations are adopting this transformation to address building users' needs.

Utility

Utility in architecture refers to a function, commodity, and serviceable design. The buildings are designed to meet some functional requirements of the users and stakeholders. The modernist theory of "Form follows Function" states that building form is determined with the help of its function. If the building is functionally good and useful, it leads users to physiological, psychological, and behavioral satisfaction. So, the performance of a building is evaluated in terms of its operation, services, and infrastructure (Figure 11).

Buildings perform various functions, such as a home, an institute, a hospital, an airport, shopping malls, a restaurant, and religious structures. The function is the designers' main priority because it determines the user's comfort in a space. Buildings are based on spatial functions and serve as a commodity for the daily users who live in and experience them. The requirements and differentiation of space define building utility. The spatial form and building function are categorized as global functions and interfaces, where inhabitants are controlled through the use of space (Turin, 1980).

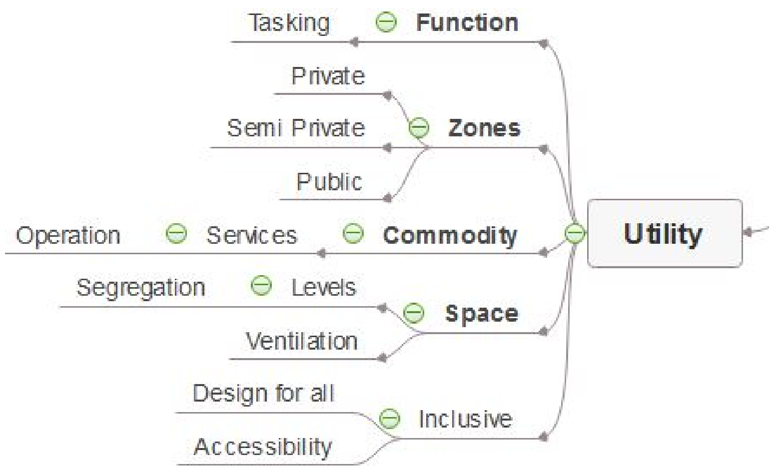


Figure 11. Mind map of U-Utility. Flowchart (Author)

Functionalism is a work of objectivity in architecture. The architects of modernism give priority to functionalism in design. For example, Le Corbusier describes architecture as "a house is a machine for living in." Buildings not only define their functional system but its interaction and linkages with the adjacent and nearby spaces. The need for high connectivity in spaces and prioritization is based on function. The division of segregation and zoning in private, semi-private, and public spaces is created by defining function and utility. Designing an office building based on function will increase the coordination amongst people, increasing work efficiency and giving them privacy. For example, hospital design must be highly utilitarian for great coordination between doctors, nurses, administrative staff, and patients. The functional properties of the design depend on the building typology. Planning techniques help achieve single and mixed-mode functions and diversity in buildings (Generalov et al., 2018). Developing the concept of tall multifunctional buildings or complex buildings requires an adequate, user-friendly regulatory framework for all its functions, including (offices, residential, office, hotels, etc.). Functionalism will help review and revisit the social, economic, and design aspects holistically and creatively.

Resources

Architecture accentuates the appropriate use of resources. Resources include materials, manpower, time, and cost. Building resources determine the suitability for a particular construction type; in other words, they significantly affect sustainable construction. Resources must be used in a way that must not disturb the ecological balance in the ecosystem (Figure 12). For meeting sustainable development challenges,

DOI: 10.15320/ICONARP.2022.213

green human resource management is taking place (Jabbour & De Sousa Jabbour, 2016). Materials should have a minimal detrimental effect on people, nature, and the environment during their use and final disposal. Architectural construction uses both natural and synthetic materials for construction. There are multiplicities of sustainable, acoustic, insulated, reflected, absorbed, paint, finish, polish, and raw materials. The use of each selection is based on the design challenge that needs to be addressed. The future challenges of the construction industry are met using smart, novel, and self-sufficient material innovation. The recent inventions of self-healing concrete with the ability to heal cracks, light-emitting concrete, lightweight 3D graphene for skyscraper construction, spider silk, prefabricated timber, modular bamboo, translucent wood, transparent aluminum, aluminum, foam, Nanocrystal, wool brick, Aerogel, Hempcrete, and hydro ceramic are just a few examples for smart construction.

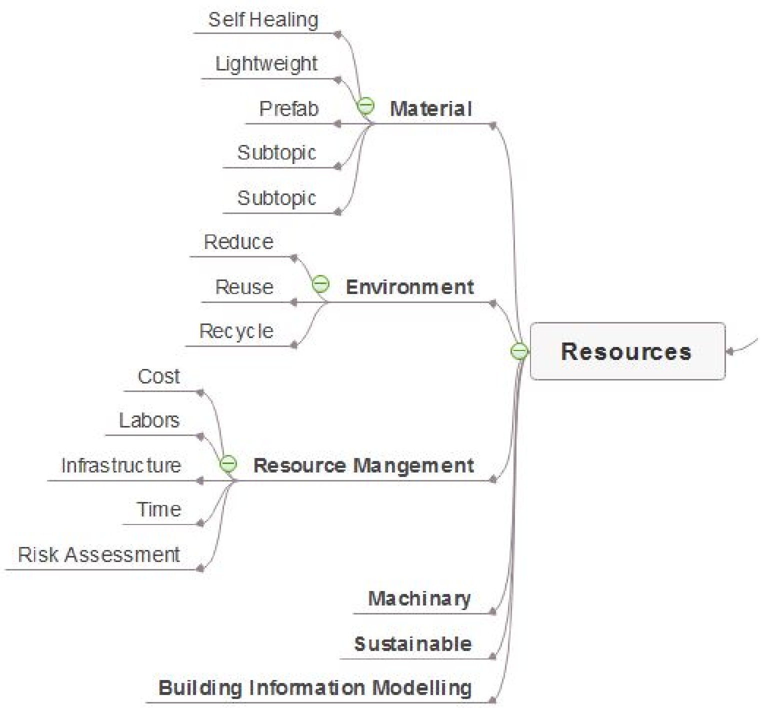


Figure 12. Mind map of R-Resources. Flowchart (Author)

Material and labor management and their productive utilization also require an innovative approach to resource consumption. Every task of construction activity is managed to increase productivity. The project life cycle gives priority to diversification in project delivery methods which are governed by Design-Build (DB), Construction Management at Risk (CMR), Design-Build Maintain (DBM), and Integrated Project Delivery (IPD). The optimum project cost, people interaction, and time management are integrated into one design through Building information modeling (BIM). To enhance the productivity and performance of labor, frequent supervision, leadership knowledge, skill of professional practices, the skill set of labor, and risk management are all necessary. Resource management has been addressed in building and urban design for the construction of smart cities. It has paved the way for the intelligent management of digital technologies through the Internet of Things (IoT). The control system and building automation ensure the most valuable resource of energy usage. IoT will provide effectiveness, efficiency, and accuracy of the resources that are being used by the whole community through a centralized network.

Economy

The economy is one of the critical vital components of architectural design. The sustainable design pillars are incomplete without considering the economic attributes of profit. Architecture is a profitable business, and it encourages productivity. It localizes itself toward on-time project delivery, successful completion, good investment, and a reasonable payback period (Figure 13). The quest for an economical solution requires life cycle cost analysis. It accounts for design, construction, maintenance, and operation costs by looking at alternatives. The most economical option is based on a comparative study of various options. Some sustainable examples of architecture may have increased initial cost but less recoverability of cost overruns. The low-cost but optimal design is the choice of stakeholders, and money is a valuable resource in design. Buildings also can use an economic model that reduces consumption, the collapse of the ecosystem, and the waste of finite resources by continually reusing materials and energy. The product and services can be redefined in architectural design using the concept of circular economy (Valenzuela et al., 2018). Architectural enterprises have shifted from the traditional linear model to the circular economy by considering the end-life perspective (Laumann & Tambo, 2018). The buildings are designed for disassembly by keeping the given circular economy design perspective (Akanbi et al., 2019). The circular economy model also plays its role in replicating the idea at a sustainable urban development level. The novel interaction between the circular economy and the Internet of things has also revolutionized business models (Askoxylakis, 2018). Architecture also borrows the theory of sharing economy. It creates places based on the collaborative use of resources for an economical approach.

Figure 13. Mind map of E-Economy. Flowchart (Author)

The economy is manifested when making choices of design. The low-budget project requires cheap construction. It could be achieved in various ways through intelligent solutions—the use of cladding materials as an affordable solution without compromising on building structural stability and aesthetics. Corrugated metal or concrete sheets are structurally resistive with a low-cost solution. Temporary shipping

DOI: 10.15320/ICONARP.2022.213

containers, prefabs, and portacabins also give the design economy. Vernacular construction based on locally available materials and construction techniques also leads to an economical design. Architecture is not only for the rich, but it also generates an economical solution for the poor, low-income people. For example, the economically sustainable models are the Khuda-Ki-Basti (KKB) and the Orangi pilot project, based on affordable housing for low-income people. Many such projects in other parts of the world strengthen the resilient infrastructure of low-cost housing through community participation methodology. Recently the work of Yasmeen Lari BASA Architecture (Barefoot Social Architecture) is an exemplary work for marginalized communities providing people with social and economic justice. The project uses a participatory community approach to low-cost and zero-emission shelters using local materials and techniques (Ramzi, 2019).

CONCLUSIONS AND RECOMMENDATIONS

Based on the results and discussion as elaborated in the former section, the article interpreted and reflected the core terminologies in the field of Architecture. It has comprehensively covered the key development that has happened in the past, along with some current innovation that is revolutionizing the discipline and paving the way for futuristic innovation in architecture and cross-disciplinary fields. The article tends to conclude an archetypal that can be practiced as a studio methodology in design classes. The twelve keywords considered at every stage of the project will help to make a conscious consideration of all project aspects. The definitions of Architecture in literature do encompass the various aspects of design consideration, but the above-mentioned methodology will support a holistic perspective of its various sub-fields. In comparison defining Architecture is the art and science of planning and constructing a building to address humans' physiological and psychological needs. The archetypal "Architecture" has a deeper meaning, a message that designers replicate at every project stage (Figure 14). Designers are trained for, and practice with the presented concepts in the etymological root of "A-R-C-H-I-T-E-C-T-U-R-E." Architecture, as the term, has an in-depth meaning required to accomplish the design. It helps designers articulate how they think of the buildings and reflect their philosophy in the built structures. The twelve-letter combination proposes an archetypal design that encompasses design thinking, empathizing, and creativity (Figure 15). It is seen that the archetypal of this content analysis has or may have the potential to contribute to the holistic analysis of the components in the discipline of architecture, which has a very complex and comprehensive relationship network. Considering the concepts used in the etymological analysis of the word architecture and their relation, it is possible to say the following: Architecture celebrates individuality and a collective approach to design. Because individual emerging themes that have been developed celebrate

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

the individuality of the ideas required for the implementation in the building design.

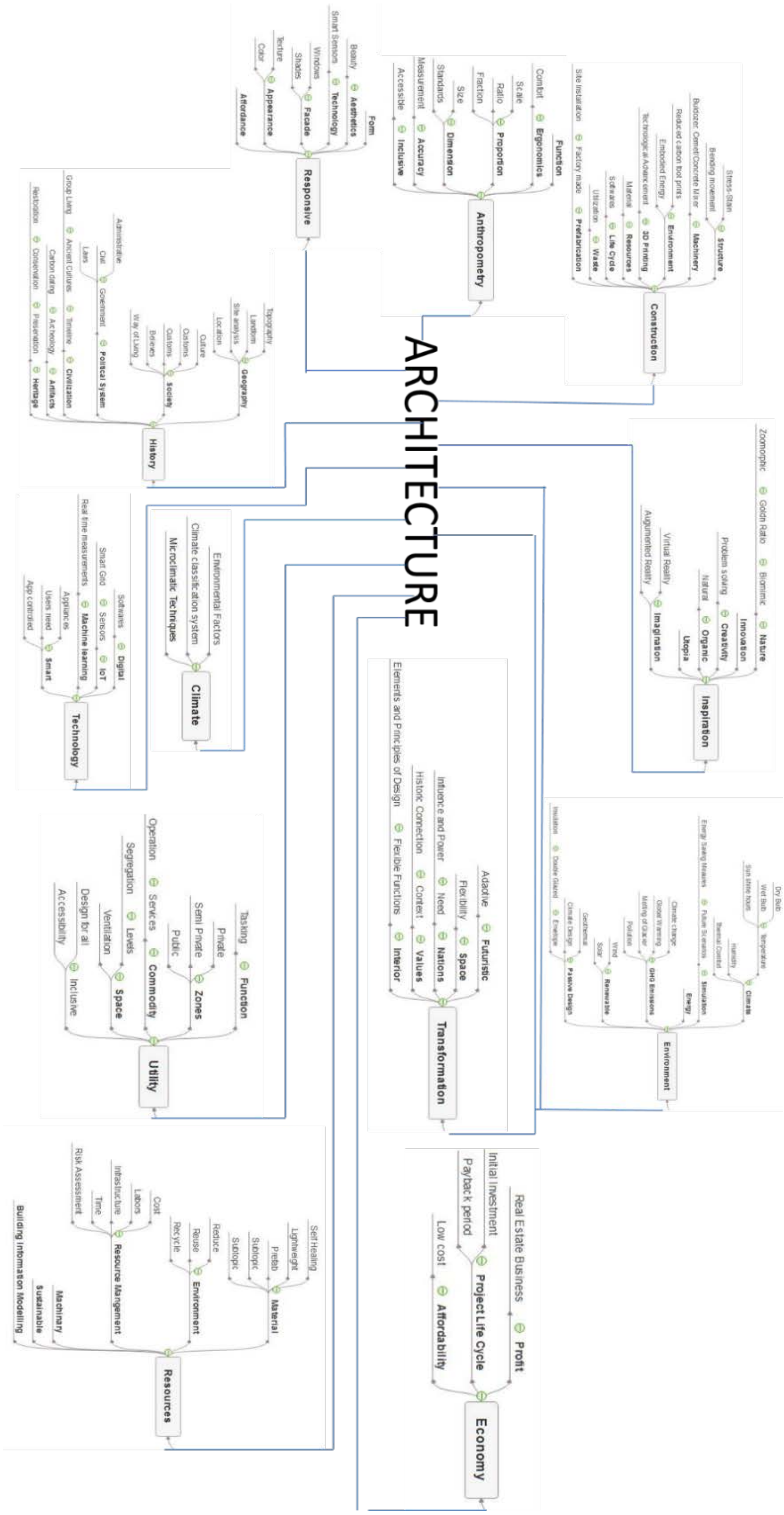


Figure 14. Archetypal of ARCHITECTURE. Flowchart (Author)

DOI: 10.15320/ICONARP.2022.213

Also, the collective approach is being considered in projects, borrowing sub-themes from individual ideas. Buildings must be designed for their function, appearance, safety, reliability, durability, and quality. The building must be well designed, meeting user needs and desires. The standards are another way of optimizing a holistic design approach. The ease of construction using available technology will also determine the pace of architectural evolution. Architecture must last longer as a landmark for the design choices of stakeholders that they made throughout the architectural process.

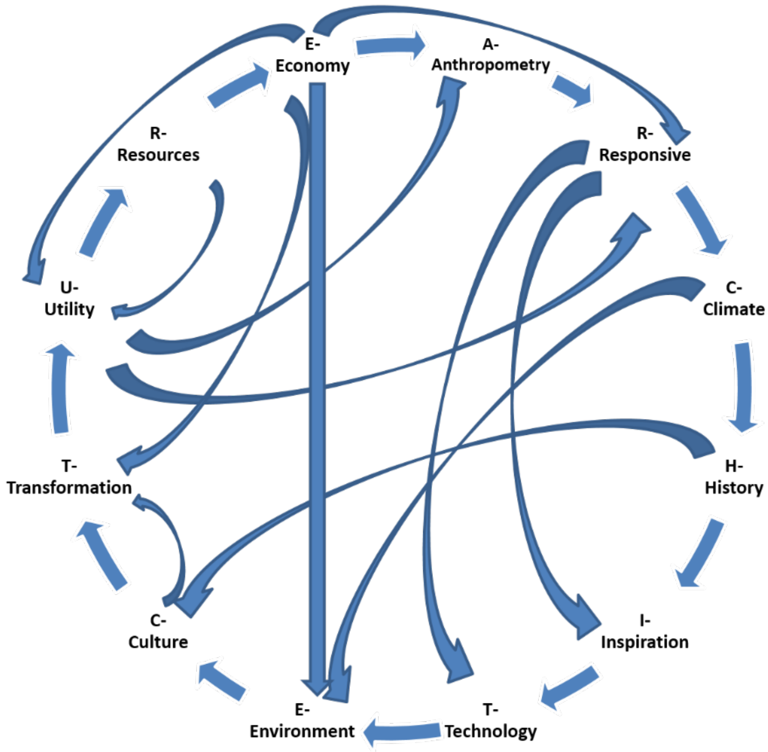


Figure 15. Archetype of Architecture. Flowchart (Author)

The analogy of Architecture is based on design thinking and creativity. The architectural design process requires an intricated cyclic relation of different parameters. It also depends on the nature of the project, whose function can be residential, commercial, industrial, institutional, community participatory, or religious. So, research explains a familiar and straightforward generic archetype based on the linkage of the closely related terminologies in architecture. The archetype also explains key terminologies' concept shift and hierarchy link (Figure 15).

Anthropometry is the beginning stage of design projects because it confines and provides fixed dimensional parameters of a design. Once the dimensions are realized, the design can shift to the next required hierarchy. It has also been observed that technology and environment form the core of the architecture discipline in the proposed archetype. This is because the use of software and its application in design has increased the freedom for the designers, where they can take early decisions at the various stages of planning, design, and final execution. Today software plays a significant role in engaging clients, measuring,

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

and enhancing energy performances, making aesthetic decisions, and coordinating the team in integrated project management.

Another core issue is the environment which has been widely debated in architecture literature and professional practices. Thereby the stakeholders are being sensitive to the sustainable environmental challenges of the future in design realms, where they are striving hard to provide a long-term solution to the climate problems. The environment-friendly design gives cost-effective and affordable solutions and has gained the attention of works of literature for decades for a sustainable future. The environment is shaped by the climate and depends on design functionality in a particular setting. Historic building commemorations are deeply rooted in the cultural practices of different regions that have the potential to bring transformation to the new digital age. The function requires minimum use of all available resources to achieve economy in design. Responsive architectural practices follow the footsteps of inspiration philosophy in design and adaptability. Similarly, the core nature of the project will determine the practical importance of different parameters and their sub-linkages. In the future, the expert response can be measured by a mixed method approach on 12 suggested acronyms. The responses on the expression of each referred term will also validate and refine its approach towards ARCHITECTURE. The author plans to conduct a more rigorous study in the future, using pictorial stimulus and expert responses to the content analysis's themes.

ACKNOWLEDGEMENTS/NOTES

The author acknowledges the methodological idea presented by Alex Milton & Paul Rodgers in his book on Product Design. It was a great inspiration for defining initial notes for this manuscript.

REFERENCES

Akanbi, L. A., Oyedele, L. O., Omoteso, K., Bilal, M., Akinade, O. O., Ajayi, A. O., Davila Delgado, J. M., & Owolabi, H. A. (2019). Disassembly and deconstruction analytics system (D-DAS) for construction in a circular economy. *Journal of Cleaner Production*. https://doi.org/10.1016/j.jclepro.2019.03.172

Al-Kodmany, K. (2018). The vertical farm: A review of developments and implications for the vertical city. In *Buildings*. https://doi.org/10.3390/buildings8020024

Al-Saidi, M., & Zaidan, E. (2020). Gulf futuristic cities beyond the headlines: Understanding the planned cities megatrend. *Energy Reports*, *6*, 114–121. https://doi.org/10.1016/j.egyr.2020.10.061

architecture | Definition, Techniques, & Theory | Britannica.com. (n.d.).

Architecture | Definition of Architecture by Merriam-Webster. (2019).

Asefi, M. (2012). Transformation and Movement in Architecture: The Marriage Among Art, Engineering and Technology. *Procedia - Social and Behavioral Sciences*.

DOI: 10.15320/ICONARP.2022.213

https://doi.org/10.1016/j.sbspro.2012.08.278

Askoxylakis, I. (2018). A framework for pairing circular economy and the internet of things. IEEE International Conference on Communications. https://doi.org/10.1109/ICC.2018.8422488

Alex Milton, P. R. (2011). Product Design. Glasgow: Quercus, Laurence King Publishing.

Bibri, S. E., & Krogstie, J. (2017). Smart sustainable cities of the future: An extensive interdisciplinary literature review. In Sustainable Cities and Society. https://doi.org/10.1016/j.scs.2017.02.016

Brown, J. (2011). Def*inition of Architecture | ArchDaily*. ArchDaily. https://www.archdaily.com/178277/definition-of-architecture

Bushell, V., Thomas, L., & Combes, J. (2020). Inside The O2: the NHS Nightingale Hospital London education center. *Journal of Interprofessional Care*, *34*(5), 698–701. https://doi.org/10.1080/13561820.2020.1823949

Cantrell, B., & Holzman, J. (2016). Responsive landscapes: Strategies for responsive technologies in landscape architecture. In *Responsive Landscapes: Strategies for Responsive Technologies in Landscape Architecture*.

Casadei, K., & Kiel, J. (2021). Anthropometric Measurement. *StatPearls*. https://www.ncbi.nlm.nih.gov/books/NBK537315/

Celani, G., Henrique, G., & Martins, S. (n.d.). *Geometric Transformation As An Architectural Form Generation Strategy: A Case Study In The Work Of Santiago Calatrava*.

Chen, D., & Chen, H. W. (2013). Using the Köppen classification to quantify climate variation and change: An example for 1901-2010. *Environmental Development*. https://doi.org/10.1016/j.envdev.2013.03.007

Crysler, C. G., Cairns, S., & Heynen, H. (2012). The SAGE handbook of architectural theory. *The SAGE Handbook of Architectural Theory*, 1–725. https://doi.org/10.4135/9781446201756

Daissaoui, A., Boulmakoul, A., Karim, L., & Lbath, A. (2020). IoT and Big Data Analytics for Smart Buildings: A Survey. *Procedia Computer Science*, *170*, 161–168. https://doi.org/10.1016/j.procs.2020.03.021

Dimitriu, L., & Botta, M. (1983). Architecture and Morality: An Interview with Mario Botta. *Perspecta*, *20*, 119–138. https://doi.org/10.2307/1567069

Donald Watson, Michael J. Crosbie, J. H. C. (2004). *Time Saver Standards for Architectural Design Data*.

Dovey, K. G. P. J. D. & G. M. (1985). Ariadne's Reinforcing Rod: Conjectures on place and architectural archetypes,. *Place and Placemaking, Proceedings of the PAPER 85 Conference*, *21*(4), 187–204.

Durmus, S. (2012). Change and Transformation in Architecture: On the Concept of Zeitgeist. In *GBER*.

Edwards, M. J., & Gjertson, W. G. (2008). La Maison de verre: Negotiating a modern domesticity. *Journal of Interior Design*.

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

https://doi.org/10.1111/j.1939-1668.2008.00004.x

Ellis-Barrett, L. (2017). Historical Dictionary of Architecture (2nd edition)RR 2017/055 Historical Dictionary of Architecture (2nd edition) Allison Lee Palmer Rowman & Littlefield Lanham, MD and London 2016 xliv + 396 pp. ISBN 978 1 4422 6308 6 (print); ISBN 978 1 6309 3 (e-book). *Reference Reviews*. https://doi.org/10.1108/rr-10-2016-0255

Feddema, J. J. (2005). A revised thornthwaite-type global climate classification. *Physical Geography*. https://doi.org/10.2747/0272-3646.26.6.442

Generalov, V. P., Generalova, E. M., Kalinkina, N. A., & Zhdanova, I. V. (2018). Typological diversity of tall buildings and complexes in relation to their functional structure. *E3S Web of Conferences*. https://doi.org/10.1051/e3sconf/20183301020

Giroux, H. A. (2003). Utopian thinking under the sign of neoliberalism: Towards a critical pedagogy of educated hope. *Democracy and Nature*. https://doi.org/10.1080/1085566032000074968

Goldschmidt, G. (2016). Architecture. In *The Curated Reference Collection in Neuroscience and Biobehavioral Psychology*. https://doi.org/10.1016/B978-0-12-809324-5.23520-7

Goodman, E. P., & Powles, J. (2019). Urbanism Under Google: Lessons from Sidewalk Toronto. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3390610

Gronostajska, B. E., & Berbesz, A. M. (2018). Responsive solutions in shaping innovative architectural structures. *E3S Web of Conferences*. https://doi.org/10.1051/e3sconf/20184900039

Helen Gardner, Horst De La Croix, R. G. T.-. (1980). *Art Through the Ages*. Houghton Mifflin Harcourt Press.

Ismagilova, E., Hughes, L., Dwivedi, Y. K., & Raman, K. R. (2019). Smart cities: Advances in research—An information systems perspective. In *International Journal of Information Management*. https://doi.org/10.1016/j.ijinfomgt.2019.01.004

Jabbour, C. J. C., & De Sousa Jabbour, A. B. L. (2016). Green Human Resource Management and Green Supply Chain Management: Linking two emerging agendas. *Journal of Cleaner Production*. https://doi.org/10.1016/j.jclepro.2015.01.052

Jamadar, A. B. (n.d.). *' Hub ' as an archetype , in design for ' sharing economy ' learning from emblematic typologies of diverse disciplines*. 1–26.

Johnson, P.-A. (1994). The theory of architecture: concepts, themes & practices. In *Choice Reviews Online*. https://doi.org/10.5860/choice.32-1328

Kunze, D. (n.d.). The Vitruvian Virtues of Architecture : Utilitas , Firmitas , Venustas. *The Vitruvian Virtues of Architecture: Utilitas, Firmitas, Venustas*, 1–4.

Laumann, F., & Tambo, T. (2018). Enterprise architecture for a facilitated transformation from a linear to a circular economy. *Sustainability*

DOI: 10.15320/ICONARP.2022.213

(Switzerland). https://doi.org/10.3390/su10113882

Li, L., Li, X., Chong, C., Wang, C. H., & Wang, X. (2020). A decision support framework for the design and operation of sustainable urban farming systems. *Journal of Cleaner Production*, *268*, 121928. https://doi.org/10.1016/j.jclepro.2020.121928

Li, S., Lu, Y., Kua, H. W., & Chang, R. (2020). The economics of green buildings: A life cycle cost analysis of non-residential buildings in tropic climates. *Journal of Cleaner Production*, *252*, 119771. https://doi.org/10.1016/j.jclepro.2019.119771

Liu, S., Kwok, Y. T., Lau, K. K. L., Ouyang, W., & Ng, E. (2020). Effectiveness of passive design strategies in responding to future climate change for residential buildings in hot and humid Hong Kong. *Energy and Buildings*, *228*, 110469. https://doi.org/10.1016/j.enbuild.2020.110469

Meagher, M. (2015). Designing for change: The poetic potential of responsive architecture. *Frontiers of Architectural Research*. https://doi.org/10.1016/j.foar.2015.03.002

Nelson, C., & Woods, R. H. (2013). Content analysis. In *The Routledge Handbook of Research Methods in the Study of Religion*. https://doi.org/10.4324/9780203154281-16

Neuman, W. L. (2011). Social Research Methods: Qualitative and Quantitative Approaches. In *Pearson Education*.

Novikov, S., & Gimazutdinova, E. (2021). The vertical cities: reality or utopia of the future. *E3S Web of Conferences*, *274*, 01014. https://doi.org/10.1051/e3sconf/202127401014

Nuttall, J. (2002). Archetypes and architecture: The coniunctio of Canary Wharf. *Psychodynamic Practice*. https://doi.org/10.1080/13533330110119259

Pheasant Stephen, M. H. C. (2017). Bodyspace: Anthropometry, Ergonomics And The Design Of Work. In *Bodyspace: Anthropometry, Ergonomics And The Design Of Work*. https://doi.org/10.4324/9780203482650

Pieczara, M. (2019). Archetypes in contemporary architecture. *Czasopismo Techniczne*, *4*(January 2019), 71–84. https://doi.org/10.4467/2353737xct.19.044.10356

Quintal Becky. (2019). *121 Definitions of Architecture | ArchDaily*. https://www.archdaily.com/773971/architecture-is-121-definitions-of-architecture

Ramzi, S. (2019). *Retrospective: Yasmeen Lari - Architectural Review*.

Reinke, S. C. (2020). The future of workplace in vertical cities:Hanging gardens, roof terraces and vertical plazas. *International Journal of High-Rise Buildings*, *9*(1), 71–79. https://doi.org/10.21022/IJHRB.2020.9.1.71

Saunders, P., & Skar, P. (2001). Archetypes, complexes and self-organization. In *Journal of Analytical Psychology*. https://doi.org/10.1111/1465-5922.00238

Seamon, D. (2017). Architecture , Place , and Phenomenology :

Lifeworlds , Atmospheres , and Environmental Wholes (2016 , forthcoming). *Phenomenology and Place*, *SEPTEMBER 2015*. http://www.researchgate.net/publication/282157109%5CnArchitecture,

Sir Banister Fletcher's Global History of Architecture. (2018). In *Sir Banister Fletcher's Global History of Architecture*. https://doi.org/10.5040/9781350064805

Stephen, R. S. (2004). Encyclopedia of 20th-century architecture. In R.Stephen Sennott (Ed.), *Fitzroy Dearborn New York* (Volume 1 A). Fitzroy Dearborn.

Sterk, T. D. E. (2005). Building upon Negroponte: A hybridized model of control suitable for responsive architecture. *Automation in Construction*. https://doi.org/10.1016/j.autcon.2004.07.003

Thomas Thiis- Evensen ' s. (1989). *Archetypes in Architecture*. Oxford University Press, Norwegian University Press.

Thomas Thiis-Evensen. (n.d.). *Archetypes in Architecture*. https://doi.org/https://doi.org/10.18261/9788215046419-2020-2

Turin, D. A. (1980). What do we mean by building? *Habitat International*, *5*(3–4), 271–288. https://doi.org/10.1016/0197-3975(80)90023-5

Valenzuela, L. M., Tisi, R., & Helle, L. (2018). High density architecture as local factory of circular economy. *International Journal of Sustainable Development and Planning*. https://doi.org/10.2495/SDP-V13-N7-985-996

Werndl, C. (2016). On Defining Climate and Climate Change. *British Journal for the Philosophy of Science*. https://doi.org/10.1093/bjps/axu048

Wolstenholme, E. F. (2003). Towards the definition and use of a core set of archetypal structures in system dynamics. *System Dynamics Review*. https://doi.org/10.1002/sdr.259

Wong, J. F. (2010). The text of free-form architecture: qualitative study of the discourse of four architects. *Design Studies*. https://doi.org/10.1016/j.destud.2009.11.002

Yi Li. (2017). *Stay Present : Using the Transformative Power of Art to Raise the Awareness of Being Present - An Exhibition Allows Visitors to Interactively Explore a Peaceful Space Through Art* (Issue May 2009). The George Washington University.

Zeunert, J. (2017). *Landscape Architecture and Environmental Sustainability: Creating Positive Change Through Design*. https://doi.org/10.5040/9781474222211

Resume

Ms. Asma Khalid is an architect and received her B.Arch. and M.Arch. from the University of Engineering and Technology Lahore. Currently, she is Assistant Professor and serving academia in the Department of Product and Industrial Design, University of Engineering and Technology Lahore. She designed courses at the newly established Department of Product and Industrial Design and has participated in organizing product design exhibitions intending to create a strong link between academics and industry. She is honored of raising awareness about

DOI: 10.15320/ICONARP.2022.213

Climate Responsive Design in Pakistan and baseline her work with the existing best practices of International Energy Conservation Codes and ASHRAE thermal comfort standards.

ICONARP
International Journal of Architecture and Planning
Received: 24.08.2021 Accepted: 04.10.2022
Volume 10, Issue 2/ Published: 20.12.2022
Research Article *DOI: 10.15320/ICONARP.2022.214 E- ISSN:2147-9380*
ICONARP

How Does “Stay Home” Transform a House? The Route Map of a Research

Armağan Seçil Melikoğlu Eke[*]
Derya Adıgüzel Özbek [**]
Gülay Usta [***]
Özge Ilık Saltık [****]
Sedef Sav Özerenler [*****]
Elif Gelmez Demir [******]
Furkan Evliyaoğlu [*******]

Abstract

COVID-19 pandemic caused transformation by influencing the physical and psycho-social status of houses, and by introducing different functions and needs which led to or will lead to changes in individuals’ expectations from their houses. Drawing on this idea, this study allows for the detection of such changes through examination and for the consideration of future house arrangements, housing designs and their production by identifying the usage possibilities of existing houses. The research design is structured in three main steps. First step is the literature part that draws the conceptual framework of the study. Second step includes survey technique with use of panel design as a quantitative research method. In the research, third step has built with semi-structured interview to be deepen analyzing of the results of the quantitative part. The findings reached through this study have the potential to lead future house arrangements as well as housing production and design which are also significant in terms of innovative and creative housing designs studied within disciplines such as interior architecture and architecture. Sample of the research is the city of Istanbul which is first of the most affected cities from COVID-19 pandemic. Selecting a big and multi-component metropolis like Istanbul as research area for residential spaces brought different difficulties in the application processes of research methods while allowing the multidimensional examination of the subject. The research design proposed by this study possess the quality of a guiding sample for future scientific studies.

Keywords:
Covid-19 Pandemic, housing, research Design, quantitative research, qualitative research

*Faculty of Architecture, Istanbul Kultur University, İstanbul, Turkey
(*Corresponding author*)
Email: as.melikoglu@iku.edu.tr

**Faculty of Architecture, Istanbul Kultur University, İstanbul, Turkey
Email: d.adiguzel@iku.edu.tr

***Faculty of Architecture, Istanbul Kultur University, İstanbul, Turkey
Email: g.usta@iku.edu.tr

****Faculty of Architecture, Istanbul Kultur University, İstanbul, Turkey
Email: o.ilik@iku.edu.tr

*****Faculty of Fine Arts, Hacettepe University, İstanbul, Turkey
Email: sav.sedef@gmail.com

******Faculty of Architecture, Istanbul Kultur University, İstanbul, Turkey
Email: e.gelmez@iku.edu.tr

*******Faculty of Architecture, Istanbul Kultur University, İstanbul, Turkey
Email: f.evliyaoğlu@iku.edu.tr

To cite this article: Melikoğlu Eke, A. S., Adıgüzel Özbek, D., Usta, G., Ilık Saltık, Ö., Sav Özerenler, S., Gelmez Demir, E., Evliyaoğlu, F., (2022). How Does “Stay Home” Transform A House? The Route Map of A Research. *ICONARP International Journal of Architecture and Planning,* 10 (2), 530-550. DOI: 10.15320/ICONARP.2022.214

INTRODUCTION

It is a well-known fact that natural disasters are processes which directly affect the physical space and even cause their total destruction and reestablishment. In addition to the political, social, and economic consequences, pandemics have always caused spatial changes throughout human history (Chang, 2020; Dejtiar, 2020; Muggah & Ermacora, 2020).

Humanity is witnessing a similar process in the 21st century. The pandemic, which started in December 2019 in the city of Wuhan, the capital of China's Hubei Province, has affected the whole world. Following the outbreak of COVID-19, which was declared a pandemic by the World Health Organization, our lives have changed rapidly. First, the borders were closed, and each country retreated to its own shell. With the application of quarantine regulations, societies were forced to withdraw into their houses.

As a result of the social isolation brought by the pandemic, public spaces were abandoned, and people had to fit their lives into all spatial layers of their homes ("COVID-19 lockdowns by country," 2022). The house which isn't thought properly about its reality and meaning during daily life routines and be seen as an equivalent to the action of sheltering, has become a haven with the pandemic.

Therefore, both the physical and the semantic realities of the idea of 'house' have changed. Houses meet people's needs for schools and offices with the use of digital tools. They function as family health centres through online health services while being used as social spaces (gym, cinema, theatre etc.) providing online broadcasts and meetings. Remote work and distance education systems made the organisation of all education and business processes possible from home. Museums can be visited at the comfort of one's home through virtual space experience (Kasapoğlu Akyol, 2020). People now enjoy their coffees on online meeting platforms. The duty of all public and semi-public spaces which bring the society together is now assigned to houses.

Houses have become a gateway for transformed online social relationships in addition to be private place of their users'.

As a result of these dynamics, the variety of functions and uses of the houses changes in addition to the transformation of their physical reality and psycho-social meaning. The perception that houses limit people's relationship with the outside world is abandoned because now they are the places where the relationship to the outside world is established (Pennington, 2021). While houses are opened to the world by means of online platforms, users' private lives become visible. On the other hand, balconies and terraces, which were once closed to increase the indoor square metre of the house, have gained importance as places of communication with the outside world. As stated in Origoni and Origoni (2020), balconies are no longer tools for observation, but places of participation in the city and public life.

DOI: 10.15320/ICONARP.2022.214

On the other hand, productive activities such as sewing, growing plants, knitting and painting became new ways to spend time at home (Yeşilay, 2020). Besides, people started to do sports by joining courses at digital platforms to avoid inactivity and support their health. All these changes and transformations have identified new spatial needs, characteristics, and relationships among them at houses. The physical thresholds of houses have changed mostly due to the understanding of hygiene.

While staying home is being encouraged, houses have undergone changes in all aspects. It is predicted that the fear created by outbreak of COVID-19 will make it difficult for people to leave their houses for a long time (Makhno, 2020). It is also suggested that instead of living in houses which are close to workplaces but with low square metres, people will prefer houses with high square metres even if they are relatively far from the city centre. Furthermore, houses will be expected to provide spaces suitable for the working environment (Başdoğan, 2020). It is also suggested that new spatial reality and meanings attached to houses after the pandemic might cause a necessity to fulfilment of different needs and the creation of a new atmosphere as a demand.

In the light of such events, this study aims to identify how COVID-19 and staying home have changed people's use of their houses, how physical realities of houses have changed, and what the meaning of houses evolved into.

Through the hypothesis that the COVID-19 pandemic affects physical and psychosocial status of houses, this study contains various determinations. Those are based on new & different functions/needs that are added to houses, and the idea of there are or will be changes in the expectations of people from their houses.

CONCEPTUAL FRAMEWORK: HOUSES DURING THE COVID-19 PANDEMIC

It is thought that one of the places most affected by the pandemic is the house. In the future, many studies and ideas are going to be put forward about how and in which direction this change happens (Düzen & Gezici, 2020). Therefore, it is suggested that identifying how the pandemic has changed and transformed the status of houses is a priority in the creation of future scenarios.

The concept of house examined within the scope of this research refers to the place where the individual lives and/or encounters with other people. It reflects the social structure and corresponds to building systems including physical, social, cultural, economic, and psychological interactions. While some of the features attributed to houses concern the individual, others include the interaction with the social environment.

According to Bachelard (2013), every place of residence hosts the idea of house at its core. However, houses are also the source of the closest and private relationship between humans and the environment

(Seagert, 1985). From this point of view, Hayward (1975) defines the house as the physical structure reflecting the characteristics of the individual as his reference point in the world, connected to the environment and as a form of social environment including the daily interactions of the individual with others. Houses are physical elements of mutual connections built up by family members between their emotional lives and possessions. (Alexander, 1970).

In short, houses are the most important and indispensable unit of life for human beings. Domestic life is a need, a way of self-expression and realization for people. When a person sets up his/her home, he/she likens it to himself/herself (Pekpostalcı, 2009). Beyond being a place that meets the physical needs of the individual, houses also meet the psycho-social needs of the individual.

For this reason, this study first identifies the psycho-social and physical components that make up a house and then examines them. It discusses how the pandemic has affected houses through these components.

While the pandemic caused changes in expectations about the house, it had to adapt itself to the actions taken outside; hence, the relationship of individuals with their houses and the environment changed which also affected the psycho-social and physical components. When lifestyles are concerned, it can be observed that the pandemic has caused changes in terms of daily routines, communications among individuals and their expectations from life. Since private life mingled with the professional life, the routines realised at home shifted and caused the communication in the household to increase. As Yıldırım emphasises in his study (2020), remote working and distance education caused the mother figure at home to appear as a professional figure too and children are also students at home now.

Another new characteristic caused by the pandemic in terms of lifestyle is the use of online social life platforms. Individuals try to fulfil their socialization and communication needs through online platforms or by communicating with individuals outside the household maintaining social distance. In Davran's (2020) study, it is concluded that after the pandemic, old cultural habits such as hosting guests will change as it will loosen guest-neighbour relations.

In terms of the privacy, borders of the privacy have been changed due to the changes in the frequency of the household’s time that they spent together and the density usage of spaces. In addition, it is suggested that the boundaries of social privacy and personal privacy are blurred with the intertwining of social life and professional life.

In terms of security, it is claimed that safe places and feeling safe have become a necessity for maintaining health (Gezici & Düzen, 2021). When being protected from the virus is concerned, houses have moved to a different level as an individual's safe space.

Communication, however, as another psycho-social component gained importance in terms of changing the values and methods of

DOI: 10.15320/ICONARP.2022.214

communication established between the household and people outside the house. This period is thought to cause change regarding the way people host their neighbours and communicate with each other as a family. Together with such changes, new communication tools are believed to be influential in people's lives and houses. In brief, it can be suggested that those changes are observed when social components such as personality, lifestyle, privacy, security, and communication dynamics constituting the psycho-social components of the house are examined.

It is thought that while the psycho-social components transformed in this way, the physical components that make up a house also have changed compared to how they were before the pandemic. When the function and usage, lighting, noise, hygiene, and personal space, which constitute the physical components of a house, are investigated, it can be observed that there has been a significant change in use. Changes in the intensity and ways of using space, as well as the emergence of new functions are distinct differences. Especially activities like remote working and distance education made the usage of already existing spaces for such purposes compulsory. It can be said that the intensity in the usage of all home spaces changes as the whole day is spent at home for individuals who are not at home during a certain period of the day. Houses are now supposed to meet the requirements of several other functions such as working, socializing and education in addition to its accommodation function (Ensarioğlu, 2020).

Along with this, there have been changes in the need of especial open spaces. Therefor the ways and frequencies of usages of the spaces such as balconies and terraces have also been changed.

During the quarantine, balconies became places of socialization. According to the report published by the American Society of Interior Architects, the state of being in touch with nature contributes to individuals' stress management and accelerates the recovery of emotions and moods. For this reason, balconies and terraces in houses have had positive effects on users who had to spend their time at home (Ak, 2020).

Lighting and noise components have also altered in parallel with the change of usage and function. Occupying houses throughout the day, using them as places of work, school, socialization and entertainment reminded us the importance of lighting and noise management. In terms of hygiene, supplying the hygiene component became more significant in order to minimise the risk of contamination. Cleaning the surfaces used at home has become more important. It is suggested that as individuals develop new hygiene methods, spaces go through changes accordingly.

When private spaces are concerned, it is thought that individuals' expectations of personal space cannot be fulfilled due to the intense usage of their houses. The extended amount of time spent together by the household, the intensity of family relations, the decline in the

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

relations with the environment outside, the deteriorations people experience while meeting their basic needs such as sleep, or nutrition have a negative influence on the future of relations (Yıldırım, 2020). It is possible to suggest that, unlike the before pandemic period, meeting the need for personal space is getting more difficult for family members who have to spend a whole day together as they cannot set up their personal boundaries properly.

In the light of the given information, it can be concluded that houses have changed in terms of their psycho-social and physical components after the outbreak of COVID-19 Pandemic. It is estimated that recent changes are likely to affect the design and production of houses after the pandemic. For this reason, the spatial correspondence of the emerging needs and reflection of changes indicated in the literature are revealed through quantitative and qualitative research methods.

RESEARCH DESIGN

The research design is built as a process in which quantitative and qualitative research techniques are used together. It based on a conceptual framework in which the changes in the psycho-social and physical components of the house are presented. The research design is developed depending on the continuation of the pandemic for the detection and investigation of spatial (physical) and semantic (psycho-social) changes experienced at houses due to the COVID-19 pandemic. Therefore, quantitative and qualitative research methods are used together in a dialectical structure. In the process with the adoption of an inductive approach, it is aimed to be cross-sectional and exploratory (Miles & Hubermen, 1994). In accordance with these aims and hypothesis, an ethics committee approval has been taken from the university which this study had been conducted. Also, an approval from the Ministry of Health about the health of the participants and process approvals from the sponsor public intuitions have been taken. Subsequently the study had been started and conducted.

First step of the study is building the conceptual framework. In the second step, it is aimed to question the changes participants' experiences about their houses during the COVID-19 pandemic and the relationships with the acts that are taken or will be taken after the pandemic. The survey technique which is a quantitative research method have been used in this step. Accordingly, panel design technique which is examines the same participants' behaviours or opinions in different times (Gifford, 2016) have been used. Thus, changes in same participants' attitudes and opinions in different times of the COVID-19 process have been determined. The survey consists of three periods: COVID-19 pandemic before quarantine (before March 2020), the COVID-19 pandemic during quarantine (between March 2020-June 2020) and the COVID-19 pandemic after quarantine (after June 2020). In the definition of these three periods official announcements of the Ministry of Health have been taking into consideration. The process has been

DOI: 10.15320/ICONARP.2022.214

started in March 2020 with the first positive case in Turkey. Between March and June 2020, quarantine measures had been taken and the measures are ended dating from June 2020 (Ministry of Health of the Republic of Turkey, 2020a; Ministry of Health of the Republic of Turkey, 2020b).

Sample group of the survey a purposeful and layered sample group which contains sub-groups that are enable to comparison (Sandelowski, 2000). Istanbul was chosen as the target case defining the sample group since it is one of the provinces most affected by the COVID-19 pandemic in Turkey. The survey has shared to the participants in between 13/10/2020 and 05/11/2020. To increase the accessibility of the survey by the sample group, a web page has built, and support from Istanbul Metropolitan Municipality and all other County Municipalities has been taken. The survey which has conducted via "Limesurvey", has reached 672 people with announcements and support of the municipalities. It has completed with 372 participants' data who are living in Istanbul. The size of the sample group has been defined according to necessary formulas (Yazıcıoğlu ve Erdoğan, 2004) for the size of the universe for total population of Istanbul province in the Turkish Statistical Institute's "Address Based Population Registration System Results for 2020" dated 04/02/2021 (Turkish Statistical Institute, 2021; Yazıcıoğlu ve Erdoğan, 2004). According to these formulas, the necessary number for participants have been reached. Distribution of the participants' counties in Istanbul has matched up with the "Address Based Population Registration System Results for 2020" (Turkish Statistical Institute, 2021). However, considering the cosmopolitan structure of the Istanbul, the diversity that can be generalized is limited. This limitation was eliminated with the qualitative research step.

In the survey, it is aimed to understanding the changes in participants' experiences about their houses during the COVID-19 pandemic and questioning the acts that are taken or will be taken after the pandemic, also their foresights about after the pandemic. The survey consists of multiple-choice question groups aiming to determine individual attitudes along with the questions that are questioning demographics, and characteristics of the houses which are defined as background variables. In addition to questions of demographics, and characteristics of the houses, in background variables group also multiple-choice questions about remote working and distance education have been take places.

Survey results were analysed through SPSS (Statistical Package for the Social Sciences) software using Pearson Correlation chi-square, average and frequencies obtained from descriptive statistics. The validity and reliability tests have been done via SPSS with assistance of statistician. Additionally, these tests have been approved by the sponsor institution.

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

Other parts of the survey which focus on the process of COVID 19 use closed-ended questions using five step likert scale in relation to attitudes and opinions determining the changes experienced at houses. As seen in Figure-1, this part of the survey includes three periods: before, during and after the quarantine. Questions which are centred upon these periods aim to identify the changes occurred at houses. Accordingly, the second part of the survey comprises questions directed at the psycho-social and physical status of the house, new hygiene and social life needs caused by COVID-19, relations amongst family members, distance education and remote work.

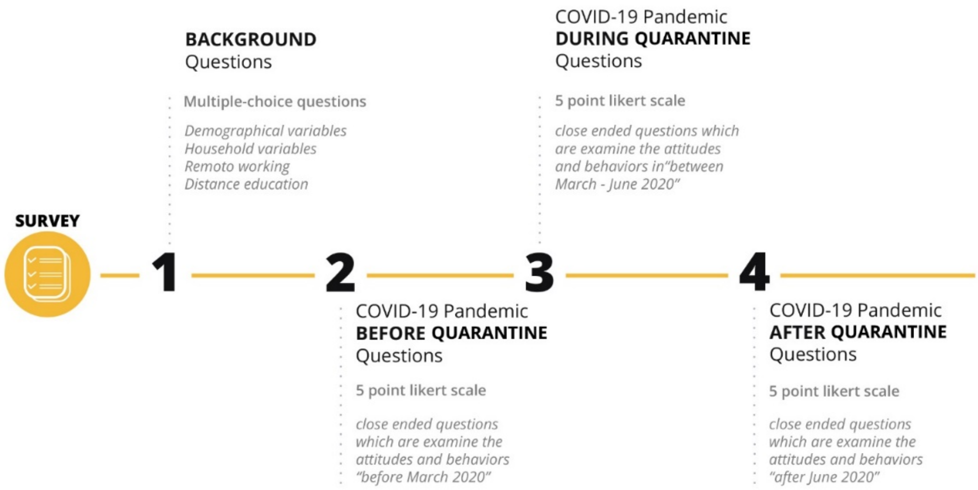


Figure 1. Drawings by the Authors**.** Question groups in the survey design (Drawings by the Authors).

Qualitative step which consists of semi-structured interviews, has been built to deepen the knowledge that have reached in the quantitative step. Results of the quantitative research part have taken into consideration for defining the sample group and generating the semi-structure interview form. Semi-structured interview form consists of background variables in the first part. The second part has been designed to question the changes and the needs in houses before-during-after the quarantine process. The third part which is named as future scenarios, questions about residential demand and expectations after the quarantine period have been take place.

42 people have completed the semi-structural interviews as sample group who have participated in the survey and supported the study via filling the interview form voluntarily. 12 people who filled the form have not been able to participate the interviews with various reasons. Due to this, interviews have been completed with 26 people. No probabilistic method was followed while determining the sample group. The sample group has been formed to support the theoretical background of the study in purposive sampling in parallel with the survey participants. Semi-structured interviews have been conducted in between 15/11/2020 and 27/11/2020 before the start of second wave quarantine measures.

DOI: 10.15320/ICONARP.2022.214

The interview question groups were prepared according to the demographic variables, background variables together with the psycho-social and physical statuses of the house, distance education and remote working as outcomes of COVID-19, social life necessities, hygiene precautions, and household relations. However, as one could observe in Figure 2, following the demographic variables, the form was arranged in such a way that it included three possible scenarios. The questions were diversified by considering the possibility of participants' moving somewhere else or going to their summer houses after the quarantine and spending after the quarantine period there. Regarding the participants who moved to another house or those who went to their summer houses and stayed there more than usual, interview forms consisted of semi-structured questions about the process of moving and the new houses. During the interviews, the participants were expected to answer each question considering three different time periods: before, during and after the COVID-19 pandemic quarantine.

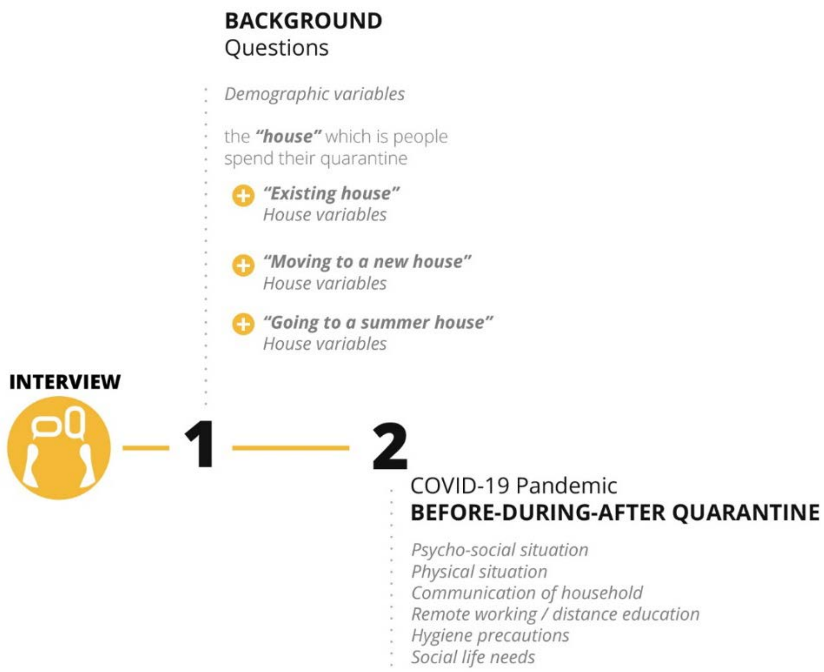


Figure 2. Question groups in the semi-structured interview form (Drawings by the Authors).

The data in the texts obtained after the interviews were divided into meaningful parts in accordance with the coding. The coding was done by the researchers with the help of the keyword scanning system provided by Microsoft Office Word. The code list was created in accordance with the conceptual framework and the hypotheses of the research so that the coding could be carried out in a systematic way. The repetition of the codes after the meaningful separation of texts according to these codes helped the qualitative data turn into quantitative sets; therefore, the data could be analysed more systematically. At this point, by means of Microsoft Office Word macro tool, the coded file was converted into tables and Excel files. Therefore, the functions and numeric values on it could be defined, which also made it possible to compare codes and to read the associations or differences.

As a result, within the scope of the research design, the information discussed in the context of the study subject was tested with quantitative and qualitative methods which was instructive in understanding the concept of house which is thought to have been transformed by the pandemic. Likewise, the findings obtained through questionnaires and interviews were also analysed quantitatively and qualitatively in the same systematic order. Starting from the conceptual framework of the study, the roadmap has been formed as can be seen in Figure 3.

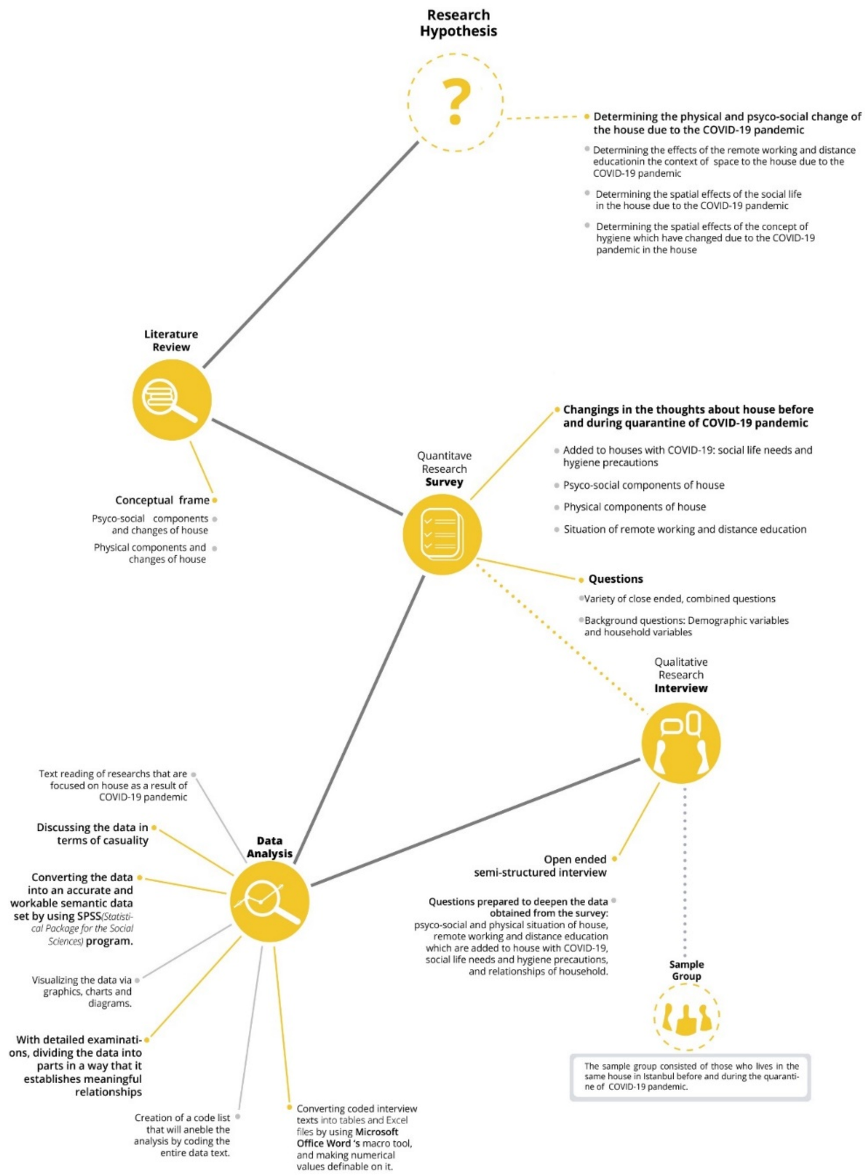


Figure 3. Devising the research design (Drawings by the Authors).

RESEARCH FINDINGS

The findings obtained in accordance with the research design of the study were itemised under two headings as quantitative findings and qualitative findings.

DOI: 10.15320/ICONARP.2022.214

Quantitative Research Findings

The questionnaire of the quantitative research step was devised with a focus on the physical and psycho-social components of the house together with hygiene measures, social life needs, home office/remote working and distance education which were added to houses due to COVID-19 pandemic quarantine processes.

Firstly, demographical features have been examined in the survey. Although there have been participants from all age groups, "25-34" and "35-44" age groups which are actively using the online platforms have participated more as expected. It is understood that this distribution is in coherent with population pyramid of registered individuals in the population of Istanbul in 2020 (Turkish Statistical Institute, 2021). This is also in parallel with results of level of education: "Undergraduate" (46%), "Graduate" (21%), "High School" (17%), "Associate Degree" (7%), "PhD" (5%), and "Primary School" (4%).

All categories in the features of houses have been participated. "Family with Children" is at the forefront with a high rate of 62% in the household type. This is followed by "Living with partner" with rate of 12% and "Extended Family" with rate of 7%. When the positions of the participants have been examined "Mother" with rate of 45% comes forward due to the high number of "Family with Children" and "Women" participants. It is followed by "+18 Child" with rate of 23% and "Partner" with rate of 15%. By reason of high participation of the families with children, rates of houses which are had 90m2 or more space and 3 or more rooms are high in the house variables. 3-4 roomed houses have higher rates. Accordingly, larger houses in terms of m2 , come to the forefront. 30% of the houses are in between 90m2-109m2, 26% are in 110m2-130m2, and 22% are larger than 130m2. 60% of the houses stated as "my own house". Types of the houses consist of "Single Apartment" with rate of 47% and "Apartment in Building Estate" with rate of 42%. When it is looked to demographic variables of participants and features of houses, a pluralist point has been reached.

Participants overall opinion on personality, way of living, privacy, security, and communication which are present the psycho-social characteristic of houses as stated in the conceptual framework are listed below:

- There is a statistically positive and significant relationship between the participants' views on the psycho-social state of the house before the quarantine, their social life needs during the quarantine and on the physical state of their houses after the quarantine.
- On the other hand, there is a statistically positive relationship between psycho-social components before and during the quarantine and physical components.
- It can be observed that while the opinions on the psycho-social state of the house before the quarantine have a positive relationship with "gender", they have an inverse correlation with the variables of education level and square metre of the house.

- It can be observed that while opinions on the psycho-social state of the house have a positive relationship between the "type of household", they have an inverse correlation with the "level of education".

Participants' opinions on the physical status of their houses are as follows.

- Participants who consider the physical status of their houses before the quarantine sufficient also have a positive opinion on the psycho-social status of them and of hygiene precautions during the quarantine period. It can be suggested that having a positive opinion of physical status allows the individuals to overcome the quarantine period at home easily.
- Participants who live in bigger houses with more rooms and fewer people tend to have positive opinions on the physical status of the house prior to the quarantine.
- An inverse correlation between the physical status of the house during the quarantine and variables of “age” and “number of rooms in the house” was detected which stands for a contrary relation to the previous item and brings to mind the question why the positive relation observed between the physical status of the house and the number rooms turned into a negative one.
- An inverse correlation between “age” and the physical status of the house was detected. The opinions of participants who are from the older age group tend to be negative regarding the physical status of their house after the pandemic. While there is a meaningful relation between opinions on the physical status of the house and the gender, there was not a relation detected between the type of the household and property variables.
- Although participants show a tendency to select “I agree” as an answer to “my house meets my daily needs” regarding their opinions on the physical status of the house before and after the quarantine, they tend to make rearrangements after the quarantine in the same context. Participants showed a positive tendency towards the usage of open spaces such as balconies/ terraces before, during and after the quarantine.
- Participants who had to spend their time at home for a long period due to COVID-19 quarantine measures showed a variety in their activities regarding their social life needs and hygiene precautions. A positive relation was identified between their views on the psycho-social and physical statuses of their houses during the quarantine and rearrangement made in the house due to social life requirements. In the same process, hygiene precautions were also taken against the risk of virus transmission at home. When the relations between the household variables and those added to the house during the quarantine period were examined, it can be observed that as the total number of rooms in participants’ houses decreased, the changes made due to the anxiety of virus contamination were more frequent.

DOI: 10.15320/ICONARP.2022.214

- When evaluation is made in terms of the working models, the participants tend to continue working from home after the quarantine and accordingly to continue making changes in their houses. They showed this tendency despite the average response to the labour productivity was "undecided". Participants tend to continue distance education after the COVID-19 pandemic quarantine and make new arrangements for it in their houses. They showed this tendency even though the average of their responses to increased learning efficiency was an average between "undecided" and "I don't agree". The uncertainty the pandemic processes has compelled the participants to act for remote working and distance education in the future.

The survey that has been done in quantitative research step of the study have presented the relationship between physical and psycho-social statuses of houses and the changes of this relationship in the process of quarantine. Along with this, relationships of hygiene precautions, social life needs, remote working and distance education which are added to house with pandemic, have been presented. Nevertheless, spatial complexity which have been made by all the physical and psycho-social variables that are mentioned in conceptual frame, have needed to examine deeply. Due to this, the study has continued with qualitative research methods to enrich the data.

Qualitative Research Findings

Qualitative research process is aimed to detail the relations put forward in the quantitative research step. In the qualitative research step, the changes in the physical and psycho-social statuses of the house with the outbreak of COVID-19, the needs arising from the quarantine processes and the need for remote working and distance education, the need for social life and hygiene measures, were discussed in a more comprehensive and detailed in a spatial context. In this step, the semi-structured interview technique was used to find out what features of spaces at houses caused certain needs and choices to emerge, what these needs and choices are, and what kind of spatial arrangements were made or planned and how these plans will be realised.

Firstly, demographical features have been examined in qualitative research. 5 of the 26 participants are living in Anatolian side and 21 are in European side. Results are in parallel with the survey data in terms of participants' distribution in counties. 25 of the participants are women, one is man. This is also in coherent with the survey data. The densest age group "25-34" with 16 participants is followed by "35-44" with 6, "18-24" with 2, "45-54" with 2, "55-64" with one, and "65+" with one. There have been participants from all age groups. It has been determined that 12 of the 26 participants' level of education are "Undergraduate", 9 are "Graduate", 4 are "High School", one is "Primary School". Among 22 participants that have family with children, 14 of them are positioned as "Mother", 7 are as "+18 Child", one is as "Father" in house. Other 4 participants' positions are "Partner" in house. Half of the participants are living in “3” roomed houses including living room. 10 participants are living in “4” and 3 participants in “+4” roomed houses. When the m2 are examined in parallel with the number of rooms, 14 participants have a house in the range of “75m2-100m2”, 7 have in “101m2-135m2”, 4 have in “+135m2”

It is possible to summarise the information gained at the end of the qualitative research as follows. Participants' opinions asked during the interviews on the changing psycho-social statuses of their houses including safety, attachment, personal space, belonging, privacy, communication with the household, hosting guests, neighbourhood with the COVID-19 are:

- The intertwining of the personal space and public space with the quarantine process made it necessary to clearly define the boundaries of private space where privacy is provided and other spaces where communication occurs.
- As a result of the quarantine period, houses became more important to the participants. The position of houses as places where one feels safe and peaceful and protected against outdoor dangers got stronger in addition to the stronger ties built up by the participants with their houses as they spent more time in them.
- Spending a long time in the house strengthened the sense of belonging. However, not being able to establish boundaries among members of a household in houses where there is a high number of people harms this sense of belonging.
- Participants' answers to questions on privacy vary. Although they consider their own rooms and bathrooms to be private, the fact that they had to share them with other members of the household for a long time has reduced the sense of privacy. On the other hand, it is clear that those who have to make online calls are concerned about privacy. Therefore, the participants pay attention to using backgrounds during online calls to make their houses less visible.
- Household members who were not able to spend enough time together before the pandemic started to spend more time during the quarantine period and strengthened communication among each other. Apart from the household, neighbourhood was positively affected by this period, and it was revealed that neighbours became more visible. However, it can also be suggested that due to the risk of virus transmission, participants have been much more cautious while communicating. When hosting guests is concerned, there is a completely opposite image regarding neighbourhood relations. Participants who frequently hosted guests before the pandemic became much more cautious during and after the quarantine period.

It is possible to list participants' opinions on the physical status of their houses in terms of hygiene, distance education, the spatial effects of remote working, the changing intensity, and ways of using various spaces of the house due to COVID-19 pandemic as follows:

DOI: 10.15320/ICONARP.2022.214

- Data ranging from macro scale to micro scale, that is, from the environment of the house to the furniture in the house was obtained by using participants' views on the physical status of their houses. Changes that are especially related to the interior of the house are dominant. The relocation of public activities to the house, the changes in daily needs and the increasing intensity of some needs have caused spatial changes in the interior of the house.
- The kitchen has become one of the spaces that are used intensely. Before the pandemic period, kitchens were places where the family members got together but they evolved into places where common breaks of remote working or distance education are taken. In addition, the fact that some participants prefer to cook or to experience cooking in their own kitchen rather than ordering food increased the intensity of kitchen usage.
- As forms of living space, living rooms have been used for various purposes such as watching television, communicating with the household, eating, and following the start of the quarantine, their functions were extended by remote working, distance education, doing sports and playing games. Therefore, due to such new functions in the living room, the arrangement of furniture and fittings was changed, especially by reducing the number of decoration products and furniture such as coffee tables in order to open up enough space.
- On the other hand, bedrooms went through changes to achieve isolation and privacy. They were frequently used for distance education and remote working, especially in crowded families. It has been revealed that various similar arrangements have been made in children's rooms for distance education.
- Terraces and balconies brought a solution to the problem of not being able to go out and use open spaces since the beginning of the pandemic. Such spaces are used more often now for dining purposes. On the other hand, they acquired a new characteristic as places where everything brought from outside is sterilized due to the concern of virus contamination.
- The entrance of houses became one of the places whose usage has changed in terms of hygiene measures. It was revealed that certain precautions were taken regarding various ways of storing shoes in front of houses, at the entrances or in the houses. What is more, other arrangements were made to store equipment such as disinfectants, masks, and gloves for hygiene purposes.
- With the transition to remote working order, the boundaries between home and workplace became ambiguous for the participants. The requirement of working could be fulfilled in various spaces of the house. Therefore, in order to create a separate space away from the household and to maintain noise management in favour of productivity, tables at living rooms, kitchens or new ones bought for the living rooms were used.

- With the transition to distance education, participants with young children have changed the arrangement of distracting elements in the children's rooms so that their children could focus on learning. Households with children from different age groups preferred to use different spaces such as living room, kitchen, or bedroom to be away from others. When the furniture is concerned, it is revealed that participants who used already existing chairs during their studies could not get the necessary comfort and wanted to buy a new office chair.

In the light of such information, one could reach the conclusion that the COVID-19 pandemic has changed and transformed the relation between the house and its user. This relationship has been strengthened by spending a long time at home. Being isolated at home for a long time has made the problems or deficiencies related to the use of the house visible. Although the activities done outside of houses are longed for, the calmness and peace of being at home under today's conditions have become the positive outcomes of this process.

It can be proposed that to understand the transformation of the concept of house, the findings received within the scope of the study should be evaluated in accordance with both subjective and objective aspects and therefore, a research design in which quantitative and qualitative findings complete each other is methodologically positive.

CONCLUSIONS

The purpose of this research is to determine the changes that houses have been through due to quarantine period. Within the scope of this purpose, the physical and psycho-social components of houses are presented through literature review, the changes that these components went through as a result of COVID-19 pandemic, new functions and usage possibilities added to the components are studied. Components which have and have not gone through changes are identified. As a consequence of the pandemic, there have been changes in the relationship between individual's personality, lifestyle and his relation to space which defines the psycho-social component, in his understanding of communication, privacy and being available online as well as the sense of security in relation to the risk of infection and being isolated. On the other hand, the readings made for the research revealed differences in physical components defined by lighting, noise control and personal space boundaries due to spending too much time at home. It has been understood that the usage of spaces, their priority in meeting daily needs have changed and hygiene measures, the need for social life, remote working and education have been added to spaces as new functions.

The holistic evaluation of the data gained through qualitative and quantitative research results gave rise to the following conclusions, deductions, and suggestions.

- It was observed that the participants' opinions about the physical and psycho-social components their houses in addition to

DOI: 10.15320/ICONARP.2022.214

hygiene measures, the need for social life, remote working and education introduced by COVID-19 in any period before, during and after the quarantine showed a positive tendency which could also be observed regarding other housing components and time periods of the COVID-19 process. Thus, it can be concluded that even simple interventions made in houses can bring about big changes in the comfort of the user.

- It was observed that the participants needed a designated area for each function during and after the quarantine. It has been understood that increasing the number of rooms does not provide a solution for such a designation because it was noticed that the participants living in houses with a large number of rooms during the COVID-19 period did not have a positive tendency in their views on the physical status of their houses. Therefore, it was understood that instead of houses with larger square meters and more rooms, flexible designs allowing various spatial arrangements and divisions for different functions and usage possibilities are needed.
- Another feature of houses which has differed with the COVID-19 pandemic is the need for social life. Participants stated that they could not enjoy the social activities they performed online at home as much as they did in real social places outside. However, experiencing online activities which are otherwise difficult to reach or go to provided psychological relief in this process.
- It can be suggested that when the pandemic loses its effect and when life returns to normal, participants will not prefer to participate in online events accessible from their homes, and therefore, there will be no significant need emerging in houses. However, meeting the participants' need for a social space has been an addition to houses which were already expected to be safe and peaceful shelters. This indicates that the social life need has integrated with the meaning of the house rather than being just a spatial need. It is now thought houses are meaningful to us to the extent that they perform as new public places.

The results of the research point out that the quarantine experience made the users question their expectations from their houses and their point of views towards them. It is possible to summarise the transformation of the houses and its reflections on their users as follows.

Now, as it shown in Figure 4, houses are expected to,

- be able to intervene by their users easily.
- provide flexible usage
- use for socialization
- have less furniture
- be functional
- to have qualities providing more interaction with the outside world.

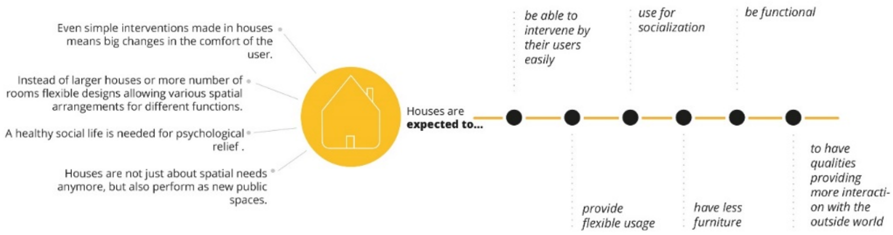


Figure 4. Users' expectations from houses (Drawings by the Authors).

While the results of spatial transformation can be listed as given above, the results and suggestions within the scope of academic studies which focus on the house are as follows.

- This research was carried out in a multi-component city like Istanbul and the expectations of each age group were taken into account as much as possible which offered a general perspective on the subject. It is thought that the research design proposed by this study can be applied to districts of Istanbul and even to districts in other provinces in detail so that more specific data can be provided in the future.
- Besides, the idea that the pandemic will last for many years or that there will be new pandemics reveal the necessity of re-examining the responsibilities of the house. Accordingly, studies on the meaning of houses and how they meet the physical and psycho-social needs gained importance. It has been revealed that it is necessary to carry out further research focusing on developing strategies towards the adaptation of houses during pandemics or similar status.

In conclusion, the effect of the COVID-19 pandemic continues, and it has had various reflections on spaces within houses. In this context, the research design proposed by this study possess the quality of a guiding sample for future scientific studies and the conclusions or findings reached through this study have the potential to lead future house arrangements as well as housing production and design that are crucial in terms of innovative and creative housing designs studied within disciplines such as interior architecture and architecture.

ACKNOWLEDGEMENTS/NOTES

This article was produced from the research project titled "How Will 'Hayat Eve Sığar (Life Fits Into Home)' Transform The House?: Housing Design Strategies For During And Post Periods of COVID-19" and project no 120K623, supported within the scope of TÜBİTAK1001-COVID-19 special call. The entire research was submitted to TÜBİTAK in December 2020. We would like to thank TUBITAK, Istanbul Kultur University and the project team for their support.

REFERENCES

Ak, Ö. (2020). Pandemi Mimarisi. TUBITAK Science and Technical Journal, 57, 33-45.

Alexander, C. (1970). Şehir Ağaç Değildir. Mimarlık Dergisi, 75, 56-64.

Bachelard, G. (2013) Mekanın poetikası. (A. Tümertekin, Trans.). Kesit Yayıncılık. (Original work published 1957)

DOI: 10.15320/ICONARP.2022.214

Başdoğan, S. (2020). COVID-19 sonrası gayrimenkul ve konut sektörü üzerine senaryolar. Arkitera. https://www.arkitera.com/gorus/covid-19-sonrasi-gayrimenkul-ve-konut-sektoru-uzerine-senaryolar/

Chang, V. (2020). The post-pandemic style. Slate. https://slate.com/business/2020/04/coronavirus-architecture-1918-flu-cholera-modernism.html

COVID-19 lockdowns by country (2022, July 15). In Wikipedia. https://en.wikipedia.org/wiki/COVID-19_lockdowns_by_country

Davran, İ. (2020, June 19-20). Reflection on 21st Century skills, smart learning environments and digitalization in education. [Paper presentation]. In M. Kurt, F. Altınay Aksal, Z. Altınay Gazi, U. Akçıl. Pandemi sürecinin toplum, kültür ve eğitime etkisi ile ilgili görüşlerin değerlendirilmesi. 2st International Conference on Interdisciplinary Educational Reflections (Cyprus), Nicosia (pp. 46-67). Near University Ataturk Faculty of Education & Graduate School of Educational Sciences.

Dejtiar, F. (2020). Is coronavirus pandemic accelerating the digitalization and automation of cities? Archdaily. https://www.archdaily.com/936064/is-coronavirus-pandemic-accelerating-the-digitalization-and-automation-of-cities

Düzen, N. E., Gezici Yalçın, M. (2020). Yeni deneyimlerin mahali olarak salgın günlerinde ev. Birikim. https://www.birikimdergisi.com/guncel/10167/yeni-deneyimlerin-mahali-olarak-salgin-gunlerinde-ev.

Ensarioğlu, S. (2020). Pandemi sürecinin "evrensel tasarım" ilkelerine etkileri. Journal of Social and Humanities Sciences Research, 7(55), 1673-1680.

Gezici Yalçın, M., Düzen, N. E. (2021). Altered meanings of home before and during COVID-19 Pandemic. Hu Arenas. https://doi.org/10.1007/s42087-021-00185-3

Hayward, D. G. (1975). Home as an environmental and psychological concept. Landscape, 20, 2-9.

Kasapoğlu Akyol, Ü. P. (2020). COVID-19 küresel salgın dönemi ve sonrası müze etkinlikleri. Milli Folklor 127, 72-86. https://dergipark.org.tr/tr/download/article-file/1192049

Makhno, S. (2020). Life after coronavirus: how will the pandemic affect our homes? Dezeen. https://www.dezeen.com/2020/03/25/life-after-coronavirus-impact-homes-design-architecture/

Miles, B. M., Huberman, A. M. (1994). An Expanded Sourcebook. Qualitative Data Analysis. Sage Publications.

Ministry of Health of the Republic of Turkey (2020a). Koronavirüs, alacağımız tedbirlerden güçlü değildir. https://www.saglik.gov.tr/TR,64383/koronavirus-alacagimiz-tedbirlerden-guclu-degildir.html

Ministry of Health of the Republic of Turkey (2020b). Tedbir alır, yayılmayı önlersek hayat normale döner. https://www.saglik.gov.tr/TR,64463/tedbir-alir-yayilmayi-onlersek-hayat-normale-doner.html

Muggah, R., Ermacora, T. (2020). Opinion: Redesigning the COVID-19 city. NPR. https://www.npr.org/2020/04/20/839418905/opinion-redesigning-the-covid-19-city

Origoni C., Origoni M. (2020). A brief history of the balcony, from Ancient Persia to the COVID-19 pandemic. . Domus.

https://www.domusweb.it/en/architecture/2020/04/03/a-brief-history-of-the-balcony-from-ancient-persia-to-the-covid-19-pandemic.html

Pekpostalcı, A. (2009). Tarihi perspektif içinde ev kavramı [Unpublished Master thesis]. University of Mimar Sinan Fine Arts.

Pennington, N. (2021). Communication outside of the home through social media during COVID-19. Computers in Human Behavior Reports, 4, 100118. https://doi.org/10.1016/j.chbr.2021.100118

Sandelowski, M. (2000). Combining qualitative and quantitative sampling, data collection, and analysis techniques in mixed-method studies. Research in Nursing & Health, 23, 246–255.

Seagert, S. (1985). The role of housing in the experience of dwelling. In I. Altman & C. M. Werner (Eds.), Home environments: human behaviour and environment (pp. 287-309). Plenum Press.

Turkish Statistical Institute (2021). Adrese dayalı nüfus kayıt sistemi sonuçları, 2020. https://data.tuik.gov.tr/Bulten/Index?p=Adrese-Dayali-Nufus-Kayit-Sistemi-Sonuclari-2020-37210

Yazıcıoğlu, Y., Erdoğan, S. (2004). SPSS Uygulamalı Bilimsel Araştırma Yöntemleri. Detay Yayıncılık.

Yeşilay (2020). Korona günlerinde ev hayatı. https://www.yesilay.org.tr/tr/makaleler/korona-gunlerinde-ev-hayati

Yıldırım, H. (2020). Salgın ve aile içi, ilişkiler. In R. Aylaz & E. Yıldız (Eds.), Yeni koronavirüs hastalığının toplum üzerine etkileri ve hemşirelik yaklaşımları (pp. 132-142). İnönü Yayınevi.

Resume

Armağan Seçil Melikoğlu Eke got her BSc and MA degree in Department of Interior Architecture at Karadeniz Technical University. She took the Phd degree in Department of Interior Architecture at Mimar Sinan Fine Arts University. She got the title of associate professor in 2021. She has publications at conference proceedings and articles in scientific journals. Since 2010, she has been continuing her studies at Istanbul Kultur University, Faculty of Architecture, Department of Interior Architecture and Environmental Design.

Derya Adıgüzel Özbek graduated from her BSc degree in Department of Interior Architecture at Istanbul Technical University by taking the third place in 2009; her masters' degree in 2011 at Kadir Has University, Institute of Social Science, department of Design. In 2016, she has received her PhD degree from Istanbul Kültür University, Institute of Science and Technology, Department of Architecture. Currently, she is worked as an Associate Professor Doctor of Department of Interior Architecture and Environmental Design at Istanbul Kültür University. Her research interests lie in interior architectural design, interior architecture education, phenomenology and architecture, spatial and social sustainability.

Gülay Usta completed her BSc in 1985, MSc in 1988 and PhD in 1994 at Karadeniz Technical University, Department of Architecture. Usta's areas of interest are architectural design issues, housing studies, architecture-design education, Anatolian architecture, and she has published papers, articles and books in national and international publications. In addition to her academic and scientific studies, Usta has participated in various architectural project competitions, national architecture exhibitions and won multiple awards. Usta has been a faculty member at Istanbul Kultur University Interior Architecture and Environmental Design Department since 2012.

DOI: 10.15320/ICONARP.2022.214

Özge Ilık Saltık got her BSc degree from the Department of Interior Architecture at ITU by graduating as in the third place in 2018. She is currently studying in YTU, Department of Architecture-Program of Restoration. Her research interests lie in preservation of historical urban fabrics, climate change and cultural heritage, adaptive re-use strategies.

Sedef Sav graduated from Kocaeli University Faculty of Architecture and Design, Department of Interior Architecture in 2013. In 2014, she started her master's degree at Istanbul Technical University International Master of Interior Architectural Design Program. She completed her master thesis in the spring semester of 2016-2017. She worked as a Research Assistant at Istanbul Kültür University and Başkent University department of Interior Architecture and Environmental Design between 2016-2020. As of 2022, she continues her studies at Hacettepe University, Department of Interior Architecture and Environmental Design Ph.D. Program and she works as a Project Manager at Publicislive.

Elif Gelmez Demir completed her undergraduate education in KOU, Faculty of Architecture and Design Interior Architecture Department. In 2019, she completed her master's degree in the Department of History and Theory of Architecture at YTU. She continues her Ph.D. Program at YTU. She has been working as lecturer at IKU.

Furkan Evliyaoğlu graduated from MSFAU, Department of Architecture in 2015. After he began master's degree at ITU in the Architecture Design Program. In 2020, he completed his master's thesis. He is currently continuing his Ph.D. education in ITU. Since 2018 he has been working as a research assistant at IKU.

ICONARP
International Journal of Architecture and Planning
Received: 17.09.2021 Accepted: 22.09.2022
Volume 10, Issue 2/ Published: 20.12.2022
Research Article *DOI: 10.15320/ICONARP.2022.215 E- ISSN:2147-9380*
ICONARP

Investigation of Housing Projects for Rural Areas in Terms of Sustainability Criteria with Revit-The Case of Kayseri

İbrahim Bektaş *
Aysun Özköse**

Abstract

To realize sustainable rural development, it aims to contribute to constructing rural dwellings that are sensitive to climate change and resistant to disasters, where resources are used efficiently. The study was carried out in five parts. In the first part, the study area was determined. Secondly, information about the subject was collected. The third part is the field study, and the architectural features of the old and new houses in the study area were determined. In the fourth chapter, the rural housing projects designed by TOKİ, the Ministry of Environment, Urbanization, and Climate Change, and Mimar Sinan Fine Arts University and the selected residences in the study area were modeled in the Revit program and analyzed based on the sustainability criteria. Finally, in the last section, the conclusions and recommendations are presented. It has been found that the housing projects prepared for the rural area are in a disadvantageous position in terms of solar orientation and daylight benefit compared to the residences in the study area and an advantageous situation in terms of energy consumption. This study is limited to examining the determined rural housing in terms of solar utilization and energy consumption characteristics of ecological sustainability. This study's findings indicate that sustainability analyses be made at the design stage of all buildings, especially rural residences. At this point, making these analyzes mandatory for obtaining construction permits may help increase energy-efficient construction. In the literature review, no study was found on examining rural houses according to the sustainability criteria with the Revit Program.

Keywords:
Kayseri, revit, rural settlement, sustainable rural development, Yamula Dam.

* Department of Architecture and Urban Planning, Tomarza Mustafa Akıncıoğlu Vocational School, Kayseri University, Kayseri, Turkey. (*Corresponding author*)
Email: ibrahim.bektas@kayseri.edu.tr

** Department of Architecture Başak Cengiz Faculty of Architecture, Karabük University, Karabük, Turkey.
Email: aysunozkose@karabuk.edu.tr

To cite this article: Bektaş, İ., & Özköse, A. (2022). Investigation of Housing Projects for Rural Areas in terms of Sustainability Criteria with Revit – The Case of Kayseri. *ICONARP International Journal of Architecture and Planning,* 10 (2), 551-574. DOI: 10.15320/ICONARP.2022.215

INTRODUCTION

Climate change, precipitation regime changes, population increase, and low soil productivity have caused financial problems in rural areas. Furthermore, as stated in the Republic of Turkey's Eleventh Development Plan (2019-2023), Special Commission Report on Rural Development, agricultural mechanization, structural problems in agriculture, and the fact that cities offer better opportunities in fields such as education, health, and employment increase migration from rural to urban areas (Ministry of Development, 2018).

New residential areas are being created in Turkey for rural areas damaged by various reasons, such as landslides, earthquakes, and dam construction. In addition, various institutions and organizations have developed housing projects according to the local texture, the region's people's needs, living conditions, and habits.

The concept of "Sustainable Development" has emerged due to the need to preserve development activities instead of continuing but not damaging the environment. The achievement of sustainable development, especially sustainable rural development, is possible through creating residential areas and spaces that align with nature and reflect the spirit and characteristics of its location. Therefore, from this point on, rural housing projects created by different institutions in our country are within the scope of the study.

LITERATURE REVIEW and ORIGINAL VALUE OF WORK

Various studies related to sustainable development, rural development, rural housing, and rural settlements are covered within the scope of the study. However, among the studies in the literature, the following current studies were chosen as the most closely related to this study's subject.

İner (2013) aimed to build sustainable rural housing by focusing on determining sustainability criteria in rural houses. The situation analysis was carried out by evaluating the rural dwellings within the borders of Edirne province based on physical, socio-cultural, and psychological criteria. The survey study tried to determine the people's age, gender, education, occupation and income status, feelings, and expectations about the rural area and housing.

Kara (2014) looked at eight different ecovillages, four of which were in countries other than Turkey and four of which were in Turkey. She looked at why the settlements were built, how they had been used in the past, the types of people who lived there, the proposed solutions for ecological sustainability, social sustainability, economic sustainability, and a comparison of exemplary buildings. So, she argued that the idea of an ecovillage is a good way to come up with comprehensive and flexible solutions. Furthermore, she stated that ecovillages develop ways to reduce the environmental footprint and end income and living level inequality. She also made suggestions for how these villages could be spread.

DOI: 10.15320/ICONARP.2022.215

Feridonzadeh et al. (2019), in their study, aimed to determine the standards for the formation of rural houses in the cold and mountainous regions of Ardabil province. Their study randomly determined that 27 of 176 settlements were located between 1500-2150 meters above sea level. From each of these villages, ten people between the ages of 20-65 have chosen a total of 270 people. Then, a survey of 50 questions was conducted on the participants to determine the characteristics of their houses. He classified the responses according to the 4-point Likert scale and analyzed them in SPSS and AMOS 18 software. As a result, he reported that the construction conditions, climate, economic conditions, scale, and traditional conditions effectively shaped the houses.

There are many studies on the sustainability of rural dwellings in the literature. In these studies, rural houses were examined in terms of design, socio-cultural, structural, and ecological features. These studies used methods such as questionnaires, interviews, and comparisons. When this study is compared to previous studies, there are three major differences. The first case is the absence of any study on rural settlements in the Yamula Dam region of Kocasinan District of Kayseri Province, which was determined as the study area. Second, while the current studies looked at the houses in terms of their design and planning decisions, this study focused on analyzing and comparing the houses in the first settlement areas under the dam, the houses built in the new settlement area, and the housing projects made by different institutions in terms of how well they use energy and daylight. Thirdly, the methods used to determine a sustainable construction strategy by creating a sustainable rural housing example in the current literature are to create a synthesis using existing references and evaluate the information obtained through questionnaires. Finally, in this study, residences were tested in a virtual environment with BIM (Building Information Modeling) based Revit program to determine sustainable performance values , and their sustainability performances were measured. This study, which was carried out in line with the three situations described above, might positively contribute to the literature in addition to other studies. As a result, it aims to contribute to sustainable rural housing development.

AIM SCOPE AND METHOD

In order to create a sustainable environment, sustainable structures must be built. Buildings should be planned with sustainability in mind, including how they use water, and energy, manage waste, recycle, and use local materials. Since each of these factors is a broad subject of study, in this study, rural housing is discussed in terms of benefiting from the sun, which is one of the natural resources, and energy management. Answers were sought in this direction to the questions of how long the residences determined within the scope of the study can benefit from daylight, what the quality of daylight in the interiors is, how much energy they consume, and in total for heating, cooling, and lighting, and how much of this consumed energy can be met from renewable sources.

This research was carried out in five stages to create an energy-efficient rural house (Figure 1). The area where the fieldwork will be conducted was determined in the first stage. In this context, rural settlement areas located on the edge of Yamula Dam in the Kocasinan district of Kayseri province were determined as the areas to be surveyed. In this region, the rural settlements of Taşhan, Çevril, Kuşçu, and Mollahacı were submerged by the dam, and the rural settlement of Obruk was destroyed due to landslides. Due to these situations, new settlement areas are planned in the regions. However, the fact that the new settlement area planning was different from the first settlements in that it was an urban design rather than a rural one, and many buildings in the rural area could not be included in the new plans. Therefore, the new houses were built in different shapes, and the architectural features of the first settlement were effective in selecting this region.

In the second stage, rural housing projects carried out by different institutions and organizations were investigated. At the end of the research, housing projects designed by the Ministry of Environment, Urbanization, and Climate Change, Mimar Sinan Fine Arts University, and TOKİ were reached.

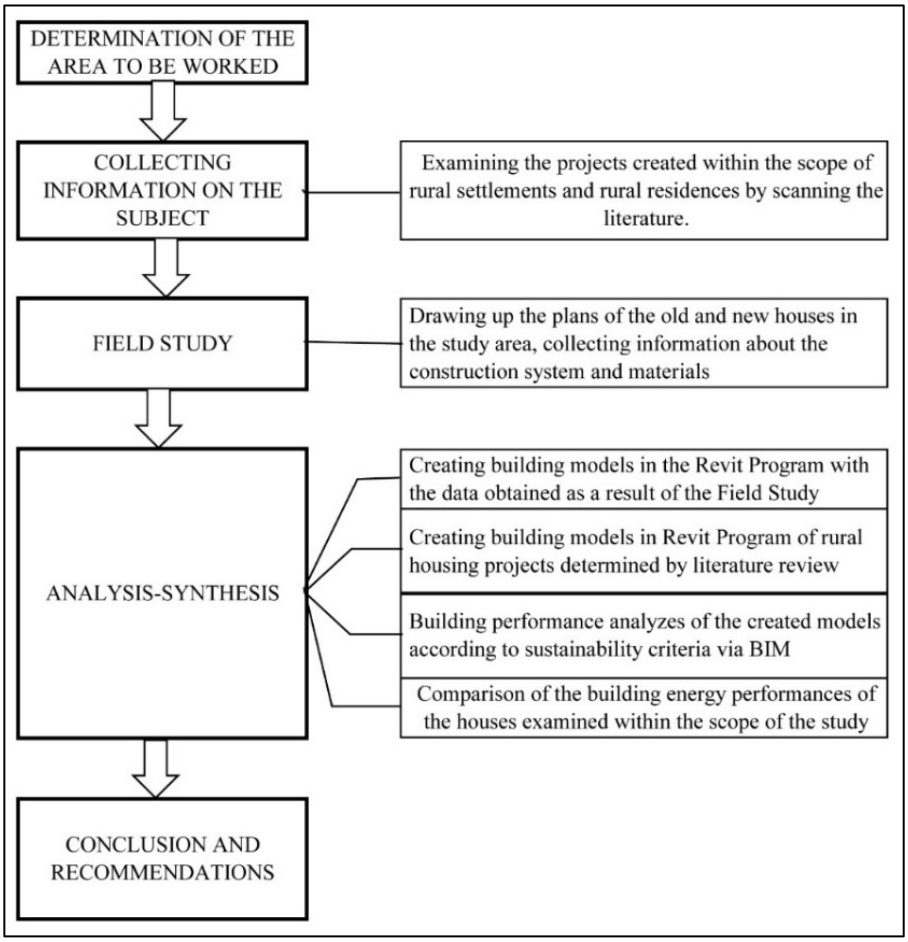


Figure 1. Work method

DOI: 10.15320/ICONARP.2022.215

In the third stage, fieldwork was carried out. In this section, the houses to be analyzed are determined. These houses were analyzed in terms of sun orientation, daylight saving, and energy consumption in the Revit Program. There are 14 rural settlements in the study area (Figure 2). Since the first settlement area of four of these rural areas was flooded and one was destroyed due to landslides, there is no old building. In both settlements, there are no old buildings due to the demolition of old buildings and the construction of new buildings. Seven old buildings were identified in the remaining seven settlements. However, the architectural features of only three old structures, which do not pose a security risk, have walls, doors, windows, floors, and roofs, and are allowed by the owner, could be determined. However, the architectural features of the three old buildings and the three new buildings allowed by the owner in the same settlement area were determined to make a better comparison. With the data obtained, the plans and sections of the structures were prepared in the AutoCAD program.

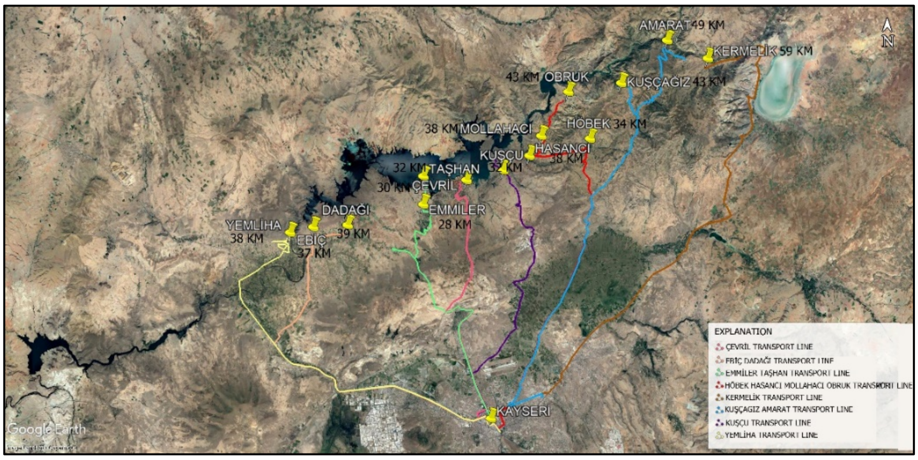


Figure 2. Rural settlements in the study area. (Google Earth, 2022)

The architectural features determined in the fourth chapter are analyzed in terms of daylight and energy consumption characteristics of ecological sustainability whether the objectives of the sustainable buildings created to reduce the damage to the environment can be realized or not can be determined by the analyzes made by considering the environmental conditions before the construction.

One of the methods used to measure sustainable performance targets is software programs. One software is the Building Information Modeling (BIM) based Revit program. Sustainability analyzes can be made by entering data on physical environmental conditions in the Revit program (Figure 3). From these analyses, regional daylight exposure times and daylight lux values can be measured indoors by analyzing sun orientation and daylight exposure. With solar energy analysis, regions where solar panels can be placed can be determined, and the amount of energy that can be produced can be calculated. With the wind analysis, the wind resistance of the building can be measured. Finally, the energy analysis can calculate the heating, cooling, and lighting energy amounts, and the total energy consumption amount can be determined (Ofluoğlu, 2016).

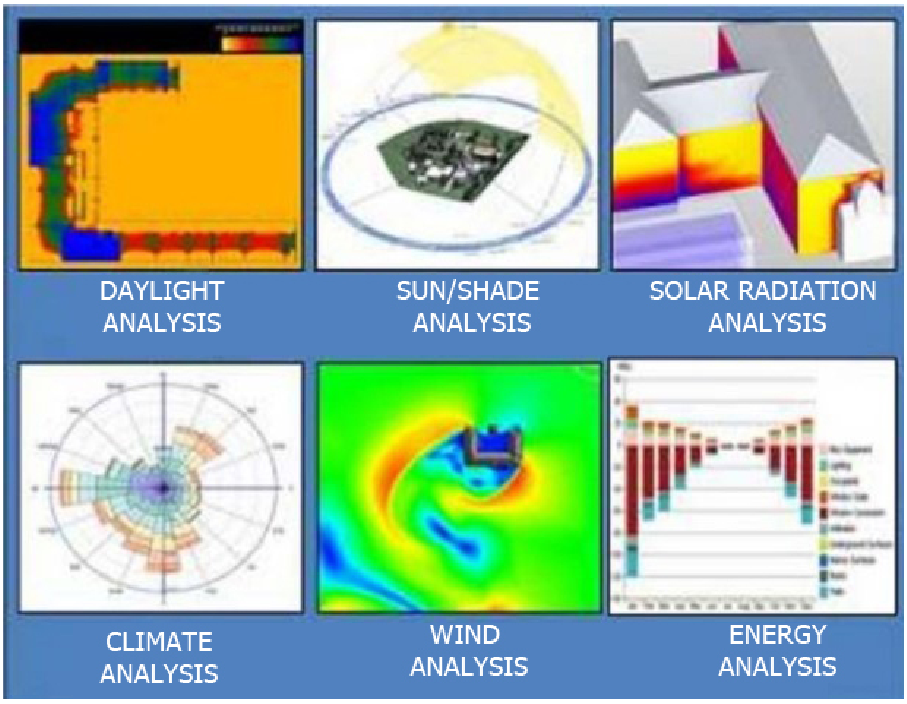


Figure 3. Analyzes in revit program revit (Ofluoğlu, 2016).

These analyses, which can be done in a digital environment, allow the targeted performances to be measured. Thanks to the data obtained from the analysis, it is possible to improve the design and eliminate the deficiencies by making interventions in the early stages of the design. In addition, problems such as problems, disruptions, and additional costs that may occur in the construction and use of buildings can be intervened by determining compliance with sustainability (Ofluoğlu, 2016).

Revit Program was used to analyze the structures determined due to these features. For this, the building plans prepared in AutoCAD were modeled in the Revit program and analyzed by creating the region's climatic conditions. In the last section, the results obtained are compared.

HOUSING INVESTIGATION IN THE SCOPE OF THE STUDY

This section provides information about rural housing projects created by the people, institutions, and organizations covered in this study. Furthermore, old, and new houses are also examined in the study field.

Realized Housing Projects in the Context of Rural Development Examined within the Scope of this Study

For various reasons, migration from rural areas to cities causes problems such as decreased production, rising unemployment in urban areas, and the spread of irregular slum areas. These problems, especially those of high-level governments, local administrations, and people who migrate from rural areas to the city with livelihood concerns become the whole country's problems. For this reason, rural development is one of the most important issues of all time. Therefore, various studies are carried out in Turkey to develop these areas. Since the proclamation of the Republic, housing projects for rural areas have been carried out by

DOI: 10.15320/ICONARP.2022.215

different individuals and institutions. However, the 1940s were one of the periods in which most projects were produced in this field. In addition to the Ideal Republic Village project (İnan, 1978), which was created with the support of Atatürk in these years, there are rural settlement and housing projects prepared by Abidin Mortaş (Mortaş, 1940), Behçet Ünsal (Ünsal, 1940), and Burhan Arif Ongun (Ongun, 1935).

These are examples of projects prepared for rural areas in the Republic's early years. From the 1940s until the 2000s, there were no projects for the countryside. Since those years, the countryside has come up again, and projects have started to be prepared. One of these projects is the Tarımköy project, which TOKİ built. In addition to housing (Figure 4), a residential area consisting of schools, mosques, barns, and health clinics is also created (TOKİ, 25.07.2021).

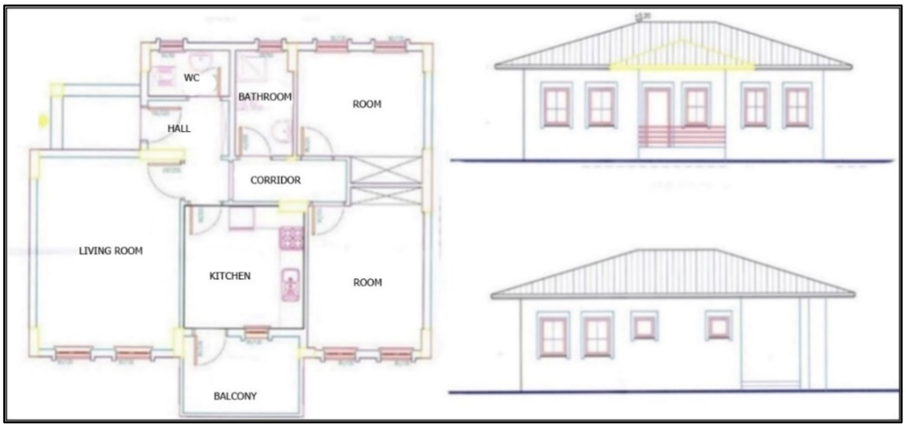


Figure 4. Kayseri Felahiye Doburcalı Tarımköy floor plan and views (Municipality of Felahiye 25.07.2021)

The other project for the countryside is the "Regional Texture and Architectural Features in the Countryside" project prepared by the Ministry of Public Works and Housing at Mimar Sinan Fine Arts University. Within the scope of the project, work was carried out for Kayseri in 2008 and Balikesir in 2010. In the study carried out in Kayseri, the villages of Kocasinan district, Çevril, Karahöyük, Tashan, and Melikgazi district, Bağpınar were selected as the working area. Project results are collected in six books. In the first book, environmental data, building materials, building elements, construction systems, units that make up rural housing, and sustainable regional architecture are discussed in the formation of rural architecture (Çorapçıoğlu et al., 2008a). The second book contains the methods used to investigate the local architectural identity and how to write the results reports (Çorapçıoğlu et al., 2008b). In the third book, information about natural and environmental information of the countryside, socio-cultural data, building materials, building elements, construction systems, rural housing departments, and settlement types are given (Çorapçıoğlu et al., 2008c). Finally, in the sixth book, idling projects and photographs of the houses in the workplace are included (Çorapçıoğlu et al., 2008d). Six different housing types were developed at the end of the study (Figure 5).

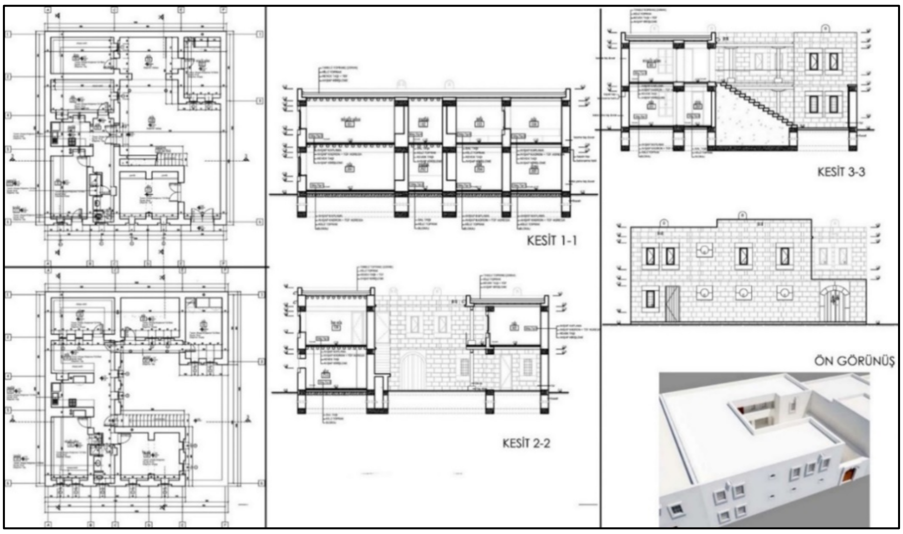


Figure 5. Local texture and architectural features in rural area project type 4C floor plans sections and views (Çorapçıoğlu et al., 2008e).

Another project related to construction in the countryside, "Housing Projects suitable for local architectural features" was carried out by the General Directorate of Building Works of the Ministry of Environment, Urbanization and Climate Change. The project aims to make new structures in rural settlements according to the local texture, the needs of the region's people, living conditions, and habits. Therefore, it was aimed to avoid constructing silhouette-disturbing structures in rural areas in favor of constructing structures appropriate for the tissue (Oruç et al., 2020). In line with the project, housing projects were carried out with the contributions of different architectural companies (Figure 6).

Figure 6. Housing projects suitable for local architectural features Kayseri type 3A Floor plans sections and views (Ministry of Environment, Urbanization and Climate Change, 25.07.2021)

Rural Housing Investigation in The Scope of This Study

New settlements have been created for the rural settlements of Taşhan, Çevril, Kuşçu, and Mollahacı, whose settlements are in the Kocasinan district of Kayseri province, which was flooded by the Yamula dam, and Obruk, whose settlement area was moved due to landslides. In addition, the former residences and new dwellings in the Höbek, Hasanci, and Emmiler regions in the vicinity have been examined as part of the study to ensure rural sustainability in these areas.

DOI: 10.15320/ICONARP.2022.215

Looking at the old and new houses examined in the Höbek settlement (Figure 7), there is no garden or courtyard in front of the building in the old residence. The ground floor consists of a barn, haystack, and home-pantry units, while the entrance and room units are placed on the upper floor to correspond to the top of the haystack (Figure 8). It was determined that the ground floor was made of rubble stone, and the upper floor was made of wood carcass filling materials with the local name "iskidas." Ground floor wall thickness varies between 70-90 cm. The wall thickness of the upper floor is 20 cm. When looking at the upper cover of the ground floor, the barn and the house-pantry section consist of round wooden beams, frequently arranged oak branches, and thick clay soil, which are thrown in the opposite direction on the thick round beam called "hezen." There is a room section above the haystack section. On the floor, there is a thick wooden beam in the center of the room, parallel to the short side at the bottom. On this beam, there are wooden beams placed in the opposite direction, coating boards, clay soil, and finally, lean concrete. The doors were created by hammering pieces of wood on the wooden lata with thick nails called pins. A locking system also opens with large keys locked in padlocks. The window sizes are small, and there are guillotine windows on the upper floor (Figure 9).

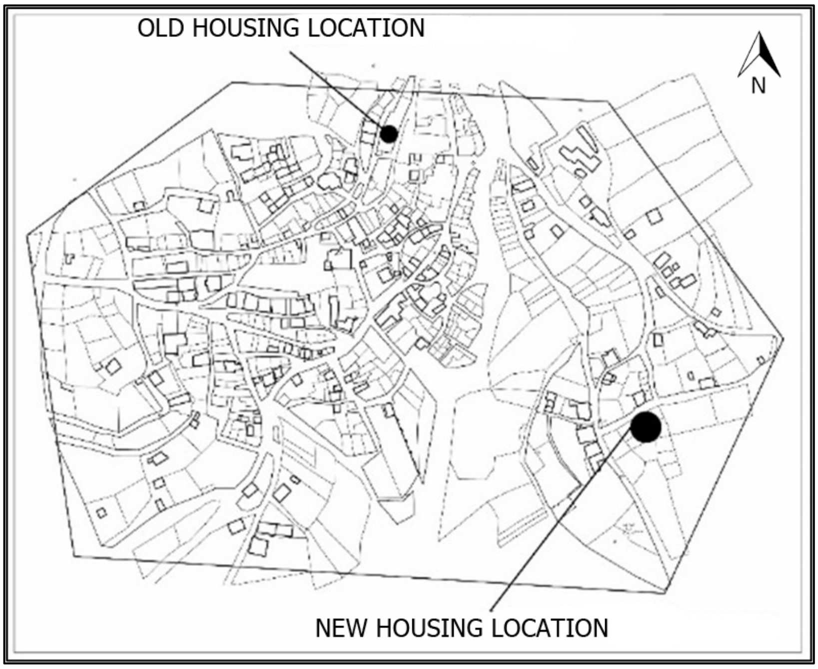


Figure 7. The location of the new and old house investigated in Höbek (Kayseri Cadastre Directorate, 2019)

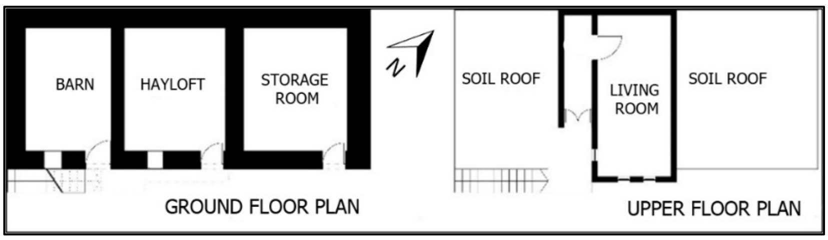


Figure 8. Plan of the old house investigated in Höbek.

Figure 9. The old house investigated in Höbek.

When we look at the newly built house in the Höbek settlement, it is seen that the ground floor, which is two stories, is used as a warehouse, garage, barn, and repair maintenance area, and the upper floor is used as a living area (Figure 10). The structure was built as masonry, and the exterior walls of the ground floor are made of 50 cm stone interior walls and 20 cm of brick. The top cover is hollow block flooring, and pumice concrete is the filling material. The upper floor is made of 20 cm of brick, and the ceiling flooring has a roof on a reinforced concrete plaque. The garage section is added and has a 50 cm stone wall, and the top cover is a trapeze sheet covering the steel carcass. The structure has no thermal insulation, and the exterior is painted on plaster. The flooring is lean concrete on a compacted floor. The living room and bedrooms upstairs have laminate flooring, while the kitchen has a ceramic finish with wet areas. The windows are PVC (polyvinyl chloride), and the doors are wooden (Figure 11).

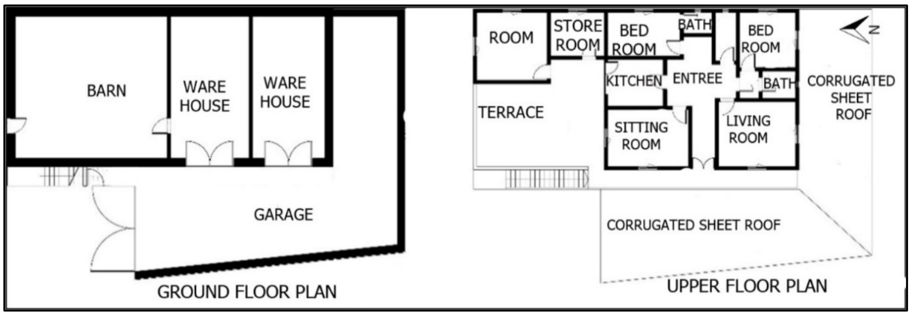


Figure 10. Plan of the new housing investigated in Höbek.

DOI: 10.15320/ICONARP.2022.215

Figure 11. New housing investigated in Höbek.

Looking at the old and new houses (Figure 12) examined in the Hasancı settlement; the old residence, in a single story, has been made of rubble stone. When the building plan is examined, the house consists of rooms, tandoors, a pantry, and cattle units, and there is no garden or courtyard in front of the building (Figure 13). The wall thickness varies between 70-90 cm. Looking at the upper cover, the round wooden beam, which is thrown in the opposite direction on the thick round beam called hezen, consists of oak branches that are frequently arranged and, finally, thick clay soil (Figure 14).

Figure 12. The location of the new and old house investigated in Hasancı (Kayseri Cadastre Directorate, 2019)

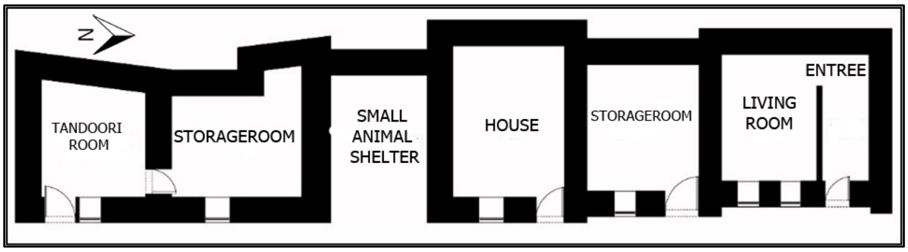


Figure 13. Plan of the old house investigated in Hasancı.

Figure 14. The old house investigated in Hasancı.

When we look at the newly built house in the Hasancı settlement, it is seen that the ground floor has two stories. The ground floor is used as a warehouse and garage, while the upper floor is used as a living space (Figure 15). The ground floor of the building is a framed structure, and the upper floor is a masonry system. All the walls in the building are made of 20 cm pumice material. The ground floor slab is made of lean concrete on a compressed floor; the ground floor ceiling is 20 cm pumice and 10 cm concrete hollow block, and the upper floor ceiling slab is a 12 cm reinforced concrete slab. It is a fringed structure and has a crushed roof. New materials are used in the structure, with no thermal insulation and only rough plaster. Upstairs, the living room and bedrooms are laminate floorings, while the kitchen is a ceramic finish with wet volumes. The windows are PVC, and the doors are wooden (Figure 16).

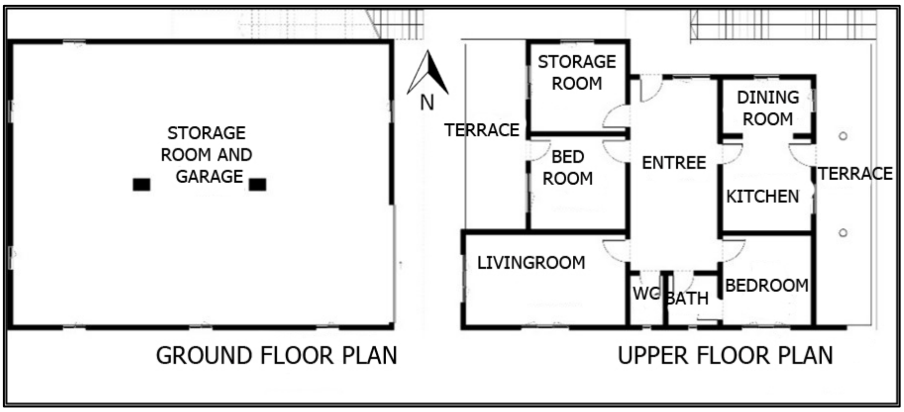


Figure 15. Plan of the new housing investigated in Hasancı.

DOI: 10.15320/ICONARP.2022.215

Figure 16. New housing investigated in Hasancı.

Looking at the old and new houses examined in the Emmiler settlement (Figure 17), the old residence is on two floors. When the building plan is examined, the lower floor is a barn, and the upper floor consists of living space. The living area is entered via a stone staircase from the road (Figure 18). The walls are made of cut stone, and the thickness is 70 cm on the lower floor and 35 cm on the upper floor. The barn and the living area flooring consist of wooden beams, branch pieces on the hezen, and concrete on the ground. The roof was added to the structure, which did not have a roof in its first form. Windows and door sizes are small (Figure 19).

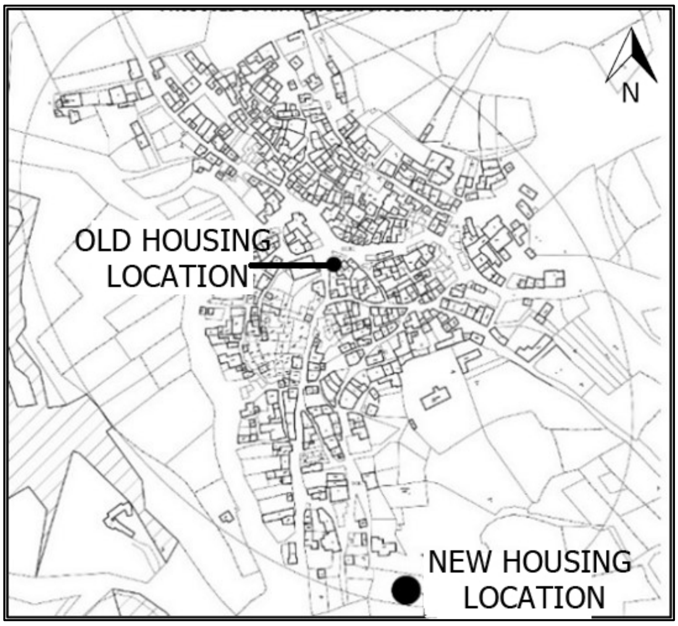


Figure 17. The location of the new and old house investigated in Emmiler (Kayseri Cadastre Directorate, 2019)

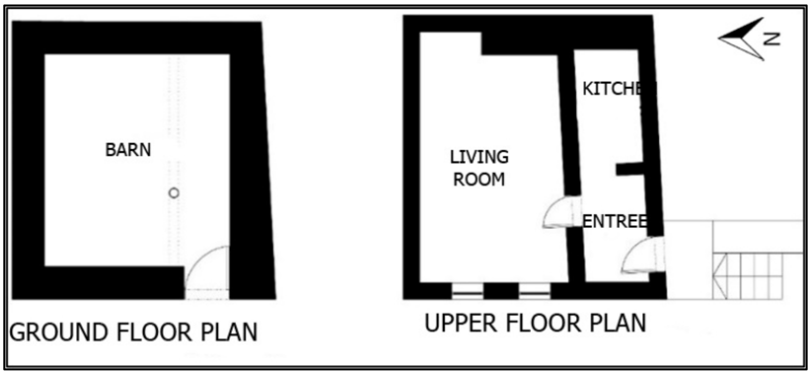


Figure 18. Plan of the old house investigated in Emmiler.

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

Figure 19. The old house investigated in Emmiler.

When we look at the newly built house in Emmiler settlement, the building consists of a basement and ground floor. While the basement is a warehouse, the upper floor consists of a living area (Figure 20). However, a semi-open tandoori area (where phyllo, tomato paste, and molasses are cooked) and a closed unit for woodland next to it; greenhouses are in the garden. The walls are made of 20 cm of pumice concrete. There is no thermal insulation, and the exterior is painted on plaster. The flooring is lean concrete on a compressed floor, the living room and bedrooms have laminate flooring, and the kitchen and wet areas are ceramic coated. The upper cover of the living area is a crushed roof on the cladding board on wooden beams with rectangular sections and is covered with Marseille-type tile. The windows are PVC, and the doors are wooden (Figure 21).

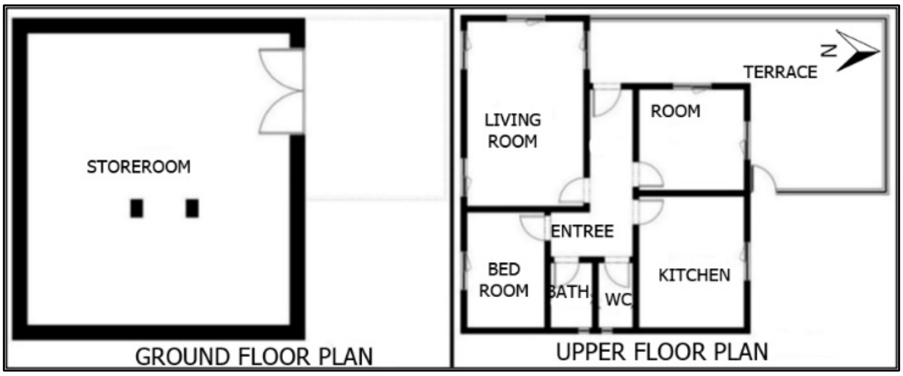


Figure 20. T Plan of the new housing investigated in Emmiler.he old house investigated in Emmiler.

DOI: 10.15320/ICONARP.2022.215

Figure 21. New housing investigated in Emmiler.

FINDINGS

Within the scope of the study, old and new residents in the rural settlements of Höbek, Hasancı, and Emmiler with the Tarımköy housing project prepared by TOKİ, the Type No. 4C housing project, one of the types of housing in the Rural Area Regional Architectural Identity Project prepared by Mimar Sinan Fine Arts University, and the Type 3A project prepared by the Ministry of Environment, Urbanization, and Climate Change were analyzed in the Revit program. Analyses carried out within this scope include analysis of solar orientation, daylight acquisition, and energy consumption.

Sun Orientation and Daylight Reception Analysis

The study included nine projects assessed based on the sun's position, the sunbathing time of the venues, and the lux value of the daylight received by the venues based on space size. According to the six project locations examined in the field of study, the type projects are positioned to face south so that the main living spaces can get more light (Figure 22). Furthermore, direct daylight retrieval times (Figure 23) and direct daylight lux values (Figure 24) were calculated depending on the sun orientation analysis.

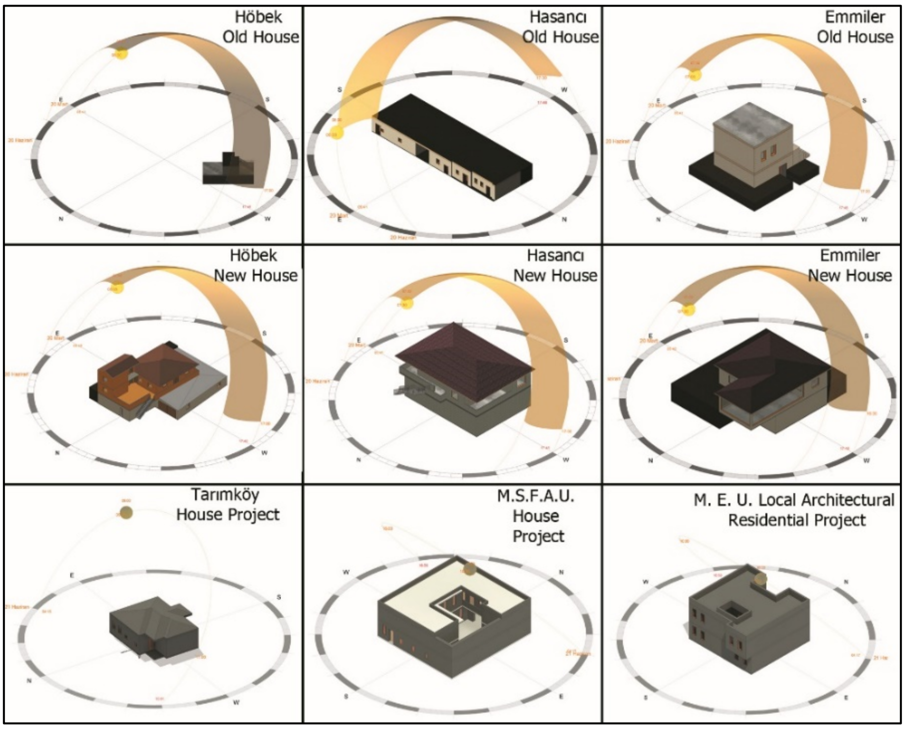


Figure 22. Land session and sun orientation of selected houses.

When looking at Figure 21, the façades of the old houses in Höbek and Hasancı looks at sunrise, Emmiler looks at sunset, and the long façades of the buildings are in the north-south direction and look in the east and west directions. When looking at the façade openings, it can be seen that all the windows and doors are on the eastern façade, and the western façade has no openings. In this case, daylight at the appropriate temperature in summer is used by taking it into the house, and coolness is created by avoiding high-temperature daylight. In the winter, thanks to the western façade being deaf or covered with soil, heat is gained by storing high-temperature daylight and giving the temperature to the interior when there is no sun. In the new housing in the workplace, the frontlines look west or north. Thanks to the presence of windows or doors on all fronts, daylight enters the interior all day. This situation provides an advantage in terms of saving the energy required for lighting by ensuring that the illumination times of the interior spaces are long both in summer and winter. On the other hand, the large number of openings causes the interior spaces to warm up more in the summer. The heat bridge areas increase in the winter, thus increasing the energy required to create the ideal ambient conditions. Thus, the sun is both benefited and adversely affected.

In the Tarımköy and Ministry of Environment, Urbanization and Climate Change housing projects, the eastern and western fronts are deaf and only receive light from the northern and southern fronts. In the Mimar Sinan Fine Arts University housing project, light is taken from the southern and eastern fronts, and other fronts are deaf. It is observed that the sun is largely not considered in type projects.

When looking at the direct daylight periods depicted in Figure 22, the lower floor of the old residence in the Höbek region is in the range of 0-1

DOI: 10.15320/ICONARP.2022.215

hours, and the upper floor is in the range of 0-3 hours, while the lower floor of the new dwelling is 0-2 and the upper floor is in the range of 0-3 hours. While the old residence in the Hasancı region is in the range of 0-0 hours, the lower floor of the new residence is 0-3, and the upper floor is 0-5 hours. When looking at the Emmiler area, the lower floor of the old residence is 0-3 upper floor in the range of 0-2 hours, while the lower floor of the new dwelling is 0-0, and the upper floor is in the range of 0-5 hours.

In the Tarımköy housing project, a small area in front of the hall window and a large room receives light for up to 3 hours, while all the rest of the places receive direct daylight in the range of 0-1 hours. When looking at the Mimar Sinan Fine Arts University Type No. 4C housing project, the courtyard receives direct daylight for up to 5 hours, while all indoor spaces receive direct daylight from 0-1 hour. A very small area in the bathroom with the south-facing room on the ground floor receives direct daylight for up to 2 hours in the Regional Architecture Type 3A housing project, while a small area in front of the window of the mansion room and south-facing room on the upper floor receives direct daylight for up to 2 hours. All other venues appear to receive direct daylight in 0-1 hours.

Figure 23. Direct daylight time analysis of selected houses.

Looking at the lux values detailed in Figure 23, the lower and upper floors of the old residence in the Höbek region and the upper floor of the new residence receive 0-6000 lux daylight, while the lower floor of the new residence receives daylight in the range of 0-63 lux. Looking at the lux values in the Hasancı region, the old residence receives 1-619 lux daylight, while the lower floor of the new residence is 4-6000, and the upper floor is in the range of 0-6000 lux. When looking at the Emmiler

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

area, the lower floor of the old residence is 0-814, the upper floor is 0-157 lux, while the lower floor of the new dwelling is 0-2, and the upper floor is in the range of 2-6000 lux.

It is identified that the rest of these rooms, where 107-6000 lux light can be obtained up to the middle parts of the hall and large room spaces of the Tarımköy housing project, and all other places in the residence are illuminated in the range of 0-107 lux. When looking at the Mimar Sinan Fine Arts University Type No 4C housing project, the only indoor room with a light value of 107-6000 lux is the room next to the kitchen. Located in the southwest direction, the rooms, barn, and guest rooms in the northeast are secondary bright spaces, and the lux value rises to 1291 lux in front of the windows and 5382 lux in front of the door in the barn. Upstairs, sofa, kitchen, and headroom spaces are the brightest spaces, receiving 6000 lux in light on window sides, while the rest have over 107 lux in light. The other bright space on this floor is in the courtyard, where it can receive up to 646 lux. All other venues receive light of 0-107 lux. On the other hand, in the Local Architectural Type 3A residential project, the headroom on the ground floor and most of the other south-facing room gets light in the range of 107-1291 lux, while the kitchen and most of the other north-facing rooms get light in the range of 107-646 lux. The areas corresponding to these places on the upper floor receive the same light value. As a result, these rooms, together with the corridor, panty, and wet volume units, which are placed in the middle and away from the window, have a light of 0-107 lux.

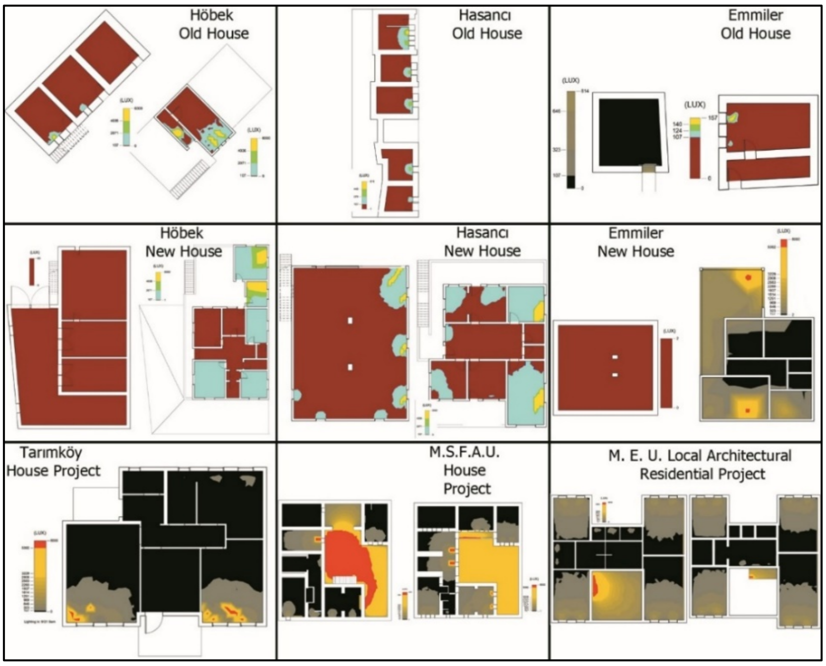


Figure 24. Lux value analysis of selected houses

Solar and Energy Consumption Analysis

In this section, the energy needs consumed in total are calculated in Table 1 in the Revit program of the selected houses to use electricity for heating, cooling, lighting, and various domestic appliances. The amount of energy consumption per sqm is also calculated in this table.

DOI: 10.15320/ICONARP.2022.215

Table 1. Annual energy consumption analysis-kwh

	Heating	Cooling	Lighting	Various domestic Appliances	Calculated	Area (sqm)	Energy per sqm
Höbek Old House	5.903	13.989	2.631	2.631	**25.154**	**113**	**222,6**
Höbek New House	16.542	199.119	10.147	13.189	**238.997**	**532**	**449,24**
Hasancı Old House	10.350	4.789	3.431	3.431	**22.001**	**140**	**157,15**
Hasancı New House	9.644	81.447	13.825	13.825	**118.741**	**350**	**339,26**
Emmiler Old House	7.050	3.556	1.936	2.519	**15.061**	**68**	**221,49**
Emmiler New House	11.858	17.297	7.100	7.100	**43.355**	**207**	**209.44**
Tarımköy House Project	8.706	1.586	1.694	1.694	**13.680**	**80**	**171**
MSFAU House Project	20.292	11.194	6.981	6.981	**45.448**	**336**	**135,26**
M. E. U. Local Architectural Residential Project	17.361	13.308	4.856	6.314	**41.839**	**226**	**185,13**

The energy obtained using renewable energy sources is clean, does not harm the environment, and contributes greatly to the family budget. Therefore, meeting the energy used in buildings in these ways will greatly contribute to ecological and economic sustainability. Based on this situation, if solar energy panels are placed on the roofs of the houses, the ratio of the produced energy to the consumed energy is calculated and shown in Table 2. Then, the annual electricity consumption amounts required for the cooling, lighting, and equipment shown in Table 1 are multiplied by 0.693408 (Kayseri Elektrik Perakende Satış A.Ş., 25.07.2021), which is the energy consumption cost of the KEPSAŞ company that distributes electricity in Kayseri province, and the annual electricity consumption cost excluding taxes are calculated in the first stage of this calculation. In the second stage, the number of 280 W Polycrystalline solar panels with dimensions of 165x100 cm, widely used for small-scale residences that can be placed on roofs, has been determined. Finally, the amount of electricity that can be produced annually was calculated by multiplying the number of panels determined at the end of this process by 280 W, the electricity generating power of the panel, and 1.588 KWh/sqm-year (GNS Solar, 25.07.2021), which is the Kayseri radiation value. Then, the annual electricity production amount and the energy consumption cost of KEPSAŞ company are multiplied, and the consumption cost corresponding to the produced amount is determined. In the last step, the ratio of the consumption price corresponding to the amount produced to meet the annual electricity consumption has been calculated and shown.

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

Table 2. Electricity consumption and production costs, consumption coverage ratio

	Heating	Cooling	Lighting	Various domestic Appliances	Calculated	Area (sqm)	Energy per sqm
Höbek Old House	5.903	13.989	2.631	2.631	**25.154**	**113**	**222,6**
Höbek New House	16.542	199.119	10.147	13.189	**238.997**	**532**	**449,24**
Hasancı Old House	10.350	4.789	3.431	3.431	**22.001**	**140**	**157,15**
Hasancı New House	9.644	81.447	13.825	13.825	**118.741**	**350**	**339,26**
Emmiler Old House	7.050	3.556	1.936	2.519	**15.061**	**68**	**221,49**
Emmiler New House	11.858	17.297	7.100	7.100	**43.355**	**207**	**209.44**
Tarımköy House Project	8.706	1.586	1.694	1.694	**13.680**	**80**	**171**
MSFAU House Project	20.292	11.194	6.981	6.981	**45.448**	**336**	**135,26**
M. E. U. Local Architectural Residential Project	17.361	13.308	4.856	6.314	**41.839**	**226**	**185,13**

As shown in Table 1, the annual energy consumption of old houses in the region is between 15,000-25,000 kwh, while the energy consumption of new houses is between 43,000-239,000 kwh. In this case, it is reported that new houses consume between 1.72 and 15.93 times more energy than old houses. When looking at type projects, the annual energy requirements are in the range of 13.000-45.500 kwh, and the minimum energy requirement is in the Tarımköy project. Compared to these projects and old housing projects, the MSGSU Housing Project and Ç.Ş.B. Regional Architectural Housing Project consume 0.66 to 2.01 times more energy than old houses. In comparison, the Agriculture Village Project consumes 0.1-0.84 times less energy. When we examine the amount of energy consumption per square meter, it is generally observed that type projects consume 0.15-0.65 times less energy than old houses and 0.13-2.32 times less energy than new houses.

As detailed in Table 2, the annual energy generation potential of old houses is between 8,000-36,000 kwh, while in new houses, it is between 29,000-51,000 kwh, and in type projects, it is between 13,000-27,000 kwh. In light of this data, in Table 3, the annual electricity consumption amount in old houses is very comfortably met. In contrast, houses other than Emmi can meet the annual electricity consumption of 15% - 45% in new houses. When looking at type projects, the Local architectural housing project can meet 89% of its annual energy consumption, while other projects can produce more than they need.

CONCLUSIONS AND RECOMMENDATIONS

Within the scope of the study, one old and new housing in Höbek, Hasancı, and Emmiler regions in the Kayseri Kocasinan district and the Tarımköy Housing Project prepared by TOKİ, Type No 4C Housing Project, one of the types of housing in the Rural Area Regional Architectural Identity Project prepared by Mimar Sinan Fine Arts University, and Type 3A project from Type Housing Projects suitable for

DOI: 10.15320/ICONARP.2022.215

regional architectural features prepared by the Ministry of Environment, Urbanization and Climate Change, have been examined by subjecting sustainability analysis to rural housing projects through the BIM-based Revit program. With these analyses, answers were sought for the questions of the duration of daylight use, quality of daylight indoors, heating, cooling, lighting specifically, and in total, how much energy consumption and how much of the consumed energy can be met from renewable energies in rural housing.

In terms of benefiting from daylight, it is discovered that the new houses in the region are more advantageous than the other houses, the old houses are in second place, and public projects are in last place. When considering the variables that contributed to the construction of this situation, the placement of the new houses on the land and their orientation to the sun, wide window sizes, and the high number of windows in space stand out. When we look over the old houses, the small size and number of windows, the high wall thickness, the light from only one direction, and the smaller interior dimensions compared to the new houses cause less sunlight than new houses. When we examine public projects, the positioning of the land so that important places can receive more daylight, the long interior dimensions, the lack of size and number of windows to meet this length, and the high number of deaf façades cause the least benefit from the sun.

In terms of energy, new residences consume the most energy in total energy consumption, while public projects are in the second place and old residences are in the last place. In the context of energy consumption per square meter, public projects consume the least energy, while old houses are in the second place and new houses are in the last place. In public projects, it is observed that the project prepared by Mimar Sinan Fine Arts University is the least energy-consuming structure in terms of energy consumption per square meter among other public projects.

The fact that the areas of the old houses are small, the façade openings are few, the number of deaf façades is high, the walls are made of stone material, and the thickness is high has ensured the total amount of energy consumption is low. In terms of public projects, it is believed that the thermal insulation of Tarımköy and Regional Architectural Housing reduces total energy usage. Aside from the fact that the total area of the residence prepared by Mimar Sinan Fine Arts University is larger than other public projects, and the amount of energy per square meter is low despite the lack of thermal insulation, the introverted design, the low number of deaf façades, and the local material, stone material, all contributed. On the other hand, when looking at the new houses, it is thought that the lack of thermal insulation, the presence of window openings on each façade, the low wall thickness, and the low heat holding capacity of the wall materials increase the amount of energy consumption.

When a general evaluation is made, while new houses are advantageous in terms of daylight use, they are disadvantageous in terms of energy consumption. On the other hand, while public projects are disadvantageous in terms of daylight use, they are advantageous in energy consumption. Then again, the old houses are in an intermediate position in both respects.

Another unique situation in rural areas is that people build their buildings without having a project prepared or necessary permits. However, per the Building Inspection Law, buildings under 500 sqm in rural areas are not subject to building inspection. Therefore, the project, building inspection, and building construction fees are high enough to affect the individual budget.

From this point of view, preparing a project and obtaining a license should be obligatory by reducing all fee prices for buildings built in rural areas. Furthermore, during the project phase, sustainability analyzes should be made mandatory in the design of all buildings, especially rural residences, and missing points should be identified and improved. In addition, the state should provide project support services, and original designs should be made by determining the needs of people instead of typical projects.

Today, rural areas are served by the Rural Services Directorates within the municipalities. Therefore, these units should be given project and construction site control procedures for all construction in rural areas, and inspections should be increased. In this way, controlled and sustainable construction can occur.

In the design of rural houses, wide openings should be included on all façades so that the sun can be benefited most, and heat-saving glasses should be preferred in the windows. Energy-saving materials should be used in the entire structure. The use of solar energy panels should be encouraged and made compulsory for obtaining licenses and building occupancy permits.

With the propositions made, it is thought that resources can be supported more effectively in a better environment. The study is expected to contribute to sustainability by serving as the foundation for future studies.

ACKNOWLEDGEMENTS/NOTES

This study is a part of the doctoral dissertation "Spatial Sustainability of Rural Settlements Around Kayseri Yamula Dam: The Case of Hasanci Settlement" prepared by İbrahim BEKTAŞ under the supervision of Professor Doctor Aysun ÖZKÖSE at Karabük University Graduate Education Institute, Department of Architecture.

REFERENCES

Çelik, Z. (2006). *Developing rural planning policies in Turkey*. (Doctoral dissertation, Dokuz Eylul University, İzmir). Retrieved from http://acikerisim.deu.edu.tr:8080/xmlui/bitstream/handle/20.500.12397/9438/202683.pdf?sequence=1&isAllowed=y

Çorapçıoğlu, K., Çakır, S., Aysel, N. R., Görgülü, H. C., Kolbay, D., Seçkin, N. P., Ünsal, E. (2008a). Local rural architectural identity, Mimar Sinan Fine Arts

DOI: 10.15320/ICONARP.2022.215

University Revolving Fund Management. Retrieved from https://webdosya.csb.gov.tr/db/mpgm/icerikler//K_TAP_1.pdf

Çorapçıoğlu, K., Çakır, S., Aysel, N. R., Görgülü, H. C., Kolbay, D., Seçkin, N. P., Ünsal, E. (2008b). Local architectural identity in rural area guidebook, Mimar Sinan Fine Arts University Revolving Fund Management. Retrieved from https://webdosya.csb.gov.tr/db/mpgm/icerikler//K_TAP_2.pdf

Çorapçıoğlu, K., Çakır, S., Aysel, N. R., Görgülü, H. C., Kolbay, D., Seçkin, N. P., Ünsal, E. (2008c). Determination of local architectural characteristics in Kayseri countryside guidebook, Mimar Sinan Fine Arts University Revolving Fund Management. Retrieved from https://webdosya.csb.gov.tr/db/mpgm/icerikler//K_TAP_3.pdf

Çorapçıoğlu, K., Çakır, S., Aysel, N. R., Görgülü, H. C., Kolbay, D., Seçkin, N. P., Ünsal, E., (2008d). Determination of local architectural characteristics in rural areas surveys, Mimar Sinan Fine Arts University Revolving Fund Management. Retrieved from https://webdosya.csb.gov.tr/db/mpgm/icerikler//K_TAP_6.pdf

Çorapçıoğlu, K., Çakır, S., Aysel, N. R., Görgülü, H. C., Kolbay, D., Seçkin, N. P., Ünsal, E. (2008e). Typological Studies for Creating Local Architectural Projects in Kayseri Rural, Mimar Sinan Fine Arts University Revolving Fund Management Retrieved from https://webdosya.csb.gov.tr/db/mpgm/icerikler//K_TAP_4.pdf

Feridonzadeh, H., Sartipi Pour, M., Saleh Sedghpour, B., & Barati, N., (2019). Structural equation modeling (SEM) of norms in rural house formation in the cold and mountainous province of Ardabil (Persian). Journal of Rural Research, 9(4),662 675. Retrieved from http://dx.doi.org/ 10.22059/jrur.2018.250421.1214

GNS Solar, (2021) Turkey Sun map Retrieved from https://www.gnssolar.com/icerik/860/turkiye-gunes-haritasi

Google Earth, (2022) “Satellite photos”

İnan, A. (1978). Our villages for the 50th anniversary of the Republic, Turkish Historical Society Publications.

İner, G. (2013). A method devoted to the determination of sustainability criteria for rural dwelling: the example of Edirne (Doctoral dissertation, Trakya University, Edirne]. Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/tezDetay.jsp?id=MZSfUYCNByUrn_gP-lExEA&no=YI133WNHTGTyLFIV7D8nUw

Kara, E., (2014). A research on all dimensions of sustainability in settlements with ecological concerns: ecovillages [Master Thesis, Istanbul Technical University, İstanbul]. Retrieved from https://polen.itu.edu.tr/items/00129c65-e4b2-4c13-8fae-2764b985bc78

Kayseri Cadastre Directorate (2019)., Cadastral Plans.

Kayseri Electricity Retail Sales Inc. “Residential electricity bill dated 20.05.2021”, Kayseri (2021)

Ministry of Development (2018). Eleventh Development Plan (2019-2023) Rural Development Specialization Commission Report, TR Ministry of Development. Retrieved from https://www.sbb.gov.tr/wp-content/uploads/2020/04/KirsalKalkinmaOzelIhtisasKomisyonuRaporu.pdf

Ministry of Environment, Urbanization and Climate Change, (2021). Housing projects in rural areas suitable for local architectural characteristics. Retrieved from https://yapiisleri.csb.gov.tr/kirsal-alanda-yoresel-mimari-ozelliklerine-uygun-konut-projeleri-i-4605

Mortaş, A. (1940). Village house types, Arkitekt, 1940-01-02 (109-110), 8-9. Retrieved from http://dergi.mo.org.tr/dergiler/2/64/569.pdf

Municipality of Felahiye, (2021). News- TOKİ final registration has started. Retrieved from http://www.felahiye.bel.tr/sayfa-news-Haber-TOKKESNKAYITLARBALADI,

Ofluoğlu, S., (2016). BIM and Sustainability, XVIII. Academic Informatics Conference, Aydın, Türkiye. Retrieved from https://www.researchgate.net/publication/328875476_BIM_ve_Surdurulebilirlik

Ongun, B. A. (1935). Village Project, Arkitekt,1935-11-12 (59-60), 320. Retrieved from http://dergi.mo.org.tr/dergiler/2/122/1388.pdf

Oruç, O., Eyüpoğlu Özeş, A., Arslan Konak, T., (2020) Housing projects suitable for local architectural features-2, Ministry of Environment, Urbanization and Climate Change General Directorate of Construction Works. Retrieved from https://webdosya.csb.gov.tr/db/yapiisleri/editordosya/file/kutuphane/yoresel_mimari_proje_kitabi_2.pdf

TOKİ, (2021). Applications according to project types Tarımköy. Retrieved from https://www.toki.gov.tr/proje-tipine-gore-uygulamalar,

Ünsal, B., (1940). Sincan Village Plan Arkitekt,1940-01-02 (109-110), 15-18. Retrieved from http://dergi.mo.org.tr/dergiler/2/64/572.pdf

Resume

İbrahim Bektaş received his undergraduate degree from Erciyes University, Faculty of Architecture, and his graduate degree from Karabük University, Institute of Science, Architecture Department. He works as a lecturer at Kayseri University Tomarza Mustafa Akıncıoğlu Vocational School.

Aysun Özköse works as a Professor at the Başak Cengiz Faculty of Architecture at Karabük University.

DOI: 10.15320/ICONARP.2022.215

Research Article

ICONARP
International Journal of Architecture and Planning
Received: 04.07.2022 Accepted: 02.12.2022
Volume 10, Issue 2/ Published: 20.12.2022
DOI: 10.15320/ICONARP.2022.216 E- ISSN:2147-9380

ICONARP

The Role of Public Interior Spaces in the Socialization of Active Elderly Individuals

İmran Kavaz Altun*
Bilge Sayıl Onaran**

Abstract

It is an indisputable fact that interaction and socialization between individuals are important for a healthy society. For this reason, it is essential to develop spaces that provide group and community interaction between all ages and all members of the society. This study is based on the assumption that the interactions of active elderly individuals aged 65 and over with individuals in public interior spaces are important in increasing their quality of life. In order to ensure this interaction, it is thought that the supportive role of public interiors should be investigated. The aim of the study is to evaluate the contribution of shopping center spaces to interaction and socialization from the eyes of active elderly individuals aged 65 and over and to determine the social interaction levels of these individuals in the shopping center. For this purpose, the study was built on social interaction, one of the spatial quality parameters. The research method consists of 2 steps: field observation on the selected shopping center and face-to-face survey. The findings obtained from the study conducted with a group of 200 people were evaluated by making descriptive analysis in the SPSS program. According to the research data, the majority of the participants are of the opinion that the areas and activities that will support social interaction are insufficient in the shopping centers where the study is conducted. In the study, it was determined that the majority of the participants used the shopping place especially for passive socialization and enduring socialization. The use of the space for fleeting sociability, however, took place in the background. It is thought that the reason for this is that the shopping center cannot offer sufficient physical conditions and activity opportunities in terms of space design.

Keywords:
Active elderly, public interior, public space, shopping mall, social interaction

* Department of Interior Architecture & Environment Design, Hacettepe University, Ankara, Türkiye
(*Corresponding author*)
Email: kavaz07@hacettepe.edu.tr

** Department of Interior Architecture & Environment Design, Hacettepe University, Ankara, Türkiye
Email: bilgeso@hacettepe.edu.tr

To cite this article: Kavaz Altun, İ., & Sayıl Onaran, B. (2022). The Role of Public Interior Spaces in the Socialization of Active Elderly Individuals. *ICONARP International Journal of Architecture and Planning,* 10 (2), 575-595. DOI: 10.15320/ICONARP.2022.216

INTRODUCTION

When it comes to old age, the first thing that comes to mind is; They are dependent, weak, disabled, disturbed, mentally incompetent, in need of care, lonely and unhappy, and have weakened social relations, who are identified with negative qualities. Contrary to these beliefs and labels, most older people are not like that. It is ignored that most of the elderly people have experienced, active and healthy old age (Montross et al, 2006: 43-51).

Active aging is the name given to the aging processes of individuals who can provide the elements of being physically and mentally active, living in a safe environment, taking part in the social environment as well as being physically healthy. The concept of active aging, which was brought to the agenda by the World Health Organization at the end of the 1990s; It is defined as "the process of providing health, social participation and security opportunities at the best level in order to enrich their quality of life as people age" and includes the process of increasing the quality of life by offering these opportunities to all individuals.

The concept of active aging has a much more comprehensive meaning than concepts such as "positive and productive aging", "optimal aging" and "successful aging", which only point to the health indicators of the individual. The word "active" used in this term does not only indicate activeness in the sense of being able to participate in any labor force physically, but also expresses continuous participation in psychological, social, cultural, economic and civic duties (WHO, 2002: 12).

The period in which individuals may most need to feel belonging to the society and interact with other individuals is the old age period. The areas where active elderly individuals can be intertwined with the society and see themselves as a part of the society are public spaces.

One of the issues that elderly people attach great importance to is being intertwined with people. Increasing the spaces where the elderly and especially the lonely elderly living in the city can be side by side with other members of the society plays a role in increasing their quality of life. Enabling the elderly to socialize and interact by increasing their visit to public interiority spaces such as shopping centers, green spaces, libraries, mosques, hospitals, restaurants and cafes is important in increasing their physical and psychological well-being. When we look at the design concept, which is widely seen today, it is felt that the idea that the user mass is universal is moved away when designing public interiors such as shopping malls, restaurants and cafes. The concept of public interior design for children, youth and adults, which is believed to support the consumption concept more, is maintained. This understanding is one of the important problems faced by elderly individuals in adapting to society and public interior spaces. However, the issue of supporting the socialization and interaction of active elderly individuals with individuals in other age groups that make up the

DOI: 10.15320/ICONARP.2022.216

society is increasing worldwide. Designing public interiors that will encourage the use of all age groups together can be considered as a big step to be taken both in breaking the prejudices about aging and in ensuring social interaction and making the active elderly feel belong to the society and public interiors.

In order to create a healthy social structure all over the world, many research and project studies (Kaplan, 1990; Kaplan, 1991; Kaplan, 1994) are carried out and their impact is gradually increasing. When the studies are examined, it has been determined that most of them are more interested in the feelings of age groups and individuals, but they ignore the role of space in supporting interaction and socialization.

As Bechtel (2000) mentioned, all social activities and human behaviors take place in a physical space. People spend their time in some kind of physical environment, and all interaction and socialization takes place within a physical space. People spend their time in some kind of physical environment, and all interaction and socialization takes place within a physical space. In this case, increasing the quality of life and well-being of the person can be achieved with positive environmental stimuli. For this reason, diversifying the places where interaction will take place and making room for elderly individuals will play a role in increasing their quality of life. Since interpersonal interaction and socialization are seen as inevitable for a healthy society, it is essential to understand and develop spaces that provide group and community interaction between all ages and all members of the society. Therefore, within the scope of this study, the effect of physical space characteristics of shopping malls, which are open to the public, on the interaction and socialization of active elderly individuals aged 65 and over will be investigated and evaluated.

PUBLIC SPACE AND PUBLIC INTERIOR SPACE

Cities are places that serve as meeting places for different segments of society, where people from all social and cultural classes, different ethnic groups and different characteristics come together, where individuals interact and socialize with each other. In particular, the structuring of the society, which is expressed as public spaces, and the spaces in which the relationship between individuals and society are supported by the physical environment have played an important role in the formation process of cities. The individual continues his socio-cultural life with the life and activities in these places, which are included in the physical environment fiction of the city he lives in (Erdönmez and Akı, 2005: 67).

Although public spaces are mostly thought of as closed spaces, it is possible to define open spaces that can be defined spatially and have the necessary features as public spaces (Sağlam et al., 2019: 48). A public space can be an open or closed space. Streets, avenues, squares, green roads and parks are examples of the former, while buildings such as cinemas, theaters, universities, schools, hospitals, airports, atriums and shopping centers where public services are provided are examples of the latter (Kaplan and Öztürk, 2004: 67). In order to avoid confusion of meaning, closed public spaces are also referred to as public interior spaces.

The concept of public space is perceived and used as structures belonging to the public. However, just like in government offices, the fact that a building was built by the government does not mean that it is always open to the public. As not every building constructed by the state can be defined as public, it would be an incomplete approach to evaluate the publicity of a space only on the basis that it is not private property. (Güney, 2007; Tanyeli, 2010; Yıldırım, 2015). Architect Neşe Gürallar states that "…for example, theater buildings may not be public property, they may belong to private individuals or theater groups, but they exist for the public, that is, they are public." This approach of her gives clarity to the situation (Gürallar, 2009).

As it can be understood from all these definitions and expressions, it turns out that the public space is a space that hosts public activity, supports, nourishes and directs social life. Within the scope of the study, the research was handled through shopping centers within public interior spaces. Although the level of publicity has been discussed and found low due to the management style, control and design of shopping centers according to certain themes, they appear as new types of public spaces in many studies with the economic and political transformation of social life. Especially in the last period, as these spaces have gained popularity and are used by the public constantly, they have become multifunctional public interiors rather than being shopping-oriented.

In order to evaluate the role of such public interiors in improving the quality of life of active elderly individuals aged 65 and over, it is necessary to mention the supportive role of space. This supporting role appears in the literature as the quality of space. For this reason, in the text flow, first of all, the quality of life and space in public interiors will be mentioned, then it will be explained how the socialization parameter, which is the main subject of the study, is reached.

LIFE AND SPACE QUALITY IN PUBLIC SPACE

The concept of quality of life is a complex structure that is directly affected by the environment in which individuals live, including their physical health, personal beliefs, psychological state and social relationships. Studies carried out on the quality of life in public spaces generally appear as urban quality of life. Urban quality of life is the interaction between individuals, the state of the built environment, the basic conditions in the field of health and the perceptions of individuals.

Quality of life in public space is a multi-faceted concept that covers the interaction of the individual with the society he lives in, the places where he spends his time, the social life and the evaluation of his satisfaction with leisure activities. Since studies on quality of life have always been carried out in large-scale and city-oriented open public

DOI: 10.15320/ICONARP.2022.216

spaces, studies have been named as urban life quality in the literature. However, all of them examine the opinions, preferences and certain behavior patterns of individuals who make up the society in a public space.

Factors affecting the quality of life are in a multifaceted interaction. Evans (1994) prepared a theoretical model in order to better understand and analyze this multifaceted structure (Figure 1). In his model, the dimensions of quality of life are included as satisfaction, abilities and biosociophysical environmental factors that form a whole with the social environment. The relationship diagram of the factors affecting this versatile quality of life of Evans is given below.

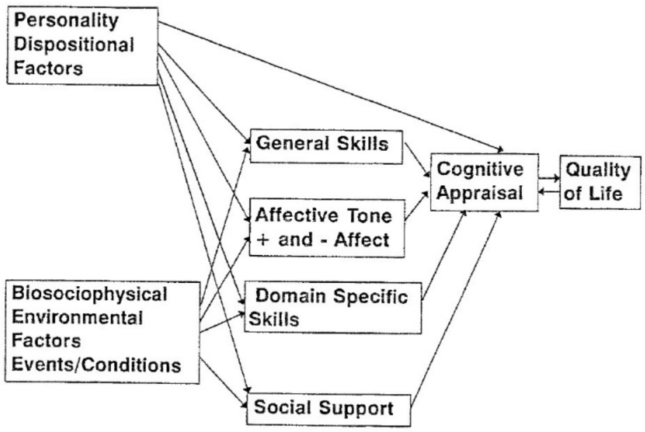


Figure 1. Model of factors affecting quality of life (Evans, 1994).

When this model of Evans is examined and evaluated, it has been observed that the quality of life is affected by the qualities of the space where the person is located. The social environment offered by the space and the opportunities provided by the activities play an important role in the quality of life of the person.

Vitruvius's work "De Architectura", which is still valid today, includes the first interpretations of the concept of quality made over space. Vitruvius determined the criteria of successful architecture with the concepts he determined as "Utilitas, Firmitas, Venustas" (usefulness, durability, beauty) and reduced the concept of quality to the dimension of space. In this way, spaces that are robust, functional and attractively beautiful are defined as quality spaces (Beardsley 1970). Later, many different researchers conducted studies on this subject in public open spaces by examining spatial quality in line with different parameters.

Lynch (1984) focused on the characteristics of a city in his work called 'Good City Form'. In order to measure the quality of the place, it has been determined that the place in question must meet criteria such as vitality, suitability, access to people, activities, resources, places, information and control.

According to Whyte (2000), for public spaces to be successful, they should be accessible, people should engage in various activities, the place should have a comfortable and good image, and it should be places where more social interaction is provided (akt. Uzgören ve Erdönmez, 2017).

PPS (Project for Public Space), which carries out studies on the quality of space in public open spaces, has determined 4 basic qualities related to the quality of space in open public spaces. These are access and connections, comfort and image, use and activities, and sociability.

Gehl (2011) examined the relationship between the quality of physical space and urban space activities, and analyzed the spatial quality with three types of activities to be performed in the space. These are necessary activities, optional activities and social activities.

Mehta defined and classified the diversity of relationships between people in open public spaces in his study titled The Street A Quintessential Social Public Space in 2013.

Table 1. Approaches to the Concept of Space Quality (Additions have been made by using the table source created by Uzgören and Erdönmez (2017)).

Space Quality Components	Quality Parameters	Researchers
Social Interaction	Being suitable places for people to socially interact	Danisworo, 1989; Whyte, 1985, 2000, Gehl, 2002; Mehta, 2014
	Attracts people to engage in activities	Danisworo, 1989; Whyte, 1985, 2000; Mehta 2014
	The emergence of various activities	Rivlin, 1994; Whyte, 2000; CABE and DETR, 2001, Gehl, 2002; Mehta, 2014
Physical Quality	Ability to engage in activities individually or as a group	Rossi, 1982; Gehl, 2002; Mehta, 2014
	Having suitable and informal areas for recreation	Whyte, 1985; Project for Public Space, 2000
	be non-exclusive and democratic	Carr, 1992, Mehta 2014
	Being accessible to people of all social classes and age groups	Gehl, 2002; CABE and DETR, 2001; Mehta, 2014
	Easy access and movement system	Lynch, 1984; Danisworo, 1989; Car, 1992; Rivlin, 1994; Project for Public Space, 2000; Whyte, 2000; Gehl, 2002; CABE and DETR, 2001; Mehta, 2014
	Integration with transportation modes and land use	CABE and DETR, 2001
	Presence of signage and guidance elements	CABE and DETR, 2001
	Adoption of human scale in design	Asihara, 1981; Shirvani, 1985; Mehta, 2014
	Responding to physiological needs and being aesthetic	Rapoport, 1982; Lang, 1994; Whyte, 2000; Gehl, 2004; Pluta, 2003; Mehta, 2014
Psychological comfort and safety	Being safe and secure	Lang, 1994, Gehl, 2002; Mehta, 2014
	Allowing the user to feel comfortable and free in the area	Gehl, 2002

DOI: 10.15320/ICONARP.2022.216

As mentioned earlier, all these exemplary works were carried out in the open public space (Table 1). Considering the studies, the point that is overlooked is that open public spaces have lost their attractiveness to a large extent, especially after the industrial revolution, while the public's interest and orientation to public interior spaces for various reasons is quite high. However, there are very few studies examining the quality of space in public interiors. So, what kind of interactions do active elderly individuals engage in in public interiors? Within the scope of this study, an empirical study was conducted on shopping malls, which are public interiority, to prevent active elderly individuals aged 65 and over from withdrawing into their shells by isolating themselves from the society. In the research, it has been tried to contribute to the literature in this field by focusing on the "suitability of the space for socializing", one of the space quality parameters.

THE RESEARCH AREA, PURPOSE AND METHOD

This study is based on the assumption that active elderly individuals aged 65 and over have an important role of their interactions with individuals in public interior spaces in increasing the quality of life. In order to ensure this interaction, it is thought that the supportive role of public interiors should be investigated. Especially in cold winter months and hot summer days, active elderly individuals aged 65 and over frequently prefer Shopping Centers to spend their time. The opportunities that the place provides for social interaction in shopping centers attract active elderly individuals to that place and determine how long they will spend in that place. For this reason, within the scope of the study, research will be carried out on "socialization and activities in the space", one of the spatial quality parameters whose effect is accepted in many studies by the literature. The social interaction levels of active elderly individuals aged 65 and over in shopping malls and the effect of the space on supporting this socialization will be investigated through Mehta's (2013) classification. The main purpose of the study is to examine the supportive role of the place with the activities carried out in the place in increasing the quality of life of active elderly individuals aged 65 and over and their interaction with other members of the society. For this reason, the study was built on the socialization parameter of space quality and other parameters were ignored.

Research Area

B shopping mall located in Çayyolu locality of Çankaya district of Ankara province was chosen for the field study (Figure 2). While choosing this shopping center, first of all, the districts and districts with the highest population of 65 years and older in Ankara were determined, then in order to narrow the area even more, the areas with the highest education and income levels were searched and this shopping center was reached (Tuik, 2020). Since the management of the Mall where the fieldwork is conducted does not allow the name of the

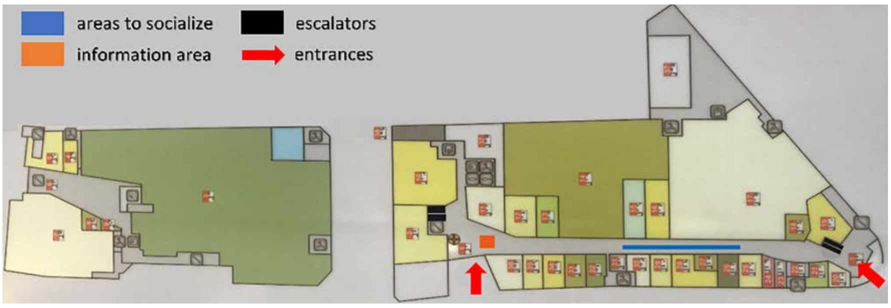
Mall to be included in the study, the Mall where the area is conducted will be referred to as "B Shopping Center" in the following sections.

Figure 2. Satellite Image of B Shopping Mall (Url -2)

Research Method

While creating the method of the research, on-site observation in the space and face-to-face survey with the participants were preferred. In the on-site observation study, the focus was on the common use and resting areas preferred by all users (Table 2).

Table 2. Floor plans of B Shopping Mall, which is the subject of fieldwork



Ground floor plan

1st floor plan

DOI: 10.15320/ICONARP.2022.216

2 st floor plan

3 st floor plan

These spaces include areas defined by large spaces on the 1st floor of the building, which make it possible to organize various activities, which we can call the square of the building, and sitting/resting units formed in a more linear order on the walking axes. In addition, there are areas where small-scale cafes serve common meeting and gathering areas and offer beverage and snack facilities to the user and the areas where the users are crowded in the dining area of the Mall where there are tables and chairs for common use. Because in these areas, there are service units with furniture elements where individuals can sit and rest in large groups, watch the surroundings, read and drink something.

On the ground floor, the back-to-back seating units centered along the walking axis are positioned in such a way that they do not hinder circulation. The seating units here are in a comfortable form with fabric covered and backrest.

On the 1st floor, areas suitable for socializing are located on both sides of the section defined as the square of the building. There are berjer seating units in groups of two and three on one side, and a coffee table in the middle. On the opposite side of the area, there is an area with three or four armchairs and comfortable seating groups consisting of a coffee table between them, equipment suitable for group seating consisting of tables and chairs, and a mixed seating group consisting of a work bench and bar stools.

In addition, there are two each armchairs placed in the form of a strip surrounding the gallery space on the left side of the 1st floor and coffee tables between them. At the right end of this floor, there are seating areas of a cafe designed as an open space without sharp limiting elements.

When it comes to the 2nd floor, there are two each armchairs facing each other, placed in a linear way, around the gallery spaces along the floor, and a coffee table is positioned between them. In addition, in the circulation area on this floor, there are seating units open to access by a cafe. These units consist of double-triple armchair groups facing each other, coffee tables and a sitting/resting unit that can serve multiple sitting in table and chair arrangement.

The shopping mall's dining area is located on the 3rd floor and there are seating units with freely positioned tables and chairs. Again on this floor, on the way to the dining area, two armchairs facing each other are placed in a linear way around the gallery spaces in the circulation areas, and a coffee table is positioned between them.

In all these areas, users and their behaviors were observed and photographs were taken.

In the second step of the study, a survey was conducted with active elderly individuals aged 65 and over, in a face-to-face conversation atmosphere, containing a total of 6 questions, excluding demographic information. While selecting the participants for the research, the criteria of being an active elderly individual aged 65 and over and having visited the B Shopping Center at least once before were taken into consideration. A survey was conducted with a total of 200 active elderly individuals, 100 males and 100 females, using random selection criteria.

The survey questions consist of 2 parts. The questions in the 1st part consist of a total of 3 questions, 2 of which are on a 5-point Likert scale and 1 of which is multiple choice, trying to understand the effect and support of the place on socialization from the user's view.

The questions in the 2nd part were created by using the classification that Vikas Mehta (2013) discussed in 3 groups as passive relationships, temporary relationships and permanent relationships in order to explain the social interaction levels of individuals in his book “The Street A Quintessential Social Public Space”.

The social relationship classification and explanations created by Vikas Mehta to determine the levels of social interaction are given below.

Passive Sociability: People need to be in the same space with other people without direct verbal contact. Mehta (2013) calls this need passive sociability. Passive relationship emerges in the form of non-verbal various behaviors and activities. Being alone in the society, watching and listening to the surroundings and people, reading something, eating and drinking are examples of these behaviors. As Milgram (1977) stated, passive sociability is a shared human interaction between strangers and familiar strangers (as cited in Mehta, 2013).

Being alone in society is a social behavior. People seek out places to be alone in public places where others are present, even if they do not intend to directly interact with or participate in any active social behavior. Perhaps it is reassuring to be able to hear other people's voices speaking or to see the activities of individuals and to feel part of a larger community. Bystanders are one of the most common passive behaviors in public. Public interiors are also important places where active elderly individuals can mix with the society in order to see, be

DOI: 10.15320/ICONARP.2022.216

seen, feel belonging and relax. All these behaviors and activities mean passive sociability and sometimes encourage temporary socialization (Mehta 2013).

Fleeting Sociability: Public spaces can lead to casual encounters, small conversations with acquaintances or brief, low-intensity contact as a result of these encounters. These encounters do not always have to be with acquaintances. While sitting and resting in an area, it can also occur in the form of instantaneous and witnessed images and events in the space with those sitting at the next table.

As Mehta (2013) mentioned in her study, chance encounters in public spaces create various opportunities for short-term, low-intensity contacts among visitors. These short, temporary contacts create casual and relatively simple easy interactions with other people. However, it is also suggested that these short-term, low-intensity contacts or weak ties are possible beginnings of deeper and enduring social interactions and participation between people (Mehta, 2013). Jacobs (1961) argues that, thanks to repeated short-term contacts, people begin to trust other users of public spaces who might otherwise be complete strangers (cited in Mehta, 2013).

A brief verbal exchange, such as waving to a familiar neighbor, a familiar face, pausing for a chat, a simple response with a nod or a smile, or asking for the time, are all temporary signs of sociability. Children, especially younger ones and pets lead to visual and verbal exchanges and even pleasant conversations between adults (Mehta, 2013).

Shows prepared for special occasions in public interiors, concerts, activities organized for the advertising and sale of any product, workshops that can be organized for a certain time interval, provide numerous opportunities for people to participate in such events, usually hoping to interact with others. This can happen not only with the activity to be organized, but also with the fiction and design of the space allowing such actions and activities. This situation occurs in the common resting, eating and drinking areas of public interior spaces.

Enduring Sociability: People may not come to public spaces solely to seek long-term relationships, but for many, the public space is a space to actively connect with friends or a group of communities, and Mehta (2013) termed this as enduring sociability. Enduring sociability includes close relationships and connections between people, which include meaningful interactions for both parties. The purpose of public interior design should be to create opportunities to support people's ability to interact with other individuals (family member, friend, acquaintance or stranger) at all levels, including meaningful associations.

Enduring sociability depends on more frequent and repeated contacts between individuals. In doing so, people spend their time and emotional energies finding or creating conditions that foster enduring sociability. One of these conditions is a suitable space to meet and communicate. Enduring sociability requires much more than space compared to passive and fleeting sociability. First of all, the space should provide physical conditions and an environment suitable for meeting. Secondly, the rules of the space should allow both casual and serious interactions (Mehta, 2013).

Mehta (2013) mentions that enduring sociability can develop from fleeting or passive sociability and gain continuity over time. The realization of this situation for active elderly individuals is a big step for them to bond with the society, feel a sense of belonging, not marginalize themselves and spend more time in these places.

In the light of this information, the face-to-face survey study conducted with active individuals aged 65 and over in the 2nd step of the study method was constructed using the passive sociability, fleeting sociability and enduring sociability classification created by Mehta. Three questions were directed to the users for the shopping mall in question, and users were asked to rate each of the questions from 1 (I strongly disagree) to 5 (Totally Agree). With these questions, it was tried to determine the social interaction levels of individuals over the age of 65 in the said space.

DATA ANALYSIS, CASE STUDY, DISCUSSION

In the first step of the study, areas that will allow active elderly individuals aged 65 and over to socialize in B Shopping Center were observed and photographs were taken.

Figure 3. Living/resting units located on the ground floor of B shopping mall

In Figure 3, the living/resting unit located on the ground floor is shown. It is thought that passive sociability is supported by the preference of back-to-back seating, which can only be found on this floor in the building. In terms of its organizational form, it does not allow the opposite.

DOI: 10.15320/ICONARP.2022.216

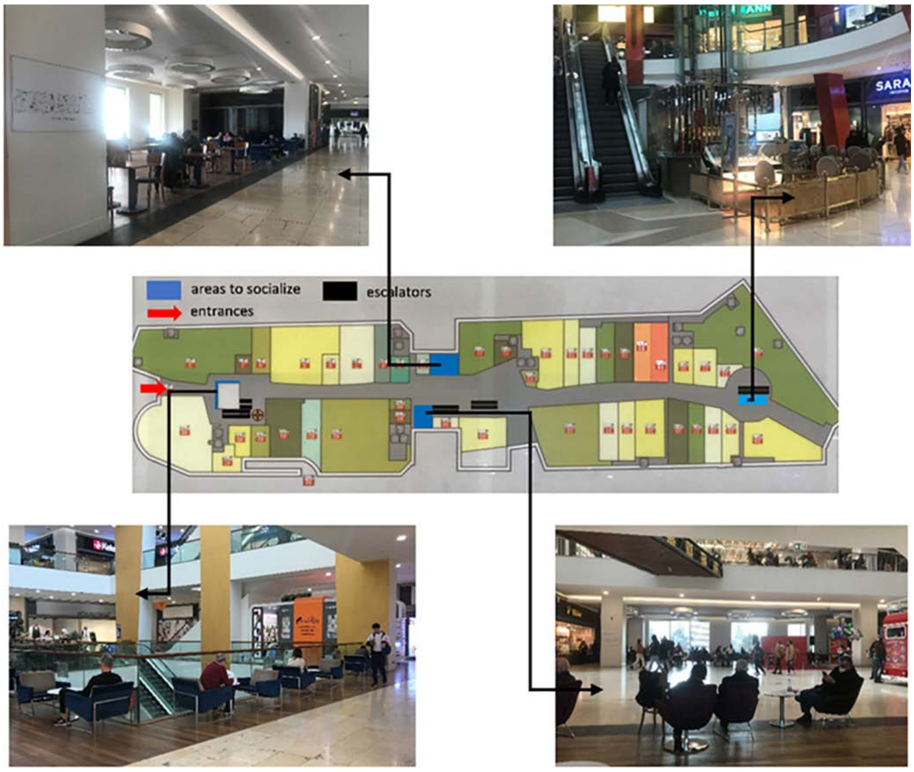


Figure 4. Living/resting units located on the 1st floor of B shopping mall

Figure 4 shows the areas where the shopping mall can be used for gathering, sitting/resting, eating and drinking, and performing any performances and concerts. In the observations, it has been determined that especially individuals over the age of 65 use this area, which is located in the square of the place, for reading newspapers, resting and watching the passers-by. In fact, as can be seen in the image, it has been determined that active elderly individuals sit by turning their seating units so that they see the circulation and circulation area and watch people just like sitting on a bench in the public open space and watching the people passing by. In this area, there are toys and a sightseeing bus for families with children/baby to spend time. It has been observed that elderly individuals often attempt to initiate conversations with these families and their children. The said area is the area on the 1st floor of the venue, which we can define as the largest common area or even the square of the venue, and where the most seating units are located for individuals to rest. When an activity is desired to be carried out in the mall, this is the place that will offer the best space for the activity, considering the current space conditions such as the size of the area, level of visual access, and location. On one side, there are berjer seating units in groups of two or three and a coffee table in the middle. On the opposite side of the area, there is an area with three or four armchairs and comfortable seating groups consisting of a coffee table between them, equipment suitable for group seating consisting of tables and chairs, and a mixed seating group consisting of a work bench and bar stools.

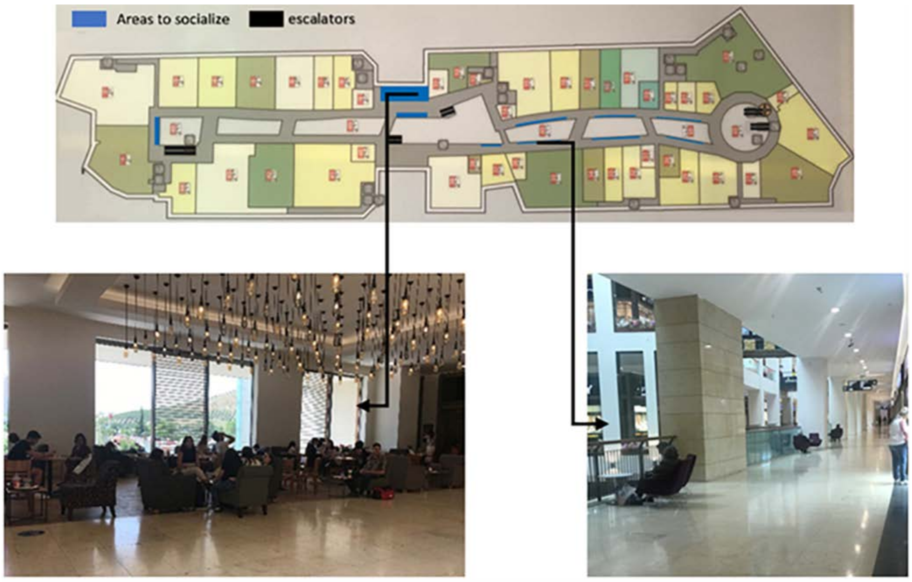


Figure 5. Living/resting units located on the 2 st floor of B shopping mall

Although the sitting/resting units located in the relatively narrow circulation areas on the other floors are not as dense as the rest area on the 1st floor, it has been observed that active elderly individuals spend time in passive sociability in these areas (Figure 5).

On the 1st, 2nd and 3rd floors, the sitting units grouped with two opposing berjers located around the gallery spaces are of a quality that can be used by the active elderly people to spend time away from the density of people and to spend time alone (Figure 5). The living/resting units located here are not very defined in terms of location and are insufficient in number compared to the size of the area where they are located. It supports passive socialization.

On the dining floor, there are units that are more suitable for eating activities than resting or socializing (Figure 6).

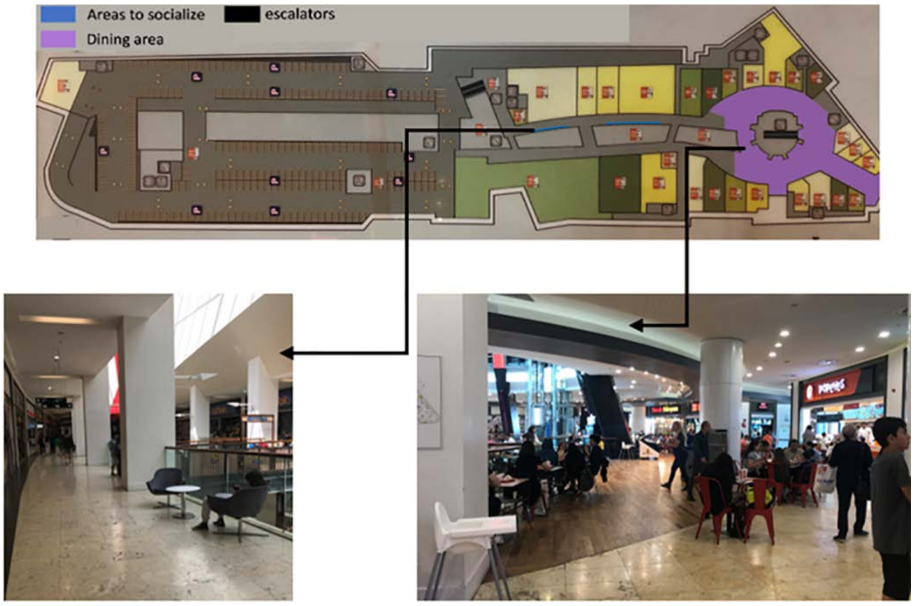


Figure 6. Equipment for living/resting and dining on the 3rd floor of B shopping mall

DOI: 10.15320/ICONARP.2022.216

In the second step of the study, as a result of the face-to-face survey conducted with active elderly individuals aged 65 and over, findings about the users' evaluations of the space and the level of interaction in the space were obtained.

Table 3. The survey section that includes the personal information of the participants and the evaluation questions about the shopping mall.

		Woman		**Man**		**Total**	
	Age	Number of people	percent	Number of people	percent	Number of people	percent
Your Age	65-69	51	51	49	49	100	50
	70-74	30	30	25	25	55	27,5
	75-80	14	14	19	19	33	16,5
	80+	5	5	7	7	12	6
	Total	100	100	100	100	200	100
		Woman		**Man**		**Total**	
		Number of people	percent	Number of people	percent	Number of people	percent
In this mall, activities are organized to encourage socializing with other people.	1 (I strongly disagree)	29	29	27	27	56	28
	2	13	13	20	20	33	16,5
	3	16	16	18	18	34	17
	4	9	9	12	12	21	10,5
	5 (Totally agree)	33	33	23	23	56	28
		Woman		**Man**		**Total**	
		Number of people	percent	Number of people	percent	Number of people	percent
There are enough and wide common areas for different activities that will encourage socialization in this shopping mall.	1 (I strongly disagree)	37	37	24	24	61	30,5
	2	15	15	12	12	27	13,5
	3	15	15	27	27	42	21
	4	15	15	18	18	33	16,5
	5 (Totally agree)	18	18	19	19	37	18,5
		Woman		**Man**		**Total**	
Have you participated in any previous activity held at this venue? (concert, exhibition, small-scale show, etc.) please explain.		Number of people	percent	Number of people	percent	Number of people	percent
	Yes	43	44,8	26	27,7	69	36,3
	No	53	55,2	68	72,3	121	63,7

50% of active elderly individuals aged 65 and over participating in the research are female and 50% are male. 50% of the participants are 65-69 years old, 27.7% 70-74, 16.5% 75-80 and 6% over 80 years old. Participants were asked to evaluate the statement "There are activities that encourage socializing with other people in this mall" by giving a score from 1 (I do not agree at all) to 5 (I completely agree). 28% of the participants stated that they never agreed with this statement, 16.5% did not agree, 17% neither agreed nor disagreed, 10.5% agreed and again 28% completely agreed (Table 3). While 44.5% of the participants stated that they strongly disagree or disagree with this statement, the percentage of those who agreed and completely agreed constituted a total of 38.5%. The users, who make up 17%, evaluated the place with 3 points corresponding to the statement of neither agree nor disagree, and it was revealed that they were indifferent and undecided against this judgment. This situation can be interpreted as the fact that there is no activity organized in the place to provide an environment for interpersonal interaction and socialization. If it were otherwise, the individual would not fall into this indecision and would evaluate the space with 4 or 5 points.

When the participants evaluated the statement, "There are sufficient and wide common spaces for different activities that will encourage socialization in this shopping mall.," 30.5% strongly disagree, 13.5% disagree, 21% neither agree nor disagree, 16.5% agreed, and 18.5% completely agreed answered as (Table 3). While the total rate of those who think that common areas are sufficient for different activities that will encourage socialization is 35%, the total rate of active elderly users who think that they are not enough is 65%. In line with the observations made by the researcher, it has been determined that there are not enough and wide common areas for different activities that will encourage the socialization of the users for the shopping center in question. The opinions of researchers and users are in the same direction.

The observations made in the field also support the results of the two questions above. The existing space size is not spatially wide enough to support different and various activities in the space. Existing areas that can be used for such activities are not well organized and designed. The venue is dense in terms of the number of active elderly users. However, a large area in the square of the place remained unorganized and undefined. In addition, there was no activity program organized as weekly or monthly programs in the venue.

“Have you participated in any previous activity at this venue? Please explain (concert, exhibition, small-scale demonstration, etc.)”, statement while 36.3% of the participants answered yes, while 63.7% answered no (Table 3). Most of the participants who answered no stated that they did not come across such an activity or that they did not see an activity that interested them. Participants who answered yes mostly stated that they either came to an activity for their grandchildren or saw them passing by. Few of them talked about concerts, music concerts and dance performances that would correspond to a real participation. This can be interpreted as the fact that the activities that offer the user the opportunity to interact in the space are not performed at a sufficient level.

In the second stage of the questionnaire, questions were asked to the active elderly individuals aged 65 and over who participated in the research to determine their social interaction levels in the space. Findings related to the questions are given in Table 4.

DOI: 10.15320/ICONARP.2022.216

Table 4. The survey section that includes evaluation questions about the social interaction levels of the participants.

		Woman		***Man***		**Total**	
		Number of people	percent	Number of people	percent	Number of people	percent
This space allows me to come and spend time alone, have a drink, read a book or newspaper, sit and watch people (Passive sociability).	1 (I strongly disagree)	25	25	26	26,3	51	25,5
	2	8	8	8	8,1	16	8
	3	14	14	11	11,1	25	12,6
	4	15	15	20	20,2	35	17,6
	5 (Totally agree)	38	38	34	34,3	72	36,2

		Woman		**Man**		**Total**	
		Number of people	percent	Number of people	percent	Number of people	percent
This space allows me to meet and establish relationships for a short time, such as greeting people I do not know or only familiar with, participating in activities offered by the space (music concert, exhibition, etc.)(fleeting sociability)	1 (I strongly disagree)	32	32	25	25,3	57	28,6
	2	12	12	8	8,1	20	10,1
	3	13	13	20	20,2	33	16,6
	4	15	15	28	28,3	43	21,6
	5 (Totally agree)	28	28	18	18,2	46	23,1

		Woman		**Man**		**Total**	
		Number of people	percent	Number of people	percent	Number of people	percent
This space allows me to establish long-term relationships with my friends and acquaintances, such as meeting, sitting, chatting, eating in a planned manner (Enduring sociability).	1 (I strongly disagree)	23	23	28	28,3	51	25,6
	2	4	4	6	6,1	10	5
	3	6	6	11	11,1	17	8,5
	4	22	22	24	24,2	46	23,1
	5 (Totally agree)	45	45	30	30,3	75	37,7

When the participants were asked to evaluate the statement "This place allows me to come and spend time alone, have a drink, read a book or newspaper, sit and watch people" for the B Shopping Center, 25.6% participants strongly disagree, 8% disagree, 12.6% of them neither agreed nor disagreed, 17.6% agreed and 36.2% completely agreed as answered (Table 4). It has been determined that the total percentage of active elderly users aged 65 and over who agree and fully agree with this judgment is 53.8%, and it has been determined that more than half of the study participants use the shopping mall for passive socialization. The answers to this question are consistent with the observations made.

When the participants were asked to evaluate the statement "This place allows me to establish short-term acquaintances and relationships, such as greeting people with whom I do not know or only familiar with, and participating in the activities offered by the space," 28.6% completely disagreed 10.1% disagreed 16.6% of them neither agreed nor disagreed, 21.6% agreed and 23.1% completely agreed answered as. When looking at the general distribution, the total percentage of those who say they strongly disagree, do not agree and neither agree nor disagree is 55.3%, while the total percentage of those who say they agree and completely agree is 44.7%. This result supports the findings obtained from the statement "Activities that will encourage socializing with other people are organized in this shopping mall" in the questionnaire. The answers to both questions prove that the space does not support fleeting sociability.

For Participants' B Shopping Center; When asked to evaluate the statement “This space allows me to establish long-term relationships with my friends and acquaintances, such as meeting, sitting, chatting, eating in a planned manner,” stated that 25.6% strongly disagreed, %5 disagreed, 8.5% they neither agreed nor disagreed, 23.1% agreed and 37.7% completely agreed indicated as. While the total of those who strongly disagree and do not agree with this view is 30.6%, the total of those who agree and fully agree is 60.8%. It has been revealed that more than half of the active elderly individuals participating in the study use the shopping mall for enduring sociality. In addition, they constitute almost twice as many of those who do not support this judgment. The observation by the researcher that active elderly individuals aged 65 and over interact for a long time in groups of 2-3 people in the space also supports the finding obtained from this question.

CONCLUSIONS

Evidence from research on the relationship between human behavior and the physical environment shows that the physical characteristics and spatial relationships of a space can have a significant impact on where and when social interaction occurs and, when it does, on the efficiency of social interaction (Steinfeld 1972: 4). While people are looking for spaces to socialize, the possibilities offered by the space significantly affect their choices. Especially for active elderly individuals aged 65 and over, the attractiveness of the place may be directly related to the opportunity for interaction and activity options that it will offer. It is very important for people in this age group to be able to live in harmony without breaking their ties with the society, in increasing their quality of life.

As can be seen as a result of the study, active elderly individuals aged 65 and over use shopping mall spaces especially for passive and enduring socialization. However, they find the physical space that will provide them with the variety of activities and socialization opportunities that the place offers them insufficient. In addition, it has been shown that the equipment and organizational forms in the physical area are chosen as repetitive elements, away from the consciousness of both supporting socialization types and thinking about the relaxation action of the user. It is important to design public interior spaces with physical places where the best possible interaction and socialization can take place, which will support increasing the quality of life of active elderly individuals aged 65 and over. For this reason, the common use areas to be designed considering the necessity of all types of socialization activities, especially in areas where this age group is high,

DOI: 10.15320/ICONARP.2022.216

should be designed as large enough, transformable areas that can serve a large number of users and organizing activities of different sizes.

Carr et al., (1992) states that Spaces are proposed, constructed and evaluated with assumptions about what should be done in them. He says these assumptions are based on the goals of space designers, clients, and venue managers, and either ignore the needs of older adults or fail to address the ways public places serve those needs. However, even when considered only from a customer focus, it is essential to develop designs and programs considering the needs and requirements of all user types in order to keep the priority of being preferred among the increasing number of shopping malls. The applications to be made for the active elderly users aged 65 and over will not only nurture them in the direction of socialization, but also enable them to spend more time in the place and provide income for the property in terms of consumption. With the activities to be organized, workshops, shows, and the spatial features that allow these activities, both active elderly individuals aged 65 and over can use these spaces more effectively, and these individuals can be intertwined with the society and socialized. As Layne (2009) puts it, “Society is about groups of people interacting collectively to create stories that are mutually shared, mutually understood, and mutually passed on to future generations.”

ACKNOWLEDGEMENTS/NOTES

This article was produced by Res Asst. İmran KAVAZ ALTUN from her doctoral thesis under the supervision of Prof. Bilge SAYIL ONARAN, at Hacettepe University, Department of Interior Architecture and Environmental Design.

REFERENCES

Beardsley, M. C. (1970). The aesthetic point of view. Metaphilosophy, 1(1), 39-58.

Bechtel, R. (2000). Assumptions, Methods and Research Problems of Ecological Psychology. S. Wapner, J. Demick, T. Yamomoto, & H. Minami içinde, Theoretical Perpectives in Environment- Behavior Research: Underlying Assumptions, Research Problems and Methodologies (s. 61-66). New York: Kluwer Academic/Plenum Publishers.

Carr, S., Francis, M., Rivlin, L.G., and Stone, A.M. (1992). Public Space, Cambridge: Cambridge University Press.

Erdönmez, M. E., & Akı, A. (2005). Açık kamusal kent mekanlarının toplum ilişkilerindeki etkileri. Megaron, 1(1), 67.

Evans, D. R. (1994). Enhancing quality of life in the population at large. Social indicators research, 33(1), 47-88.

J, Gehl. (1987, 2011) Life Between Buildings: Using Public Space, Arkitektens Forlag, Copenhagen.

Güney, Z. (2007). “Kamusal Alan Nedir? Kamusal Mekan Nedir?” 25 Ekim 2007. (www.arkitera.com/h21487-kamusal-alan-nedirkamusal- mekan-nedir.html)

Gürallar Yeşilkaya, N. 2009. Kamu – Kamusal Alan – Kamu Yapıları – Kamusal Mekân: Modernite Öncesi ve Sonrası İçin Bir Terminoloji Tartışması. Mimarlık Dergisi, (350), 52-55.

Kaplan, M. (1990). Designing Community Participation Special Events that Cross Generational Boundaries. Proceedings of the 21 st Annual Conference of the Environmental Design Research Association, 120-128.

Kaplan, M. (1991). Neighborhoods-2000: An Intergenerational Urban Studies Curriculum (Guidebook for Teacher). New York: Center for Human Environments: CUNY Graduate Center (Sponsored by the Mount Vernon Youth Bureau).

Kaplan, M. (1994, mart). Promoting Community Education and Action through Intergenerational Programming. Children's Environments, 11(1), 48-60.

Kaplan, H., & Öztürk, M. (2004). Engelliler, kamu mekânı ve engelsiz tasarım: Kamusal iç mekânlarda irdelenmesi için bir çerçeve. Planlama Dergisi, 2(4), 67-74.

Layne, M. R. (2009). Supporting intergenerational interaction: Affordance of urban public space. Doctoral dissertation, North Carolina State University, Raleigh, NC.

Lynch, K. (1984). Good city form. MIT press.

Mehta, V. (2013.) The Street. A Quintessential Social Public Space. Florence Production Ltd, Stoodleigh, Devon, UK.

Montross, L. P., Depp, C., Daly, J., Reichstadt, J., Golshan, S., Moore, D., ... & Jeste, D. V. (2006). Correlates of self-rated successful aging among community-dwelling older adults. The American Journal of Geriatric Psychiatry, 14(1), 43-51.

Project for Public Spaces (2000) How to Turn a Place Around: A Handbook of Creating Successful Public Spaces, New York: Project For Public Space.

Sağlam, A. İ., Öztürk, A. Ç., & Kaçar, A. D. (2019). Türkiye'de Kamusal Mekânın Gelişimi. ATA Planlama ve Tasarım Dergisi, 3(1), 47-58.

Steinfeld, E. H. (1972). Physical planning for increased cross-generation contact. University of Michigan.

Tanyeli, U. (2010). Türkiye'nin Görsellik Tarihine Giriş. Metis Yayınevi, İstanbul.

TUIK, 2020. Ankara ili Adrese Dayalı Nüfus Kayıt Sistemi Yaş Grubu Ve Cinsiyet Ayrımında Belediye Mahallelerinin Nüfusları. https://www.tuik.gov.tr/Kurumsal/Bilgi_Edinme

Url -1 Active Ageing A Policy Framework. [http://whqlibdoc.who.int/hq/2002/WHO_NMH_NPH_02.8.pdf] adresinden 18/04/2012 tarihinde erişilmiştir

Url-2 . https://yandex.com.tr/harita/11503/ankara/?l=sat&ll=32.697992%2C39.898040&z=15

Uzgören, G., & Erdönmez, M. E. (2017). Kamusal açık alanlarda mekan kalitesi ve kentsel mekan aktiviteleri ilişkisi üzerine karşılaştırmalı bir inceleme. Megaron Dergisi, 12(1), 41-56.

WHO (2002). Active Ageing: A Policy Framework, World Health Organization, Geneva.

Yıldırım, B. (2015). Kamusal Mekan: Türkiye'de Devlet ve Kamusal Alan Üzerine. Mimarlık, 382, Mart-Nisan, 45-49.

Resume

İmran KAVAZ ALTUN graduated from Hacettepe University, Department of Interior Architecture and Environmental Design in 2011. She completed her

DOI: 10.15320/ICONARP.2022.216

master's degree at Karadeniz Technical University, Department of Interior Architecture in 2017. She has been a PhD student at Hacettepe University, Department of Interior Architecture and Environmental Design since 2018. In the same year, she started to work as a research assistant at Hacettepe University. She is still working at Hacettepe University.

Bilge Sayıl Onaran is a professor at Hacettepe University, Department of Interior Architecture and Environmental Design. Her research continues in the fields of social and human sciences, restoration, restitution, technology and society.

ICONARP
International Journal of Architecture and Planning
Received: 13.08.2022 Accepted: 23.09.2022
Volume 10, Issue 2/ Published: 20.12.2022
Research Article
DOI: 10.15320/ICONARP.2022.217 E- ISSN:2147-9380
ICONARP

What Fundamental Indicators Should Be Used to Measure the Change in the Historic Urban Landscape Approach?

A. Balin Koyunoğlu *
Nuran Zeren Gülersoy**

Abstract

Historic Urban Landscape (HUL) identifies an urban area due to its cultural and natural values and the qualities of its historical plane. Within this context, this article aims to determine and categorize these values used in the HUL approach as indicators. The research question focuses on finding specific indicators used in the HUL approach to measuring change beyond considering natural and cultural heritage values in the landscape context. These indicators in 228 peer-reviewed publications implementing the HUL from 2008 to 2021 are assessed. The six-step inclusive and exclusive theoretical framework is established as a method in this article to detect the inadequate implementations of HUL in case studies. The initial finding of this article is that the adequacy of using the HUL approach in publications is questionable as the implementation of the HUL approach processes was incomplete or misunderstood in most of them. Only 29 articles of the 228 publications implemented the HUL approach in its entirety. The other finding is that when the change measurement indicators in the HUL approach are examined, it is evident that natural indicators were the least used group compared to cultural and identity indicators. Each cultural, natural, and identity indicator group should be utilized evenly to implement the HUL approach adequately. This article presents a fundamental indicator list that includes cultural, natural, and identity groups for correctly using the HUL approach.

Keywords:
Heritage indicators, historic urban landscape, landscape context, limits of change

*City and Regional Planning Doctorate Program, Institute of Science and Technology, Istanbul Technical University, Istanbul, Turkiye. (*Corresponding author*)
Email: balinozcan@gmail.com or koyunoglua15@itu.edu.tr

** Professor, Faculty of Art, Design and Architecture, Department of Architecture, FMV Isik University, Istanbul, Turkiye.
Email: zeren.gulersoy@isikun.edu.tr

To cite this article: Koyunoglu, A.B., & Zeren Gülersoy, N. (2022). What Fundamental Indicators Should Be Used to Measure the Change in the Historic Urban Landscape Approach?. *ICONARP International Journal of Architecture and Planning,* 10 (2), 596-613. DOI: 10.15320/ICONARP.2022.217

INTRODUCTION

The landscape is an archive of layers of the history of interaction between humankind and nature. The meaning of landscape refers to the natural and cultural characteristics of an area as a whole. The definition of the landscape can have diverse meanings in different languages, disciplines, and approaches. "Landscape" is the instruments and processes of identification, conservation, and promotion of outstanding cultural heritage sites with an integrative cross-border in the European Landscape Convention (EU, 2000). This convention provided collective and holistic content in the landscape context. This content has induced the landscape to be considered a tool in conservation studies to make cultural, natural, and identity studies together.

According to an area's natural and cultural characteristics, the landscape can be examined in two subtopics: natural and cultural landscapes. The natural landscape consists of a collection of landforms not created by humans: forestlands, wetlands, mountains, vegetation such as tundra, mangroves, and all topography.

Different disciplines, including geographers, conservation organisations, and historians, define the cultural landscape. In UNESCO's World Heritage Cultural Landscapes 1992 publication, "cultural landscape" represents the change in human society and settlements throughout time and recognised characteristics (UNESCO, 1992). The term cultural landscape refers to a complex and productive concept that includes the physical environment and the cultural and social meanings that create a sense of belonging to a place. The cultural landscape was also considered the tangible reflection of human practices, needs, and beliefs related to the natural landscape and was regarded as an essential factor in ensuring the continuity of daily life (Melnick, 1984; Fowler, 2003).

UNESCO also defined the concept of the cultural landscape as the reflection of the joint work of nature and humankind (1992). Cultural landscapes are formed according to the mutual interaction between culture and nature that shapes the physical environment and includes a contemporary landscape. The cultural landscape consists of three main categories: "Human designed and created landscapes," "organically evolved landscapes," and "associative cultural landscapes" (UNESCO, 2008). Human-designed and created landscapes are samples of urban landscape configurations on various scales, from historic settlements to small formal gardens. An organically evolved landscape mainly refers to rural aspects of cultural landscapes. Associative cultural landscape refers to indigenous tracks on the landscape and historical and spiritual interpretations of landscapes.

After establishing the cultural landscape context in conservation literature in 2011, the Historic Urban Landscape (HUL) approach introduced the urban landscape as a conservation tool in historic environments (Martinez, 2017; Von Oers, 2014; UNESCO, 2011). It reconceptualised the urban landscape as a dynamic complex

DOI: 10.15320/ICONARP.2022.217

environment where "change can occur at different intervals and levels and with different magnitudes" (Bandarin & Von Oers, 2012, p. 143). HUL, therefore, consists of an evolving system that changes over time, including multi-dimensional indicators that define the layers of a landscape.

The inadequacy of conservation approaches against the dynamism of the historic urban environments led to reconsidering the conservation methodologies to adapt them to the rapidly changing elements in the urban context (Rodwell, 2018). Therefore, urban conservation through change management has become an essential topic in natural and cultural conservation (Yang et al., 2019; Martinez, 2017). The challenge was to sustain authenticity by establishing "the limits of change" or "the level of acceptable change" according to heritage values (Bandarin & Von Oers, 2012). These discussions led to the emergence of new landscape conservation content where historic urban landscapes with a comprehensive approach to natural, cultural, intangible, and historic heritage became crucial to establish the limits of acceptable change.

Consequently, in 2010, UNESCO proposed the urban landscape approach, which was used to define, protect, and manage historic urban areas and determine their values (2010). The urban landscape approach should be extended to cover a much broader context that includes physical forms and their interactions, spatial organisation, natural features, and their relationship with the development of the settlement type, as well as cultural and social values. Later in 2011, UNESCO defined the concept of HUL as a historical layering of cultural and natural values and attributes. This definition included the natural attributes of the city, such as its topography, geomorphology, and hydrology; the historic and modern settlements; the infrastructure above and below ground; the open areas and gardens; the methods of land use and area organisation; the perceptions and visual relations, and all other elements of the urban structure (UNESCO, 2011, Article 9).

This article evaluates HUL literature based on the indicators used to measure the change in the historic urban environment. Landscape content in the literature was first analysed to determine the HUL approach indicators. Secondly, research involving case studies was systematically analysed to categorise the indicators. Then, distribution analyses of these indicators were made according to the HUL steps followed by the researchers and their research objectives. Finally, the indicators used to measure changes in the HUL approach implementation were listed. The methodology of the articles is constructed on a six-step inclusive and exclusive theoretical framework that is utilised to eliminate inadequate publications for this article. As a result, this article proposes a fundamental data set to understand the historic city's landscape as defined in the HUL Recommendation.

EXAMINING THE CONTENT OF THE HISTORIC URBAN LANDSCAPE APPROACH FOR MEASURING CHANGE

Particular articles in the HUL Recommendation are a continuation of earlier historic urban conservation approaches, while others describe the original nature of this approach. Articles that are a continuation of the earlier historic urban conservation approach emphasise the natural and cultural heritage connection and the importance of geographical setting. Article 5, which is based on the relational principle among the physical forms of the urban contexts, mentions "the spatial organisation and connection, their natural features and settings, and their social, cultural and economic values." It suggests searching for creative combinations of different landscape forms to activate new urban dynamics (UNESCO, 2011). Additionally, Article 8 defines the historic urban landscape as a metropolitan area that is the result of a historical layering of cultural and natural values and attributes which extend beyond the notion of a "historical centre" or "ensemble" (UNESCO, 2011).

These descriptions indicate that the requirements of the broader urban context and geographical settings should be considered in conservation practices. Tryzna mentions the necessity of considering natural and cultural components and the broad content defined for conservation together (2017). For this integration, joint studies of ICOMOS and IUCN were started. These collaborative studies aim to define new methods and strategies for recognising and supporting the corresponding character of landscapes' natural, cultural, and social value (IUCN & ICOMOS, 2017). This joint study also supports the ideas of the Urban Protected Areas Guide, which states that the conservation of natural heritage in cities can only be maintained by including cultural aspects of urban areas (Edmiston et al., 2014). Based on their characteristics and status, natural areas should be made accessible for daily usage to integrate cultural aspects (Edmiston et al., 2014). With this access, the interconnected nature of the urban landscape is demonstrated to conserve natural areas, and these areas have become more adaptable to change.

The original nature of the HUL approach is that it focuses on change and the management of change. This change is emphasised in Article 11 of the Recommendation to preserve "the quality of the human environment, enhancing the productive and sustainable use of urban spaces, while recognising their dynamic character, and promoting social and functional diversity" (UNESCO, 2011). To Article 26 of the Recommendation, it is inevitable "to document the state of urban areas and their evolution, facilitate the evaluation of proposals for change, and improve protective and managerial skills and procedures" (UNESCO, 2011). The skills to document the state and the evolution of a historic environment and determine the indicators that serve to comprehend landscape context became the main objectives of a guideline published after the Recommendation (WHL & UNESCO, 2019). Theoretical

DOI: 10.15320/ICONARP.2022.217

research and case studies were included in this guideline. The guideline is an essential reference for researchers to utilise the HUL approach.

ANALYSING THE HUL IMPLEMENTATION PROCESS WITH THE SELECTED CASE STUDIES

After the HUL approach was adopted, more research was used to examine its implementation. This part of the article focuses on content analysis of the HUL, primarily on the theoretical categorisation of indicators used in case studies. Content analysis was utilised to organise and elicit meaning from the data collected from HUL-related topics and to draw realistic conclusions from it (Bengtsson, 2016). Given the innovative and flexible nature of the HUL approach, this categorisation aims to reveal and discuss how indicators are adopted in this approach.

A systematic evaluation of peer-reviewed publications was analysed in international journals between 2008- 2021 to categorise the HUL indicators available in databases such as Scopus and Google Scholar. The term HUL started to be published in 2008 within the scope of the content discussed in this article. By searching for "Historic Urban Landscape" in titles, abstracts, and keywords, 322 potential publications were identified. Repetition in publications was removed, leaving 228 publications. A theoretical framework for elimination was constructed for the aim of this article. According to this elimination methodology, six inclusion and exclusion criteria were applied to the publications. The first criterion references "historic urban landscape" in the title, abstract, and keywords. The second is online accessibility, either open source or accessible through the İstanbul Technical University network. The third criterion excludes books without an academic index or conference proceedings and includes peer-reviewed journals and scholarly book chapters. The fourth criterion is to be written in English. The fifth is to have a case study in the research. The last criterion concerns applying the HUL approach and its competence. Therefore, publications that misused the HUL approach were excluded.

Similar studies were encountered while conducting a literature review and establishing the methodology. For the inclusion and exclusion criteria determination, Rey Perez and Pereira Roders' elimination methodology provided valuable insight for this article (2020). Similarly, the inclusion/exclusion criteria were determined in both studies. However, since the objectives of both studies are different, the content of each criterion is also different. Firstly, this study's elimination methodology is utilised whether HUL implementation includes a case study. If it consists of a case study, the aim is to analyse whether cultural, natural, and identity indicators were used in case studies or not. In addition to these two differences, the interval in which the literature review was conducted is also different. After applying the first four inclusion-exclusion criteria, 169 articles out of 228 publications remain.

The remaining publications were subjected to another elimination to see if a case study had covered them. Eighty-nine publications include case studies (the fifth criterion). Of these 89 publications, 29 included relevant HUL research and understood the HUL approach. Some excluded publications have case study implementations similar to the HUL approach but no reference to the Recommendation (Taha, 2014; Siravo, 2015). Some correctly refer to the HUL approach, but their focus shifted in the implementation phase (Psarra, 2018; De Medici et al., 2018; Berg, 2018; Moertiningsih et al., 2020; Garau, 2020; Hussein et al., 2020; Dhingra & Chattopadhyay, 2021; Kashihara, 2021; Klingmann, 2021; Giuliani et al., 2021). The 29 remaining publications reference the Recommendation, comprehend the approach, implement it in some cases, and develop proposals to improve implementation. After the determination of 29 publications, each publication was reviewed according to an implementation process described within the HUL approach. This process is summarised in six steps: mapping, consensus, vulnerability, integration, prioritisation, and partnership (Bandarin, 2014; Rey Perez & Pereira Roders, 2020; Pintossi et al., 2021 a; Pintossi et al., 2021 b).

The implementation of the six-step process in the HUL approach is analysed for the 29 remaining publications. The first "mapping" and third "vulnerability" steps are examined separately because, in these steps, case studies are analysed for spatial change. "Mapping" overlays natural, cultural, and social resources. "Mapping" assists researchers in combining and interpreting distinct heritage resources. The third step, "vulnerability," is used to determine changes and the reasons that trigger the changes. The first step of the HUL, "mapping", was not applied to 6 case studies (Bonadei et al., 2017; Ji et al., 2020; Muminovi et al., 2020; Pintossi et al., 2021a; Pintossi et al., 2021b). The third step, "vulnerability," was not implemented in 2 case studies (Yang et al., 2019; Ji et al., 2020). The third step, "vulnerability," is the most applied. This distribution within the steps may indicate that the HUL approach is used to understand "limited change," as emphasised.

After understanding the distribution of the six-step process of the HUL approach among case studies, the publications that implement the first and third steps were selected for the subsequent analysis of this article. Thus, it was ensured that all the remaining publications had done at least one case study and represented a measurement of change. 21 out of 29 publications remain. The remaining 21 publications have distinct research aims implementing the HUL approach in 29 case studies. According to these specific research aims, these publications address various natural, cultural, and identity indicators on different scales.

DOI: 10.15320/ICONARP.2022.217

ANALYSING HUL INDICATORS ACCORDING TO SELECTED CASE STUDIES

The HUL approach has a flexible and innovative implementation process for distinct scales with different contents. The use of indicators differs in most publications due to this flexible process. However, the HUL Recommendation has stated some fundamental indicators that need to be included to measure spatial transformation in a historic environment (UNESCO, 2011). Buildings, building groups, and transportation networks are defined as the form of the urban landscape. Intangible and tangible cultural values comprise the identity of the urban landscape. Flora and fauna constitute biotic features. Topography, hydrology, and climate data include abiotic components. These abiotic and biotic features define the ecology of the historic urban landscape (Von Oers, 2014).

This article has reviewed the indicator lists used in the case studies of 21 publications that correctly implement HUL in Table 1. This review is aimed to see that cultural, natural, and identity indicators are included in the process evenly, as stated in the HUL Recommendation. Wang and their colleagues focus on the ancient city wall in Xian, China (2019). Therefore, its list of indicators is limited to cultural data according to this site-specific context. Like Wang, Margottini has utilised the HUL approach on the remnants of different ancient cities in the World Heritage List (2015). The list of indicators is mainly gathered from each ancient city's cultural and topographic aspects. Another similar study is Shin and their colleagues' publication (2015). It focuses on the change in the Gwanghalluwon Garden in Namwon, Korea (Shin, 2015). These aim-specific HUL implementations do not necessarily focus on measuring all indicators' changes. They eliminate unnecessary indicators and design their indicator lists specific to their aim. Nevertheless, they still measure change and indicate conservation priorities according to the HUL approach.

Hill and Tanaka's publication focuses on a historic street in the Havana District, Cuba (2016). This research aims to analyse the effect of two different regimes in Cuba on the historical street structure and dwellers. Therefore, instead of mapping cultural, natural, and identity indicators, the researchers focus on collecting traditional practices such as special hair salons, haircutting, street vendors, or other folkloric traditions. They conduct interviews and attempt to establish a spatial relation out of these interviews. Another compelling study is Kudumovic's research in Bosnia Herzegovina, focusing on Tesanj and Vranduk towns in the Valley of Bosna River (2015). Kudumovic analysed two towns by comparing their conservation status and the factors affecting heritage conservation. The researcher proposes a conservation approach to evaluate the valley as a single cultural, historical and geographical area due to the similarities of the valley's towns (Kudumovic, 2015). Therefore, it suggests utilising the HUL approach to expand the conservation area and its vision to a valley scale by considering the entire valley instead of applying it to individual historic towns. Rather than measuring the change with indicators, the research tried to bring a perspective on conservation, so case studies were completed on observations of monumental structures. Other studies use the HUL approach uniquely, such as Carone and his/her colleagues' research, which focuses on the metropolitan area of Naples, Italy (2017). They utilise the HUL approach with Health Impact Assessment (HIA) to examine the issues that affect individual and collective well-being and health. Therefore, they assess a specific set of indicators as a determinant of health, such as biological factors (age, gender), family and personal background, public services, and social events.

The status of the three indicator groups that should be used in the HUL approach was examined according to 29 case studies in 21 publications. Three different usage statuses were identified in Figure 1. These statuses are named "included," "excluded," and "partially included." According to this analysis, all 29 case studies included cultural indicators. Identity indicators were used in 18 case studies. One of the case studies was partially included in the identity group analysis. Partial inclusion in the identity indicator group is because the publications only make observations and evaluations. When natural indicators were examined, it was revealed that they were used only in 17 case studies. In three case studies, natural indicators are included partially. Natural indicators were not analysed in 9 case studies. According to Figure 1, the least applied indicator group in these 29 case studies is the natural indicator group.

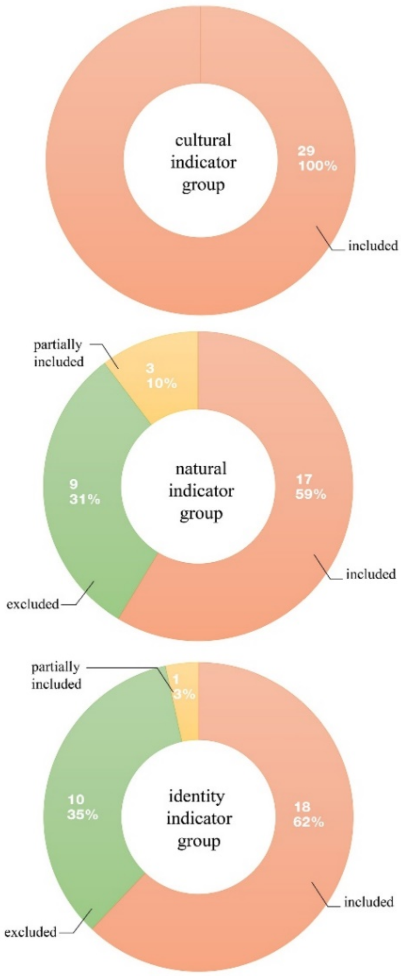


Figure 1. Inclusion of HUL indicator groups according to case studies.
The status of the three indicator groups that should be used in the HUL approach was examined according to 29 case studies in 21 publications.

DOI: 10.15320/ICONARP.2022.217

Table 1a. The list of indicators used in case studies

1	Case study Info	Oumelkheir & Nadia (2021)
	Cultural Indicators	Urban fabric, historical paths, traditional city border, architectural monuments, city walls, historic gardens
	Natural Indicators	Natural coastline, topography, protected areas
	Identity Indicators	Beauty configurations
	Content	Evaluation of a waterfront city evolution focusing on the development pattern
	Scale	City
2	Case study Info	Kırmızı & Karaman (2021)
	Cultural Indicators	Monuments, road network, land-use pattern
	Natural Indicators	Air pollution, natural disasters, green areas
	Identity Indicators	A participatory approach among stakeholders and administrative bodies
	Content	Understanding spatial transformation of the historic port area and its surrounding
	Scale	Site/ historic port
3	Case study Info	Wang & Gu (2020)
	Cultural Indicators	Historic walls, traditional courtyards, modern buildings, grid street system, land-use pattern, city-wall park
	Natural Indicators	Vegetative cover
	Identity Indicators	Observation of the displacement of residents
	Content	Measuring historic city centre transformation focusing on walled settlement and its surrounding
	Scale	Site / historic city centre
4	Case study Info	Rey Perez & Dominguez Ruiz (2020)
	Cultural Indicators	Administrative boundaries, characteristic rural architecture, monuments, archaeological and ethnographic heritage, road networks, land-use patterns, typological studies, historical irrigation systems
	Natural Indicators	Geomorphology, geology, hydrology, environmental study, contour lines, flora and fauna, hydrography, geo-ecological and livestock potential, protected natural spaces, landscape units
	Identity Indicators	Religious, cultural, and gastronomic rites, intangible heritage study, census of empty houses and housing in ruins
	Content	Assessing rural historic settlement heritage management focusing on diverse stakeholders' involvement
	Scale	Site / historic city centre
5	Case study Info	Colavitti & Serra (2020)
	Cultural Indicators	The restricted historic centre, residential areas, services, road network, civil and religious hubs, garden walls, gates on the street, typologies of courtyards, urban morphology, courtyard typologies, gardens
	Natural Indicators	Courtyard's vegetation
	Identity Indicators	-
	Content	Historic rural town centre transformation analysis
	Scale	Site / historic city centre
6	Case study Info	Wang et al. (2019)
	Cultural Indicators	City wall, urban historical and cultural heritage conservation, construction data sets, land-use, gates, urban road systems, space composition, axis relationships
	Natural Indicators	Green belt park, geographical features, natural environment data observations
	Identity Indicators	Archives, local chronicles, yearbooks, publications, memoirs, new materials, maps, conferences records, historical photos, observation of the relationship between social activities and public space, observation of the relationship between historical heritage and urban public space
	Content	Retrospective spatial transformation in a historic city centre focusing on the ancient city wall.
	Scale	Site / historic city centre

Table 1b. The list of indicators used in case studies (continue)

7	Case study Info	Fabbricatti & Biancamano (2019)
	Cultural Indicators	Heritage sites, security and land management, infrastructure services, energy and waste, agricultural and floricultural sectors
	Natural Indicators	Geographical characteristics, protected green areas
	Identity Indicators	Local economic growth, economic and commercial vitality, attractiveness, demographic structure, collaborative resource management, civic commitment
	Content	Life quality, real estate, and spatial change in a city that has heritage value, quality of the built environment
	Scale	City
8	Case study Info	Rey Perez & Valencia Avellan (2018)
	Cultural Indicators	Waterfront land use, the materiality of the facilities and streets, infrastructure, consolidation of neighbourhoods, landmarks, monuments, cultural and recreational uses, regulatory issues, governmental aspects
	Natural Indicators	Waterfront, natural values (river and hills), vegetation
	Identity Indicators	Intangible heritage, economic productive and cultural-social activities, urban image
	Content	Development impacts on the historic waterfront boulevard of the city
	Scale	City
9	Case study Info	Yan (2018)
	Cultural Indicators	Boundaries of the site, buffer zone, historic buildings and their gardens, historic sites and structures, cultural relics, historical road networks, public service facilities, industrial and commercial facilities, well-preserved residential buildings
	Natural Indicators	Significant topography (7 hills), visual landscape relations, natural landscape, essential landscape elements
	Identity Indicators	Cravings, inscriptions, religious, social, and art groups; residents, local celebrations and festivals, construction skills
	Content	The retrospective spatial analysis primarily focuses on urban morphology.
	Scale	Site/ historic island settlement
10	Case study Info	Rey Perez & Martinez (2018)
	Cultural Indicators	Institutional transformation, governmental organisations, and strategic guidelines focus on development, infrastructure, planning, housing facilities, public transportation, and declared heritage areas.
	Natural Indicators	Lake, gardens, fresh air, green spaces, proximity to nature, sound, smell, views, lookouts, significant trees
	Identity Indicators	Sense of community, safety, community feel, friendliness, generosity, culture-access to music and arts, markets, gastronomy, handicrafts, traditional clothing
	Content	Analysing HUL implementation and comparison with Ballarat and Cuenca cases
	Scale	City
11	Case study Info	Rey Perez & Siguencia Avila (2017)
	Cultural Indicators	City structure, historic cartographic study, regulatory systems, heritage studies, categories of built heritage, architectural typologies
	Natural Indicators	The natural landscape, territorial components
	Identity Indicators	Economic activities, perception analysis from the citizenship participation workshops
	Content	Retrospective spatial analysis
	Scale	City

DOI: 10.15320/ICONARP.2022.217

Table 1c. The list of indicators used in case studies (continue)

12	Case study Info	Verdini et al. (2017)
	Cultural Indicators	Cycling routes, commercial developments, heritage conservation areas, new housing development, proposed bridge, decorative rose garden, rose cultivation area, and agricultural activities.
	Natural Indicators	Green road, preserved fishponds
	Identity Indicators	Interviews with decision-makers, cultural mapping with local inhabitants, residential workshops
	Content	Spatial change analysis focusing on participatory practices
	Scale	Site /historic city centre
13	Case study Info	Carone et al. (2017)
	Cultural Indicators	Public safety, design of urban space, transportation, land use, waste disposal, accessibility to public services, environmental health, and quality of house and workplace
	Natural Indicators	Balance of built and natural landscape
	Identity Indicators	Age, gender, nutritional factors, family structure, education, employment, risk behaviour, physical activity, conflicts between different interests, cultural groups, discrimination, social support, participation in cultural and spiritual life, public policy
	Content	Health and spatial change analysis
	Scale	City
14	Case study Info	Siguencia & Rey Perez (2016)
	Cultural Indicators	Urban planning, historic cartography analysis, land uses.
	Natural Indicators	Geomorphology, vegetation, hydrology
	Identity Indicators	Symbolic and iconic images of the city
	Content	Developing an integrated tool in heritage conservation
	Scale	City
15	Case study Info	Murphy et al. (2016)
	Cultural Indicators	Community services and infrastructure, regulatory tools, boundaries, land-use patterns, cultural landscape
	Natural Indicators	Hydrology, ecology, geology, topography
	Identity Indicators	Points of interest, community values
	Content	Indigenous and colonial period analysis
	Scale	City
16	Case study Info	Buckley et al. (2016)
	Cultural Indicators	Cultural mapping of streets, places, and cultural features
	Natural Indicators	Natural features
	Identity Indicators	Needs of walkers and drivers
	Content	Discussing the managerial efficiency for better implementations
	Scale	City
17	Case study Info	Hill & Tanaka (2016)
	Cultural Indicators	Architectural heritage, streets, plazas, infrastructure, changes in the names of developments
	Natural Indicators	-
	Identity Indicators	Art of haircutting, street vendors, artisans, book vendors, street artists, taxis, drivers, musicians, folkloric groups, self-employed workers
	Content	Historic streetscape spatial change according to regime changes
	Scale	Site/historic streetscape

Table 1d. The list of indicators used in case studies (continue)

18	Case study Info	Margottini (2015)
	Cultural Indicators	wooden buried fence, wooden check dam, stone check dam, stone and wooden check dam, open water channel, buried pipe, retention pool, maintenance hole, stone channel, wall, drainage network, remains, paths, vegetative fencing
	Natural Indicators	-
	Identity Indicators	-
	Content	Ancient city centre's conservation status and their spatial analysis
	Scale	Site / historic city centre
19	Case study Info	Sil Shin et al. (2015)
	Cultural Indicators	Road network, relation to central district and residential area
	Natural Indicators	Hydrology, green areas, lawn area, vegetation covers, silhouette
	Identity Indicators	The popularity of the garden
	Content	Historic garden retrospective spatial change analysis
	Scale	Site / historic garden
20	Case study Info	Kudumovic (2015)
	Cultural Indicators	Administrative boundaries, state of conservation, monumental buildings, protection zones
	Natural Indicators	Residential areas with unique natural settings - topographic evaluations
	Identity Indicators	-
	Content	Ottoman and Byzantine period comparison
	Scale	Site/ historic valley settlement
21	Case study Info	De Rosa & Di Palma (2013)
	Cultural Indicators	Institutional organisations, cultural organisations, cultural events, heritage sites, recycling, regeneration
	Natural Indicators	CO2 emission, water material recovery, green spaces
	Identity Indicators	Employment ratio, ethnicity, crime, festivals, celebrations in a year, business count, tourists port flows, funds for the cultural heritage, national and international awards for virtuous policies
	Content	Climate change resilience
	Scale	Site/ historic port

THE FUNDAMENTAL INDICATORS FOR MEASURING CHANGE WITH THE HUL

This article aimed to determine fundamental indicators of the HUL approach to measuring the change in the historic urban environment. According to analyses, the cultural, natural, and identity indicator groups differ in line with the scale and content of the research. However, if the intention is to conduct a case study within the scope of the HUL approach, the indicators in these three groups should be considered evenly. When these three groups are not considered together, it is impossible to reach the scope targeted by the HUL approach with the term landscape. A list of suggested fundamental indicators that can be used in case studies with different scales and contents has been created to reach this landscape scope (Table 2). While creating this list, 21 publications that correctly use the HUL approach were referenced to develop the indicator grouping specified in the HUL Recommendation.

DOI: 10.15320/ICONARP.2022.217

The three indicator groups in this proposed fundamental list are detailed with spatial data indicators. Cultural, natural, and identity indicators establish spatial datasets in the historic urban environment. These three indicators enable us to understand the historic urban environment in landscape content. The analyses conducted in this article determined that the least used group among the indicator groups was natural indicators. There may be two reasons for this result. The first reason is that the researchers who analyse the change using the HUL approach focus on cultural and identity data. Understanding the necessity of using landscape content in conservation applications is essential because natural and cultural data have an equal impact on shaping historic urban environments. The second reason may be the lack of integration of studies in analysing cultural and natural heritage data. To rectify this situation, studies that will enable standard heritage analyses, such as "CultureNature Journey," have been initiated with the joint coordination of ICOMOS and IUCN. With these studies, the HUL approach will be developed, allowing the holistic analysis of the natural, cultural, and identity data that shape historic settlements.

Table 2. Proposed Fundamental Indicator List for the HUL Approach Implementation

Cultural Indicators	Regulatory systems	political boundaries, conservation areas and buffers
	Infrastructure	roads and routes, sewage systems, electric and high-power lanes, piers, bus stops
	Built environment	residential, commercial, industrial, educational, military, public/civic, mixed-used
	Historic environment	the historic centre, historic and listed buildings
	Green areas	recreational areas, cemeteries, parks and green areas, sports facilities
	Production	orchards, nurseries, urban farming areas and hobby gardens
Natural Indicators	Abiotic	topography, slope, aspect, geology, shoreline, hydrology
	Biotic	natural vegetation, folkloric activities
Identity Indicators	Socio-cultural practices	traditional practices, economic activities, vendors
	Memory	events, festivals, cultural activities, tales, narratives, points of interest, images of the city, perception, photos in personal archives
	Demography	population and population density, income, education level

CONCLUSIONS

It has been understood that the data sets that make up the indicator groups can differ according to the content and purpose of the research, even if they are considered evenly. The diversity of these data sets proves the flexibility and adaptability of the HUL approach according to the case study and purpose under consideration. It is thought that this flexibility and adaptability in the HUL approach allows us to bring together the authentic heritage values specific to each case study. This flexibility also offers the opportunity to adapt the conservation content in the HUL to case studies with different purposes, such as quality of life, climate crises, or resilience.

The case studies analysed in the literature do not focus equally on natural, cultural, and identity components as defined in the HUL approach. The first finding of the research is that the most studied component group in the case studies is cultural components. Another result is that the identity component group is less studied than the cultural component group. It was determined that the least examined group within the scope was natural components. With these findings, it has been concluded that the natural and identity indicators are not as focused as the cultural components in the case studies made within the scope of the HUL approach. The need for a primary data list has been identified to ensure that all indicators are examined in the case studies carried out within the scope of the HUL approach. A list of fundamental indicators that should be analysed was created in this research to meet this need.

After the publication of the HUL Recommendation in 2011, the main initiatives were led by UNESCO (The United Nations Educational, Scientific and Cultural Organization) and WHITRAP (World Heritage Institute of Training and Research for the Asia and the Pacific Region under the auspices of UNESCO). UNESCO's headquarters is in Europe, and WHITRAP's is in China; therefore, most case studies are located in these regions. It is necessary to establish open-access databases that include geo-referenced historical, past, and present studies of natural, cultural, and identity indicators to broaden the case studies. Thus, not only local administrative bodies or institutes implement the HUL approach, but non-governmental organisations, the private sector, or other individual professionals could also have the opportunity to access indicators and implement the HUL approach.

The HUL approach should be associated with the impact assessment studies in Turkiye. With this association, the reason for vulnerability in conservation can be addressed holistically. The change in the indicators of the HUL approach should be interpreted with urban dynamics and used in determining priorities in heritage conservation, site management, and planning practices. It is also evidently important to include professionals who can use landscape tools that can integrate cultural, natural, and identity data in the conservation and planning processes in the Turkiye applications.

ACKNOWLEDGEMENTS/NOTES

This article is an excerpt from a part of A. Balin Koyunoğlu's PhD dissertation titled "Tarihi Kentsel Peyzaj Yaklaşımı ile Doğal Ve Tarihi Çevre Değişiminin Ölçümü için Bir Model Önerisi: İstanbul Boğaziçi Sit Alanı Örneği," supervised by Professor Nuran Zeren Gulersoy at Istanbul Technical University.

REFERENCES

Bandarin, F. (2014). Introduction. Reconnecting the City: The Historic Urban Landscape Approach and the Future of Urban Heritage, 9781118383988, pp. 1–16. doi:10.1002/9781118383940.ch0

Bandarin, F., & van Oers, R. (2012). The historic urban landscape: Managing heritage in an urban century. The historic urban landscape: Managing heritage in an urban century. doi:10.1002/9781119968115

Bengtsson, M. (2016). How to plan and perform a qualitative study using content analysis. Nursing Plus Open. 2. 10.1016/j.npls.2016.01.001.

DOI: 10.15320/ICONARP.2022.217

Berg, S. K. (2018). "Conditional values of urban heritage: context and scale," Journal of Cultural Heritage Management and Sustainable Development, 8(1), 17–29.

Bonadei, R., Cisani, M., & Viani, E. (2017). "City Walls as Historic Urban Landscape: a Case Study on Participatory Education," Almatourism. Journal of Tourism, Culture, and Territorial Development, 8(7), 75–88. http://doi.org/10.6092/issn.2036-5195/6756

Buckley, K., Cooke, S., & Fayad, S. (2016). Using the historic urban landscape to re-imagine Ballarat: The local context. Urban heritage, development, and sustainability: International frameworks, national and local governance (pp. 93-113) doi:10.4324/9781315728018

Carone, P., De Toro, P., & Franciosa, A. (2017). Evaluation of urban processes on health in historic urban landscape approach: Experimentation in the metropolitan area of Naples (Italy). Quality Innovation Prosperity, 21(1), 202-222. doi:10.12776/QIP.V21I1.793

Colavitti, A. M., & Serra, S. (2020). Non-financial compensation for the redevelopment of the historic urban landscape: The case study of Villasor in Sardinia (Italy). City, Territory and Architecture, 7(1) doi:10.1186/s40410-020-00124-9

De Medici, S., Riganti, P., & Viola, S. (2018). Circular economy and the role of universities in urban regeneration: The case of Ortygia, Syracuse. Sustainability (Switzerland), 10(11) doi:10.3390/su10114305

De Rosa, F., & Di Palma, M. (2013). Historic urban landscape approach and port cities regeneration: Naples between identity and outlook. Sustainability (Switzerland), 5(10), 4268-4287. doi:10.3390/su5104268

Dhingra, M., & Chattopadhyay, S. (2021). A fuzzy approach for assessment of smart socio-cultural attributes of a historic urban landscape: A case study of Alwar walled city in India. Sustainable Cities and Society, p. 69 doi:10.1016/j.scs.2021.102855

Edmiston, J. T., Hyman, G., McNeely, J. A. & Trzyna, T. (2014). Urban protected areas Profiles and Best Practice Guidelines Series No. 22, Gland, Switzerland: IUCN. pp. xiv + 110pp.

EU (2000). European Landscape Convention. Strasbourg: Council of Europe Publishing.

EU (2005). Council of Europe Framework Convention on the Value of Cultural Heritage for Society, Faro.

Fabbricatti, K., & Biancamano, P. F. (2019), "Circular Economy and Resilience Thinking for Historic Urban Landscape Regeneration: The Case of Torre Annunziata, Naples", Sustainability (Switzerland), 11(12), art. no 3391. http://doi.org/10.3390/su11123391

Fowler, (2003). World Heritage Cultural Landscapes 1992-2002, UNESCO World Heritage Centre, Paris.

Garau, C., Annunziata, A., & Yamu, C. (2020). The multi-method tool 'PAST' for evaluating cultural routes in historical cities: Evidence from Cagliari, Italy. Sustainability (Switzerland), 12(12) doi:10.3390/SU12145513

Giuliani, F., De Paoli, R. G., & Di Miceli, E. (2021). A risk-reduction framework for urban cultural heritage: A comparative study on Italian historic centres. Journal of Cultural Heritage Management and Sustainable Development, doi:10.1108/JCHMSD-07-2020-0099

Hill, M. J., & Tanaka, M. (2016). Entrepreneurial heritage: Historic urban landscapes and the politics of "comprehensive development" in post-soviet Cuba. Urban heritage, development, and sustainability: International

frameworks, national and local governance (pp. 214-231) doi:10.4324/9781315728018
Hussein, F., Stephens, J., & Tiwari, R. (2020). Memory for social sustainability: Recalling cultural memories in Zanqit Alsitat historical street market, Alexandria, Egypt. Sustainability (Switzerland), 12(19) doi:10.3390/su12198141
IUCN & ICOMOS (2017). Connecting Practice Phase II: Final Report.
Ji, X., Shao, L., & Du, Y. (2020). Collaborating with local communities to identify improvement priorities for historic urban landscape based on residents' satisfaction: An application of asymmetric impact-performance analysis in Dandong, China. Sustainability (Switzerland), 12(4), 1-16. doi:10.3390/su12041463
Kashihara, S. (2021). Redefining urban heritage value for Hanoi trade streets. Journal of Cultural Heritage Management and Sustainable Development, 11(1), 78-94. doi:10.1108/JCHMSD-11-2019-0147
Klingmann, A. (2021). Re-scripting Riyadh's historical downtown as a global destination: A sustainable model? Journal of Place Management and Development, doi:10.1108/JPMD-07-2020-0071
Kırmızı, O. & Karaman, A. (2021). A participatory planning model in the context of Historic Urban Landscape: The case of Kyrenia's Historic Port Area. Land Use Policy, 102. doi: 10.1016/j.landusepol.2020.105130
Kudumovic, L. (2015). "Toward historic urban landscape approach: Serial properties along the Bosna River," Open House International, 40(4), 37–43.
Margottini, C. (2015). "Engineering geology in shaping and preserving the historic urban landscapes and cultural heritage: Achievements in UNESCO world heritage sites," in Lollino, G., Giordan, D., Marunteanu, C., Christaras, B., Yoshinori, I., and Margottini, C. (Eds.), Engineering Geology for Society and Territory – Volume 8: Preservation of Cultural Heritage, Springer, Cham, pp. 1–28.
Martinez, G.P. (2017), "Urban authenticity at stake: A new framework for its definition from the perspective of heritage at the Shanghai Music Valley," Cities, 70, 55–64.
Melnick R.Z. (1984). Cultural Landscapes: Rural Historic Districts in the National Park System, Washington DC: US Department of the Interior, National Park Service.
Moertiningsih, S., Nurgandarum, D., & Nurfanty, O. (2020). Sense of place dynamics in historic city centre of Tangerang. International Journal of Scientific and Technology Research, 9(3), 2095-2099.
Muminovic, E., Radosavljević, U., & Beganović, D. (2020). Strategic planning and management model for the regeneration of historic urban landscapes: The case of historic center of Novi Pazar in Serbia. Sustainability (Switzerland), 12(4) doi:10.3390/su12041323
Murphy, A., Dahlhaus, P., & Thompson, H. (2016). "Historic Urban Landscapes and Visualising Ballarat: Citizen Participation for Sustainable Urban Planning and Design, in Both, A., Duckham, M. and Kealy, A. (Eds.), CEUR Workshop Proceedings, 1570, CEUR-WS, Melbourne, pp. 41–46.
Oumelkheir, B., & Nadia, D. (2021). Assessment process in the delimitation of historic urban landscape of Algiers by AHP. Miscellanea Geographica, 25(2), 110-126. doi:10.2478/mgrsd-2020-0053
Pintossi, N., Ikiz Kaya, D., & Pereira Roders, A. (2021 a). Assessing cultural heritage adaptive reuse practices: multi-scale challenges and solutions in Rijeka. Sustainability (Switzerland), 13(7) doi:10.3390/su13073603

DOI: 10.15320/ICONARP.2022.217

Pintossi, N., Ikiz Kaya, D., & Pereira Roders, A. (2021 b). Identifying challenges and solutions in cultural heritage adaptive reuse through the historic urban landscape approach in Amsterdam. Sustainability (Switzerland), 13(10) doi:10.3390/su13105547

Psarra, S. (2018). The role of spatial networks in the historic urban landscape: Learning from Venice in the fifteenth and sixteenth centuries. Historic Environment: Policy and Practice, 9(3-4), pp. 249–273. doi:10.1080/17567505.2018.1516380

Rey Perez, J., & Dominguez Ruiz, V. (2020). Multidisciplinary, citizen participation and geographic information system, cross-cutting strategies for sustainable development in rural heritage. The case study of Valverde de Burguillos (Spain). Sustainability (Switzerland), 12(22), 1-31. doi:10.3390/su12229628

Rey Perez, J., & Martinez, G. P. (2018). "Lights and shadows over the Recommendation on the Historic Urban Landscape: "managing change" in Ballarat and Cuenca through a radical approach focused on values and authenticity," International Journal of Heritage Studies, 24(1), 101–116.

Rey Perez, J. & Pereira Roders, A. (2020). Historic urban landscape: A systematic review, eight years after the adoption of the HUL approach. Journal of Cultural Heritage Management and Sustainable Development. doi:10.1108/JCHMSD-05-2018-0036.

Rey Perez, J., & Siguencia Avila, M. E. (2017). Historic urban landscape: An approach for sustainable management in Cuenca (Ecuador). Journal of Cultural Heritage Management and Sustainable Development, 7(3), 308-327. doi:10.1108/JCHMSD-12-2016-0064

Rey-Perez, J., & Valencia Avellán, D. (2018). "Towards the implementation of The Historic Urban Landscape approach in the Guayaquil waterfront (Ecuador): A scoping Case Study," The Historic Environment: Policy and Practice, 9(3-4), 349–375.

Rodwell, D. (2018). "The Historic Urban Landscape and the Geography of Urban Heritage," The Historic Environment: Policy& Practice, 9(3-4), 180–206.

Shin, H. S., Chen, Y., Lee, W. H., & Kim, D. H. (2015). Sustainability of historical landscape to Gwanghalluwon garden in Namwon city, Korea. Sustainability (Switzerland), 7(7), 8565–8586. doi:10.3390/su7078565

Siguencia Avila, M. E., & Rey Pérez, J. (2016). Heritage values protection, from the monument to the urban dimension. Case study: The historic centre of Santa Ana de Los Ríos de Cuenca, Ecuador. Historic Environment: Policy and Practice, 7(2), 164-176. doi:10.1080/17567505.2016.1172785

Sil Shin, H., Chen, Y., Ho Lee, W., & Hyun Kim, D. (2015). "Sustainability of Historical Landscape to Gwanghalluwon Garden in Namwon City, Korea," Sustainability, 7, 8565–8586. http://doi.org/10.3390/su7078565

Siravo, F. (2015), "Planning and Managing Historic Urban Landscapes", in F. Bandarín and R. van Oers (Eds.), Reconnecting the City. The Historic Urban Landscape Approach and the Future of Urban Heritage, John Wiley and Sons, Ltd., Chichester, pp. 161–202.

Taha, S. (2014). "Still a place to call home? Development and the changing character of place", Historic Environment: Policy and Practice, 5(1), 17–35.

Trzyna, T. (2017). Connecting people, nature, and culture through metropolitan conservation alliances. Background paper for a workshop at the 2017 George Wright Society Conference on Parks, Protected Areas, and Cultural Sites, Norfolk, Virginia, April 2017: "Making nature-culture connections by broadening metropolitan conservation alliances."

UNESCO, (1992). Cultural Landscapes, Paris.

UNESCO, (2008). Guidelines On the Inscription of Specific Types of Properties on the World Heritage List, Paris.

UNESCO, (2010). Managing Historic Cities. Paris.

UNESCO, (2011). Recommendation On the Historic Urban Landscape, Paris.

Verdini, G., Frassoldati, F., & Nolf, C. (2017). Reframing China's heritage conservation discourse. Learning by testing civic engagement tools in a historic rural village. International Journal of Heritage Studies, 23(4), 317-334. doi:10.1080/13527258.2016.1269358

Von Oers, R. (2014). Conclusion: The Way Forward: An Agenda for Reconnecting the City in Reconnecting the City: The Historic Urban Landscape Approach and the Future of Urban Heritage. Editor: Francesco Bandarin ve Ron Von Oers. pp. 317.

Wang, S. & Gu, K. (2020). Pingyao: The historic urban landscape and planning for heritage-led urban changes. Cities, 97, https://doi.org/10.1016/j.cities. 2019.102489

Wang, S., Jiang, Y., Xu, Y., Zhang, L., Li, X., & Zhu, L. (2019). Sustainability of historical heritage: The conservation of the Xi'an city wall. Sustainability (Switzerland), 11(3) doi:10.3390/su11030740

WHL & UNESCO (2019). Operational Guidelines for the Implementation of the World Heritage Convention. Paris.

Yan, S. (2018). "HUL and Conservation of the Historic City of Kulangsu: A Scoping Case" The Historic Environment: Policy and Practice, (9:3-4) pp.376–388.

Yang, M., Brumana, R., & Previtali, M. (2019). "Heritage and Development" Strategy on Historic Urban Landscape (HUL): The added value of multi-Temporal hub application," ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences, 42(2/W11), pp. 1151–1158. Citing a Group or Organisation: (International Citation Association, 2020)

Resume

A.Balin KOYUNOĞLU is a PhD candidate at Istanbul Technical University. Her research interest is systematising a methodological framework to measure the limits of change in historic urban landscapes. She worked in the USA and Japan between 2006 and 2011. Later, she established an urban landscape design office in Istanbul.

Prof. Nuran ZEREN graduated as an architect from Istanbul Technical University (ITU), where she received her master's degree and her doctorate in urban planning and worked for the ITU between 1977 and 2018. Presently, she is the Department Head of Architecture at FMV Işık University. She is currently the General Secretary of the International Planning History Society (IPHS) and serves as a Europa Nostra member, ICOMOS CIVVIH Group, and OWH Tourism working group.

DOI: 10.15320/ICONARP.2022.217

ICONARP
International Journal of Architecture and Planning
Received: 17.03.2022 Accepted: 05.12.2022
Volume 10, Issue 2/ Published: 20.12.2022
Research Article *DOI: 10.15320/ICONARP.2022.218 E- ISSN:2147-9380*
ICONARP

Qualitative/Quantitative Comparison of Changes in Alanya Rural Architecture in terms of CO2 Emissions and Energy Conservation within the Scope of Sustainability

Ercan Aksoy*
Özlem Sağıroğlu Demirci**

Abstract

Due to the rapid growth and development caused mainly by tourism of Alanya, rural areas are affected, losing their original texture and authentic structures and being exposed to unqualified interventions. The aim of this study is to determine the original features and reveal the value of Alanya rural architecture within the framework of the sustainability principles, and to determine how these values have changed with the unqualified interventions, by detailing qualitatively and quantitatively on the basis of each intervention. Within the scope of the study, the rural architectural heritage in Alanya has been documented in terms of settlement texture, space organization, architectural elements, material, construction and energy efficiency. For the analysis, a rural house that preserves its original values was used. A comparison was made between the values of this house and the values obtained as a result of the changes in the other buildings in the area. In cases where these interventions are applied in various variations, the changes in the heating and cooling load of the house are compared with the CO_2 emission. It has been determined that the rural houses of Alanya provide energy conservation in a way that is perfected by tradition, both in terms of settlement features and space and materials on the basis of structure. It has been determined that the heating/cooling energy requirement can decrease but the CO_2 emission increases in the individual changes made by evaluating different types of deterioration. When the most common application variations detected in the field are evaluated, it has been determined that both the heating/cooling energy requirement and the CO_2 emission have increased. Rural settlements and residences define an architecture that has reached the highest level in terms of convenience, functionality and economy. Since any intervention to these structures means the loss of their energy conservation properties as well as their originality, a very careful decision should be made. The study reveals the first data in which the rural architecture of Alanya is evaluated within the scope of sustainability and energy and CO_2 emissions are compared depending on deterioration/changes.

Keywords:
Rural architecture, rural conservation, rural sustainability, vernacular architecture, design builder

* Eha Construction & Architecture, Ankara, Turkey. (*Corresponding author)*
E-mail: ercanaaksoy@hotmail.com

**Faculty of Architecture, Gazi University, Ankara, Turkey.
E-mail: osagiroglu@gazi.edu.tr

To cite this article: Aksoy, E., & Sağıroğlu Demirci, Ö. (2022). Qualitative/Quantitative Comparison of Changes in Alanya Rural Architecture in Terms of CO2 Emissions and Energy Conservation within the Scope of Sustainability. *ICONARP International Journal of Architecture and Planning,* 10(2), 614-639. DOI: 10.15320/ICONARP.2022.218

INTRODUCTION

Rural structures are formed entirely within the framework of livelihoods such as agriculture and animal husbandry, and needs for life. These structures, which are designed as fully functional, have been shaped on the basis of social rules and needs for sharing since the existence of humanity; designed with material obtained from the immediate environment. Over time, they have formed a certain understanding and style with environmental conditions, the limitations of climate and topography, and traditional construction technique and craftsmanship tradition. They have come to encompass the most suitable, economical and easy solutions within the framework of material, atmospheric and environmental conditions, needs and traditions. For this reason, they have been accepted as the structures with the highest value, the lowest carbon footprint and the highest resource conservation within sustainability all over the world. However, steps have been taken recently to protect these values. For this reason, undesirable textural changes have occurred within the scope of rural settlements. Similarly, changes and transformations have occurred in the organization of space and architectural elements in original buildings. For this reason, these settlements and structures of superior value have lost their original qualities. Among the regions where these changes and transformations take place the fastest and unplanned, rural areas close to the city centres and rural areas subject to tourism supply have a great place in the context of migration. However, in the recent past, with the realization of the importance of the quality and quantity of these deteriorations, steps have been taken to protect rural areas. For this reason, rural areas have been registered under the name of 'urban protected area' and protection and construction conditions have been brought, or rural design guides have been created and criteria for new buildings to be built have been started to be determined. For the new buildings to be built in the area, similar criteria such as gauge, colour, window/door gap ratios, roof shape were determined and applied within the scope of quality and quantity. On the other hand, in the buildings to be protected, criteria in terms of quantity have been determined and applied, on the condition that the original features are adhered to. However, in all these steps, what is considered and designed in general is the structural and visual preservation of the texture and structures. For this reason, modifications and transformations of materials and architectural elements are generally allowed. In this context, architectural elements made of cement-based materials, plastic, aluminium, metal or polycarbon-based materials that do not require mastery or can be easily found in their cheap and processed form; it was preferred as long as it remained within the criteria determined within the scope of elevation-colour-texture-benefit/harmful. Similarly, in rural areas that are not under protection and do not have a rural design guide, since there were no zoning-construction criteria until recently; modern materials that can be easily found and applied; texture etc. applied without complying with such

DOI: 10.15320/ICONARP.2022.218

criteria. Thus, the unique characteristics of rural areas have been deteriorated.

SUSTAINABILITY AND EFFICIENT USE OF ENERGY

The energy need increases depending on the population with the development of technology and industry. However, energy resources are decreasing day by day due to excessive use, unconscious/unplanned consumption and the use of faulty production techniques. This situation also causes environmental pollution, climate change and degradation of natural areas. Especially the use of heavy fuels is a triggering factor for this cycle. The efforts to break this cycle over time have revealed the necessity of using renewable energy sources. However, studies have revealed that using only renewable resources is not enough, it is necessary to reduce the energy need and to obtain the highest efficiency with the least energy.

Construction sector and unplanned development plays an important role in environmental pollution, ecological deterioration, reduction of natural resources and deterioration of human-environment relationship (Ergöz Karahan, 2017; Dikmen, 2011; Amasyalı & El-Gohary, 2018). The construction industry uses 39% of the global energy and 42% of the water stand-alone (Sayın, 2016; Nejat et al., 2015). In addition, construction is effective in the deterioration of clean water, 40% of stone-gravel and sand consumption, and 25% of forests (Lippiatt & Norris, 1995). In addition, 38% of the world's CO_2 emissions are also generated by buildings (Zhong et al., 2019). Particles and gases generated by the products used in the construction industry are also a source of pollution (Vural & Balanlı, 2005; Marzouk et al., 2017).

Architecture before the industry and industrial revolution has been created with clean energy within the scope of materials, techniques and technology. This phenomenon is accepted in the direction of traditional architecture to create a clean energy solution for today's cities and architecture. This has enabled a detailed examination of traditional architecture in terms of sustainability and energy conservation. Within the scope of the investigations; The sustainability of the cultural heritage has been determined in terms of environment, energy and tourism (Butler, 2009; Barthel-Bouchier, 2016), the design criteria and sustainability of an ecological neighborhood settlement have been examined within the scope of sustainability at the city scale (Gebel et al., 2021). Thermal comfort conditions were analyzed in a traditional palace (Al-Sakkaf et al., 2021), traditional Turkish house in Safranbolu (Harputlugil & Çetintürk, 2005) and on churches that were severely damaged and restored (De Rubeis at al., 2020). Sustainability of rural architecture has been researched through a traditional settlement in Cyprus; As a result, it is emphasized that it has many of the criteria, but it needs to be developed to meet contemporary needs (Philokyprou & Michael, 2021). In studies examining sustainability in terms of traditional buildings in different countries, courtyard houses in Iran and China

(Soflaei et al., 2017) and local houses in Southern Italy and Lithuania were evaluated (Samalavičius & Traškinaitė, 2021). The environmental effects of materials and their recycling costs were examined in the context of masonry walls, and their data were presented under 15 parameters (Erduran et al., 2020). Green building and energy certification systems in new buildings were compared and their pros and cons were determined, and a study was conducted to determine which one would be suitable for Turkey (Said & Harputlugil, 2019). Utkutug, on the other hand, examined examples of high-performance green buildings around the world and stated their characteristics (Utkutuğ, 2011). In addition to these studies, there are studies in which sustainability should be included in the architectural education process and applied. In this context, sustainable architectural designs were desired from students in the 3rd year studio course (Mohamed & Elias Özkan, 2019), sustainability was evaluated within the scope of the architectural project competition (Yurtsever et al., 2013) and the integration of sustainability with the architecture master's program was compared with domestic and international examples (Gökşen et al., 2020). In addition, there are studies in which traditional houses are evaluated in terms of thermal analysis (Temur, 2011) and it is determined that they save thermal comfort better by consuming less energy (Vissilia, 2009). In the studies, it is understood that the housing structures are built in accordance with the climate, topography and atmospheric conditions. It has been determined that due to the use of local materials, they are highly energy efficient and healthy buildings, and therefore they can set an example for sustainable new constructions (Yüksek & Esin, 2013; Sanchez & Medrano, 2015).

Sustainability is defined as “meeting the needs of the present without compromising the ability of future generations to meet their own needs”; (WCED, 1987) is discussed under three headings as economic, environmental and social (Akdiri et al., 2012; Li, 2011; Sev, 2009; Williams & Dair, 2007; Juan et al., 2019). These criteria are examined within the scope of environmental protection with low resource use, minimum pollution and natural life in environmentally. In terms of economy, the main topics are the minimum use of energy and water resources, the preference of local materials, and the construction of suitable functional-reliable structures. On the other hand, social sustainability is addressed within the framework of a safe and healthy environment, providing social opportunities such as education and health for the public, improving access opportunities, giving importance to urban design and evaluating the traditional housing stock. Good project management is required for sustainable buildings. For this reason, energy, water, land and cost should be used at the minimum rate during the construction and use of the building (Hill & Bowen, 1997; Cole & Larsson, 1999). If possible, renewable energy sources and recyclable materials should be used (Miyatake, 1996). Decisions should be made in line with the needs and requirements, and it should be ensured that employees and the environment are not exposed to pollutants and waste

DOI: 10.15320/ICONARP.2022.218

materials (no chemical products are used) during construction. A healthy built environment should be created, natural habitats should be improved or not damaged at worst (Halliday, 2008; Kibert, 2008). When considered in this context, it can easily be said that traditional settlements and houses are very good examples within the scope of sustainability principles, and that they are a serious instructor by creating a document value from the past to the future.

SUSTAINABILITY IN ALANYA RURAL ARCHITECTURE

Alanya is a district of Antalya Province, with a length of 73 kilometers along the Mediterranean coast. There is the Mediterranean sea in the south and the Taurus Mountains which has altitude of 2500 – 3000 meters in the north. There are settlements in the district between 0-1500 meters altitude. For this reason, rural settlements have different characteristics depending on the topography. In the district where the Mediterranean climate is observed; the summers are hot and the winters are mild. Although it is a very fertile region due to its climate and soil quality, forests with cedar, oak and juniper trees cover a large area (Özgür, 2018). Many vegetables and fruits are grown Due to the fertile agricultural areas; In addition to its natural habitats (Sapadere Canyon, Dimçayı National Park, İncekum Nature Park), it also shows diversity in terms of flora and fauna.

Topography and Settlement

The climatic structure of the region is an important factor in the settlement of the houses on the land. The southern slopes of the hills are warmer, while the northern slopes are colder and shady in the northern hemisphere. The eastern and western slopes are hot and sunny, especially in summer. For this reason, it is recommended that the settlements should be established on the south slope of the hills in hot and dry summer months, cold winter months, on the south slope in cold climates, on the hilltop in hot and humid climates, on the north slope in hot and dry summer months and warm winter months (Lechner, 2015). Positioning the houses in harmony with the land and the environment, preserving the slope with minimal interference to the topography, and not blocking the sun and wind by not blocking each other while the buildings are being built are also important criteria in terms of energy conservation.

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

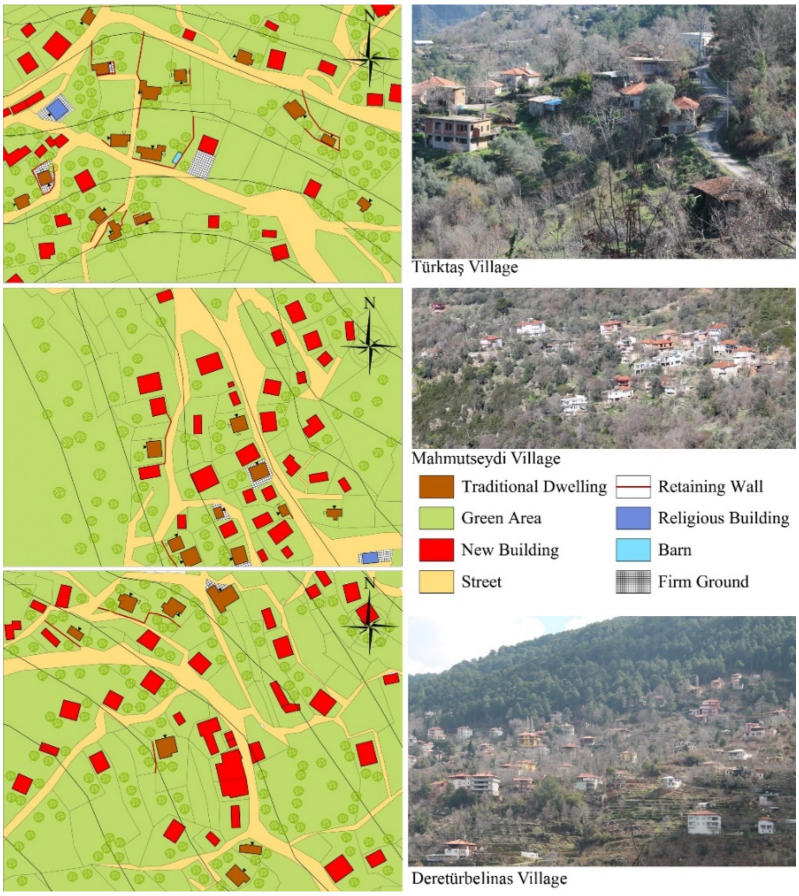


Figure 1. Topographic maps and settlement views of the villages.

It has been determined that the villages in the higher parts of Alanya district are mostly located on the southern or northern slopes of the hills (Figure 1, Türktaş Village) and rarely in the southwest direction (Figure 1, Mahmutseydi & Deretürbelinas Village). Traditional dwellings are positioned in accordance with the topography in an energy efficient manner. For this reason, it is understood that organic texture is preserved in all villages. The buildings are positioned in such a way that they do not block each other's sun and wind, if there is a landscape they are directed towards the landscape. In coastal villages, traditional residences were built on the southern slopes but located at higher elevations.

Solar Control

The first design principle in solar control, which can be provided naturally, is reforestation. Trees that allow shadow control, especially in temperate and warm climatic regions, also maximize solar use. Trees that will be used to reduce the effect of the sun in summer should allow sunlight in winter. For this reason, deciduous trees with low light permeability in summer and trees with high light permeability in winter should be used. However, considering the position of the sun, evergreen trees can be planted in the northern parts of the buildings as there will be no direct sunlight from the north. In the east-west direction, in particular, trees with high trunk sizes should be selected that do not prevent airflow while providing solar control (Figure 2).

DOI: 10.15320/ICONARP.2022.218

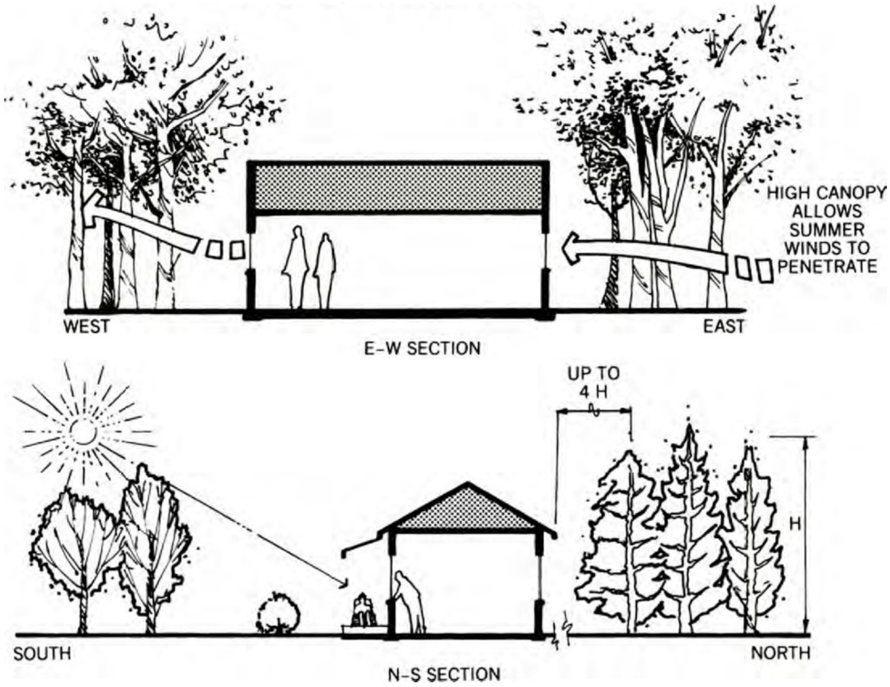


Figure 2. Afforestation scheme in temperate climate zones (Lechner, 2015).

However, reforestation, which is one of the alternative methods of solar control, also has a great visual and environmental impact (Gürsel Dino, 2017). Another parameter that has an important place in solar control, along with trees, is the architectural elements used in the building design. Roofs, fringe widths, cantilevers, and window elements, which will be designed depending on the direction and angle of the sunlight, directly affect energy use. Designs that cut off the summer sun but do not block the winter sun are evaluated for their sustainability. In addition, it is important to add auxiliary architectural elements in order to use not only indoor spaces but also open spaces.

Alanya rural housings are mostly located in the northern parts of the parcels. For this reason, there are more deciduous trees, especially in the southern and western parts of the buildings, and sparse deciduous trees (figs, walnuts, apples, olives, etc.) in the eastern part. In the houses located to the south of the parcel, on the other hand, there are trees in the adjacent parcel that cover the southern facades of the buildings (Figure 3).

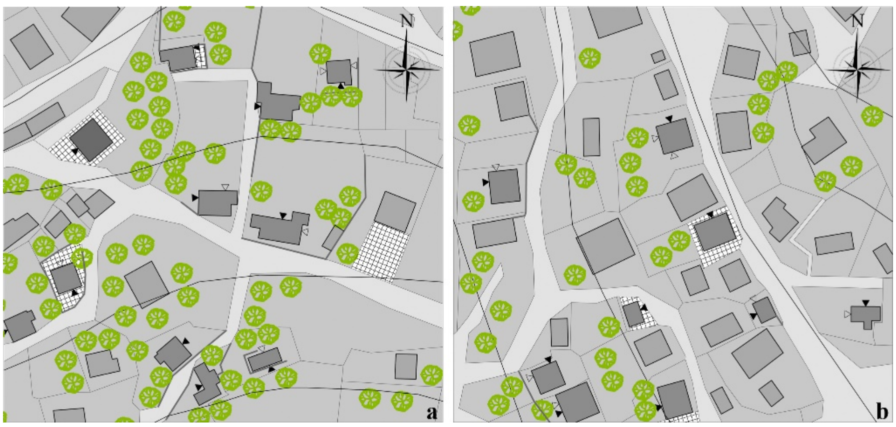


Figure 3. Topographic maps and settlement views of the villages; Türktaş (a), Mahmutseydi (b).

The district is located between the "36°30'07" and "36°36'31" northern latitudes. The sun angle was determined as 36.33° on average at the midpoint of the district boundaries (it was found by adding the latitude degrees at the northernmost (36°36' N) and the southernmost (36°30' N) of the district and dividing them by 2 (36.36+36.30)/2). For this reason, the incidence angle of the sunlight in Alanya district was calculated by subtracting the degree between the latitude of the district and the tropic of Cancer from 90° by using the 76.94° (23°27' N to the tropic of Cancer on June 21) of sunlight in summer (based on June 21) (90-(36.33-23.27), while it is calculated as 30.40° in winter (based on December 21), (23°27' S to the tropic of Capricorn on December 21), calculated by subtracting the degree between the latitude of the district and the tropic of Capricorn from 90° (90-(36,33+23,27)). Ground floors are not used as housing in Alanya rural residences. For this reason, there are no windows under the cantilevers, and the cantilevers are not used for solar control. There are small ventilation spaces on the ground floors used for storage purposes such as animal shelters or haystacks. However, when the few houses with large ground floor windows were examined, it was found that the sunlight does not enter directly in summer depending on the wall thickness, but in winter the sunlight can enter depending on the angle (Figure 4a). In addition, shutters are available in buildings where ground floor windows are large (Figure 4b). On the first floors, which are used as living spaces, both the eaves distance and the canopies on the windows blocks prevent unwanted sunlight. The use of wooden meshworks (Figure 4c) and shutter (Figure 4d) is also frequently seen in the windows in order to get controlled light. Especially when the meshworks have air permeability, they have a positive effect in the summer months thanks to their low sunlight permeability. The shutters are designed to have 4 equal-sized parts in some of the houses. With these shutters, sunlight can be blocked from entering the upper or lower sections, ventilation is provided, and this approach makes solar control easier.

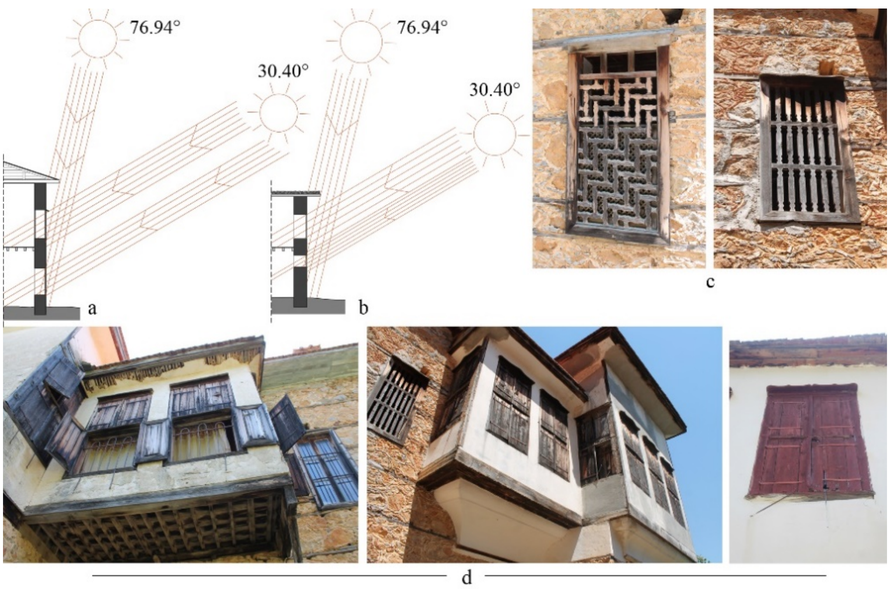


Figure 4. Building-sun relationship and window designs; angle of incidence of sun (a, b), meshwork (c), shutter (d).

DOI: 10.15320/ICONARP.2022.218

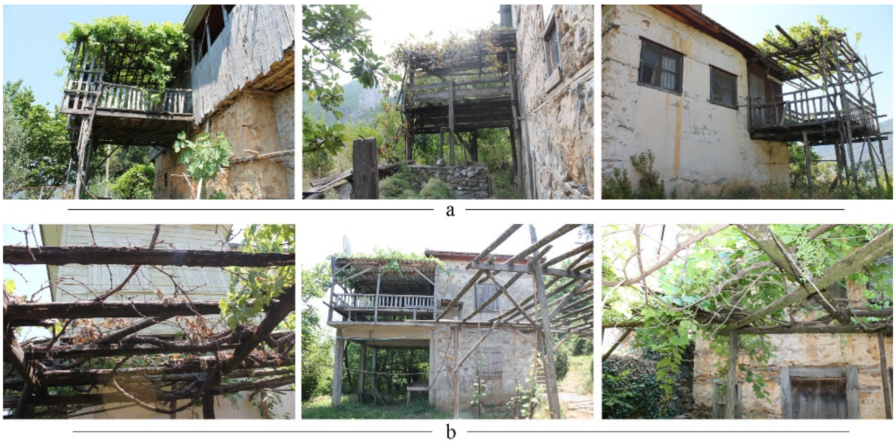


Figure 5. "İskenet" designs in rural dwellings in Alanya

In order to provide wind and solar control in semi-open or open spaces, the vast majority of housings in the area have wooden suspended gazebos called "iskenet". These gazebos are used to create canopies and semi-enclosed spaces in the garden or to provide solar control by covering the gazebos, which are the open cantilevers of the buildings (Figure 5a, b). The 'iskenet' gazebos, which provide the highest level of use of open spaces in summer, are designed in the south and west directions of the houses. In this way, shading and solar control can be achieved. Vines can be found on the tops of the gazebos and on all facades of the buildings and provide shading in summer, while in winter they allow sunlight due to falling leaves.

Wind Control

The positive or negative factors of the wind differ according to the climate data of the settlements. It is expected to avoid the wind effect in cold climatic zones and to benefit from wind in hot climatic zones. One of the best-known methods for wind control and therefore reducing cooling costs is controlled planting of trees to block wind in cold climatic zones and allow wind in hot climate zones. The prevailing wind direction throughout Alanya is between northeast and east (N 69.9° E) (Sabancı, 2012). The trees in the gardens of the rural houses are largely not located in the direction of prevailing wind (Figure 6a). Thus, they do not block the wind of places such as the gazebo and the main room (known as 'çağnışır'), which are frequently used in the summer.

Another element that allows cooling by allowing the wind is that the railings of the gazebos are made with gaps. This pattern, which causes increased comfort conditions even at the sitting level of the users, is seen in the entire authentic gazebo architecture (Figure 6b).

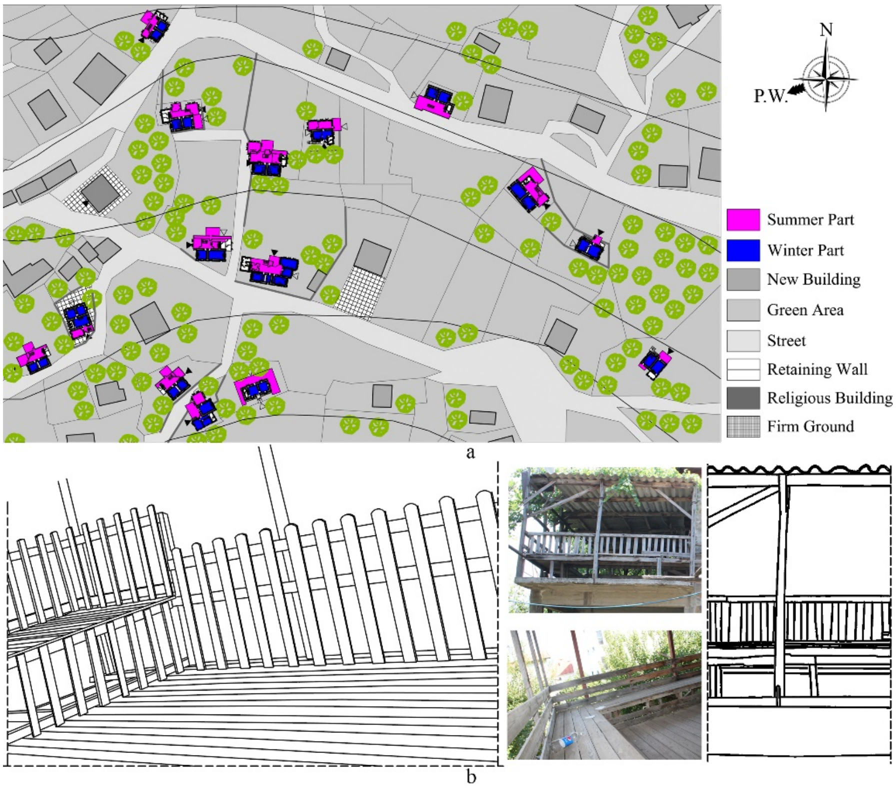


Figure 6. Planting trees so as not to cut the wind (a) and wind permeable elements (b).

Another control method is to direct the building based on the wind direction and design a building geometry for ventilation and cooling. Buildings with a squarish shape are less affected by the wind when placed perpendicular to the wind direction (Figure 7a). Buildings with the same form allow more wind when placed diagonally in the wind direction (Figure 7b). Rectangular buildings get less wind when their narrow edges are in the wind direction, while the wide edge gets more wind when it is in the wind direction (Figure 7c) (Watson & Labs, 1983).

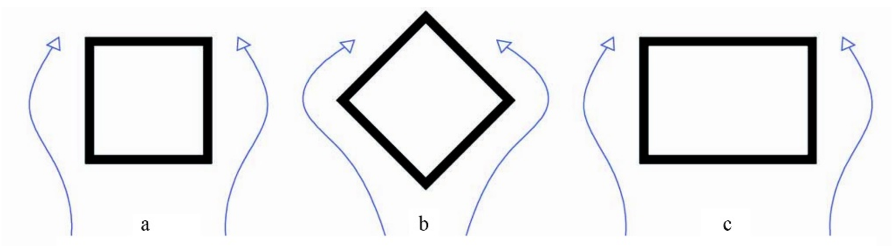


Figure 7. Orientation of structures against the wind (Watson & Labs, 1983).

The buildings in the Alanya countryside are largely made in square or rectangular form. In addition, the orientation of the buildings varies according to the locations of the villages, with the principle of taking advantage of the wind or protecting against it. Therefore, in villages with warmer and milder weather conditions, the buildings are positioned diagonally according to the prevailing wind direction (Figure 8a). In villages with colder conditions, however, they are designed perpendicular to the prevailing wind direction (Figure 8b). Thus, it was possible to benefit more from the wind in hot regions, and the effect of wind was alleviated in cold regions, adhering to sustainability principles.

DOI: 10.15320/ICONARP.2022.218

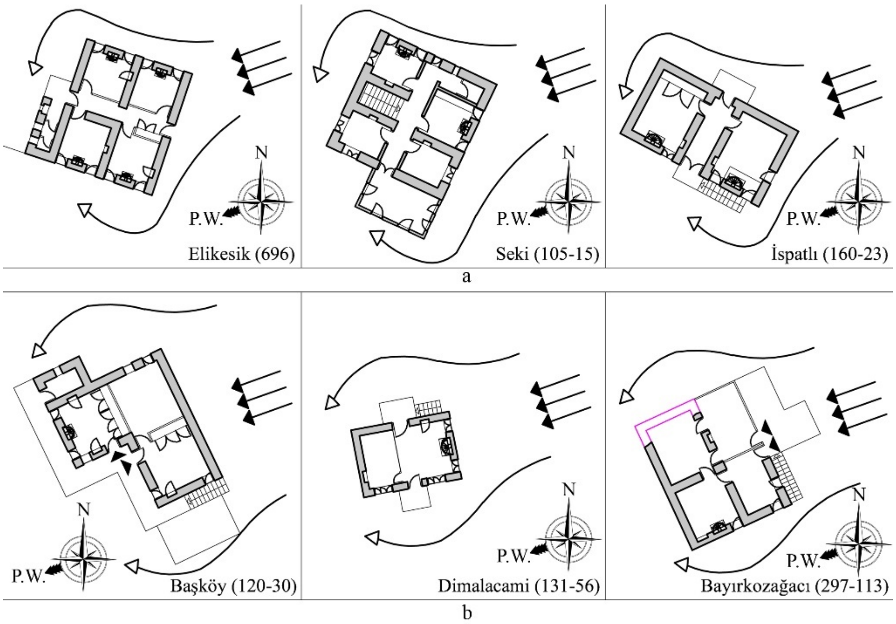


Figure 8. Orientation of Alanya rural dwellings against the wind.

Ventilation and Cooling

It is important to use natural factors to provide ventilation and cooling in regions with hot and temperate climates. For this reason, the places of the spaces (windows, doors) in the building and the positions/arrangements of the spaces can be used for natural ventilation. Windows or ventilation gaps are designed in the direction of the wind and in other places accordingly. When the windows are installed in the opposite part of the air flow direction, they cause the air flow to be fast while providing air flow indoors (Figure 9a). However, in this case, the air flow is fast and the ventilation of the spaces is insufficient. For this reason, it is suggested that windows and spaces should be installed on the side facades and diagonally according to the wind direction (Figure 9b) (Aktuna, 2007). The gaps in the structures are made in accordance with the passage of the air flow in Alanya villages. Windows and spaces are positioned diagonally on different façades. Thus, maximum ventilation is provided and climatic effect is created. Natural cooling is provided and the dwellings are designed to consume low energy (Figure 10).

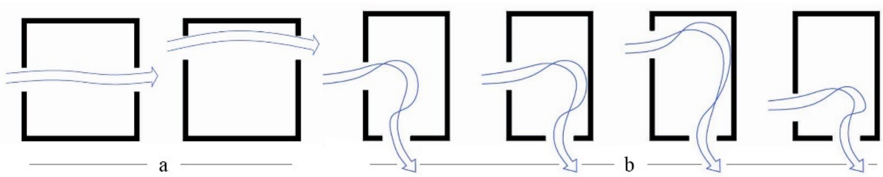


Figure 9. Air movements according to space directions (Aktuna, 2007).

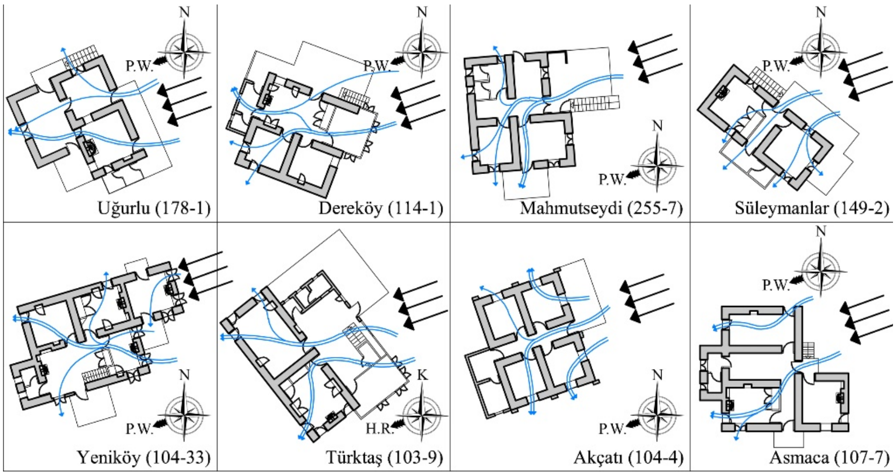


Figure 10. Air flow paths in rural dwellings in Alanya.

While it is important for the building form to be sheltered like square and rectangular in terms of heat loss, turning the spaces used in summer to the prevailing wind direction and increasing the surface areas in these spaces are the elements that provide cooling. The surface area is increased by removing the walls of the summer spaces by disrupting the compact form and cooling can be more effective.

The places used in the summer months of the qualified houses in the region are positioned in the direction of the wind (Figure 11). In addition, the wall surface areas of these spaces are increased in order to receive the wind better, allowing for better cooling (Figure 12). Most of the time, the pergola sections, which are limited only by railings without being limited by walls, are also constructed in the direction of the prevailing wind.

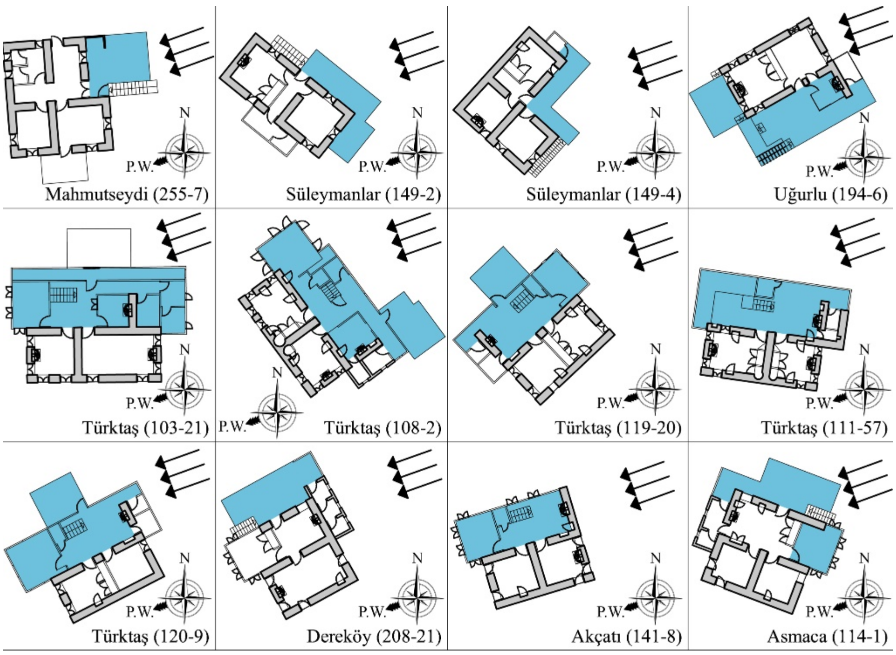


Figure 11. Summer space locations in rural dwellings in Alanya.

DOI: 10.15320/ICONARP.2022.218

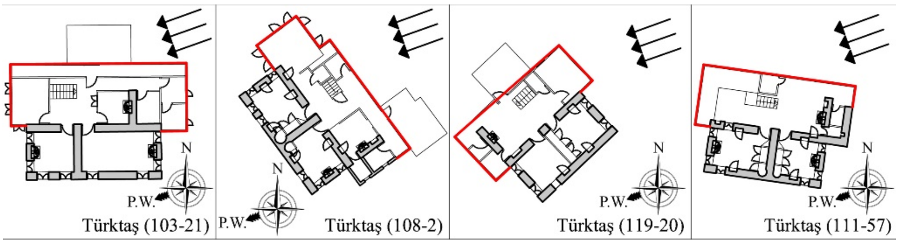


Figure 12. Increased summer space surfaces in Alanya rural dwellings.

Heating

The kitchen spaces of traditional houses that produce heat should be designed in a way to ensure that the heat is transferred to other spaces at least in hot climatic regions. These spaces should have good ventilation or should be set up outside the building if possible. On the contrary, these spaces should be designed in the center of the building to allow the heat to spread in cold climate regions (Aktuna, 2007). In buildings where different spaces are used in summer and winter months, even in hot regions, the presence of a fireplace in at least one of the winter spaces is beneficial in meeting the need for cooking and heating at the same time.

In buildings with barns or sheepfold on the lower floors, positioning the rooms on the upper floors and the barns on the same axis creates a positive situation for the need for heating. This allows to use of the animals body heat and makes it easier to heat the upper floors.

Figure 13. Kitchen and fireplace settlements in rural dwellings in Alanya.

It is seen that in the rural houses of Alanya, the kitchen space of which is designed separately, all of the kitchens are located in the summer section, that is, in well-ventilated sections (Figure 13a). The fireplaces, which are not limited by any divider and used directly in the sofa, are also the sections where the kitchen function is performed, causing the heat dissipation to be at the minimum level. In addition, the fireplaces in the summer section allow to be heated of these spaces and make it possible to use them in the winter (Figure 13b). In addition, fences which known as “daraba” were used to limit the kitchen spaces and the ventilation was ensured to be at a high level.

A fireplace is designed in at least one room in houses without a separate kitchen and sofa. The fireplace was used to provide both cooking and heating functions. In the houses with a single fireplace, heat loss is reduced by using a square or rectangular plan scheme and care is taken to distribute the heat within the spaces. In buildings with more than one fireplace, it is possible to heat the desired spaces at different times (Figure 13c).

98% of Alanya rural houses were built with two floors and the lower floors were used as barns. The upper floor plan setup can be followed in the same way on the lower floor due to the carrier system. For this reason, there are rooms on the upper floors of the barns on the lower floor (Figure 14). This made it possible to use the warmth of the animals to heat the rooms.

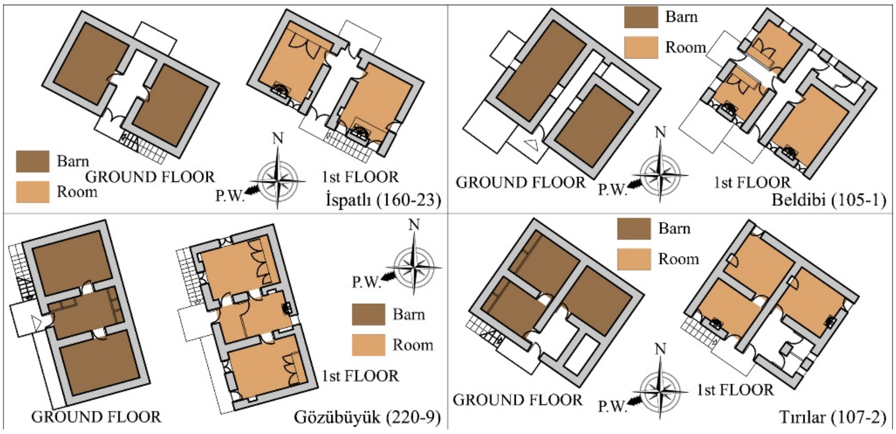


Figure 14. Barn-room settlements in rural dwellings in Alanya.

Building Envelope and Transparency Rate

The elements that form the outer boundaries of the building and limit the interior spaces are called the building envelope. In order to reduce the energy consumed for buildings and to provide comfort conditions with the least energy consumption, keeping the hot air out in the summer and the cold air in the winter is a priority. For this reason, especially the window sizes and numbers should be designed according to the usage purposes of the spaces.

Looking at the building envelopes of the rural dwellings in Alanya, it is understood that the windows of the spaces used in winter are smaller in size, but their number is also less (Figure 15a). The windows of the spaces used in the summer are both larger and more numerous (Figure 15b). Due to the fact that the ground floors of the rural dwellings are used as service floors (barn, hayloft, warehouse (depot)), the windows are kept small in order to prevent unwanted heat loss/gain and at the same time to provide ventilation at the optimum level. In the design of these windows, joinery was generally not used (Figure 15c), and in very few examples, shutters (Figure 15d) or railings were used (Figure 15e). In

DOI: 10.15320/ICONARP.2022.218

addition to the windows, it is seen that small spaces are designed in the building envelope for ventilation purposes (Figure 15f).

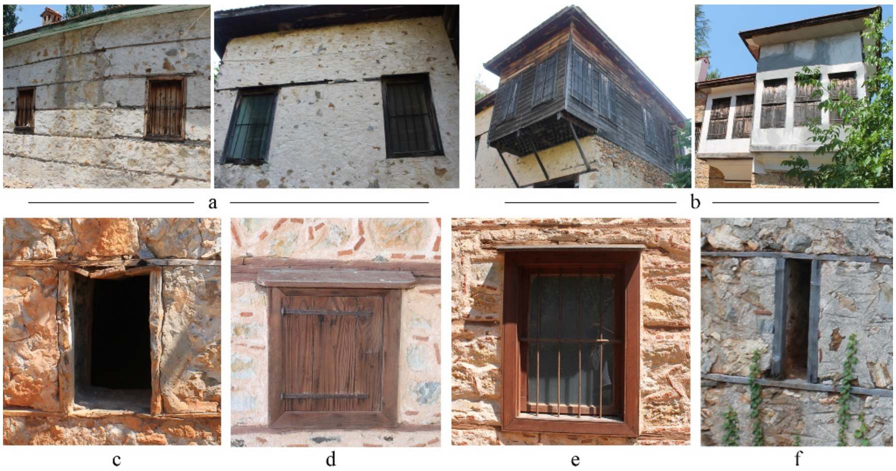


Figure 15. Summer-winter spaces and service floor windows in Alanya rural dwellings.

The ratio of the window and door openings on the building facades to the whole facade is called the transparency ratio. This ratio determines the comfort conditions and energy use by directly affecting the heat losses or gains depending on the values on different facades. Especially window designs provide gain for heating, ventilation and lighting, but also cause heat loss due to low heat permeability resistance. For this reason, the opaque-transparent ratio in structures is important. In order to prevent excessive heat loss and gain, it is recommended that the transparent-opaque ratio should not exceed 10-15% (Soysal, 2008), and that the space-occupancy ratio should be limited to a maximum of 40%, taking into account adequate ventilation and lighting in sustainable design (Aktuna, 2007; Çakır, 2011; Kuşçu, 2006).

When the houses are evaluated in terms of transparent-opaque ratio, it is determined that they have a ratio of at least 10,36% and at most 23,20%. The average value of these ratios was determined as 17.56% in 9 housing samples (Figure 16). It is understood that the transparent-opaque ratio, which should be around 15% in terms of optimum thermal insulation, is provided in Alanya rural residences. In addition, the ratio, which should be max. 40% in terms of ventilation and lighting, has not been exceeded in any residence. For this reason, it is seen that the houses provide optimum energy use in terms of the building envelope.

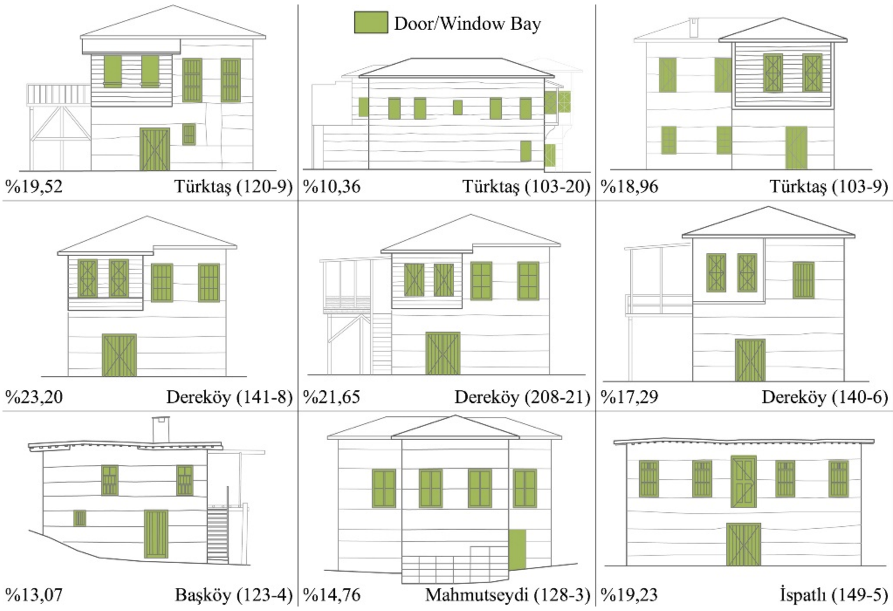


Figure 16. Transparent-opaque ratios in Alanya rural dwellings.

Construction Materials

Construction materials have important effects in terms of sustainability on the basis of production, use and after-use effects. The amount of energy consumed during the production of materials varies according to the type of material. The materials most commonly used in buildings are wood (5 kWh/m^3), concrete (45 kWh/m^3), glass (60 kWh/m^3), brick (140 kWh/m^3) and steel (550 kWh/m^3). There are great differences between the values in the production of these materials (İnanç, 2010). For this reason, it is important to choose materials that can be produced with low energy in terms of efficiency principles. In addition, materials that can be obtained from the environment close to the building and produced without creating waste material have a great value for the environment.

The low repair and maintenance costs of the materials to be used and the fact that they do not emit harmful gases to the environment are important in terms of their impact on the environment when used. When the building has completed its life, the materials should be reusable, recyclable and should not harm the ecosystem by leaving excavation residues. Based on these values, sustainable, durable, easily repairable/available, long-lasting and renewable materials should be used, which consume less energy, are not harmful to the environment and humans, or are least harmful for their production, use and after use.

Stone (Figure 17a), wood (Figure 17b) and soil (Figure 17c, d) were used as building materials in Alanya qualified rural dwellings. Quartzite, barite, limestone, travertine and marble are mined throughout the district. The most commonly used stones in buildings are limestone and travertine, which can be obtained from the nearest area. Wood is obtained from pine, cedar, fir, juniper and oak trees found in the region. The plaster/mortar content is the soil in which quartz mineral is predominantly seen. Soil was used on the top cover of the structures (Aksoy and Sağıroğlu Demirci, 2022). When the materials are examined,

DOI: 10.15320/ICONARP.2022.218

it is seen that the amount of energy needed in the production of all of them is at the lowest level, the maintenance / repair costs are low, they can be easily obtained from the region, harmless to the environment, durable, long-lasting and renewable materials.

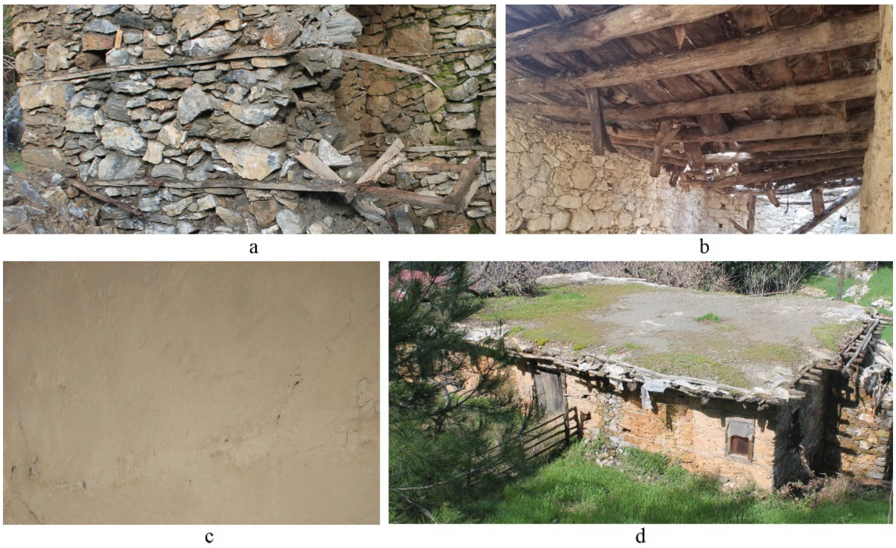


Figure 17. Transparent-opaque ratios in Alanya rural dwellings.

CHANGES MADE IN ALANYA RURAL HOUSES

The characteristics of the original examples of Alanya rural architecture show that they contain the most effective solutions in many respects. However, over time, the structures have changed due to changes and developments in comfort conditions, difficulties in finding craftsmen and materials, and functional or spatial transformations within the scope of tourism. For these reasons, changes and transformations were made in the original spaces and architectural elements, with additions, changes or transformations in the infrastructure and superstructure.

The changes and transformations in which the calculations will be made were identified among the most common examples within the scope of the study (Aksoy, 2021) carried out in 68 villages in the area between 2018-2021. In addition to unique situation (Figure 18a), the most intense changes detected in the area are; adding a concrete flat roof (Figure 18b), adding a hipped roof (Figure 18c), plastering the walls with cementitious plaster (Figure 18d), replacing the exterior door with a metal door (Figure 18e), replacing the windows with metal or PVC windows (Figure 18f, g), increasing the size of the window (Figure 18h) and making the walls concrete instead of stone.

Figure 18. Building materials used in rural dwellings in Alanya.

CHANGES IN ENERGY REQUIREMENTS RESULTING FROM ORIGINAL ATTRIBUTES BY ADDITIONS, REMOVALS AND REPLACEMENTS

In order to determine the effect of changes, additions and removals in the buildings in the area, a 4-room residence in Başköy, which is one of the original examples, was determined. The house was modeled in the "DesignBuilder" software and compared with the original space and its elements in terms of energy conservation through the changing space and elements.

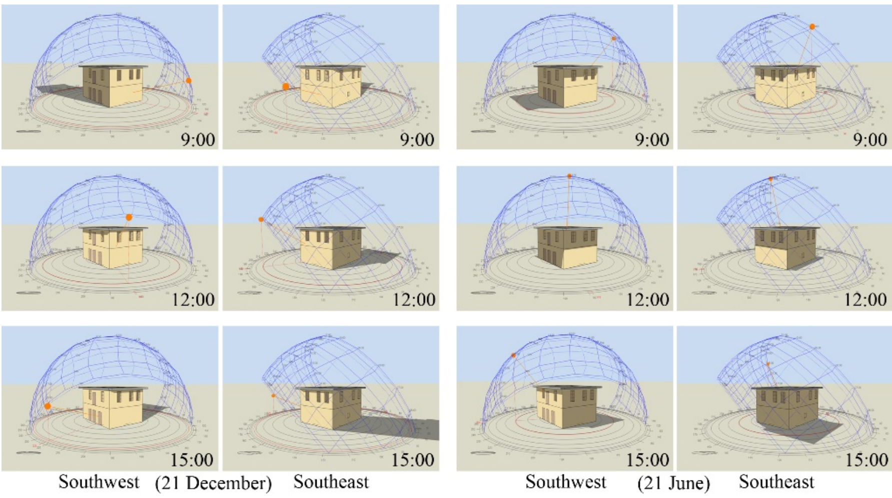


Figure 19. Sun angles depending on the location of the qualified dwelling in Başköy.

The shadow formations that occur with the sun angles on different dates were determined regarding the extent to which the 4-room house in Başköy can benefit from the sun. For this, the dates of June 21st and December 21st, when the sun's rays are the most vertical and horizontal, were used; In order to see the angle of incidence of the sun's rays during the day, 3 different time zones were determined as 09:00, 12:00 and 15:00. In line with the building location, material and window designs, it is understood that while it is protected from sunlight during the summer months, it is utilized efficiently in the winter months (Figure 19). This is achieved especially by turning the winter spaces to the southeast-southwest direction and keeping the window sizes smaller, and by turning the summer spaces to the prevailing wind direction and positioning the windows at different angles.

In order to determine the energy loads in the modelling, values for both heating and cooling were determined; the maximum energy

DOI: 10.15320/ICONARP.2022.218

consumption for the use of the house in its original state has been determined. The total area of the building is 70.08 m^2, and the heated and cooled building area is 35.04 m^2. The ground floor and upper floor walls of the building are made of 60 cm masonry stone, and the roof is 25 cm thick as an earthen roof. The floor of the building is covered with 3 cm of wood on the beams, and the floor of the ground floor is soil, and it is modelled in the same way. In addition, the doors are 4 cm thick, wooden knock-out doors and windows are available as 3 mm single-layer glass in 4 cm thick joinery and have been chosen in the same way.

Considering the months, the most energy is spent in January (72.53 kWh/year) for heating the building, and the most energy is spent in August (688.15 kWh/year) for cooling the building. The total amount of energy needed annually is 220.15 kWh for heating and 2048.71 kWh for cooling. The amount of energy spent for heating per square meter is 1034.89 Wh/m^2 in January, and the amount of energy spent for cooling is 9819.49 Wh/m^2 in August. The annual total amount of energy needed according to the characteristics and location of the building is 3141.41 kWh/m^2 for heating and 29233.84 kWh/m^2 for cooling (Table 1).

Table 1. The heating and cooling energy needs of the building according to the months, in its original form

Months	**Cooling (kWh)**	**Heating (kWh)**	**Cooling (Wh/m^2)**	**Heating (Wh/m^2)**	**CO_2 emission (kg)**	**CO_2 emission (gr/m^2)**
January	0	72,52528	0	1034,893	439,6887	6274,096
February	0	56,90601	0	812,015	393,8193	5619,568
March	0	38,43453	0	548,4379	426,5338	6086,383
April	-1,567337	0,587215	-22,365	8,37921	399,0284	5693,899
May	-30,21868	0	-431,203	0	419,0276	5979,275
June	-268,111	0	-3825,79	0	463,4120	6612,613
July	-632,844	0	-9030,31	0	565,1039	8063,697
August	-688,1501	0	-9819,49	0	578,5101	8254,995
September	-373,0504	0	-5323,21	0	488,8492	6975,588
October	-49,80738	0	-710,722	0	423,7759	6047,031
November	-4,958916	2,847986	-70,7608	40,63907	400,7229	5718,078
December	0	48,84897	0	697,0458	430,5525	6143,728
TOTAL	**-2048,708**	**220,15**	**29233,84**	**3141,41**	**5429,024**	**77468,95**

A high level of energy is consumed in the production of building materials. In addition, buildings emit carbon (CO_2 emissions) to the environment according to the materials they are built from. The higher the emission, the higher the damage to the environment, while the lower level causes it to decrease. The CO_2 emissions of the materials vary throughout the year depending on the temperature and climatic conditions. The highest CO_2 emission of the selected residence in the Alanya countryside is 578.51 kg in August; the lowest CO_2 emission is in April with 399.03 kg; the annual total CO_2 emission is 5429.02 kg. The CO_2 emission per square meter is 8255.00 gr/m^2 in August, 5693.90 gr/m^2 in April, and the annual total is 77468.95 gr/m^2 (Table 1).

In line with the changes in Alanya rural buildings, energy needs and CO_2 emissions have been determined depending on different factors. In addition, the total energy need and carbon emissions that occur when all

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

the changes are made together were calculated and the differences between the original situation and the new situation were determined.

Heating, cooling and CO2 emission values were determined by considering each of the changes detected in the area as a different parameter. However, in many of the examples encountered in the field, it was determined that more than one of these parameters were changed at the same time; these samples were also evaluated (Table 2).

In the calculations of the parameters, the most frequently encountered and documented values in the field investigations were used. In this context, the most common applications are: removing the earthen roof and making a 12 cm reinforced concrete roof cover or a wooden hipped roof without insulation and tile; It is the use of cement-based interior and exterior plaster instead of soil and lime plaster, replacing the original doors and windows, and using 4 cm thick iron joinery doors and 130 cm wide modern windows (double glazed PVC joinery with a glass thickness of 3 mm and a gap of 13 mm). In the analysis, it was determined that the positions of the buildings did not change. In addition to the changes applied individually, the variations in which more than one change was applied together were also determined and analysed (Table 2).

Table 2. The heating and cooling energy needs of the building according to the months, in its original and different forms

Changes		Cooling (kWh)	Heating (kWh)	Cooling (Wh/m²)	Heating (Wh/m²)	CO_2 emission (kg)	CO_2 emission (gr/m²)	CO_2 emission (kg)-Including Material Production
1	Unique Situation	2048,708	220,15	29233,84	3141,41	5429,024	77468,95	9036,5
2	Concrete Roof (12cm)	2896,932↑	238,7109↑	41337,50↑	3406,263↑	5641,796↑	80505,08↑	9768,2↑
3	Hipped Roof	1893,485↓	158,2521↓	13116,93↓	1096,276↓	5367,513↓	37182,91↓	13402,8↑
4	Cement plaster (interior-exterior)	1929,463↓	207,3402↓	29520,9↑	3172,318↑	5068,636↓	77550,46↑	14441,8↑
5	İron door	2111,137↑	220,5824↑	30124,67↑	3147,58↑	5444,324↑	77687,27↑	14194,0↑
6	İron window	2050,342↑	220,9029↑	29257,16↑	3152,153↑	5429,711↑	77478,75↑	9036,5←→
7	PVC Window (Double glazed)	1978,241↓	215,764↓	28228,32↓	3078,824↓	5410,25↓	77201,06↓	9537,5↑
8	Windows are enlarged	2549,531↑	198,2949↓	36380,29↑	2829,55↓	5541,99↑	79080,91↑	8938,7↓
MOST COMMON APPLICATION VARIATIONS IN EXAMPLES WHICH DETECTED IN THE FIELD								
9	2-4-5-6-8*	3351,194↑	207,2296↓	51273,49↑	3170,626↑	5413,221↓	82822,63↑	19963,1↑
10	3-4-5-6-8*	2487,937↑	121,1832↓	17831,81↓	867,8659↓	5170,635↓	37030,04↓	23597,7↑
11	2-4-5-7-8*	3256,073↑	198,8544↓	49818,13↑	3042,485↓	5386,932↓	82420,41↑	20113,8↑
12	3-4-5-7-8*	2317,899↑	100,8142↓	16599,88↓	721,9917↓	5121,687↓	36679,5↓	23748,3↑
13	Reinforces Concrete-3-4-5-7-8*	2397,239↑	96,44875↓	14123,28↓	568,2259↓	7588,948↑	44710,13↓	39696,2↑
* It indicates the equivalents of the applied changes in the first 8 items.								

EVALUATION AND CONCLUSION

Sustainability is an important parameter that should be considered long-term and also in new constructions. The importance of efficient use of energy resources and energy, reducing environmental pollution and building in accordance with nature is increasing day by day. For this reason, it is important to consider the environmental impact in both the

DOI: 10.15320/ICONARP.2022.218

interventions to the existing structures and the newly designed structures.

While traditional buildings in rural areas, which were built within the framework of limited opportunities in the past, are mostly compatible with topography, climate and nature, these features are put into the background in today's buildings. This leads to overuse of resources, depletion of resources, pollution of the environment and air, and more energy consumption. For this reason, it is necessary to benefit from the design data of traditional buildings in the new construction and to be developed by taking them as an example.

Alanya is located in a region with hot summers and mild winters. For this reason, it is seen that qualified houses are positioned on the slopes of the hills and in this way they benefit more from the wind. In addition, the structures built by adhering to the organic texture of the residential areas are designed in a way that does not cut each other's sun/wind and in accordance with the slope.

Although it is seen that solar control is also considered in qualified buildings, trees, structural and architectural elements are used for this. Since the houses are located close to the northern part of the parcels, trees have been planted in the south and west parts. Thus, while the unwanted sun rays are prevented in the summer months, cooling is not hindered since the northeastern parts, which are the dominant wind direction, are not closed. In addition, keeping the south facade windows smaller, the use of grids and shutters on the windows and the orientation of the building show that solar control is considered. The frameworks created to provide shade over the arbor sections also provide open space solar control.

Wind control can be achieved by positioning the buildings according to the prevailing wind direction, depending on their mass characteristics. In addition, the hollow design of the wooden partition elements used in the building allows the wind to pass through and provides cooling in open and summer spaces. In order to ensure adequate indoor ventilation, positioning to the wind direction has been realized and the windows have been designed on the side facades, not opposite, to prevent linear/fast flow.

There are stoves in the winter spaces to heat the houses during the winter months. The furnaces are made in different numbers according to the size of the building. It is also seen that the furnaces are built in a single room due to the sufficient heat dissipation depending on the building form. In the houses with kitchens, these spaces are designed inside the summer sections in order to provide heating in the winter and to disperse the heat in the summer. Benefiting from the body heat of animals in buildings whose lower floors are used as barns is also seen throughout the region. The gaps designed in the building envelopes for thermal insulation were found to be 17.56% on average. This provides about 15%, which is necessary for optimum insulation.

Since the materials used in the original buildings are completely natural materials, they have low maintenance costs, are easily obtainable, consume less energy in both production and use, and are recyclable. In addition, materials that are harmless to the environment and nature are used.

Changes in original buildings and new buildings built in rural areas were analyzed and the amount of heating and cooling energy needed, CO_2 emissions in use and CO_2 emissions, including the production of materials, were determined. In the analyzes made depending on a single parameter change in the houses whose qualities are deteriorated due to different factors, it has been determined that although the heating and cooling energy can decrease, CO_2 emissions do not decrease, except for one situation, considering the production processes of the materials. However, the total effect ratio was found by evaluating the data of all parameters proportionally (Table 3).

Table 3. Total rate of change due to changes in quality housing

Changes		Total Energy Cooling-Heating (kWh)	CO_2 emission(kg) -Material Production Inc.	Energy Exchange (%)	CO_2 emission Exchange (%)	Total Effect (%)
1	Unique Situation	2268,858	9036,5	-	-	-
2	Concrete roof (12cm)	3108,6429↑	9768,2↑	%37,01	%8,10	%45,11↑
3	Hipped roof	2051,7371↓	13402,8↑	-%9,57	%48,32	%38,75↑
4	Cement plaster (interior-exterior)	2136,8032↓	14441,8↑	-%5,82	%59,82	%54,00↑
5	İron Door	2331,7194↑	14194,0↑	%2,77	%57,07	%59↑
6	İron window	2271,2449↑	9036,5←→	%0,11	-	%0,11↑
7	PVC Window (Double glazed)	2194,0050↓	9537,5↑	-%3,30	%5,54	%2,24↑
8	Windows are enlarged	2747,8259↑	8938,7↓	%21,11	-%1,08	%20,03↑
MOST COMMON APPLICATION VARIATIONS IN EXAMPLES WHICH DETECTED IN THE FIELD						
9	2-4-5-6-8	3558,4236↑	19963,1↑	%56,84	%120,92	%177,76 ↑
10	3-4-5-6-8	2609,1202↑	23597,7↑	%14,10	%161,14	%175,24 ↑
11	2-4-5-7-8	3454,9274↑	20113,8↑	%52,28	%122,58	%174,86 ↑
12	3-4-5-7-8	2418,7132↑	23748,3↑	%6,60	%162,80	%169,40 ↑
13	Reinforces Concrete-3-4-5-7-8	2496,6878↑	39696,2↑	%10,04	%339,29	%349,33 ↑

Depending on the change of individual building elements, the energy need increased mostly as a result of enlarging the windows (21.11%) and decreased (-9.57%) as a result of the hipped roof construction. The amount of CO_2 emission increased mostly due to the plastering of the walls with cement-based plaster (59.82%), and decreased due to the enlargement of the windows (-1.08%). On the other hand, in the

DOI: 10.15320/ICONARP.2022.218

integrated deteriorations in the buildings, the increase in energy demand is seen mostly due to the concrete roof, cement-based plaster, metal doors and windows and window enlargement (55.84%), while the increase in CO_2 emission is seen in the new buildings made with reinforced concrete system and added spaces (hipped roof, cement plaster, metal door, PVC and large-sized windows are used) (339.29%). Depending on the application of combined variations, there is no reduction in energy demand and CO_2 emissions. Considering the sum of the proportional values of the energy change and the CO_2 emission change, no reduction was detected in any case. While the least increase is seen in the use of metal windows in the replacement of individual structural elements (0.11 %), the highest increase is seen in the construction of new reinforced concrete system buildings (349.33%) (Table 3).

The data obtained within the scope of this study show that all kinds of non-specific interventions to the buildings, with the exception of the roof addition, increase the heating and cooling load and increase the CO2 emission. In this context, the necessity of applying original materials and details in interventions to qualified buildings has been determined. The buildings that make up the rural architectural heritage have a superior experience in terms of harmony with the topography, orientation to the sun/shade, protection of the built and natural environment, and the use of materials with energy efficiency and environmental sensitivity in terms of structural and architectural elements. In the problems that depend on atmospheric conditions, environmental data and the user, the protection of the structure requires intervention. However, making these interventions using easily available but non-original shapes and materials causes a decrease in energy efficiency and an increase in environmental pollution due to both the alteration/deterioration of traditional buildings and the materials and production techniques selected in new buildings.

REFERENCES

Al-Sakkaf, A., Mohammed Abdelkader, E., Mahmoud, S., & Bagchi, A. (2021). Studying Energy Performance and Thermal Comfort Conditions in Heritage Buildings: A Case Study of Murabba Palace. *Sustainability*, 13(21), 12250.

Akadiri, P.O., Chinyio, E.A. & Olomolaiye, P.O. (2012). Design of A Sustainable Building: A Conceptual Framework for Implementing Sustainability in the Building Sector, *Buildings*, *2(2)*, 126-152.

Aksoy, E. (2021). Determination of Protection Possibilities in Rural Areas Which Transformed Under the Influence of Tourism and Changing Production Dynamics: The Case of Alanya. Ankara: Gazi University, Graduate School of Natural and Applied Science (Unpublished PhD Thesis).

Aksoy, E. & Sağıroğlu Demirci, Ö. (2022). *Alanya Kırsal Mimarisi*. Gece Yayınları.

Aktuna, M. (2007). The Analysis of Buildings in Vernacular Architecture Regarding to Sustainable Design Principles with Example of Antalya Kaleiçi Houses. İstanbul: Yıldız Technical University, Graduate School of Natural and Applied Science (Unpublished MSc Thesis).

Amasyali, K. & El-Gohary, N.M. (2018). A Review of Data-Driven Building Energy Consumption Prediction Studies, *Renewable and Sustainable Energy Reviews*, *(81),* 1192-1205.

Barthel-Bouchier, D. (2016). *Cultural Heritage and the Challenge of Sustainability*. Routledge.

Butler, R. (1991). Tourism, Environment, and Sustainable Development. Environmental Conservation, 18(3), 201-209.

Cole, R.J. & Larsson, N.K. (1999). GBC'98 and GBTool: background, *Building Research & Information*, *27(4-5)*, 221-229.

Çakır, G. (2011). In The Context of Sustainable Architecture Examining of High-Rise Buildings. İstanbul: Mimar Sinan Fine Arts University Graduate School of Natural and Applied Science (Unpublished MSc Thesis).

Darwin, C. (2009). *The Expression of the Emotions in Man and Animals (Digitally)*. Cambridge University Press.

De Rubeis, T., Nardi, I., Muttillo, M., & Paoletti, D. (2020). The restoration of severely damaged churches–Implications and opportunities on cultural heritage conservation, thermal comfort and energy efficiency. *Journal of Cultural Heritage,* 43, 186-203.

Dikmen, Ç.B. (2011). Enerji Etkin Yapı Tasarım Ölçütlerinin Örneklenmesi, *Politeknik Dergisi*, *14(2)*, 121-134.

Erduran, D.U., Demirel, İ.O. & Elias-Özkan, S.T. (2021). Analysis of Brick Wall Debris for Reusing, *Journal of the Faculty of Engineering and Architecture of Gazi University*, *36(4),* 1923-1938.

Ergöz Karahan, E. (2017). Geleneksel ve Günümüz Konutunda Sürdürülebilirlik ve Yaşam Alışkanlıkları: Osmaneli Örneği, *MEGARON-Yıldız Technical University Faculty of Architecture E-Journal*, *12(3),* 497-510.

Gebel, Ş., Ayçam, İ. & Kalfaoğlu Hatipoğlu, H. (2021). "Eko mahalle" yerleşimi ve örneklemeleri. In H.B. Henden Şolt (Eds.). *Mimarlık Planlama ve Tasarım Alanında Araştırma ve Değerlendirmeler* (pp. 223-260). Gece Kitaplığı.

Gökşen, F., Ayçam, İ. & Güner, C. (2020). Sürdürülebilirliğin Mimarlık Yüksek Lisans Programı ile Bütünleştirilmesi: Yurt Dışı ve Türkiye Örneklerinin Karşılaştırmalı Analizi, *Uluslararası Doğu Anadolu Fen Mühendislik ve Tasarım Dergisi*, *2(2),* 401-433.

Gürsel Dino, İ. (2017). Binalarda Güneş Kontrol Yöntemlerinin Optimizasyon Temelli Performans Değerlendirilmesi, *Gazi Üniversitesi Fen Bilimleri Dergisi Part C: Tasarım ve Teknoloji*, *5(3)*, 71-87.

Halliday, S. (2008). *Sustainable Construction*. Butterworth Heinemann.

Hill, R.C. & Bowen, P.A. (1997). Sustainable Construction: Principles and A Framework for Attainment, *Construction Management & Economics*, *15(3),* 223-239.

Juan, Y.K., Hsing, N.P. & Hsu, Y.H. (2019). Applying the Kano Two-Dimensional Model and Quality Function Deployment to Develop Sustainable Planning Strategies for Public Housing in Taiwan, *Journal of Housing and the Built Environment*, *34(1)*, 265-282.

Kibert, C.J. (2008). *Sustainable Construction: Green Building Design and Delivery, 2nd edition*. Wiley and Sons, Inc.

Kuşçu, A.C. (2006). Research of Traditional Konya House in Sustainabile Architecture Context. İstanbul: Yıldız Technical University, Graduate School of Natural and Applied Science (Unpublished MSc Thesis).

Lechner, N. (2015). *Heating, Cooling, Lighting Sustainable Methods for Architects*. John Wiley and Sons Inc.

DOI: 10.15320/ICONARP.2022.218

Li, W. (2011). Sustainable Design for Low Carbon Architecture, *Procedia Environmental Sciences*, *(5)*, 173-177.

Lippiatt, B.C. & Norris, G.A. (1995). *Sustainable Building Technical Manual, Selecting Environmentally and Economically Balanced Building Materials*. Public Technology Inc.

Marzouk, M., Abdelkader, E. M., & Al-Gahtani, K. (2017). Building information modeling-based model for calculating direct and indirect emissions in construction projects, *Journal of cleaner production,* 152, 351-363.

Miyatake, Y. (1996). Technology Development and Sustainable Construction, *Journal of Management in Engineering*, *12(4),* 23-27.

Mohamed, K.E. & Elias Özkan, S.T. (2019). Sustainable Architectural Design Education: A Pilot Study in A 3rd Year Studio, *The Academic Research Community Publication*, *2(3),* 126-135.

Nejat, P., Jomehzadeh, F., Taheri, M. M., Gohari, M., & Majid, M. Z. A. (2015). A global review of energy consumption, CO2 emissions and policy in the residential sector (with an overview of the top ten CO2 emitting countries). *Renewable and sustainable energy reviews*, 43, 843-862.

Özgür, F. (2018). Determination of Botanical Composition and Hay Yield On Different Altitudes Rangeland in Alanya. Düzce: Düzce University, Graduate School of Natural and Applied Science (Unpublished MSc Thesis).

Philokyprou, M. & Michael, A. (2021). Environmental Sustainability in The Conservation of Vernacular Architecture. The Case of Rural and Urban Traditional Settlements in Cyprus, *International Journal of Architectural Heritage*, *15(11)*, 1741-1763.

Sabancı, S. (2012). Climate Properties of Alanya and Manavgat. İstanbul: İstanbul University, Graduate School of Social Sciences (Unpublished MSc Thesis).

Said, F.S. & Harputlugil, T. (2019). A Research On Selecting the Green Building Certification System Suitable for Turkey, *GRID-Architecture Planning and Design Journal*, *2(1)*, 25-53.

Samalavičius, A. & Traškinaitė, D. (2021). Traditional Vernacular Buildings, Architectural Heritage and Sustainability, *Journal of Architectural Design and Urbanism*, *3(2),* 49-58.

Sánchez, P.A.L. & Medrano, F.J.S. (2015). Sustainable Architecture in the Traditional Rural Environment: Moratalla. In C. Mileto, F. Vegas, L. Garcia, V. Cristini (Eds.). *Vernacular Architecture: Towards a Sustainable Future* (pp. 449-454). Taylor and Francis Group.

Sayın, S. (2006). The Significance of the Use of Renewable Energy in Our Countrie's Building Sector and The Opportunities of Utilizing of Solar Energy in Buildings. Konya: Selçuk University, Graduate School of Natural and Applied Science (Unpublished MSc Thesis).

Sev, A. (2009). How Can the Construction Industry Contribute to Sustainable Development? A Conceptual Framework, *Sustainable Development*, *17(3),* 161-173.

Soflaei, F., Shokouhian, M. & Zhu, W. (2017). Socio-Environmental Sustainability in Traditional Courtyard Houses of Iran and China, *Renewable and Sustainable Energy Reviews*, *(69),* 1147-1169.

Soysal, S. (2008). The Relationship of Design Parametrics with Energy Consumption in Residences. Ankara: Gazi University, Graduate School of Natural and Applied Science (Unpublished MSc Thesis).

Temur, H. (2011). The Evaluation of Traditional Edirne Housing Architecture in Terms of Energy Efficiency and Thermal Analysis in The Context of

Sustainability. Edirne: Trakya University, Graduate School of Natural and Applied Science (Unpublished MSc Thesis).

Ulukavak Harputlugil, G. & Çetintürk, N. (2005). Geleneksel Türk Evi'nde Isıl Konfor Koşullarının Analizi: Safranbolu Hacı Hüseyinler Evi, *Gazi Üniversitesi Mühendislik Mimarlık Fakültesi Dergisi*, *20(1),* 77-84.

Utkutuğ, G. (2011). Sürdürülebilir Bir Geleceğe Doğru Mimarlik ve Yüksek Performanslı Yeşil Bina Örnekleri, X. Ulusal Tesisat Mühendisliği Kongresi, 13-16 April 2011, pp. 1517-1538, İzmir.

Vissilia, A.M. (2009). Evaluation of A Sustainable Greek Vernacular Settlement and Its Landscape: Architectural Typology and Building Physics, *Building and Environment*, *44(6),* 1095-1106.

Watson, D. & Kenneth Labs. (1993). *Climatic Design: Energy-Efficient Building Principles and Pracrise*. McGraw-Hill Book Company.

WCED (World Commission on Environment and Development). (1987). *Our Common Future*. Oxford University Press.

Williams, K. & Dair, C. (2007). What Is Stopping Sustainable Building in England? Barriers Experienced by Stakeholders in Delivering Sustainable Developments, *Sustainable Development*, *15(3)*, 135-147.

Yurtsever, B., Ulukavak Harputlugil, G. & Harputlugil, T. (2013). Sürdürülebilir Bina Tasarımının Mimarlık Eğitim Süreci Içerisinde Değerlendirilmesine Yönelik Bir Çalışma, 11. Ulusal Tesisat Mühendisliği Kongresi, 17-20 April 2013, pp. 1437-1443, İzmir.

Yüksek, İ. & Esin, T. (2013). Analysis of Traditional Rural Houses in Turkey in Terms of Energy Efficiency, *International Journal of Sustainable Energy*, *32(6)*, 643-658.

Zhong, H., Wang, J. & Jia, H. (2019) Vector Field-Based Support Vector Regression for Building Energy Consumption Prediction, *Applied Energy*, *(242),* 403-414.

Resume

Dr. Ercan AKSOY received his B.Arch and M.Arch from Selçuk University, Faculty of Architecture, and Ph.D. from Gazi University, Faculty of Architecture. He currently works as General Director in Eha Cons. & Architecture in Ankara. His research focuses on the preservation of built heritage, rural architecture, restoration and conservation.

Assoc. Prof. Dr. Özlem Sağıroğlu Demirci received her B.Arch from Karadeniz Technical University, Faculty of Architecture, and M.Arch and Ph.D. from Gazi University, Faculty of Architecture. She has been working in Gazi University, Department of Architecture. Her research focuses on vernacular architecture, digital works at conservation of heritage and architectural design in historical environment.

DOI: 10.15320/ICONARP.2022.218

ICONARP
International Journal of Architecture and Planning
Received: 07.11.2022 Accepted: 01.12.2022
Volume 10, Issue 2/ Published: 20.12.2022
DOI: 10.15320/ICONARP.2022.219 E- ISSN:2147-9380
Research Article
ICONARP

Why Is There a Need for a Value-Based Zoning Application Method in Urban Areas in Turkey?

Vuslat Salalı *
Şaban İnam **
Mehmet Topçu***

Abstract

In addition to the economic and social problems experienced due to migration from rural to urban areas in developing communities, there are also problems of 'physical settlement and use of property' in urban areas. After determining the needs for the solution of urban problems, it is necessary to "manage urban settlements and existing resources" in a fast, effective, accurate and sustainable approach. In this regard, the approaches implemented by central and local governments within the scope of the '11th Development Plan of the Republic of Turkey', titled "Free Individual, Strong Society, More Democratic Turkey" published by the Ministry of Justice in 2021 are based on the perspective of 'individual rights and social reconciliation'. In addition, the importance of real estate property right, its strengthening and the need to use it without any problems were mentioned. In the process of ensuring the development of the 'zoning plan implementation in the Land Readjustment method' model including the sustainable, innovative and applicable qualifications for Turkey; Institutional level projects are produced by practitioners, users and academics. In this method/model development process, in the Land Readjustment (LR) method, it is important to 'pre-regulation and post-regulation equality of land value and protection of property rights' in the process of allocating zoning parcels to the property owner. In the phenomenon of sustainable urbanization, real estate is also the determinant of the social life of living in urban sociology in terms of 'problem-free use of property'. For this reason, innovative solution proposals are needed in cities where 'zoning planning and plan implementation processes will be carried out in a sustainable land management approach and interactively'.

In this study, the deficiencies and negativities encountered both in the legislation and during the implementation of the LR method currently applied in Turkey will be revealed; in this regard, the methods applied in the world and the 'appliance based on value equality' models will be examined. Taking into account the social habits regarding the use of property, an answer will be sought to the question of why it is necessary to switch from the area-based application (equiproportion) principle to the value-based application (equivalence) model in the LR method in Turkey.

Keywords:
Equiproportion, equivalence, land readjustment, sustainability

*Department of Architecture and Urban Planning, Vocational School of Technical Sciences, Isparta University of Applied Sciences, Isparta, Turkey
(Corresponding author)
Email: vuslatsalali@isparta.edu.tr

**Geomatics Engineering, Konya Technical University, Konya, Turkey
Email: sinam@ktun.edu.tr

***Urban and Regional Planning, Konya Technical University, Konya, Turkey
Email: mtopcu@ktun.edu.tr

To cite this article: Salalı, V., İnam, Ş. & Topçu, M. (2022). Why Is There a Need for A Value-Based Zoning Application Method in Urban Areas in Turkey? *ICONARP International Journal of Architecture and Planning,* 10 (2), 640-659. DOI: 10.15320/ICONARP.2022.219

INTRODUCTION

A growing understanding of the importance of land as a limited/scarce resource is leading to the adoption of sustainable land use and management practice (Solly et al., 2021). The technical, social and economic changes experienced over time; in particular, the consequential effects of the Second World War gradually accelerated the transformation of the land, causing its 'over-exploitation despite the recognition of its finite nature'. The COVID-19 epidemic, which is experienced at the global level today, has warned us very strongly about 'sustainability of the natural environment and being able to be resilient in unexpected situations' for the sustainable construction of both today and the future (Cotella and Vitale Brovarone 2020/a). In this context, it is even more important to find and adopt integrated solutions in order to protect the past and ensure sustainable development today and in the future (Filho et al. 2021). The approach of political decision makers who play a role in the social process, 'careful and correct decision-making on urbanization and land management that will positively affect the welfare and quality of life of the society' will be the most effective solution.

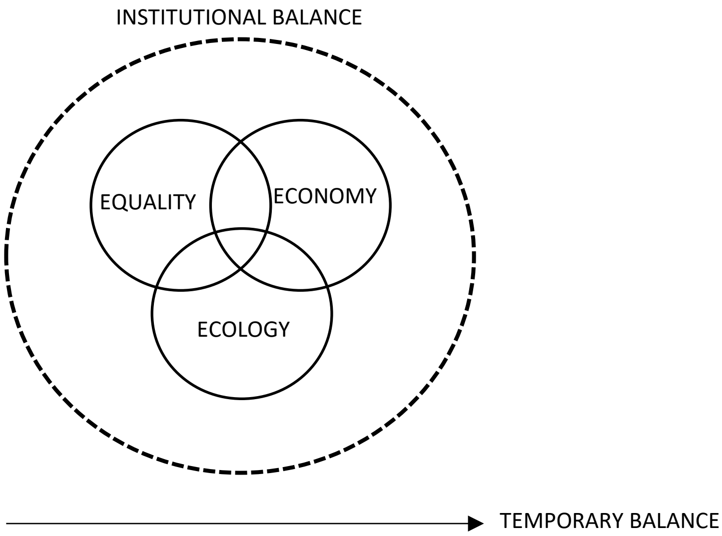


Figure 1. Sustainable development balance (Cotella et al. 2020/b

The research and studies on sustainable urbanization and land use have increased in terms of developing different definitions and interpretations of the concept of 'sustainability'. Sustainable urbanization: It focuses on the diversity of land use in the transfer of the current urban development to the future, which is environmentally friendly, with efficient resource management. Sustainable land use, in particular, seems to depend on both the social and economic processes that accelerate spatial development and the effectiveness of the tools that regulate these processes (Solly et al., 2020). In this context, when the existing literature at national and international level is examined, it is seen that sustainable development consists of a cycle both individually and interconnected, depending on three basic (equality-

DOI: 10.15320/ICONARP.2022.219

ecology-economy) principles (Nulkar, 2018) (Figure.1). In addition, while the adoption of the principle of transparency in taking, implementing and auditing the right decisions requires ensuring institutional balance; It should not be forgotten that the solutions found to periodic problems provide temporary balance.

After determining the needs for the solution of urban problems, it is necessary to "manage urban settlements and existing resources" in a fast, effective, accurate and fair manner, but with a sustainable approach. In this regard, the approaches implemented by central and local governments within the scope of the '11th Development Plan of the Republic of Turkey', enrichment of zoning implementation methods in Turkey with the perspective of 'individual rights and social reconciliation' put forth by the Ministry of Justice in the plan titled "Free Individual, Strong Society, More Democratic Turkey" published in 2021 and attention was drawn to the issue of transparency of the implementation process; the importance of the right to property attached to real estate properties, its strengthening and the need to use it without any problems have been mentioned.

In the process of ensuring the development of the 'zoning plan implementation in the readjustment method' model including sustainable, innovative and applicable qualifications for Turkey; alternative solution proposals necessary for the construction of more livable cities are studied on the platforms of practitioners, users and academics, and projects at the institutional level are produced. In this method/model development process, in the Land Readjustment (LR) method, which is the priority zoning plan application, it is important to do the application with transparency, accountability and objectivity, aiming 'pre-regulation and post-regulation equality of land value and protection of property rights' in the process of allocating zoning parcels to the property owner.

Real estate, which is a tool of economic wealth in the phenomenon of sustainable urbanization, is also the determinant of the social life standard in urban sociology with its 'seamless use of property' aspect. For this reason, innovative solution proposals are needed in cities where 'zoning planning and plan implementation processes will be carried out in a sustainable land management approach and interactively'. In this context, it is of great importance that the solutions needed are reflected in the field by the local administrations.

In this study, the deficiencies and negativities encountered both in the legislation and during the implementation of the Land Readjustment method currently applied in Turkey will be revealed; in this regard, the methods applied in the world and the 'appliance based on value equality' models will be examined. Taking into account the social habits regarding the use of property, an answer will be sought to the question of why it is necessary to switch from the area-based application (equiproportion) principle to the value-based application (equivalence) model in the Land Readjustment method in Turkey.

LAND READJUSTMENT

Sustainable urban development, at the URBAN 21 conference held in Berlin in July-2000; it has been defined as "improving the quality of life in a city, including ecological, cultural, political, institutional, social and economic components, without leaving a burden to future generations". The basis of sustainable urban development is urban planning and institutional policies based on sustainability principles. In order to achieve this, zoning plan implementation methods are important tools. In this context, the most effective zoning plan implementation method used in our country is the Land Readjustment method.

For the first time in our country, "Ebniye Nizamnamesi (Building Regulations)" was issued in 1848, during the reign of Mustafa Reşat Pasha, to be implemented only in the province of Istanbul. In 1864, "Turuk and Ebniye Nizamnamesi (Building and Roads Regulations)" was enacted. Considering that it has been practiced for nearly 160 years, it can be said that it is a well-established practice that has its own characteristics. The method can be briefly defined as 'forming the real estates and determining the usage characteristics', taking into account the legal, economic and social characteristics, in order to "ensure that the real estates registered in the land registry are used in accordance with the order brought by the provisions of the zoning plan".

It can be seen that the practice of land readjustment basically causes two major changes. The first is the changes in the ownership structure, and the second is the changes that occur in the urban area. It is normal for these changes to occur, as the application to be made is basically for development purposes. The change in ownership of the real estate with the application is given in Figure 2.

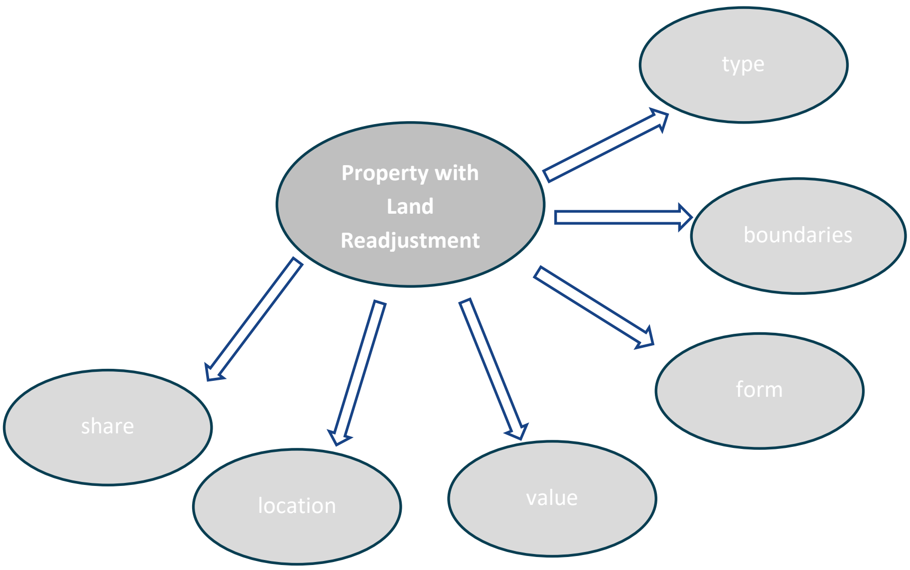


Figure 2. Changes to property by LR applications.

The change in the real estate for the welfare of the urban life and the rights and security of the inhabitants is closely related to the change in the urban areas (Figure 3). In this context, an application that "advocates the development of the region, is non-profit/income,

DOI: 10.15320/ICONARP.2022.219

provides more effective use for both the public and the inhabitants" is possible with sustainable land development, which is the basis of common development.

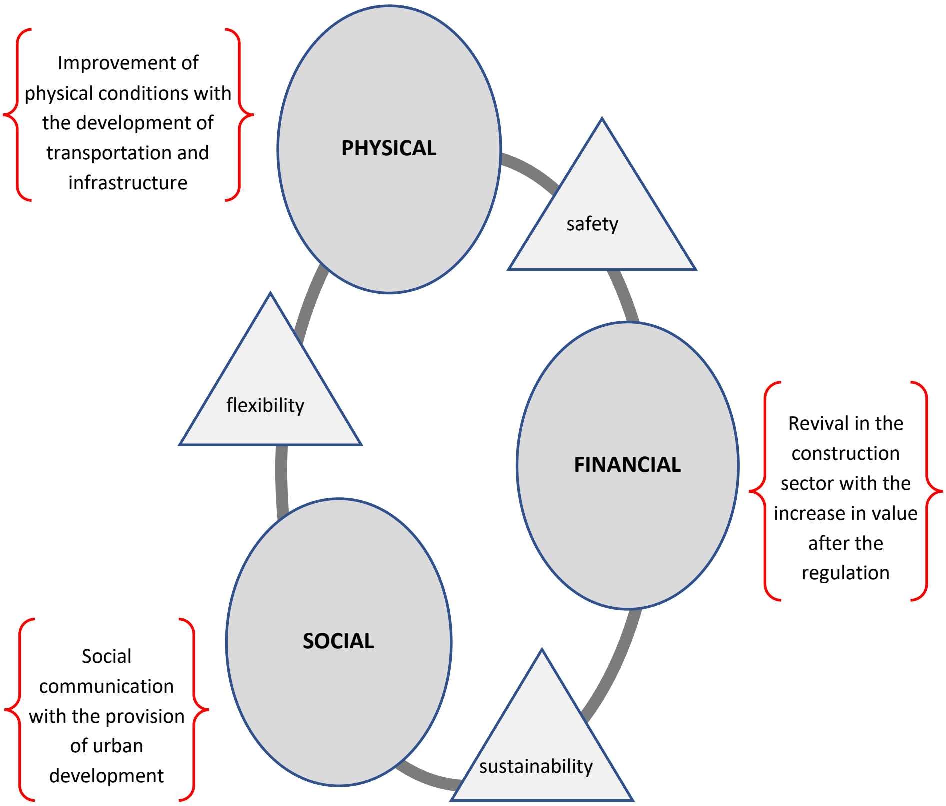


Figure 3. Changes caused by LR practices in urban areas

On September 25, 2015, the United Nations published a result document after the action plan for the post-2015 period themed “Transforming Our World: 2030 Agenda for Sustainable Development” (UNGA, 2015). Among the 17 different global sustainable development goals published under the title of “Sustainable Development Goals” in this outcome document, “Goal 11: Making cities and human settlements inclusive, safe, resilient and sustainable” is of great importance. With the “High Level Panel on the Post-2015 Development Agenda (HLP)” held by the United Nations in 2013, it was emphasized that sustainable urban development and management are important for the quality of life of the people (SDG, 2013). Again, in the same panel, the employment problem of the urban population, which would be experienced after the rapid flow of the world population from rural areas to cities, was also included. Therefore, within the scope of Goal 11, it is recommended that the land readjustment method be applied effectively in the process until 2030 for inclusiveness, security, flexibility and sustainability for sustainable urban development and planning and management of human settlements.

In this context, the land readjustment method, as a different approach to financing urban development, is a zoning implementation tool that 'combines significant advantages with a series of technical intermediate processes'. In a world agenda where the urban population is likely to continue to increase in the coming years, it is necessary to make a new regulation with the content of creating legislation for the 'most appropriate model/principle application' in land readjustment method in order to make the urban infrastructure healthy and to solve the existing problems.

Methodology of Land Readjustment

Problems related to urbanization (land acquisition, planning, financing, permission by the authorities, infrastructure, construction of buildings and evaluation of the project, etc.) experienced in our country keep increasing day by day in different ways, like the rest of the world. Solving existing problems, ensuring a sustainable environment for the inhabitants and the public good are possible by placing development strategies on a solid and stable basis (Köktürk and Köktürk, 2005).

The model/principle in the land readjustment method applied in Turkey is the practice of 'making equal proportional land deductions from each parcel', which is perceived by everyone as "sharing as a regulation partnership portion in return for the value increases in the parcel due to the arrangement". Although this practice is similar to expropriation by some circles due to the deduction of the regulation partnership share (DOP) made on behalf of the public interest, it is clear that it is not an expropriation (Köktürk, 2007). Transactions related to zoning are the ones emerged from public law as planning and implementation, and public power is used (Aksay, 1999). Therefore, the land readjustment process has features that "restrict the right to property for the purpose of public benefit" (Türk and Türk, 2006). As of the date the method started to be implemented in Turkey, the DOP ratio has changed with an increasing momentum over time in order to provide the necessary equipment as a result of urban development. Although the phrase 'provision for the increase in the value of the parcel' is used for these increases, the expectation that the same amount will be deducted from each parcel is wrong. Because each parcel does not have the same zoning right, the post-implementation value gain will be at different rates. The relationship between value increase according to different DOP rates in the process of land readjustment practices in Turkey is given in Figure.4.

DOI: 10.15320/ICONARP.2022.219

Land Interruption Rate (p) %	Value Increase on the Real Estate %	Applicable Law or Name of Practice	Law Date / No
15	18	Building and Roads Law / For All Municipalities	21.06.1933 / 2290
25	33	Zoning Law / Article 42	09.07.1956 / 6785
35	54	Zoning Law	03.05.1985 / 3194
40	67	Law on changing the DOP rate in the Zoning Law	03.12.2003 / 5006
45	82	Law on Amending the Land Registry Law and Some Laws	4.7.2019 / 7181
50	100	-	-

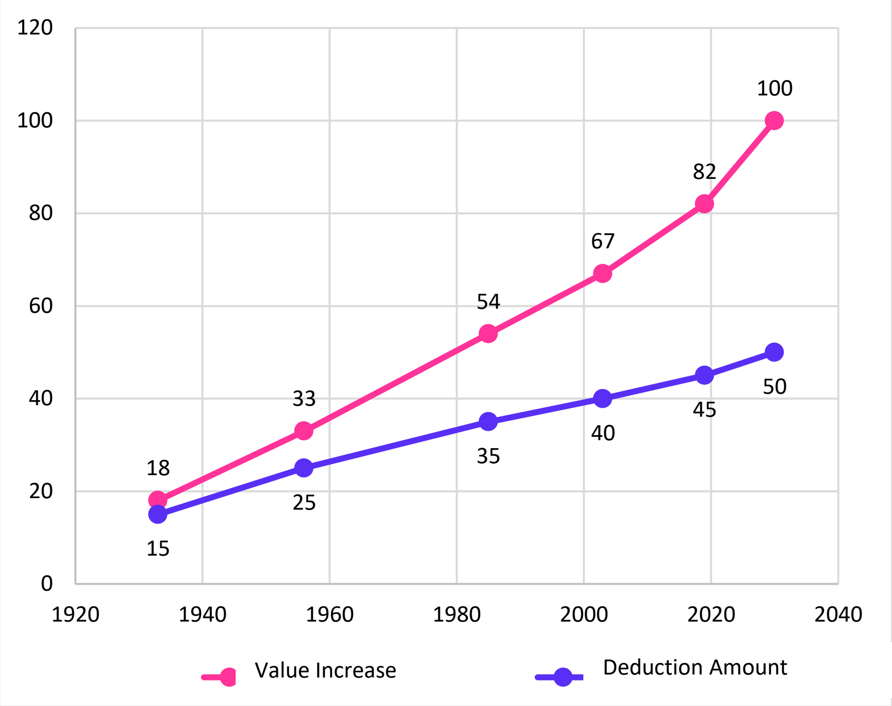


Figure 4. Comparison of the theoretical value increase amounts (Köktürk and Köktürk, 2019) with the DOP

To explain the application of the method with a simple example; let there be a 1000 m2 field real estate belonging to owner A within the passed regulation limit for an application to be made. If the calculated DOP rate, in accordance with the zoning plan decisions and on the basis of the regulation limit, is 45%; owner A has to leave 450 m2 of his real estate to the municipality free of charge. After the implementation, a 550 m2 zoning parcel is allocated to the owner A. If the DOP rate is more than 45%, donations are requested. If an agreement cannot be reached, expropriation is made from each parcel in accordance with the provisions of the expropriation legislation. In the application of this method, it is theoretically thought that 'the increase in value corresponding to the deduction rate is provided equally for each parcel'. However, in reality, it is seen that 'the amount and rate of increase in value after the implementation does not occur equally for every parcel within the same regulation area'.

Advantages and Disadvantages of Land Readjustment Method

In the land readjustment method, the plan implementation process allows to improve the condition of the property that cannot be used for construction purposes in accordance with the current zoning plan decisions, and it is the most ergonomic method that also serves the public interest for 'making arrangements in at least one zoning building block'. Basically, there are some benefits of land readjustment for both public administration and landowners (Yomralıoğlu, 1993; Uzun, 2000). When the advantages of the method at both national and international levels are compared, it would be correct to group the main benefits as given in Figure 5.

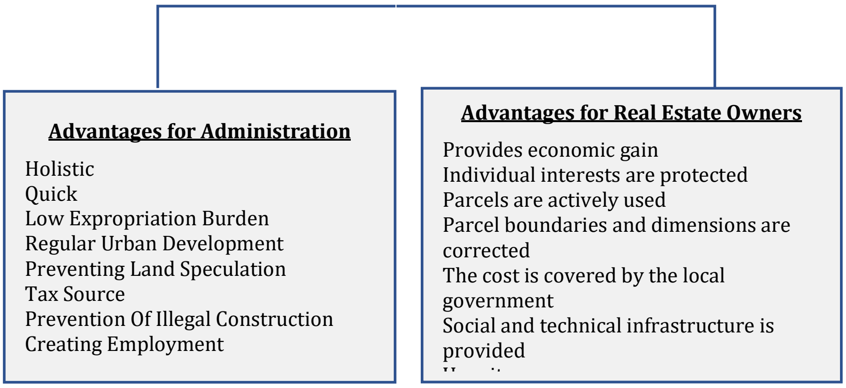


Figure 5. Advantages of LR applications

As a requirement of practice, it is impossible to avoid changes in the real estate. The important thing is that these changes are reflected in every real estate in a balanced way. Problems occur when this balance cannot be achieved (Salalı, 2014). The distribution of serviced urban parcels is limited to the original owners only. After the arrangement, the property structure is reshaped, and the distributed land may be of relative size due to the contribution percentage. This situation does not cause a problem in the transformation of large enough real estate into development parcels. However, it cannot guarantee the formation of decent urban areas that will form the output of the planning in small-area and multi-share real estates (Manandhar, 2019). It is a time-consuming and stressful process as it requires the agreement of each property owner (Larsson, 1997). It would be correct to collect the most basic problems arising from the operation of the method and the applications made in our country under four main headings as “technical, legal, economic and planning-urban problems encountered before, during and after the implementation” (Figure. 6) (Salalı, 2014).

DOI: 10.15320/ICONARP.2022.219

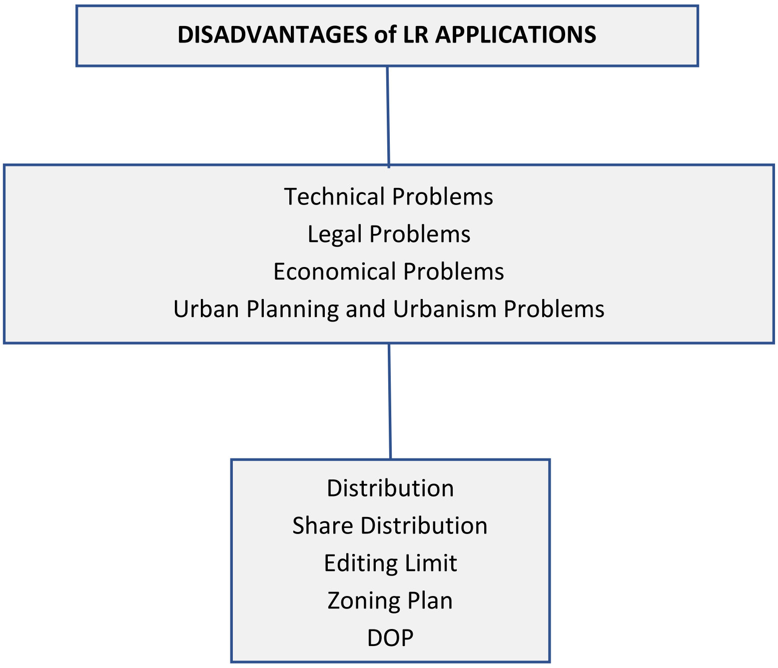


Figure 6. Disadvantages of LR applications

The 'Land Readjustment' method, which has been applied in our country since the 1950s, especially in the development areas;

- Failure to provide equality,
- It does not cover the construction of technical and social equipment areas,
- Failure to ensure participation outside the suspension process,
- Not making the increase in value public,
- It is only area-based,
- Administrative and political demand concern,
- Lack of alternative approaches,
- Changes in parcel locations,
- Inadequacy of technical specifications and lack of a transaction standard,
- Confusion of authority and responsibility,
- Inconsistencies experienced in distribution and parcellation principles,
- Lack of judicial review and problems in recycling processes,
- Formation of prejudice due to non-participation in the application,
- The problem of unqualified expert,

often criticized for its reasons.

When the negative features of the LR method are examined in general terms; it is seen that the method has a major disadvantage in terms of 'regulation pre-post-editing equality'. The application is applied only for the purpose of urban land production, rather than the construction of technical infrastructure and social equipment facilities, which are indicators of urban development. Also, there is no coordination between planning and implementation.

Considering that the practice concerns the real estate owners very closely, not ensuring participation is a major disadvantage. For this reason, most of the objections made by the real estate owners are rejected by the municipalities and the issue is brought to the administrative jurisdiction. The fact that the DOP concept, which is at the center of the application, is only the basis of an 'area-based' application, causes many legal problems in addition to the existing technical problems. The reviewed decisions of the Supreme Court and the Council of State (Figure 7) reveal the seriousness of the issue.

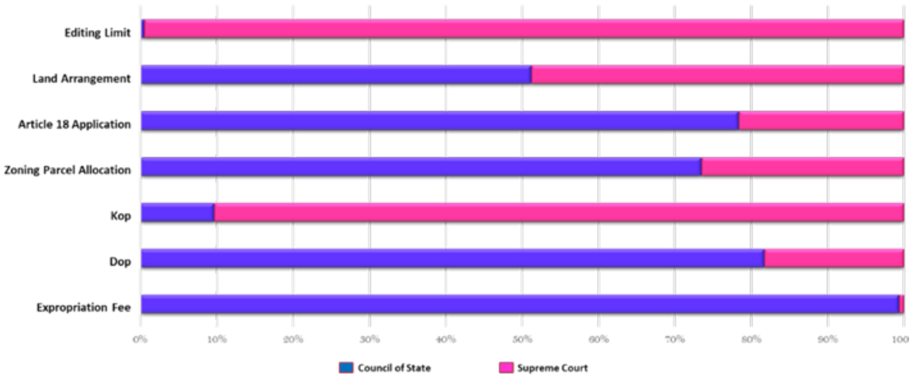


Figure 7. The decisions of the Council of State and the Supreme Court for the institutions that make/have made Land Readjustment practices according to the 18th article of the Zoning Law No. 3194

In this context, it is not only possible "to bring the increase in the value of the real estate to the public after the implementation". For this reason, it is important to adopt the principle of value-based practice (equivalence) in the LR method in Turkey, taking into account our social habits regarding the use of property. Moreover, there is a consensus in all countries of the world on the application of the LR method based on the 'equivalence principle/model'.

Among the 31 countries that apply LR or similar methods worldwide, especially Germany and Japan models come forward. While these countries apply the method not only for urban development but also in the land development process; at the same time, they make a profit by marketing their methods to different countries. In the light of the experience gained as the applications are made, it is seen that the process of 'optimization in value-based application models' is still going on. In this context, it would be beneficial to examine the applicability of the method application of the two mentioned countries for Turkey with the main lines.

LAND READJUSTMENT IN GERMANY AND JAPAN MODELS

Land Readjustment in Germany Model

German Law is based on the principle that "property bears responsibility; the exercise of this right must bring benefit to society". Therefore, with the regulations made in urban areas, the property right is used only in line with the zoning plan. There is a situation where the property is inspected. Initiatives aiming at unfair zoning gain (return) are not allowed, and the surplus values created on the urban area are transferred to the public. Thus, the German Federal Zoning Law (BauGB) directs the real estate market by balancing the interference with land ownership. Municipalities in Germany are required to prepare 'urban

DOI: 10.15320/ICONARP.2022.219

land use plans' as soon as possible and to the extent necessary for 'sustainable urban development'. Urban land use plans, 'preparatory land use plan' and legally binding it consists of a two-stage process, namely the 'land use plan' (Linke, 2018).

The purpose of the land readjustment (also called reallocation, land pooling, reorganization of land, zoning or land holdings) in effect; improvement of local public infrastructure, creation/improvement of the transport system and to open new fields both developed/mature and undeveloped/raw lands, is to rearrange it to form parcels suitable for building development and special areas or other uses in terms of location, shape or size (BauGB, art.45). In the distribution where the value criterion is used, "new parcel or parcels with a value equal to the market value on the day the real estate is decided to be arranged" is allocated to each owner. Therefore, participation and allocation value must be known. Participation value is the market value of the real estate for which an implementation development plan has been made but the land arrangement has not been made. The allocation value, on the other hand, is the market value that takes into account the financial gain of the owner after the land arrangement (BauGB art.57; Linke and Yıldız, 2012). Distribution based on value criteria has a more flexible structure in terms of implementation. The only difficulty of the method is to objectively determine the pre- and post-regulation values of the parcels participating in the regulation. The regulations in which the value criterion is applied are mostly suitable for the infrastructures of which have been completed, the urban reconstruction (rehabilitation) zones or the depression and improvement areas (urban transformation) (Çağdaş and Linke, 2019).

Implementation first begins with the decision to regulate. Before this decision is taken, the owners are interviewed, information about the application is shared and the regulation area is determined. The parcels within the regulation area must be specified one by one (BauGB, art.47). The parcels are calculated according to their area and combined as the arrangement mass (BauGB, art.55/1). The distribution mass is determined by subtracting the public areas from this mass (BauGB, art.55/4). Area and market value are calculated for each parcel (BauGB, art.56/1). A zoning parcel equivalent to the parcels in the distribution mass in terms of location, size or value should be determined and allocated (BauGB, art.59). If the real estate cannot be allocated from an equivalent place, value equalization can also be made with money. Financial compensation and compensatory measures are based on the value valid at the date of acceptance of the allocation (BauGB, art.58). In cases where it is not possible to allocate the parcels calculated according to the zoning plan and implementation regulation, some solutions can be provided with the approval of the real estate owners. These solutions giving money in the value of real estate, establishment of joint ownership on another real estate or a land outside the allocation area, granting zoning rights similar to real estate property rights, it takes place in the form of granting rights under the Condominium Law (Wohnungseigentumsgesetz) or other real rights within and outside the reallocation area (BauGB, art.59). In such a case, with the agreement of the owners, the lands can be allocated to common ownership, or the shared ownership can be converted into individual ownership (determined to correspond to various legal relations and to replace individual plots or powers) (BauGB, art.62).

The arrangement is made on the basis of the land readjustment plan, which is prepared according to the decision to be made by the organizing committee after the negotiations with the owners (BauGB, art.66). The allocated parcels replace the old parcels in terms of 'the rights of the old parcels and the conditions concerning these parcels' according to article 63, paragraph 1 of the German Zoning Law. With the distribution according to the value criterion, the owner of the real estate is given a new real estate with the same value as the value of the parcel that was put into process at the time of the decision to arrange. However, if equivalence cannot be achieved due to various reasons, the difference is eliminated by "equalizing in money according to the market value at the time the arrangement plan is made". If a more valuable land is allocated to the owner of the real estate than the old parcel, the right owner is debited as much as the difference. If a less valuable piece of land is given to the right holder, a one-time payment is made by the land readjustment office. The basic principle in the value criterion is to provide equivalence in regulation (Yıldız, 1977; 1987; 1990; Köktürk and Köktürk., 2009; Çağdaş and Linke, 2019).

Land Readjustment in Japan Model

Tochi Kukaku Seiri, which is the land readjustment in Japan, it is a 'public private partnership' tool where governments and landowners bear the costs of urban development and benefit where existing land use models are inadequate and inefficient. The purpose of the law is to facilitate the construction of sound urban areas, to promote the public interest by taking necessary measures for the allocation of implementation and project costs to LR projects (art.1). According to this law, land readjustment means "to establish public facilities in the urban area or to improve the existing ones in order to change the shape and condition of the lands, to create better public facilities and to increase the efficiency of use of each land" (art.2/1). Also, according to the law, there are six types of executors for LR projects (art.3). These take shape as individuals, landowners and leasing associations. LR share companies established by the landowners, the Ministry of Land-Infrastructure-Transportation and Tourism (MLIT), Urban Renaissance Agency (a central government agency), and Housing and Urban Development Organizations (governor's or municipal administrations) take part in the implementation process in this context (Larsson, 1997; Sorensen, 1999; Desouza and Ochi, 2018). The first three of the executors are considered as private practitioners, while the others are

DOI: 10.15320/ICONARP.2022.219

considered as public administrators. The Japanese LR model, which enables the implementation process to be shaped in support of the law; It is a method that varies according to the location, the practitioner and the purpose of its construction. The implementation regulation is prepared by the relevant institutions according to the needs of each region or application area.

In the Japanese LR application, the design of the parcellation is determined so that the parcels correspond to their location before the project. This work is called the 'principle of equivalence'. The model is based on the cooperation of real estate owners using the land. Made up of personal property applications made with the aim of remodeling an urban environment, apart from its function of producing zoning parcels, it is also considered as a 'land development project'. LR applications have important purposes such as "evaluating the contribution of reserve land, calculating compensation for loss of damage, calculating re-registration area, calculating stock collection and payment". Compensation is money that will be collected and paid to correct the imbalance of value, if any. Evaluation of land and valuation of real estate; In addition to the traditional system based on market value, the Japanese LR model is based on street value. The street value is converted into an index for each plot size multiplied by its individual characteristics. Evaluation of every parcel; adjusted for land market prices in the region and taking into account property-tax values for sale or indices, national assessment for inheritance tax, and publicly disclosed land prices (Hayashi, 1982). New parceling plan "the plot must comply with the 'legal compliance principle' overseen by the enforcement agency, along with former land, location, soil, water condition, land use, environment and other characteristics" (Desouza, 2018). In Japan LR applications, project costs are shared among the stakeholders. Reserve land is a resource for project cost recovery. Landowners share the project costs by "contributing some of their real estate for the reserve land". Thus, a situation is achieved where the total value of all new development parcels is equal to the total value of all private lands prior to the project (theoretically, a landowner does not profit from his land)' (Desouza, 2018).

When these models applied in both Germany and Japan are examined, it can be said that the success of the LR practice is directly related to the existence of legal legislation. In practices, the process is regularly shared with the public and participation is ensured. In both models, the process is open and transparent. These models, which have effective real estate valuation systems, also have serious legal penalties. In both countries, there are special 'land regulation boards' for implementation. However, since the application is aimed at 'developing infrastructure and superstructure on a field basis', the implementation times are long.

Implementing a value-based model is somewhat more complex than an area-based method. The main idea is to share the benefits of urban development between the landowner and the municipality. The method, in its simple form, is based on neither profit nor loss of the owner of the real estate. But this theoretical condition cannot be fulfilled. Landowners, earn the income from the land value increase over time as a result of the 'real estate maturation' that occurs through LR.

BASIC PRINCIPLES OF VALUE-BASED (PRINCIPLE OF EQUIVALENCE) REGULATIONS

The LR method, which is made according to the current implementation legislation in Turkey, is frequently criticized for reasons such as not being able to provide equivalence in distribution and the public not being able to benefit from the increase in value after the implementation. However, instead of the 'area' basis, it is clear that it would be more beneficial to use the 'value' basis as a distribution principle, considering that many factors that cause comparison between parcels have an effect on the parcel value (Öngören, 2016). The equalization of pre-regulation (BR) and post-regulation (PR) real estate value is called the 'equivalence principle'. The method depends on the value of the real estate. This approach is based on the idea that the value of real estate in the same regulation area will increase at the same rate. However, it should not be forgotten that there will be different economic value increases in each of the real estate in practice (İnam, 2020). The main purpose of the proposed model is primarily to reorganize the property rights and real estate conditions for structural uses with the implementation zoning plan. Secondly, it is the provision of the necessary supply for the public space uses of the real estate. In this context, five principles that will always be valid for the editing studies to be carried out with the proposed model can be mentioned (Linke and Yıldız, 2012):

- **Exclusive use principle:** The municipality takes action when there is a publicly justified need to provide new development plots. In the arrangements it makes, it provides possible zoning parcels to the owners in the zoning plan.
- **Eligibility principle:** With the arrangement, the location, shape and size of the real estates change. But this change has to comply with the zoning plan determinations.
- **Protectionism principle:** The increase in value resulting from the reorganization of the real estate and exceeding the participation value is calculated on behalf of the owners.
- **Solidarity principle:** Some real estate owners are at a disadvantage in the creation of technical infrastructure and public spaces in the zoning zone. The public use areas are therefore balanced among the owners who benefit from it.
- **Balancing of gains principle:** Although the municipality covers all costs, the taxes of the owners who are not in the regulation area can also be used. Therefore, after the arrangement, expenses can be distributed in line with the gains of the real estate owners.

DOI: 10.15320/ICONARP.2022.219

Since the day the AAD method was started to be implemented in our country, it has also shown important developments. In general, although the process seems to be working, the problems experienced in technical, legal and implementation issues especially reveal the need for the distribution criterion to be 'value-based'. When the applications made using the value criterion are examined, it is necessary to mention three different approaches on the basis of equivalence. These approaches based on the value of the real estate are the regulation models based on the current value, nominal value and development rights.

The basic philosophy in the model, which is based on the current value, is to allocate the parcels that have entered the regulation to new parcels based on the value before the regulation. The resulting increase in value should be transferred. There is no DOP or similar interruption in this approach. TL, that is, monetary value, is used as the criterion. In the applications made with this method, the parceling planning is done according to the minimum parcel size and the distribution (zoning parcel allocation) is done on these zoning parcels. The resulting zoning parcels are distributed to the owners of the real estate according to their values before the arrangement. There will definitely be a surplus or a deficiency in the meaning of value. Instead of making shares, money equalization is done. In fact, the method is not so foreign to us in this sense. In the applications made pursuant to Article 10/c of the Law No. 2981, the owner of the real estate may be the 'mortgage creditor or debtor' of the price to be determined according to the Law No. 2942. A kind of monetary equalization is made. The method uses the “q” factor, which is the ratio of the total value resulting from the regulation to the total value determined before the regulation. With this method, it can be said that the increase in value can be seen clearly.

In the model, which is based on the nominal value, the 'characteristics and location' of the real estate is taken as the basis before the value. For this reason, each real estate is defined by the value factors to be determined before and after the regulation. Each of the factors that will affect the value of the property is scored over 100%. In this method, there will be two different scoring as before and after the regulation (Yomralıoğlu et al., 2007). Because at the end of the application, there will be changes in the location and geometric shape of the real estate. For this reason, weight coefficients are determined by considering the factors that will affect the value of the real estate. The allocation of the real estate according to this method is made according to the criteria of points, not money. It is a method that can be applied more actively than other alternatives, especially in cases where the regulation area is large and the number of real estates is high (Güngör and İnam, 2019). However, it is criticized for reasons such as the absence of a price index on a country basis, the absence of certain standards in valuation studies, and the fact that the number of factors is variable (not clear).

The model, which is based on zoning rights, uses the zoning right (equivalent or total construction area right, building quality, etc.) as the basic criterion to ensure equivalence. In this context, it can be said that it is a 'hybrid' method. The basic philosophy of this method is that the zoning right that will occur after the regulation is the most important factor affecting the value of the real estate. The method is based on 'the distribution of the proposed development right for the regulation area in direct proportion to the real estate areas before the regulation' of the real estates located in the regulation area. The distribution is made on the basis of the area criterion, but the value increases arising from the zoning right are taken into account. This method is particularly It is envisaged to be applied in places where "pre-regulation real estate value is similar and distribution of development right is homogeneous". After the arrangement, the owner may not use the zoning right. In such a case, the development right can be converted into a price, a certificate can be obtained through land banking, or the given right can be transferred to another region. Çağdaş (2019) stated that this model is more effective than other methods; bringing the increase in value to the public and even distributing a part of this increase equally to the owners of the real estate, it has been summarized as eliminating the possible problems arising from the valuation processes and "eliminating the value differences that may occur due to the location" by allocating the real estate from the same place or close to it.

All the approaches described show that the success of the method is related to the correct determination of the real estate value. It is clear that the main problem of the proposed approaches is 'valuation problems'. Considering the countries that make value-based practices, it is seen that the success of the method depends on their experience in real estate valuation and their legal regulations. In this context, the existence of independent committees to determine the real estate value gains the trust of the participants. Because value is relative. Considering that the value appreciated by the administration in expropriation procedures is transferred to the judiciary by the owners of the real estate, the necessity of independent valuation boards emerges.

CONCLUSION

For a sustainable development in urban areas, the elements of economic, ecological and social equality should be provided together. In this respect, ensuring sustainability urban development are one. People's actions and thoughts are shaped in cities, which are direct living spaces, and continue in a mutual interaction with urban development. For this reason, the success of sustainable development policies is possible by reflecting them to the space. In this sense, the implementation of policies and practices that will ensure sustainable urbanization is the basic principle for sustainable development.

The fact that land is seen as a limited resource increases its value even more, especially in urban areas. In this sense, it becomes difficult to

DOI: 10.15320/ICONARP.2022.219

provide technical and social equipment areas that are needed by urban life. Although the DOP deduction is seen as a legal compensation for the increase in value in the method applied in our country (in line with the law, regulation and the decisions of the Council of State), the 'legal confiscation' lawsuits at the end of the implementation, the success rate of the applications and the trust in the application are open to discussion.

In line with the explanations, it should be noted that regardless of the proposed application principle/model, we must first have a strong 'real estate valuation' system. The biggest deficiency in our country in this regard is the valuation process and the relevant technical and legal infrastructure. In accordance with the principle of the responsibility of the state in the establishment of the right to property, the title deed areas of the real estates are under guarantee. However, due to our lack of infrastructure in valuation, it is possible to experience problems after implementation. With the Land Registry and Cadastre Modernization Project (TKMP) realized in 2008, real estate valuation was put on the agenda. In 2019, the Department of Real Estate Valuation was established within the body of TKGM. With the 2019-2023 strategic planning of the relevant institution, especially the creation of real estate value maps and integrating them with property information, the implementation of real estate valuation legislation and the establishment of a reliable registration system came to the fore. LR practices will also be positively affected by the presentation of healthy and accurate data on valuation in the Land Registry and Cadastre System in our country.

When the practices of different countries are examined, it becomes clear that participation and public empowerment are necessary for a strong and sustainable land management and development. In this context, a 'value-based' application method should be adopted within the scope of an urban land development awareness and acquisition initiative created by the public and real estate owners. In fact, the issue is not the abandonment of the 'area-based' method with a radical change and the replacement of the 'value-based' method. The aim is to diversify and enrich the application principles in the current LR method within the scope of laws and regulations. Therefore, recommended methods need to be modeled and tested in accordance with the regulation.

Whichever model is adopted as an approach, the proposed method should balance the interests of the people and the public, and their participation in the implementation process should be ensured. It should also have a clear and simple methodology, rather than a detailed and complex method. The increase in the value of the land should definitely be brought to the public. It should be fair and transparent, eliminating the share ownership structure as much as possible. It should be a sustainable method that takes into account the location of the cadastral parcels as well as the values before and after the regulation.

As a result, the adoption of a value-based implementation method is important and necessary within the scope of our country's sustainable development goals. However, the transition process from the current method to the proposed method should be clearly defined. In the short term, the general structure of the currently applied LR system should be preserved and justice should be ensured with the arrangements to be made on the issues of valuation and compensation. In the long term, all legal, technical, legal and valuation processes related to the system to be implemented should be established.

REFERENCES

Aksay, B., 1999. Hukuki Açıdan Arsa ve Arazi Düzenlemesi 3194 Sayılı İmar Kanunu'nun 18. Maddesi Uygulaması Danıştay ve Yargıtay Kararları. Mahalli İdareler Derneği, 265s, Ankara.

Baugesetzbuch (BauGB). Accessed in 27 September 2022 https://www.gesetze-im-internet.de/bbaug/

Cotella, G., & Vitale Brovarone, E., 2020/a. Questioning Urbanisation Models in the Face of Covid-19. TeMA Journal of Land Use Mobility and Environment, 105–118. https://doi.org/10.6092/1970-9870/6913

Cotella, G., Evers, D., Janin Rivolin, U., Solly, A., 2020. Berisha, E. ESPON SUPER—Sustainable Urbanisation and Land-Use Practices inEuropean Regions. A Guide to Sustainable Urbanisation and Land Use. ESPON EGTC: Luxembourg.

Çağdaş, V., & Linke, H. J., 2019. Almanya'da Arazi Düzenlemesi. Jeodezi ve Jeoinformasyon Dergisi Cil:06, Sayı: 2, 96-114.

Çağdaş, V., 2019. İmar Hakkı Esasına Dayalı Arazi ve Arsa Düzenlemesi Modeli. Harita Dergisi, Ocak 2019; 161: 57-66.

De Souza, F.F., & Ochi, T., 2018. The Japanese Procedures and Methodology for Land Readjustment, Land Readjustment: Solvıng Urban Problems Through Innovatıve Approach. Japan International Cooperation Agency Research Institute (JICA-RI), 39-51.

De Souza, F.F., 2018. A Brief History of Land Readjustment in the World and Case Studies. Land Readjustment: Solvıng Urban Problems Through Innovatıve Approach. Japan International Cooperation Agency Research Institute (JICA-RI) Sayfa 81-96.

Filho, W.L., Azul, A.M., Brandli, L., Salvia, A.L., Wall, T., 2021. Life on Land; Encyclopedia of the UN Sustainable Development Goals. Springer, Berlin/Heidelberg, Germany. ISBN 978-3-319-95980-1

Güngör, R., & İnam, Ş., 2019. İmar Uygulamalarında Farklı Dağıtım Metotlarının Karşılaştırılması. Geomatik Dergisi, 4(3), 254-263.

Hayashi, K. 1982. "Land Readjustment in Nagoya." In Land Readjustment: A Different Approach to Financing Urbanization, edited by W. A. Doebele, 107-125. Lexington: Lexington Books.

İnam, Ş., 2020. Yüksek Lisans Ders Notları. Konya Teknik Üniversitesi, Konya.

Köktürk, E., & Köktürk, E., 2005. Yeni Bir İmar Tüzesinin ve En Önemli Öğesi Olarak Arsa Düzenlemelerinde Eşdeğerlik İlkesinin Oluşturulması. 10. Türkiye Harita Bilimsel ve Teknik Kurultayı, 28 Mart-1 Nisan 2005, Ankara, Cilt 1, 564–605.

Köktürk, E., & Köktürk, E., 2009. Eşdeğerlik İlkesine Dayalı Arsa Düzenlemesinde Taşınmaz Değerinin Belirlenmesi. Jeodezi, Jeoinformasyon ve Arazi Yönetimi Dergisi, Sayı:101, 10-17.

DOI: 10.15320/ICONARP.2022.219

Köktürk, E., 2007. Arsa Düzenlemeleri ve Yargı İlişkisi. 18. Maddenin İdari Yargıda İptali ve Ortaya Çıkan Sorunlar, 06 Ekim, İstanbul, 1-85.

Larsson, G.,1997. Land Readjustment: Modern Approach to Urbanization. Avebury, 150 s, Aldershot.

Linke, H. J. (2013). Siedlungsumbau aufgrund des demografischen Wandels, E. Hepperle, R. Dixon-Gough, R. Mansberger, V. Maliene, J. Paulsson & A. Pödör (ed.), Land Management: Potential, Problems and Stumbling Blocks (s. 107-121). European Academy of Land Use and Development, vdf Hochschulverlag: Zürich

Linke, H. J., 2018. The Land Readjustment System in Germany, Land Readjustment: Solving Urban Problems Through Innovative Approach, 128-136.

Linke, H.J., & Yıldız, N., 2012. Almanya'da İmar Uygulama ve Eşdeğerlik Sistemi. TMMOB Harita ve Kadastro Mühendisleri Odası İstanbul Şubesi, Arazi Yönetimi Günleri, 15-17 Kasım, İstanbul.

Manandhar, R., 2019. Land Readjustment for Regularızatıon of Informal Settlements. JScE Vol. 6, 40-50.

Ministry of Land, Infrastructure, Transport and Tourism (MLIT), LR Law. Accessed in 27 September 2022 https://elaws-e--gov-go-jp.translate.goog/document?lawid=330CO0000000047&_x_tr_sl=ja&_x_tr_tl=tr&_x_tr_hl=tr&_x_tr_pto=sc

Nulkar, G., 2018. Ecology, Equity and the Economy: The Human Journey. Ecological Society, Columbus, OH, USA. ISBN 978-81-935577-0-9.

Öngören, G., 2016. Yargı Kararları Işığında İmar Hukuku. Öngören Hukuk Yayınları No:8, İstanbul, 350s.

Regulation about Land and Plot Arrangements (2020). Date of Official Gazette: 9/5/1985 Number: 18749.

Salalı, V., 2014. Arazi ve Arsa Düzenlemesinin Eşdeğerlik İlkesi Açısından Yeniden Değerlendirilmesi. Süleyman Demirel Üniversitesi. Fen Bilimleri Enstitüsü. Şehir ve Bölge Planlama Anabilim Dalı, 227 s.

SDG Knowledge Hub, 2013. http://sdg.iisd.org/news/unga-briefed-on-report-of-high-level-panel/ Erişim tarihi: 04.03.2020

Solly, A., Berisha, E., Cotella, G., 2021. Towards Sustainable Urbanization. Learning from What's Out There. Land 10, no. 4: 356. https://doi.org/10.3390/land10040356

Solly, A.; Berisha, E.; Cotella, G.; Janin Rivolin, U., 2020/b. How Sustainable Are Land Use Tools? A Europe-Wide Typological Investigation. Sustainability 2020, 12, 1257, 21s.

Sorensen, A. 1999. "Land Readjustment, Urban Planning and Urban Sprawl in the Tokyo Metropolitan Area." Urban Studies 36(13): 2333-2360.

Türk, C., & Türk, Ş. Ş., 2006. Hukuki ve Teknik Boyutları ile Arazi ve Arsa Düzenlemesi. Beta Basım, 249s, İstanbul.

United Nations General Assembly (UNGA). 2015. The 2030 Agenda for Sustainable Development. New York: United Nations.

Uzun, B., 2000. Çevre Yolu- Mülkiyet İlişkilerinin İmar Hakları Açısından İncelenmesi ve Arazi Düzenlemesi Yaklaşımıyla Bir Model Önerisi. Karadeniz Teknik Üniversitesi, Doktora Tezi, 162, Trabzon.

Yıldız, N., 1977. Arsa Düzenlemesi. Yıldız Teknik Üniversitesi, Profesörlük Takdim Tezi, 62, İstanbul.

Yıldız, N., 1987. Arsa ve Arazi Düzenlemelerinde Eşdeğerlik ve Eşitlik İlkelerinin Karşılaştırılması. Türkiye 1. Harita Bilimsel ve Teknik Kurultayı, 23-27 Şubat 1987, Ankara, 415-428.

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

Yıldız, N., 1990. Arsa Düzenlemelerinde Eş Değerlilik. 18. Madde Uygulamaları Semineri, 10-11 Ekim 1990, Ankara, 49-66.

Yomralıoğlu, T. 1993. A Nominal Asset Value-Based Approach for Land Readjustment and Its Implementation Using Geographical Information System, PhD Thesis, Supervisor: Prof. Dr. David Parker, Department of Surveying, University of Newcastle upon Tyne, pp.1-327, England.

Yomralıoğlu, T., Nisancı, R. ve Yıldırım, V., (2007). “An Implementation of Nominal Asset Based Land Readjustment”, FIG Working Week, 13-17 Mayıs, China.

Zoning Law, (1985). Law Number: 3194, Date of Adoption 3/5/1985, Date of Official Gazette: 22/2/2020 Number: 31047.

Resume

Vuslat Salalı was born in 1974 in Konya. She graduated from Selcuk University, Faculty of Engineering and Architecture, Department of Geodesy and Photogrammetry Engineering in 1996. She completed her master's degree at Süleyman Demirel University, Department of City and Regional Planning in 2014. She currently has been studying for Ph.D. In Department of Surveying Engineering at Konya Technical University.

Şaban İnam was born in Konya in 1964. He graduated from Selcuk University, Faculty of Engineering and Architecture, with a bachelor's degree in 1985, a master's degree in 1989, and a doctorate degree in 1999. He is still working as an Assistant Professor at Konya Technical University, Faculty of Engineering and Natural Sciences, Department of Geomatics Engineering.

Mehmet Topçu is received his B.Arch, MSc. and PhD in Urban and Regional Planning from Faculty of Architecture at İstanbul Technical University. He is currently working as an Associate Professor at Konya Technical University. His major research interests include urban planning, urban economy, urban morphology, urban design, space syntax.

DOI: 10.15320/ICONARP.2022.219

Research Article

ICONARP
International Journal of Architecture and Planning
Received: 06.06.2022 Accepted: 02.10.2022
Volume 10, Issue 2/ Published: 20.12.2022
DOI: 10.15320/ICONARP.2022.220 E- ISSN:2147-9380

ICONARP

Reconsidering Urban Densification for Microclimatic Improvement: Planning and Design Strategies for Istanbul

Deniz Erdem Okumus*
Fatih Terzi**

Abstract

One of the key issues of the urban planning agenda is how urban density be decided in the spatial configurations of future neighbourhoods to overcome complex challenges such as urban warming. This paper aims to reconsider urban density as a spatial planning instrument to develop effective densification policies, planning and design strategies in terms of surface urban heat island (SUHI) mitigation in Istanbul. The quantitative research embraced a four-stage methodology including grid-based sampling design, decoding the taxonomy of urban density-matrix (UDM), land surface temperature mapping, and ANOVA tests. Tests were conducted on the UDM consisting of nine building typologies representing the horizontal and vertical urban density. The research indicated that the impact of urbanisation on SUHI can be mitigated by controlling densities and urban forms based on quantitative findings. The highest temperatures were recorded in areas with high-coverage-mid-rise and mid-coverage-mid-rise development. The different levels of SUHI in different building typologies having the same density indicated the mitigation potentials of the built-form in Istanbul's local urban warming. Low coverage and high-rise building forms were an optimal solution for mitigating SUHI in densely populated urban areas. The research gives insight into an ongoing debate among urban professionals in Istanbul concerning the impacts of density and the urban form for climate adaptation. It enables professionals to understand the impact of urban planning decisions on microclimate and integrate them into the operational processes. Considering quantitative research findings as a strong foundation for developing policy recommendations and using them as a guideline may create new opportunities for researchers, practitioners, and policymakers. The study has an original value for exploring design strategies to improve microclimate and promoting sustainable urban development.

Keywords:
Istanbul, spatial planning, urban density, urban design, urban heat island

*City and Regional Planning Department, Yildiz Technical University, Istanbul, Turkey
(*Corresponding author*)
Email: denizer@yildiz.edu.tr

**Urban and Regional Planning Department, Istanbul Technical University, Istanbul, Turkey
Email: terzifati@itu.edu.tr

To cite this article: Erdem Okumus, D., & Terzi, F. (2022). Reconsidering Urban Densification for Microclimatic Improvement: Planning and Design Strategies for Istanbul. *ICONARP International Journal of Architecture and Planning,* 10 (2), 660-687. DOI: 10.15320/ICONARP.2022.220

INTRODUCTION

The population growth in cities (U.N., 2019) has brought bidirectional consequences of urbanisation: urban sprawl and urban intensification. While urban sprawl has caused changes in the land cover from natural to impervious and hard urbanised surfaces, urban intensification has increased the building density and created a more heterogeneous urban area with different urban geometries. These consequences triggered micro-climate issues such as local urban warming named the urban heat island (UHI) effect. UHI creates warmer urban areas with high surface temperatures compared to the rural and suburban surroundings (Hu, White, & Ding, 2016; Oke & Maxwell, 1975; Santamouris, 2013; Stewart & Oke, 2012; James A Voogt & Oke, 2003). Today, cities in different shapes and sizes around the world suffer from urban warming regardless of the climatic type. UHI intensity makes urban areas more vulnerable to the extreme climatic effects, particularly increases the heat stress during the heat waves which are more frequently occurred by global warming (Chow, Brennan, & Brazel, 2012; Santamouris, Ding, & Osmond, 2019). According to the latest reports of IPCC (2021, 2022), ongoing urbanisation trends with the increasing UHI effects will expose the urban areas to *more frequent, longer and warmer heatwaves*, enhance surface warming even towards rural surroundings and cause a new local warming crisis, particularly on minimum temperatures, as serious as global warming (IPCC, 2021, 2022). National/international climate targets particularly highlight the need for sustainable urban environments associated with rethinking the policies on the optimal use of urban space (Metz, Berk, den Elzen, de Vries, & van Vuuren, 2002; Pomponi, Saint, Arehart, Gharavi, & D'Amico, 2021; Swart, Robinson, & Cohen, 2003; Yilmaz, Irmak, & Qaid, 2022). The United Nations Sustainable Development Goals (SDGs), particularly goals of *'sustainable cities and communities'* (SDG.11) and *'climate action'* (SDG.13), emphasize the supplemental effect of microclimate actions on sustainable urban development and point out the localization of the concept through urban design strategies (U.N., 2015; U.N.D.P., 2015). Therefore, there is a strong need for exploring design strategies to improve microclimatic conditions by mitigating urban warming, and to promote sustainable urban development.

The urban planning and design fields take a critical approach to understand the key components of urbanisation that contributed to temperature variations and developing effective design strategies to prevent future crises in built-up environments through local warming mitigation. Recent research on the warming effects of three-dimensional urban geometry has identified urban density as a commonly referenced phenomenon of urbanisation (Guo, Zhou, Wu, Xiao, & Chen, 2016; Song et al., 2020; Sun, Gao, Li, Wang, & Liu, 2019; X. Yang & Li, 2015; Yin, Yuan, Lu, Huang, & Liu, 2018; Zheng et al., 2019; Zhou, Huang, & Cadenasso, 2011). As a microclimate response, reconsidering urban densification and reorganizing the heterogenic spatial structure of

DOI: 10.15320/ICONARP.2022.220

urban density have become a privileged strategy in urban metabolism to explore the density limitations of existing urban form and fabric (Knuth, Stehlin, & Millington, 2020). Hamin and Gurran (2009) refer to the exploration process as solving the "*density conundrum*" for urban cooling, whether designing a denser environment with a compact urban form or more open spaces with a sprawling urban form (Hamin & Gurran, 2009). The UHI literature includes multi-parameter evaluations (MPE) through various indicators as representative of vertical and horizontal urban density but most of them are not decision variables. The issue is that the MPE approach leads to an abstraction of understanding the effect of urban fabric elements on positive temperature anomalies. Literature needs an in-depth and site-specific reinvestigation on the impacts of building coverage (BC) and height (BH) as crucial spatial planning instruments and decision variables to develop effective densification policies in the planning and design practices. Therefore, throughout this study, the urban density phenomenon has been handled in two legs; horizontal building density represented by BC, and vertical building density which stands for BH captured by the *site-specific* maximum height of the building envelope (Alexander, 1993).

BC and BH variations have unequivocal effects on urban microclimate conditions and surface temperature anomalies due to the influences of solar radiation exposure, multiple reflections of solar radiation, natural ventilation and air circulation (Kleerekoper, Van Esch, & Salcedo, 2012; Liao, Hong, & Heo, 2021; Wong et al., 2011; Junyan Yang, Shi, Xia, Xue, & Cao, 2020). They bear the substantive cooling capacity, especially defined by the distances between buildings, in correlation with the other urban fabric components. UHI studies generally emphasize the strong promoting effect of BC and the reducing effect of BH on surface temperatures (Oke, 1987; Song et al., 2020; Sun et al., 2019; Yin et al., 2018; Zhou et al., 2011). Guo et al. (2016) revealed that lower building density and medium building height significantly caused a high land surface temperature (LST) variation in Guangzhou. Yin et al. (2018) explained that higher building densities create higher LSTs in Wuhan. Zheng et. al. (2019) demonstrated significant differences among districts with varied building densities and heights by analysing LST variations among residential areas in Beijing.

Despite the fact that there is a wealth of literature on the relationship between density and UHI, determining the appropriate density standards remains a challenge for practical urban planning strategies to minimise local urban warming. Therefore, we developed an extensive urban density-matrix (UDM), an instrument of the decision mechanism in the spatial planning system, that includes horizontal and vertical density units for a clear understanding of the relationship between UHI and urban densification. UDM approach promotes UHI mitigation regulations and local policies focusing on building urban densification standards in spatial planning practices. The current situation in the cities demands that climate science be localised through urban design policies, guidelines, and design strategies based on quantitative research. According to Corburn (2009), the localisation of climate policies requires '*scientific facts*' (Corburn, 2009). It is obvious that only cities having scientific resources and quantitative findings will be able to develop such policies and design standards to improve built forms and design. Urban design standards, eventually codes, might easily find a place within the planning system especially in terms of local urban warming mitigation purposes through urban density control.

In this context, the purpose of this paper is to (1) utilize ANOVA tests to determine the statistical differences between the contributions of different building typologies in the UDM to UHI variations, and (2) develop concrete urban planning strategies focusing on density-based UHI mitigation. We believe that urbanisation's impact on urban warming may be minimised by controlling urban densities and urban forms, and we would like to discover if the optimal urban density and typology exist to regulate and mitigate the UHI effect. The quantitative findings will add to the current debate among urban professionals concerning the role of urban density in meeting climate goals. Istanbul is the case study on which we base our ideas, as the city offers a diverse range of densities for studying the effects of urban layout on heat island formation. Overall, we provide a reference to the localization of the SDGs (SDG.11,13) through design strategies focusing on reconsidering urban densification.

CONTEXT IN ISTANBUL

Istanbul, a megacity located in the Eastern Mediterranean climate zone, has been suffering from abnormally high urban temperatures (Dihkan, Karsli, Guneroglu, & Guneroglu, 2015). The outcomes of the unplanned urbanisation process induced by informal housing developments, enormous mass housing projects, and uncontrolled urban densification (Bolen, 2004; Keles, 1993; Terzi & Bolen, 2012) have triggered local warming and changes in micro-climatic conditions (Kaya, Basar, Karaca, & Seker, 2012). Even planned developments (high-rise and mixed-use projects in the city centre, and low-density sparse housing in the peripheries) have resulted in further heterogeneity in the urban fabric. Until recently, the city followed a linear development, mainly on the east-west axis without touching the borders of the northern forest areas and water basins. However, in the past decade, this traditional development pattern changed to a sprawl towards the north. This increase in the built-area also made a dramatic impact on the UHI effect and caused even higher temperatures (Basar, Kaya, & Karaca, 2008; Bektas Balcik, 2014; Ezber, Sen, Kindap, & Karaca, 2007; Kaya et al., 2012). The dispiriting urban warming trend in Istanbul requires us to rethink urbanisation for a policy remake of urban densification embracing effective UHI mitigation strategies.

DOI: 10.15320/ICONARP.2022.220

We consider two important limps for the urban warming problem in Istanbul: Underestimation of the local warming crisis and the UHI risks to heat stress by the local governmental authorities; lack of efficient and tangible urban planning strategies grounded in quantitative research findings on the correlation between UHI and urban density phenomena. Even though local governments have started to prepare various assessment reports on climate action plans and the factors contributing to climate change in the past couple of years (İ.B.B., 2018), the UHI issues are either not included or only mentioned peripherally in these reports. However, the city has a highly heterogeneous spatial layout with different levels of urban densities and building typologies which are unequivocally contributing to urban warming. Therefore, the city initially needs to investigate the effects of the building typologies based on urban density on the UHI formation for a policy remake on urban densification.

The urban density phenomenon is intrinsically a spatial planning instrument in the decision-making processes. The indicators of horizontal and vertical building density - building coverage and the maximum height of the building - are two main factors of spatial plans within the regulations of the urban planning system in Turkey. In the current situation, such metrics, which define the limitations of the structuring of the three-dimensional urban environment, are used to prioritise predominantly economic concerns. Spatial planning approaches without micro-climate concerns promote unplanned densification and heterogeneity in the urban area, which eventually leads to a significant rise in the graphic of temperature variations in the urban area (Feng & Myint, 2016; F. Yang, Lau, & Qian, 2010; Yin et al., 2018; Zheng et al., 2019). Therefore, the planning authorities should consider the UHI effects in spatial planning decisions based on urban densification to reduce urban warming and achieve climate-sensitive urbanisation.

MATERIALS AND METHODS

This study was conducted in 4 basic stages, each with its sub-steps: (1) *grid-based sampling design*, (2) *decoding the taxonomy of UDM*, (3) *LST mapping*, and (4) *Univariate analyses of variance: ANOVA tests* (Figure 1). The paper proposed an UDM based on the horizontal and vertical building density to provide a better understanding of the relationships between urban warming and density phenomena for the case of Istanbul.

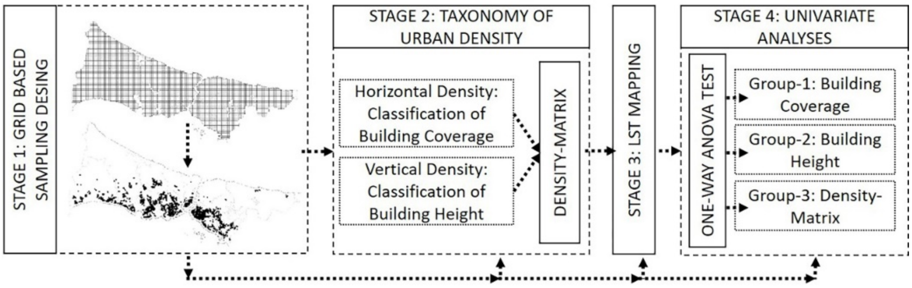


Figure 1. Research design scheme.

Study Area and Grid-Based Sampling Design

Istanbul is located in the northwest of the country and spans the divide between the European and Asian continents, a quality that gives the city unique characteristics (Figure 2). The coastal city also occupies the transition zone between the Sea of Marmara and the Black Sea, and takes advantage of the natural ventilation potential of the Bosphorus Strait and its complex topography (Ç.Ş.B., 2018). Approximately 27% of Istanbul is covered by urbanised areas (Figure 2).

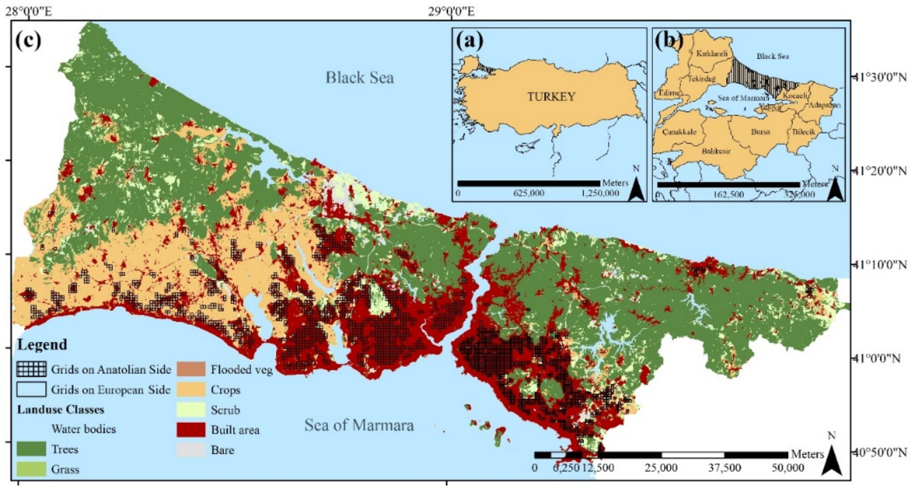


Figure 2. The location of the study area in Turkey (a), in Marmara Region (b) and the sample grid cells in Istanbul (c). Sample grids are shown on the 2020 land cover map which was produced and shared freely by ESRI.

The grid-based sampling method was adopted to represent different urban fabrics in the study area. First, the provincial borders of Istanbul were divided into sample grid cells at a resolution of 500x500m which is approximately a neighbourhood size. The grid elimination method of four basic criteria was then implemented to remove the influences of uncontrollable factors: Removing (a) cells containing water masses, or those with no buildings, (b) cells less than 1km from a large water mass, (c) cells located within forests or valleys and (d) cells with over 25% slope coverage. Thus, the sample size was reduced to 1949 grid cells – 1265 located on the European and 684 located on the Anatolian side (Figure 2). The 1949 grids represent the unique morphologies of Istanbul, which were developed by diverse social and economic drivers in different eras (Masoumi, Terzi, & Serag, 2019; Terzi & Bolen, 2009, 2012).

DOI: 10.15320/ICONARP.2022.220

Decoding the Taxonomy of Urban Density-Matrix

Regarding the UDM, building coverage ratio (BCR) and building height (BH) are numerical measurements that refer to the planning codes in the planning system and built-up features of the city. The operations here were based on the analysis of spatial characteristics in 1949 sample grid cells through the codifying taxonomy of the UDM. The vector-based building geodatabase was obtained from the CAD-source city map produced in 2017 by Istanbul Metropolitan Municipality. Buildings were identified into sample grid cells, and each cell was considered as a parcel of intersecting buildings to calculate the BCR and BH. The BCR was calculated as the ratio of the total footprint occupancy to the area of the grid cell. BH captured the average height of the building envelopes in the grid cell. Both the BCR and the BH were classified as *High/Mid/Low Coverage* and *High/Mid/Low Rise* in the density-matrix. Nine typologies comprising the cross-referenced classes of BCR and BH were employed in the UDM (Table 1). For instance, HighCoverage-HighRise (HCHR) defines the areas with a BCR between 0.51-1, meaning the building stock covers over half of the parcel. HCHR also includes the arrangement of buildings over 21-meters in height, meaning that the building stock is over 7 storeys. MidCoverage-MidRise (MCMR) indicates areas BCR ranging between 0.25-0.50 and mid-rise buildings of between 12-21 meters in height (building stocks between 4-7 storeys) (Table 1).

Table 1. The taxonomy of urban density.

Taxonomy	Typology	Code	Definition
Building Coverage (BC)	HighCoverage	HC	1.00 ≥ BCR ≥0.51
	MidCoverage	MC	0.50 ≥ BCR ≥0.25
	LowCoverage	LC	BCR <0.25
Building Height (BH)	HighRise	HR	BH >21 m
	MidRise	MR	21 m ≥ BH ≥12 m
	LowRise	LR	12 m > BH
Urban density-matrix (UDM)	HighCoverage-HighRise	HCHR	1.00 ≥ BCR ≥0.51 ; BH >21 m
	HighCoverage - MidRise	HCMR	1.00 ≥ BCR ≥0.51 ; 21 m ≥ BH ≥12 m
	HighCoverage - LowRise	HCLR	1.00 ≥ BCR ≥0.51 ; 12 m > BH
	MidCoverage - HighRise	MCHR	0.50 ≥ BCR ≥0.25 ; BH >21 m
	MidCoverage - MidRise	MCMR	0.50 ≥ BCR ≥0.25 ; 21 m ≥ BH ≥12 m
	MidCoverage - LowRise	MCLR	0.50 ≥ BCR ≥0.25 ; 12 m > BH
	LowCoverage - HighRise	LCHR	BCR <0.25 ; BH >21 m
	LowCoverage - MidRise	LCMR	BCR <0.25 ; 21 m ≥ BH ≥12 m
	LowCoverage - LowRise	LCLR	BCR <0.25 ; 12 m > BH

Land Surface Temperature Mapping

LST variations and anomalies were used as proxy indicators of the surface urban heat island (SUHI) effect. The thermal remote sensing method for LST mapping allows the observation of the surface energy balance and can produce more accurate models at multiple spatial scales. The spatial distribution of LST is affected by urbanisation patterns and surface characteristics (Arnfield, 2003; Bektas Balcik, 2014; Mirzaei & Haghighat, 2010; Quattrochi & Goel, 1995; James A Voogt & Oke, 2003; Weng, 2009). However, it is important to note the probability of a cloudy sky, the difference between observed surface temperature and air temperature, and the limitations of any vertical or horizontal structures within urban areas (Mirzaei & Haghighat, 2010).

In the Mediterranean climate region, SUHI rises to a peak in the summer season due to the high levels of solar radiation (Arnfield, 2003; Oke, 1982; Salvati, Roura, & Cecere, 2017). The effect of urbanisation on Istanbul's local climate is further exacerbated during the summer months because wind speeds are at a minimum (Ezber et al., 2007). Moreover, in 2017, the highest annual temperature and daily hours of sunshine were recorded in the July months (M.G.M., 2022). Therefore, Istanbul's LST was mapped by using the Landsat-8 OLI/TIRS satellite image of July 25, 2017, with 0% cloud cover (The satellite image was recorded for 1 minute between 08:43-08:45). The Operational Land Imager (OLI) sensor of Landsat-8 consists of nine bands at 30m resolution (the panchromatic Band 8 is at 15m resolution), and the Thermal Infrared Sensor (TIRS) has two thermal bands (Band 10-11) at re-sampled 30m resolution (collected at 100m resolution). Band-10 (10,60-11,19) was used as a single spectral band (Guha, Govil, Dey, & Gill, 2018) in this study due to concerns about the calibration uncertainty of Band-11 (11,50-12,51) for quantitative analyses and retrieval of LST values (USGS, 2019).

The Landsat-8 images were operated on with the following image processing steps. (1) Converting the digital numbers of pixels to the top of the atmosphere's reflectance (Barsi et al., 2014). (2) Transforming the band data to brightness temperature (Xu & Chen, 2004). (3) Calculating the Normalized Vegetation Index (NDVI), Proportion of Vegetation (PV), and Land Surface Emissivity (Jiménez-Muñoz, Sobrino, Gillespie, Sabol, & Gustafson, 2006; Jiménez-Muñoz et al., 2009; Sobrino, Jiménez-Muñoz, & Paolini, 2004; Weng, Lu, & Schubring, 2004). (4) Calculating LST. Due to the limited number of monitoring stations in Istanbul's settlement area, LST values could not be verified by in situ measurements. Therefore, LST anomaly values (LSTa) calculated according to the average temperature of the urbanised area were used in the statistical analyses.

Univariate Analyses of Variance: One-Way ANOVA Post Hoc Testing

One-way analysis of variance, a method to compare means of and identify the specific differences between more than two groups, was used to demonstrate whether there are statistically significant differences between building typologies in density-matrix in terms of their contributions to the SUHI variations. ANOVA tests were iterated in three groups, BC (Group-1), BH (Group-2), and the taxonomy of the UDM (Group-3), to detect the difference between the LSTa means. Before analysing the differences, we tested two assumptions of ANOVA that are normality and homogeneity of variance (HOV) between groups to determine whether it was appropriate to use ANOVA. Analytical and graphical examinations through Kolmogorov–Smirnov tests, histograms,

DOI: 10.15320/ICONARP.2022.220

Q-Q plots, and boxplots of LST variations were applied for normality testing. HOV tests calculated the Levene statistic to control the equality of group variances. The assumptions (equal variances assumed) were satisfied to use ANOVA associated with the HOV test results in which sig.>0.05. Since ANOVA results showed that there is a significant difference between groups with sig.<0.05, one-way ANOVA tests were conducted through post hoc tests based on Scheffé's Method. Scheffe's examines linear combinations of group means and compares all possible pairs in unequal sample sizes (Scheffe, 1953, 1959). We conducted Sheffe's post hoc tests in three groups, in which group-1 was for BC typologies (with subgroups of HC-MC-LC), group-2 was for BH (with subgroups of HR-MR-LR) and group-3 was for UDM with seven subgroups (Table 1).

RESULTS

Land Surface Temperatures in Istanbul

The LST map showed that the large water bodies surrounding the coastal city, Istanbul, provide a certain level of reduction in the UHI effect. Even though the surface temperatures were lower in the coastal zone than in the inner parts of the city through the proximity to large water bodies, this cooling effect could not be maintained over long distances towards the inner city due to high urban densities (Figure 3). Particularly, the high-density urbanisation of the southern part of Istanbul eliminated any cooling effect from the Sea of Marmara. Because the northern parts of the city are mostly covered by natural surfaces such as water basins, forests, and agricultural areas, and as they also benefit from the cooling effect of the Black Sea, their surface temperatures remain lower than those found within the southern districts. The higher surface temperatures in the south part (the most urbanised and industrialised area) than in the north indicated that the distribution of LST is directly related to the urbanisation pattern in Istanbul (Figure 3). However, surface temperatures tended to increase in certain northern regions due to the new transportation hubs and residential developments.

Surface temperatures in Istanbul ranged between 22.03°C and 47.76°C, and the temperature difference between urban and rural areas was 4.29°C on 25th July 2017. Even if the average LST was 30.40°C in Istanbul, the urban average was 34.73°C (Figure 3). According to the long-period statistics, the average temperature is 25.8°C, the maximum is 30.9°C and the minimum is 21.6°C in July in Istanbul (M.G.M., 2022). Surface temperature statistics (min-max-average values) above the long-period averages confirmed the urban warming in July 2017. The highest surface temperature, nearly 16°C above the maximum long-term average, signalled a significant warming crisis in Istanbul.

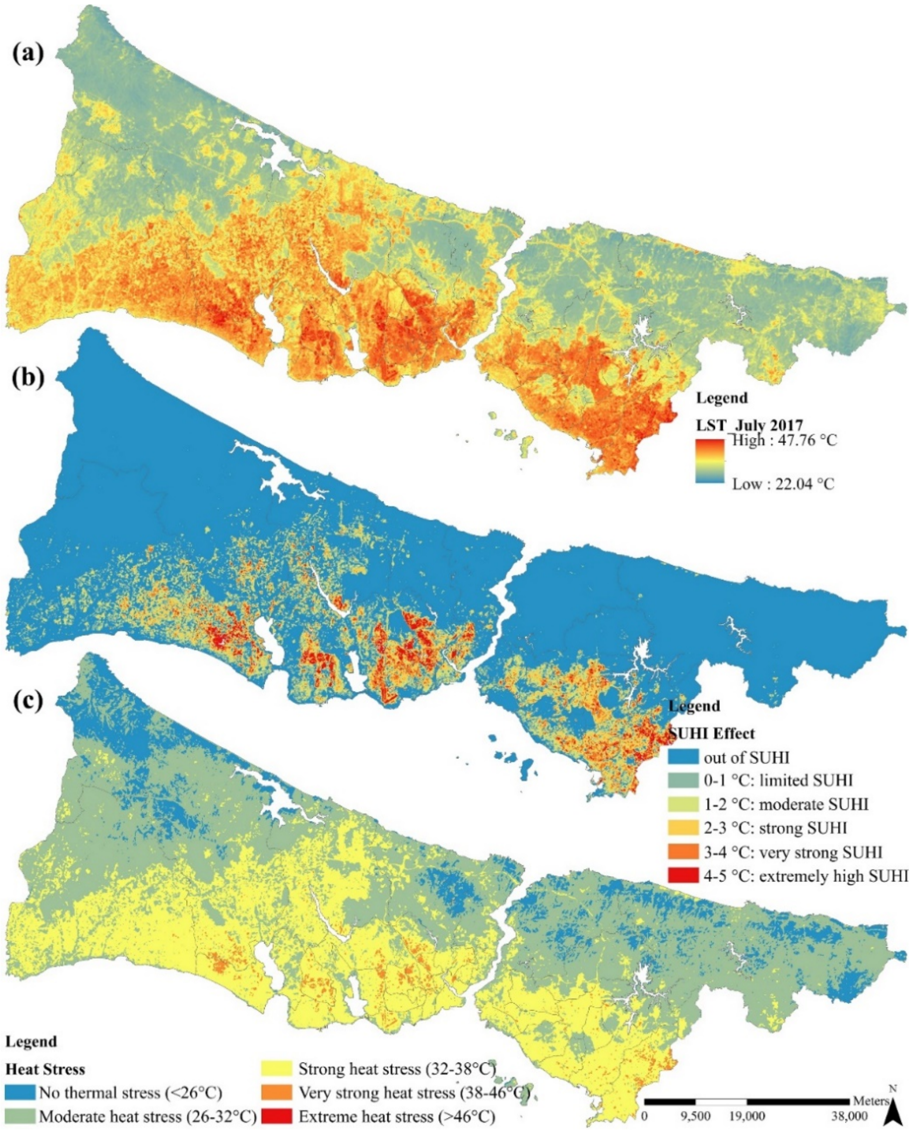


Figure 3. LST distribution (a), maps of SUHI effect (b) and heat stress (c) of Istanbul on 25th July 2017. (a) was produced from Landsat-8 thermal image. (b) and (c) were extracted from LSTs. (b) indicates the LST anomalies above the urban average as a proxy of the SUHI effect. (c) was classified as for Błażejczyk et. al. (2013)'s thermal stress categorisation.

While the LSTa below 34.73°C showed the non-SUHI effect, surface temperatures above the urban average indicated the potential SUHI effect (Figure 3). The natural northern parts were generally out of the SUHI effect with surface temperatures below the urban average. However, LST anomalies reached 5°C in the inner and high-density parts of the city and indicated an extremely high SUHI effect (Figure 3). 51% of the built-up area had a SUHI effect at various levels. Accordingly, the built-area's 16% was under the limited (LSTa: 0-1°C) and 14% was under the moderate (LSTa: 1-2°C) SUHI effect. Although temperature anomalies of 2°C are considered as extreme heat events on a global scale, limited and moderate SUHI effects might be minimised by minor interventions such as increasing urban vegetation in urban space. However, minimising the LSTa above 2°C, strong-very strong-extremely high SUHI effects requires structural interventions in the urban fabric such as reconfiguration of urban density and form (Erdem Okumus & Terzi, 2021). In Istanbul, 12% of the built-area was subject to a strong SUHI effect (LSTa: 2-3°C), 10% was subject to a very strong (LSTa: 3-4°C), and 5% was subject to an extremely high (LSTa: 4-5°C) SUHI effect.

DOI: 10.15320/ICONARP.2022.220

Since the humidity rate in coastal cities is higher than in the inner settlements, heat stress increases with the combination of humidity and SUHI and reaches a critical level. In Istanbul, strong SUHI effects intensified in the urbanised areas, creating very strong heat stress but also putting even rural parts under strong heat stress (Figure 3). According to Blazejczyk et al. (2013), temperatures over 26°C indicate thermal heat stress and temperatures over 32°C show strong heat stress (Błażejczyk et al., 2013). While Istanbul's 89% was under heat stress, 97% of the built-up area had moderate or strong heat stress. Another critical finding that explains the severity of the urban warming issue in Istanbul was that 65% of Istanbul's lands, which had not yet encountered the SUHI effect, are under heat stress at various levels.

Density Typologies and Spatial Distributions in Istanbul

The heterogeneous urban fabric in Istanbul includes various urban forms and geometries based on building density (Figure 4). Findings demonstrated that horizontal and vertical building densities are higher on the European side than on the Anatolian side. The BCR is lower on the Anatolian side due to the dominance of residential land use. High coverage typologies intensify in the city centre of the European side, and the BCR values decrease significantly away from the centre towards the peripheries for both sides. Contrarily, high-rise typologies are concentrated on the peripheries, mostly covering mass housing units. City centres are dominated by mid-rise typologies for both sides (Appendix 1).

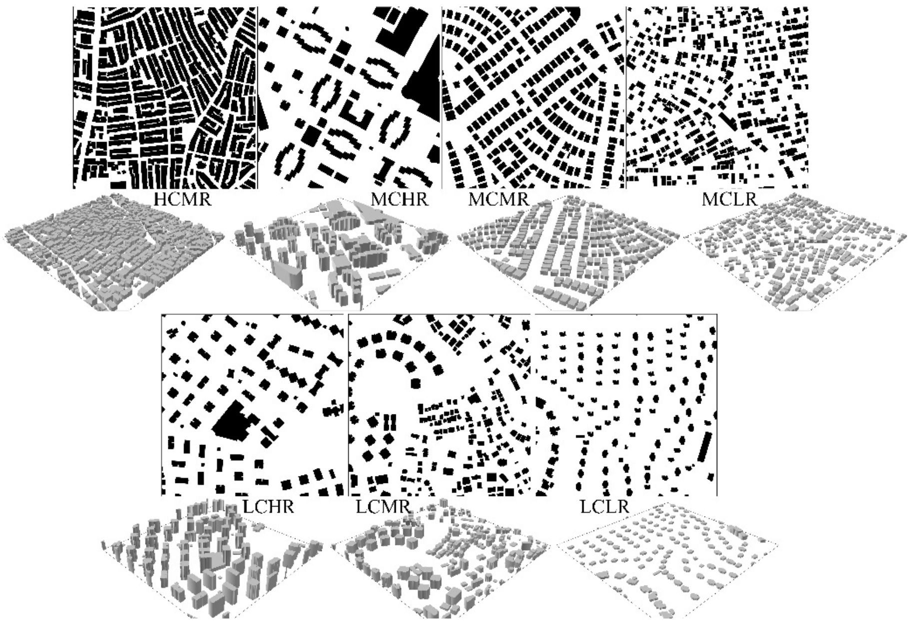


Figure 4. 2D/3D views from sample layouts of building typologies in UDM. Morphological form of long-linear building arrays in HCMR unfastens to distributed molecular form towards the LCLR typology.

The spatial distribution of the UDM supports the bidirectional development process in Istanbul: the construction of lower horizontal and vertical density areas in the peripheries; the higher horizontal density redevelopment of the city centre (Appendix 1). The findings showed that Istanbul's urbanised area has 7 types of building typologies

–HCMR, MCHR, MCMR, MCLR, LCHR, LCMR, LCLR- in the UDM (Appendix 1, Table 2). The typologies of HCHR and HCLR could not be identified in Istanbul. 44% of the grid cells are LCLR, 20% are MCMR, 19% are LCMR, 7% are MCLR, 6% are LCHR, 3% are HCMR and 1% are MCHR, respectively. The most prevalent morphologies in Istanbul are low-coverage and low-rise, the molecular form of urban sprawl towards semi-urban zones (Figure 4). Mid-coverage-mid-rise and low-coverage-mid-rise morphologies share the second rank. The mid-coverage and high-rise array is the least common typology, with only 6 grid cells. High-coverage and mid-rise morphology consisting of long-linear building arrays existed in 63 grid cells and concentrated on the European side (Figure 4).

Table 2. Descriptives of building typologies in Istanbul.

	Code	N	$BCR_{max.}$	$BCR_{min.}$	$BH_{max.}$	BH_{min}	$FAR_{max.}$	$FAR_{min.}$
BC	HC	63	0.62	0.51	18	12	3.22	1.89
	MC	531	0.50	0.25	30	3	3.64	0.35
	LC	1355	0.24	0.10	51	3	2.71	0.10
BH	HR	127	0.43	0.10	51	24	3.64	0.10
	MR	830	0.62	0.10	21	12	3.24	0.10
	LR	992	0.46	0.10	9	3	1.50	0.10
UDM	HCHR	0*	NA	NA	NA	NA	NA	NA
	HCMR	63	0.62	0.51	18	12	3.22	1.89
	HCLR	0*	NA	NA	NA	NA	NA	NA
	MCHR	6	0.43	0.28	30	24	3.64	2.19
	MCMR	394	0.50	0.25	21	12	3.24	0.93
	MCLR	131	0.46	0.25	9	3	1.50	0.35
	LCHR	121	0.24	0.10	51	24	2.72	0.10
	LCMR	373	0.24	0.10	21	12	1.80	0.10
	LCLR	861	0.24	0.10	9	3	0.88	0.10

N: Number of grid cells regarding the stated typology in 1949 sample grids.
FAR (Floor area ratio): one of the density metrics that indicate the construction rights in the urban regulatory planning system, is detected by the formula: (BCR*(BH/3)/ParcelArea).
* Typologies are not available in 500x500m grid resolution in Istanbul.

Surface Temperatures in Urban Density Typologies

Temperatures at the HC typologies were highest during the day, ranging between 35.50 and 39.24°C. The LST_{mean} was around 37°C and resulted in a 2.63°C temperature anomaly on average which indicates a strong SUHI effect in HC areas. Temperature conditions led to strong heat stress dominantly; however, there were grid cells experiencing very strong heat stress in HC typology. Similarly, the MC areas also recorded strong heat stress caused by temperatures between 32.27 - 38.70°C. The MC typology created a moderate SUHI effect at 1.08°C of LSTa. The LC areas tended to be cooler with mean temperatures of 34.20°C, which is very close to but lower than the urban average. The $LST_{max.}$ at 38.79°C demonstrated that there were LC neighbourhoods having a strong SUHI effect as outliers. Even though LST_{mean} in LC grid cells presented no SUHI effect, strong and moderate heat stress was identified in LC neighbourhoods (Table 3, Appendix 1, Figure 5).

DOI: 10.15320/ICONARP.2022.220

Table 3. Surface temperatures of building typologies in urban density.

ANOVA Groups	Code	*$LST_{2017max}$	*$LST_{2017min}$	*$LST_{2017mean}$	*SUHI ($LSTa_{2017mean}$)	Std. Dev.
Group-1: Building Coverage (BC)	HC	39.24 °C	35.50 °C	37.36 °C	**2.63 °C**	0.99
	MC	38.70 °C	32.27 °C	35.81 °C	**1.08 °C**	1.28
	LC	38.79 °C	26.18 °C	34.20 °C	-0.53 °C	1.60
Group-2: Building Height (BH)	HR	37.86 °C	31.60 °C	33.69 °C	-1.06 °C	1.00
	MR	39.24 °C	27.98 °C	35.24 °C	**0.51 °C**	1.61
	LR	38.79 °C	26.18 °C	34.46 °C	-0.27 °C	1.77
Group-3: Urban density-matrix (UDM)	HCHR	NA	NA	NA	NA	NA
	HCMR	39.24°C	35.50 °C	37.36 °C	**2.63 °C**	0.99
	HCLR	NA	NA	NA	NA	NA
	MCHR	37.86 °C	33.05°C	35.54 °C	**0.81 °C**	1.42
	MCMR	38.70 °C	32.27 °C	35.82 °C	**1.09 °C**	1.35
	MCLR	38.15 °C	32.57 °C	35.80 °C	**1.07 °C**	1.05
	LCHR	35.96 °C	31.60 °C	33.58 °C	-1.15 °C	0.87
	LCMR	37.79 °C	27.98 °C	34.27 °C	-0.46 °C	1.28
	LCLR	38.79 °C	26.18 °C	34.26 °C	-0.47 °C	1.77

* Statistics show the average values of grid cells related to the specific typology.

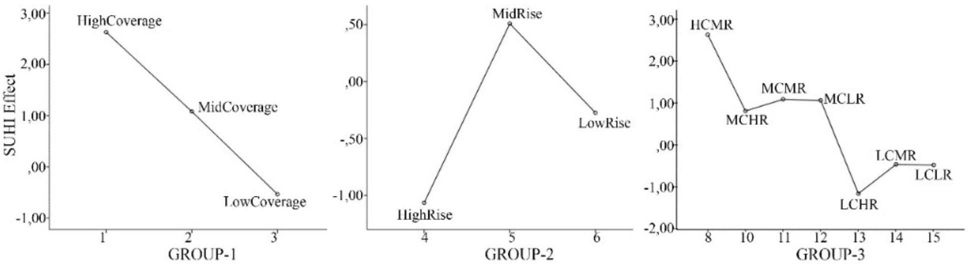


Figure 5. SUHI effect ($LSTa_{2017mean}$) plots of BC (Group-1), BH (Group-2) and UDM (Group-3).

In the group of building heights, the MR was the unique typology, creating a limited SUHI effect with a positive temperature anomaly on average. However, high LSTmax values in the BH typologies stated that there still might be neighbourhoods creating strong SUHI effects individually. There was a downward trend in the average temperatures of the HR typologies. Moreover, the HR areas were the coolest typology in the BH group, with around 1°C below the urban average. Similar to the BC group, BH typologies were under the dominant effect of moderate and strong heat stress (Table 3, Appendix 1, Figure 5). Throughout the UDM typologies, the highest temperature anomaly was detected in the HCMR areas with a strong SUHI effect. While MCMR and MCLR areas had moderate effects, neighbourhoods with the MCHR typology embodied a limited SUHI effect. Temperatures were lower in LCHR, LCMR and LCLR typologies and LCHR were the lowest (Table 3, Figure 5).

ANOVA Test Results

Analytical and graphical analyses of normality tests and the results of the Levene statistic regarding HOV testing met the requirements to apply ANOVA examination in this study. Varying temperatures of typologies in the UDM directly affected the normal distribution graph. Particularly, MCMR had both a wider range and a higher average temperature value. However, MCHR had a narrower range and lower LST_{mean} than other MC typologies. While MCMR typologies led to the highest LST variation, MCHR created the lowest temperature variation in Istanbul. In LC typologies, LCLR had a wider range but LCMR had a higher LST_{mean}. Even though the frequency distributions of UDM did not entirely overlap with the normal curve, typologies were close enough to a normal distribution with p-values >0.05 (Figure 6).

According to the ANOVA post hoc tests, even though significant differences were detected between some subgroups, a few typologies appeared to have similar effects on SUHI formation. Initially, tests showed that each BC and BH typology has a distinct influence on the SUHI effect (sig. 0.05). The biggest differences appeared between the HC and LC typologies in the BC group (mean diff.: ±3.16; sig.:0.00). While the HC typology created a warming trend in the neighbourhoods, LC assisted in a decrease in temperature anomalies. In the BH group, the test proved that the mean difference is significant between HR and MR pairs (mean diff.: ±1.57; sig.:0.00). HR typology resulted in the lowest anomalies below the urban average, but MR contributed to increasing the SUHI effect (Appendix 2). According to adj. R2 values of univariate analysis, BC emerged as a more efficient and stronger indicator for SUHI examinations than BH (adj. R^2_{BC}: 0.25; adj. R^2_{BH}: 0.07).

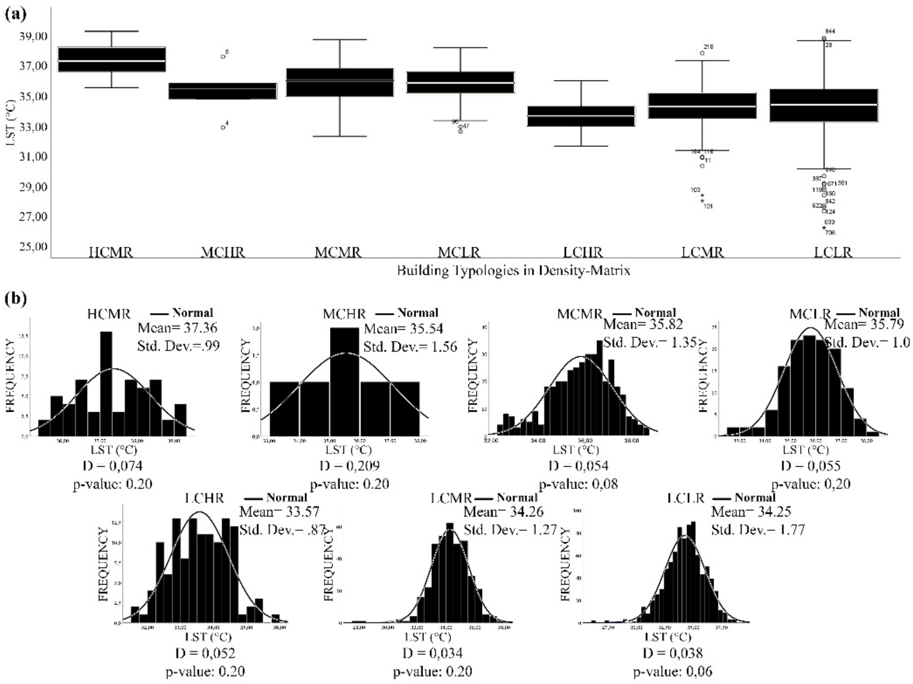


Figure 6. LST distributions (a) and frequency distributions (b) of UDM typologies (Landsat-8, 25th July 2017). (a) was produced according to the taxonomy of density-matrix in Istanbul (average temperature is 34.73°C). (b) demonstrates the typologies in UDM with a normal distribution line and the results of Kolmogorov-Smirnov normality test. The variable is normally distributed if p-value > 0.05.

Throughout the UDM typologies in group-3, the highest difference appeared between HCMR and LCHR pairs (mean diff.: ±3.79; sig.:0.00). While HCMR created a strong SUHI effect with the highest departure from the urban average of LST, the lowest LST was detected at LCHR with the temperature far below the urban average. HCMR demonstrated differences at various levels with other typologies, except MCHR. Because HCMR and MCHR typologies had similar effects (sig.: 0.23) on LSTa in Istanbul, densification decisions in urban space based on HCMR or MCHR typologies have identical effects on urban warming. Indeed,

DOI: 10.15320/ICONARP.2022.220

MCHR did not have any particularly unique effect among the UDM typologies (sig. values>0.05). MCMR, on the other hand, distinguished itself not only from HCMR but also from LCHR (mean diff.: 2.25; sig.: 0.00), LCMR (mean diff.: 1.55; sig.: 0.00), and LCLR (mean diff.: 1.57; sig.: 0.00). The highest difference in MCMR occurred in LCHR. In addition, MCLR had dissimilar effects on HCMR (mean diff.: 1.57; sig.: 0.00), LCHR (mean diff.: 2.22; sig.: 0.00), LCMR (mean diff.: 1.53; sig.: 0.00), and LCLR (mean diff.: 1.54; sig.: 0.00); the highest difference score was obtained with LCHR.Since the effects of MCLR were similar to those of MCHR and MCMR, the same coverage ratios seemed to create similar impacts on urban warming. However, it is not the same for low coverage fabrics (Appendix 2). The findings contribute significantly to urban planning and design strategies relating to urban densification and the selection of appropriate building typologies, with the goal of reducing urban warming through SUHI mitigation.

DISCUSSION

Density-Matrix Approach in Evaluating SUHI Impact of Urbanisation

Density is not only an instrument of certain policies followed by spatial planning but also a common concept in measuring the environmental impacts of urbanisation. Varying urban development dynamics create different densification patterns in cities, horizontally and/or vertically. The heterogeneous spatial structure of building typologies formed based on urban densification policies creates substantial consequences in terms of SUHI formation. Our findings strongly emphasised that different typologies of horizontal and vertical densification in UDM produce varied levels of temperature anomalies. A comprehensive framework of UDM helped both evaluate the SUHI impacts of horizontal and vertical densification patterns and breed the combinatorial solutions of building typologies based on UDM classes, in terms of SUHI mitigation. Such combinatorial solutions can offer alternative solutions for SUHI mitigation with different density trials, instead of producing a single solution in urban neighbourhoods. The matrix also provides an input to urban planning practices by facilitating the urban density distribution on the city having complex development dynamics.

The important gap in the UHI-density literature is that the low, medium and high-density categories have non-standardised ranges that vary depending on the characteristics of the city in each research. For example, a high-density perception in Oklahoma City, USA, could be interpreted as medium or even low density in Istanbul. Because of this relativity, cross-comparisons for comprehending the UHI-density relationship remain limited. The UDM shows the quantitative ranges of both horizontal and vertical density classes, resulting in an adaptable framework for cities around the world with varying cultures and urban development dynamics. This approach paves the way for similar studies

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

that consider both horizontal and vertical density, as well as the development of more concrete, effective, and density-based heat island mitigation strategies.

SUHI Impacts of Building Typologies in Density-Matrix

Empirical analyses indicated both the contribution of urbanisation on SUHI formation in terms of urban density in Istanbul and the differentiating effects of building typologies in the heterogeneous spatial structure of the city. Even though almost each of the horizontal and vertical densification typologies in the density-matrix has an independent effect on SUHI formation, findings highlighted that building coverage is a more efficient and stronger indicator for SUHI studies than the building height (Guo et al., 2016; Liao et al., 2021; Yin et al., 2018). BCR had a higher relationship with LST than BH in Istanbul. Attempts for SUHI mitigation in Istanbul might take the advantage of the robust impact of BCR in the neighbourhoods.

The positive linear relationship between BCR and LST anomalies (Guo et al., 2016; Liao et al., 2021; Yin et al., 2018) promotes decreasing building coverage to mitigate the SUHI in Istanbul's neighbourhoods. According to the researchers, the increasing tendency in LST with higher building coverage is based on concerns of fewer green spaces and poor ventilation in the neighbourhoods (Liao et al., 2021; Yin et al., 2018). Low BCR values possibly provide larger open green spaces and sparsely distributed urban layout design supporting the airflow, and weaken the SUHI effect (Yin et al., 2018; Zhao, 2018; Zhou et al., 2011). Ventilation and green coverage were not directly subjected to this study, but the decreasing trend in surface temperatures in the low coverage typology might be caused by the cooling effects of the large vegetative surfaces and the accelerated heat loss due to the gratifying airflow in sparsely built-areas in Istanbul. More likely, since the Landsat's transit time is during 08:43-08:45 when the sun just rises, low temperatures occurred in the areas with low building coverage typologies might be due to the nocturnal cooling effect of the high sky openness (Arnfield, 1990a). Contrarily, the greater potential of absorbing solar radiation through a large number of roof surfaces and lower radiation reflectance from street surfaces possibly led to higher surface temperatures in medium and high coverage areas (Chun & Guldmann, 2014; X. Yang & Li, 2015).

Even though studies have asserted that building height has a negative relationship with LST (Zheng et al., 2019), a non-linear mechanism was detected between building height and LST anomalies in Istanbul. Guo et al. (2016) supported the non-linear relationship between urban morphology and LST variations even if they indicated the positive correlation between BH and LST. For the case of Istanbul, MR typologies produced the highest surface temperatures among the BH classification (Guo et al., 2016; Lin, Lau, Qin, & Gou, 2017). Potentially, having more vegetative coverage and promoting airflow inside the neighbourhood

DOI: 10.15320/ICONARP.2022.220

explain the lowest contribution of HR typologies to the SUHI effect (Feng & Myint, 2016; Zheng et al., 2019; Zhou et al., 2011). Moreover, tall buildings provide a large amount of shading which might influence the behaviour and intensity of SUHI (F. Yang et al., 2010). Researchers declared that site shading conditions are directly related to day-time LST variations and SUHI effects, and explained that the shadows formed by HR buildings decrease temperatures and heat island intensity by creating a cooling effect (Guo et al., 2016; F. Yang et al., 2010).

Findings highlighted that the highest temperature values were recorded in HCMR areas among the typologies in density-matrix. HCMR typology creates high horizontal and vertical density neighbourhoods including enclosed urban areas surrounded by buildings, attached-long row city blocks and mostly hard and impervious pavements (Figure 4). In comparison to other typologies, its deeper canyon geometry, lower level of sky visibility, less ventilation capacity produces a significant effect on SUHI intensity by determining the amount of solar radiation that can reach and be absorbed in urban surfaces (Hu et al., 2016; Oke, 1987; Shishegar, 2013; F. Yang et al., 2010; Yin et al., 2018). On the other hand, the lowest LSTa were recorded in LCHR typologies in Istanbul. Areas with lower horizontal densities, sparsely distributed buildings and larger open spaces produce the highest levels of sky visibility and a uniform canyon geometry. A few researchers emphasised that as the depth of canyon geometry increases and the visibility of the sky decreases, the heat island effect may tend to decrease due to the limited exposure of the surfaces to solar radiation (Arnfield, 1990b; Giridharan, Lau, Ganesan, & Givoni, 2007; Strømann-Andersen & Sattrup, 2011). Contrary to this, Oke (1981) and Hu et al. (2016) revealed that urban temperatures tend to increase in such districts due to the impediment to cooling of the urban surfaces caused by buildings having high horizontal and vertical density and lower levels of sky visibility (Hu et al., 2016; Oke, 1981).

Contributions to the Micro-Climate Sensitive Planning and Design Strategies

Herein, we discuss the contributions to the design strategies regarding SUHI mitigation. Rethinking the overall urban densification policies while renewing built-up areas and developing new urban areas helps to control the temperature anomalies and promotes the reduction of local warming. The findings demonstrated that high-building coverage creates higher temperature anomalies; therefore*, decreasing horizontal density with a lower building coverage ratio helps to mitigate UHI effects significantly*. One of the design strategies to reduce the SUHI effect in neighbourhoods is to develop residential areas by keeping the BCR below 0.50. This means that the building footprint covers less than half of the parcel. To keep the SUHI effect even lower, the BCR should be kept below 0.25.

In areas with high land values, where building rights must be preserved to ensure construction feasibility (e.g., in or near the city centre), the design combination of a lower horizontal density (BCR<0.25) and a higher vertical density (BH>21 meters) provides the optimal solution for mitigating SUHI. While prior research has demonstrated that increasing building height can help lower LST in residential areas (Zheng et al., 2019; Zhou et al., 2011), this study discovered a nonlinear relationship between BH and LST. MCHR and LCHR are the two typologies that resulted in a reduction in the density matrix's LST anomalies. The minimal impact of high-rise and low-coverage urban areas on surface temperatures demonstrates their potential for heat islands (Gago, Roldan, Pacheco-Torres, & Ordóñez, 2013). The second design strategy, here, is based on lowering the building coverage, and it is formulated as the *combination of low building coverage and high building height within the density matrix's building height limitations.* We explain the relatively better results of LCHR than LCLR as the horizontal density of the LCHR model (the distance between buildings is much greater) compared to the LCLR model: in other words, there are fewer buildings per unit area.

In urban renewal practices, there may be market pressure to enhance construction rights in terms of project feasibility, particularly in or near the city centre. The demand of local stakeholders to preserve or expand economic assets puts pressure on increasing urban density both horizontally and vertically in attempts to renew the urban area. Under such market pressure, we might be able to give a picture of what configurations might be utilised to reduce local warming without compromising existing development rights while also renewing built-up areas. Despite the constant but high construction rights in built-up areas, regulating the spatial configurations of building typologies can nevertheless decrease the SUHI impact. Different amounts of SUHI impact in different building typologies might all be referring to the same construction rights. For example, when re-building urban areas using HCMR urban fabric, it may be preferable to use MCHR or LCHR typologies. The quantitative outcomes of this investigation showed that whereas HCMR produces the greatest LSTa, MCHR and LCHR contribute less to the temperature anomalies. Despite having almost the same land development rights as the HCMR type, surface temperatures in LCHR urban areas were significantly lower. Various amounts of the SUHI impact are generated by urban areas with the same development rights but different building forms and typologies.

The third design strategy is formulated as *designing high-rise buildings but with higher distances between them.* The height and coverage (as a proxy for the distance between buildings) of the buildings are strong structures controlling the wind direction and speed which is an important cooling factor in the urban area (He, Ding, & Prasad, 2020b, 2020a; Jun Yang et al., 2019). High-rise buildings and low building coverages with larger spaces between buildings provide a

DOI: 10.15320/ICONARP.2022.220

preferred situation in the summer month by increasing windiness and allowing the surface temperatures to drop. This built-form also increases thermal comfort in the outer environment and reduces the energy demands for cooling indoors. However, the wind is an undesirable factor in winter. Increasing the cooling effect with the wind may cause a decrease in thermal comfort and an increase in the energy demand for heating. Therefore, taking the advantage of promoting wind to minimise urban warming in the summertime might cause disadvantageous ventilation conditions in wintertime (Kleerekoper et al., 2012).

Design strategies for urban spatial development might provide heat loss presumably by enhancing airflow and/or ventilation conditions, creating more shadowed surfaces and enabling more open spaces for urban vegetation coverage (Kleerekoper et al., 2012; Yilmaz, Külekçi, Mutlu, & Sezen, 2021; Yin et al., 2018). It should not be forgotten that local characteristics are significant for the efficiency of such standards, which might lead to conflicting situations. For instance, Kleerekoper et al. (2012) specified for the Netherlands that designing urban areas in compact built form might be preferable for temperature mitigation due to the fewer heat storage capacity of fewer facades. However, even though the design of the deep street canyon with high-rise buildings and narrow streets obstruct the overheating, it minimises natural ventilation and increases the energy demand for heating in the wintertime by creating dark shadows (Kleerekoper et al., 2012; Wong et al., 2011). Another example, Pomponi et al. (2021) supported the idea that taller buildings are better for the environment when having the urban layout design (building footprints) perspective since they present optimal use and maximal efficiency of space and prevent urban sprawl. However, they also stated that high coverage low rise urbanisation might be more environmentally friendly than vertically denser patterns from a perspective of the construction tall and heavier structures with carbon-intense building materials (Pomponi et al., 2021).

This paper reveals the limits of what building height and footprint cause how much surface warming effect, from the urban densification perspective. Hereby, we need to state that while low coverage typologies might cause urban sprawl in metropolitan areas resided high populations, vertical development associated with the high-rise typologies raises concerns about damaging human scale perception, breaking street-building relationships, and ruining the image, identity and culture of the city. Therefore, the spatial organisation of density-dependent typologies and urban density distributions should be optimised to both minimise urban warming and eliminate the abovementioned concerns. Moreover, controlling urban density is not highlighted as the most powerful strategy to minimise urban warming in this study. Even if the urban density is strongly correlated with LST, any single morphological factor is not enough to minimise urban warming related to the heat island effect. It is also not claimed that the

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

urban fabric with high-rise blocks with a low coverage ratio is the best morphological design for Istanbul's neighbourhoods. We need to mention that the strategy based on reducing BCR should be applied with the maximum building height (hmax.) limitation. The reduction of horizontal density allows vertical densification to the extent of the existing construction area. Due to the hmax boundary, it may not be possible to produce the density levels suggested by this research in all neighbourhoods with HC and MC in Istanbul. Besides that, any structural modification might not be applied to the urban fabrics located in Istanbul's historical centre or in the regions with high historical value. In such cases, minor improvements, such as increasing vegetation coverage, help to improve urban micro-climate (Erdem Okumus & Terzi, 2021).

Technical Limitations

Directional variations in observed temperatures are among the technical limitations of the study. Using the thermal image for a certain date might cause the anisotropy effect of urban surface temperatures (James A Voogt & Oke, 1997, 1998; James Adrian Voogt, 1995). The downward trend at the temperatures in the areas with especially HR typologies and the shadow impact might also be related to the anisotropy effect of LST extracted by satellite images. As the sun angle is too low at the time the image was recorded, LST trends depending on BH are directly affected by the anisotropy effect. The effect might be eliminated by using another thermal image recorded at different periods, however, there is not another thermal image on July 25, 2017, recorded by Landsat-8. Therefore, the study remained within the limitations of the anisotropy effect.

CONCLUSION

One of the key issues of the urban planning agenda is how urban density be decided in the spatial configurations of future neighbourhoods to overcome complex challenges such as urban warming. Herein, reducing urban warming is essential motivation by examining and rearranging the urban densities through the comprehensive UDM approach presented in this study. The significance of this paper lies in the urban density concept and providing tangible contributions to urban reconstruction in Istanbul.

This paper indicated the possibility of mitigating SUHI by reorganizing urban spatial configurations on a density basis and assisting policy decisions using quantitative measurements. Surface temperature anomalies become more apparent when UDM typologies are considered. Variable spatial layouts of urban communities based on the combination of varying horizontal and vertical density levels can modulate the LSTa-measured urban warming. Horizontal density has a greater effect on variations in LST than vertical density does. While horizontal density was positively correlated with LSTa, vertical density

DOI: 10.15320/ICONARP.2022.220

had a non-linear relationship with LSTa. Urban areas with a high density of buildings and a medium building height resulted in a much higher LST. In comparison, the lowest LST values were found in districts with low coverage and high-rise buildings. Additionally, spatial configurations with equal construction permissions but varied building typologies generate distinct SUHI values. While urban density is a critical topic for SUHI research, densification strategies should not be regarded as a stand-alone tool for mitigating urban warming. Any intervention that integrates additional morphological and urban fabric aspects has a high probability of achieving SUHI minimisation with high efficiency.

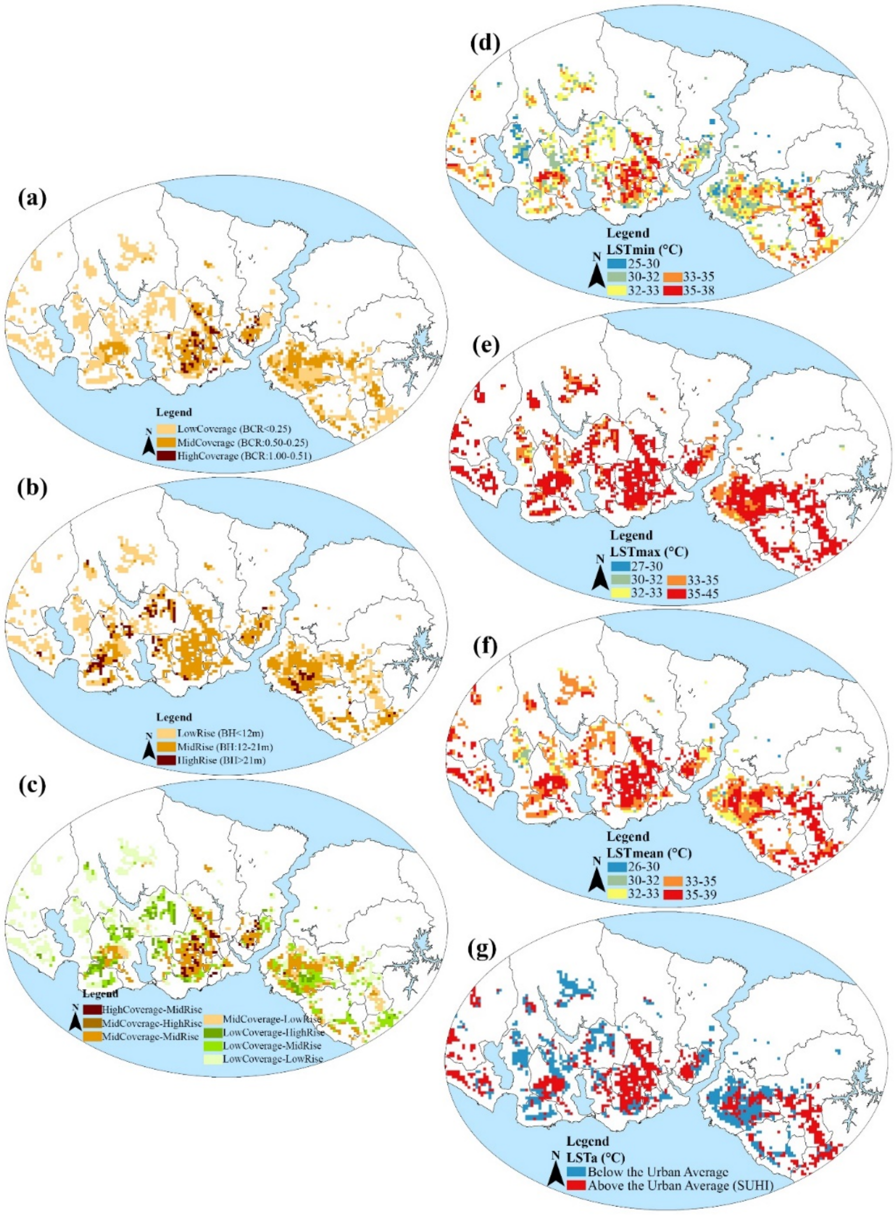
Urban density, which includes building coverage and height, is also a critical aspect of Turkey's urban regulatory planning system since it helps define the three-dimensional urban environment's boundaries. We propose that Istanbul's local warming be mitigated by using of density as a control mechanism. Decisions about urban densification should be developed in line with SUHI impact studies during the planning and design processes.

Overall, analysing the effects of different building typologies and densities on SUHI enables urban planners and designers to better understand the impact of urban planning/design decisions on microclimate elements and to develop ways to mitigate UHI effects. Considering quantitative research findings as a strong foundation for developing policy recommendations and using them as a guideline may create new opportunities for researchers, practitioners, and policymakers.

ACKNOWLEDGEMENTS/NOTES

This paper was produced from the PhD thesis conducted by the corresponding author under the supervision of the second author. The study conception and design were supported by the Scientific Research Projects Department of Istanbul Technical University, Istanbul, Turkey [grant number 42088]. The final manuscript has been completed by the support of the Scientific and Technological Research Council of Turkey (TUBITAK), 2214-A International Research Fellowship Program for Ph.D. Students.

APPENDICES



Appendix 1. Distribution of the UDM typologies (a), (b), (c) and LSTs of sample grid cells (d), (e), (f), (g) in Istanbul. (g) demonstrates the LSTa of sample grid cells regarding the average temperature of 34.73°C on 25th July 2017.

DOI: 10.15320/ICONARP.2022.220

	(I) Typologies	(J) Typologies	Mean Difference (I-J)	Std. Error	Sig.
GROUP-1: BC	HC	**MC**	**1.549***	0.199	0.000
		LC	**3.163***	0.193	0.000
	MC	**HC**	**-1.549***	0.199	0.000
		LC	**1.613***	0.076	0.000
	LC	**HC**	**-3.163***	0.193	0.000
		MC	**-1.613***	0.076	0.000
GROUP-2: BH	HR	**MR**	**-1.572***	0.158	0.000
		LR	**-0.790***	0.156	0.000
	MR	**HR**	**1.572***	0.158	0.000
		LR	**0.782***	0.078	0.000
	LR	**HR**	**0.790***	0.156	0.000
		MR	**-0.782***	0.078	0.000
GROUP-3: UDM	HCMR	MCHR	1,817	0,638	0,230
		MCMR	**1,539***	0,202	0,000
		MCLR	**1,566***	0,228	0,000
		LCHR	**3,786***	0,232	0,000
		LCMR	**3,092***	0,203	0,000
		LCLR	**3,106***	0,194	0,000
	MCHR	HCMR	-1,817	0,638	0,230
		MCMR	-0,277	0,614	1,000
		MCLR	-0,251	0,623	1,000
		LCHR	1,968	0,624	0,128
		LCMR	1,274	0,614	0,636
		LCLR	1,288	0,611	0,618
	MCMR	**HCMR**	**-1,539***	0,202	0,000
		MCHR	0,277	0,614	1,000
		MCLR	0,026	0,150	1,000
		LCHR	**2,246***	0,155	0,000
		LCMR	**1,552***	0,107	0,000
		LCLR	**1,566***	0,090	0,000
	MCLR	**HCMR**	**-1,566***	0,228	0,000
		MCHR	0,251	0,623	1,000
		MCMR	-0,026	0,150	1,000
		LCHR	**2,220***	0,188	0,000
		LCMR	**1,526***	0,151	0,000
		LCLR	**1,540***	0,140	0,000
	LCHR	**HCMR**	**-3,786***	0,232	0,000
		MCHR	-1,968	0,624	0,128
		MCMR	**-2,246***	0,155	0,000
		MCLR	**-2,220***	0,188	0,000
		LCMR	**-0,693***	0,156	0,003
		LCLR	**-0,680***	0,144	0,001
	LCMR	**HCMR**	**-3,092***	0,203	0,000
		MCHR	-1,274	0,614	0,636
		MCMR	**-1,552***	0,107	0,000
		MCLR	**-1,526***	0,151	0,000
		LCHR	**0,693***	0,156	0,003
		LCLR	0,013	0,092	1,000
	LCLR	**HCMR**	**-3,106***	0,194	0,000
		MCHR	-1,288	0,611	0,618
		MCMR	**-1,566***	0,090	0,000
		MCLR	**-1,540***	0,140	0,000
		LCHR	**0,680***	0,144	0,001
		LCMR	-0,013	0,092	1,000

*The mean difference is significant at the 0.05 level.

Appendix 2. Scheffé's post hoc test results for Groups of BC, BH and UDM.

REFERENCES

Alexander, E. R. (1993). Density measures: A review and analysis. Journal of Architectural and Planning Research, 181–202.

Arnfield, A. J. (1990a). Canyon geometry, the urban fabric and nocturnal cooling: a simulation approach. Physical Geography, 11(3), 220–239.

Arnfield, A. J. (1990b). Street design and urban canyon solar access. Energy and Buildings, 14(2), 117–131.

Arnfield, A. J. (2003). Two decades of urban climate research: a review of turbulence, exchanges of energy and water, and the urban heat island.

International Journal of Climatology, 23(1), 1–26.
Barsi, J., Schott, J., Hook, S., Raqueno, N., Markham, B., & Radocinski, R. (2014). Landsat-8 thermal infrared sensor (TIRS) vicarious radiometric calibration. Remote Sensing, 6(11), 11607–11626.
Basar, U. G., Kaya, S., & Karaca, M. (2008). Evaluation of urban heat island in Istanbul using remote sensing techniques. Commission VII, WG VII/5. The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, 37.
Bektas Balcik, F. (2014). Determining the impact of urban components on land surface temperature of Istanbul by using remote sensing indices. Environmental Monitoring and Assessment, 186(2), 859–872. https://doi.org/10.1007/s10661-013-3427-5
Błażejczyk, K., Jendritzky, G., Bröde, P., Fiala, D., Havenith, G., Epstein, Y., … Kampmann, B. (2013). An introduction to the universal thermal climate index (UTCI). Geographia Polonica, 86(1), 5–10.
Bolen, F. (2004). Housing policy and housing systems in Turkey. A| Z ITU Journal of the Faculty of Architecture, 1(1), 14–31.
Ç.Ş.B. (2018). İstanbul İli 2017 Yılı Çevre Durum Raporu. Retrieved from https://ced.csb.gov.tr/2017-yili-il-cevre-durum-raporlari-i-85928
Chow, W. T. L., Brennan, D., & Brazel, A. J. (2012). Urban heat island research in Phoenix, Arizona: Theoretical contributions and policy applications. Bulletin of the American Meteorological Society, 93(4), 517–530.
Chun, B., & Guldmann, J.-M. (2014). Spatial statistical analysis and simulation of the urban heat island in high-density central cities. Landscape and Urban Planning, 125, 76–88.

Corburn, J. (2009). Cities, climate change and urban heat island mitigation: localising global environmental science. Urban Studies, 46(2), 413–427.
Dihkan, M., Karsli, F., Guneroglu, A., & Guneroglu, N. (2015). Evaluation of surface urban heat island (SUHI) effect on coastal zone: The case of Istanbul Megacity. Ocean & Coastal Management, 118, 309–316.
Erdem Okumus, D., & Terzi, F. (2021). Evaluating the role of urban fabric on surface urban heat island: The case of Istanbul. Sustainable Cities and Society, 73. https://doi.org/10.1016/j.scs.2021.103128
Ezber, Y., Sen, O. L., Kindap, T., & Karaca, M. (2007). Climatic effects of urbanization in Istanbul: a statistical and modeling analysis. International Journal of Climatology: A Journal of the Royal Meteorological Society, 27(5), 667–679.
Feng, X., & Myint, S. W. (2016). Exploring the effect of neighboring land cover pattern on land surface temperature of central building objects. Building and Environment, 95, 346–354.
Gago, E. J., Roldan, J., Pacheco-Torres, R., & Ordóñez, J. (2013). The city and urban heat islands: A review of strategies to mitigate adverse effects. Renewable and Sustainable Energy Reviews, 25, 749–758.
Giridharan, R., Lau, S. S. Y., Ganesan, S., & Givoni, B. (2007). Urban design factors influencing heat island intensity in high-rise high-density environments of Hong Kong. Building and Environment, 42(10), 3669–3684.
Guha, S., Govil, H., Dey, A., & Gill, N. (2018). Analytical study of land surface temperature with NDVI and NDBI using Landsat 8 OLI and TIRS data in Florence and Naples city, Italy. European Journal of Remote Sensing, 51(1), 667–678.
Guo, G., Zhou, X., Wu, Z., Xiao, R., & Chen, Y. (2016). Characterizing the impact of urban morphology heterogeneity on land surface temperature in

DOI: 10.15320/ICONARP.2022.220

Guangzhou, China. Environmental Modelling & Software, 84, 427–439.

Hamin, E. M., & Gurran, N. (2009). Urban form and climate change : Balancing adaptation and mitigation in the U . S . and Australia. Habitat International, 33(3), 238–245. https://doi.org/10.1016/j.habitatint.2008.10.005

He, B.-J., Ding, L., & Prasad, D. (2020a). Relationships among local-scale urban morphology, urban ventilation, urban heat island and outdoor thermal comfort under sea breeze influence. Sustainable Cities and Society, 60, 102289.

He, B.-J., Ding, L., & Prasad, D. (2020b). Urban ventilation and its potential for local warming mitigation: A field experiment in an open low-rise gridiron precinct. Sustainable Cities and Society, 55, 102028.

Hu, Y., White, M., & Ding, W. (2016). An urban form experiment on urban heat island effect in high density area. Procedia Engineering, 169, 166–174.

İ.B.B. (2018). İstanbul Büyükşehir Belediyesi İstanbul İklim Değişikliği Eylem Planı. Retrieved from https://www.iklim.istanbul/wp-content/uploads/FinalRaporu.pdf

IPCC. (2021). Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Retrieved from https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report.pdf

IPCC. (2022). Climate Change 2022: Impacts, Adaptation and Vulnerability. Retrieved from https://www.ipcc.ch/report/ar6/wg2/

Jiménez-Muñoz, J. C., Sobrino, J., Gillespie, A., Sabol, D., & Gustafson, W. (2006). Improved land surface emissivities over agricultural areas using ASTER NDVI. Remote Sensing of Environment, 103(4), 474–487.

Jiménez-Muñoz, J. C., Sobrino, J., Plaza, A., Guanter, L., Moreno, J., & Martínez, P. (2009). Comparison between fractional vegetation cover retrievals from vegetation indices and spectral mixture analysis: Case study of PROBA/CHRIS data over an agricultural area. Sensors, 9(2), 768–793.

Kaya, S., Basar, U. G., Karaca, M., & Seker, D. Z. (2012). Assessment of urban heat islands using remotely sensed data. Ekoloji, 21(84), 107–113.

Keles, R. (1993). Kentleşme politikası. İmge Kitabevi.

Kleerekoper, L., Van Esch, M., & Salcedo, T. B. (2012). How to make a city climate-proof, addressing the urban heat island effect. Resources, Conservation and Recycling, 64, 30–38.

Knuth, S., Stehlin, J., & Millington, N. (2020). Rethinking climate futures through urban fabrics:(De) growth, densification, and the politics of scale. Urban Geography, 1–9.

Liao, W., Hong, T., & Heo, Y. (2021). The effect of spatial heterogeneity in urban morphology on surface urban heat islands. Energy and Buildings, 244, 111027.

Lin, P., Lau, S. S. Y., Qin, H., & Gou, Z. (2017). Effects of urban planning indicators on urban heat island: a case study of pocket parks in high-rise high-density environment. Landscape and Urban Planning, 168, 48–60.

M.G.M. (2022). General statistical data of the provinces. Retrieved 6 April 2022, from Turkish State Meteorological Service website: https://mgm.gov.tr/veridegerlendirme/il-ve-ilceler-istatistik.aspx?k=A&m=ISTANBUL

Masoumi, H. E., Terzi, F., & Serag, Y. M. (2019). Neighborhood-scale urban form typologies of large metropolitan areas: Observations on Istanbul, Cairo, and Tehran. Cities, 85, 170–186.

Metz, B., Berk, M., den Elzen, M., de Vries, B., & van Vuuren, D. (2002). Towards an equitable global climate change regime: compatibility with Article 2 of the Climate Change Convention and the link with sustainable development. Climate Policy, 2(2–3), 211–230.

Mirzaei, P. A., & Haghighat, F. (2010). Approaches to study urban heat island–abilities and limitations. Building and Environment, 45(10), 2192–2201.

Oke, T. R. (1981). Canyon geometry and the nocturnal urban heat island: Comparison of scale model and field observations. Journal of Climatology, 1(3), 237–254. https://doi.org/10.1002/joc.3370010304

Oke, T. R. (1982). The energetic basis of the urban heat island. Quarterly Journal of the Royal Meteorological Society, 108(455), 1–24.

Oke, T. R. (1987). Boundary layer climates. Routledge.

Oke, T. R., & Maxwell, G. B. (1975). Urban heat island dynamics in Montreal and Vancouver. Atmospheric Environment (1967), 9(2), 191–200.

Pomponi, F., Saint, R., Arehart, J. H., Gharavi, N., & D'Amico, B. (2021). Decoupling density from tallness in analysing the life cycle greenhouse gas emissions of cities. Npj Urban Sustainability, 1(1), 1–10.

Quattrochi, D. A., & Goel, N. S. (1995). Spatial and temporal scaling of thermal infrared remote sensing data. Remote Sensing Reviews, 12(3–4), 255–286.

Salvati, A., Roura, H. C., & Cecere, C. (2017). Assessing the urban heat island and its energy impact on residential buildings in Mediterranean climate: Barcelona case study. Energy and Buildings, 146, 38–54.

Santamouris, M. (2013). Using cool pavements as a mitigation strategy to fi ght urban heat island — A review of the actual developments. Renewable and Sustainable Energy Reviews, 26, 224–240. https://doi.org/10.1016/j.rser.2013.05.047

Santamouris, M., Ding, L., & Osmond, P. (2019). Urban Heat Island Mitigation. In Decarbonising the Built Environment (pp. 337–355). Springer.

Scheffe, H. (1953). A method for judging all contrasts in the analysis of variance. Biometrika, 40(1–2), 87–110.

Scheffe, H. (1959). The Analysis of Variance, New York: JohnWiley & Sons. SchefféThe Analysis of Variance1959.

Shishegar, N. (2013). Street Design and Urban Microclimate: Analyzing the Effects of Street Geometryand Orientation on Airflow and Solar Access in Urban Canyons. Journal of Clean Energy Technologies, 1(1).

Sobrino, J. A., Jiménez-Muñoz, J. C., & Paolini, L. (2004). Land surface temperature retrieval from LANDSAT TM 5. Remote Sensing of Environment, 90(4), 434–440.

Song, J., Chen, W., Zhang, J., Huang, K., Hou, B., & Prishchepov, A. V. (2020). Effects of building density on land surface temperature in China: Spatial patterns and determinants. Landscape and Urban Planning, 198, 103794.

Stewart, I. D., & Oke, T. R. (2012). Local climate zones for urban temperature studies. Bulletin of the American Meteorological Society, 93(12), 1879–1900.

Strømann-Andersen, J., & Sattrup, P. A. (2011). The urban canyon and building energy use: Urban density versus daylight and passive solar gains. Energy and Buildings, 43(8).

Sun, Y., Gao, C., Li, J., Wang, R., & Liu, J. (2019). Quantifying the effects of urban form on land surface temperature in subtropical high-density urban areas using machine learning. Remote Sensing, 11(8), 959.

Swart, R., Robinson, J., & Cohen, S. (2003). Climate change and sustainable development: expanding the options. Climate Policy, 3(sup1), S19–S40.

DOI: 10.15320/ICONARP.2022.220

Terzi, F., & Bolen, F. (2009). Urban sprawl measurement of Istanbul. European Planning Studies, 17(10), 1559–1570.

Terzi, F., & Bolen, F. (2012). The potential effects of spatial strategies on urban sprawl in Istanbul. Urban Studies, 49(6), 1229–1250.

U.N. (2015). Transforming Our World:The 2030 Agenda For Sustainable Development. Retrieved from https://sdgs.un.org/sites/default/files/publications/21252030 Agenda for Sustainable Development web.pdf

U.N. (2019). The strategic plan 2020-2023. Retrieved from UN Habitat website: https://unhabitat.org/sites/default/files/documents/2019-09/strategic_plan_2020-2023.pdf

U.N.D.P. (2015). Sürdürülebilir Kalkınma Amaçları. Retrieved from https://www.tr.undp.org/content/turkey/tr/home/sustainable-development-goals.html

USGS. (2019). Landsat 8 Data Users Handbook Version 5.0 November 2019. Nasa, 8(November), 97. Retrieved from https://landsat.usgs.gov/documents/Landsat8DataUsersHandbook.pdf

Voogt, James A, & Oke, T. R. (1997). Complete urban surface temperatures. Journal of Applied Meteorology, 36(9), 1117–1132.

Voogt, James A, & Oke, T. R. (1998). Effects of urban surface geometry on remotely-sensed surface temperature. International Journal of Remote Sensing, 19(5), 895–920.

Voogt, James A, & Oke, T. R. (2003). Thermal remote sensing of urban climates. Remote Sensing of Environment, 86(3), 370–384.

Voogt, James Adrian. (1995). Thermal remote sensing of urban surface temperatures. University of British Columbia.

Weng, Q. (2009). Thermal infrared remote sensing for urban climate and environmental studies: Methods, applications, and trends. ISPRS Journal of Photogrammetry and Remote Sensing, 64(4), 335–344.

Weng, Q., Lu, D., & Schubring, J. (2004). Estimation of land surface temperature–vegetation abundance relationship for urban heat island studies. Remote Sensing of Environment, 89(4), 467–483.

Wong, N. H., Jusuf, S. K., Syafii, N. I., Chen, Y., Hajadi, N., Sathyanarayanan, H., & Manickavasagam, Y. V. (2011). Evaluation of the impact of the surrounding urban morphology on building energy consumption. Solar Energy, 85(1), 57–71.

Xu, H., & Chen, B. (2004). Remote sensing of the urban heat island and its changes in Xiamen City of SE. Journal of Environmental Sciences, 16(2), 276–281.

Yang, F., Lau, S. S. Y., & Qian, F. (2010). Summertime heat island intensities in three high-rise housing quarters in inner-city Shanghai China: Building layout, density and greenery. Building and Environment, 45(1), 115–134.

Yang, Jun, Jin, S., Xiao, X., Jin, C., Xia, J. C., Li, X., & Wang, S. (2019). Local climate zone ventilation and urban land surface temperatures: Towards a performance-based and wind-sensitive planning proposal in megacities. Sustainable Cities and Society, 47, 101487.

Yang, Junyan, Shi, B., Xia, G., Xue, Q., & Cao, S.-J. (2020). Impacts of Urban form on Thermal Environment near the Surface Region at Pedestrian Height: A Case Study Based on High-density Built-up Areas of Nanjing City in China. Sustainability, 12(5), 1737.

Yang, X., & Li, Y. (2015). The impact of building density and building height heterogeneity on average urban albedo and street surface temperature.

Building and Environment, 90, 146–156.

Yilmaz, S., Irmak, M. A., & Qaid, A. (2022). Assessing the effects of different urban landscapes and built environment patterns on thermal comfort and air pollution in Erzurum city, Turkey. Building and Environment, 109210.

Yilmaz, S., Külekçi, E. A., Mutlu, B. E., & Sezen, I. (2021). Analysis of winter thermal comfort conditions: street scenarios using ENVI-met model. Environmental Science and Pollution Research, 28(45), 63837–63859.

Yin, C., Yuan, M., Lu, Y., Huang, Y., & Liu, Y. (2018). Effects of urban form on the urban heat island effect based on spatial regression model. Science of The Total Environment, 634, 696–704.

Zhao, C. (2018). Linking the local climate zones and land surface temperature to investigate the surface urban heat island, a case study of San Antonio, Texas, US. ISPRS Annals of Photogrammetry, Remote Sensing & Spatial Information Sciences, 4(3).

Zheng, Z., Zhou, W., Yan, J., Qian, Y., Wang, J., & Li, W. (2019). The higher, the cooler? Effects of building height on land surface temperatures in residential areas of Beijing. Physics and Chemistry of the Earth, Parts A/B/C, 110, 149–156.

Zhou, W., Huang, G., & Cadenasso, M. L. (2011). Does spatial configuration matter? Understanding the effects of land cover pattern on land surface temperature in urban landscapes. Landscape and Urban Planning, 102(1), 54–63.

Resume

Deniz Erdem Okumus is a faculty member in the City and Regional Planning Department at Yildiz Technical University. The area of interest focuses on urban climate, climate-responsive urban design, computational design approaches, urban informatics and GIS. Dr. Erdem-Okumus worked as a visiting researcher in the Chair of Design Informatics at Delft University of Technology, The Netherlands in 2021.

Fatih Terzi is a faculty member in the Department of Urban and Regional Planning at Istanbul Technical University. The area of interest focuses on sustainable urban development, climate responsive design, and eco-smart cities. Fatih Terzi paid a visit to Clemson University, SC, USA, in 2004; the Center for Advanced Spatial Analysis Center (CASA), University College London, in 2008; and the Technology and Community Research Center of the Technical University Berlin in 2017 as a guest researcher.

DOI: 10.15320/ICONARP.2022.220

ICONARP
International Journal of Architecture and Planning
Received: 09.05.2022 Accepted: 30.10.2022
Volume 10, Issue 2/ Published: 20.12.2022
DOI: 10.15320/ICONARP.2022.221 E- ISSN:2147-9380
ICONARP

Research Article

Utilizing Nighttime Photos to Locate Attraction Zones at the Metropolitan Scale: An Analysis of Istanbul

Asli Ozdarici-Ok*
Kivanc Ertugay**

Abstract

Up-to-date information about different forms of land-use (residential areas, industrial areas, central business districts, recreational areas, etc.) is essential for city planning processes to obtain better urban and regional planning decisions. Traditional methods (e.g., field surveying or WEB/GPS based data collection) used to gather up-to-date information can often contain some errors and can also be time-consuming and expensive, especially for large metropolitan urban areas. With the integration of Remote Sensing (RS) and Geographic Information Systems (GIS) related technologies, the difficulty of providing up-to-date information about different types of land-use can be greatly reduced. On the other hand, in terms of urban and regional planning, the level of utilization of these technologies is still considered to be insufficient. In this respect, authors wanted to draw attention to another possible usage of night-time data in urban and regional planning discipline for the purpose of determination of the location, size, and hierarchy of the attraction zones in urban scale which are mostly composed of central business districts (CBD), commercial zones, touristic corridors and/or concentration areas etc., as these regions are more illuminated areas compared to other zones of a city. Thus, a methodology based on GIS and RS integration and spatial and statistical analysis capabilities of GIS is presented in this study to determine the boundary and size of the attraction zones and their hierarchical levels by using the night-time imageries. To show how effective the suggested model is, the proposed methodology has been used in the city of Istanbul. The assessment of the location, size, and hierarchy of the attraction zones could give an essential decision support for the decision makers, especially those working in the urban planning discipline, as the attraction zones of cities need to be developed in a more specific and detailed manner. Thus, the model's outputs' reliability and potential applications in the field of urban planning are also examined.

Keywords:
Night-time photo, GIS (geographic information systems) and RS (remote sensing) integration, city attraction zones, urban scale, Istanbul

*Ankara Hacı Bayram Veli University, the Academy of Land Registry, Ankara, Türkiye. (Corresponding author)
E-mail: asli.ok@hbv.edu.tr

**Akdeniz University, Faculty of Architecture, Urban and regional planning department, Antalya, Türkiye. (Corresponding author)
E-mail: kivancertugay@akdeniz.edu.tr

To cite this article: Ozdarici-Ok, A., & Ertugay, K. (2022). Utilizing nighttime photos to locate attraction zones at the metropolitan scale: An analysis of Istanbul. *ICONARP International Journal of Architecture and Planning,* 10(2), 688-710. DOI: 10.15320/ICONARP.2022.221

INTRODUCTION

Obtaining up-to-date information about different forms of land-use (e.g., residential areas, industrial areas, central business district areas, recreational areas etc.) is significantly important for many disciplines but especially for urban and regional planners. Therefore, new technologies and strategies are used to obtain repeatable and reliable up-to-date information.

Remote Sensing (RS) technology is a powerful tool for gathering information about an object, area, or fact without requiring physical intervention (Lillesand et.al. 2004). Geographic Information Systems (GIS) are powerful tools for supporting RS technology because they can collect, store, retrieve, transform, and display spatial data acquired by RS products (Burrough, 1986). In this study, a method is tested to identify attraction zones and their hierarchical levels with RS and GIS supported techniques and spatial and statistical data analysis related capabilities of GIS using night-time images. Section below summarizes the fundamental research that uses nighttime imagery to obtain various types of information.

Based on the literature, a number of research demonstrate that night-time lights and socioeconomic indicators such as population, gross domestic product, wealth, poverty, migration, etc. have high correlation. Thus, utilizing night-time lights is an inventive way to figure out socioeconomic markers. Multi-date night-time data series is also particularly vital for tracing human activities at the desired time interval (Li, et.al., 2016). Despite these facts, there are a limited number of valuable research papers in this respect in the literature. For this reason, it is necessary to perform systematic studies to widespread the usage of night-time images in terms of monitoring urbanization activities. Night-time lights can be categorized into three main categories in terms of spatial resolution: (i) low, (ii) moderate, and (iii) high. Defense Meteorological Satellite Program/Operational Linescane System (DMSP/OLS) (launched by U.S. Airforce) forms the low-resolution category of night-time images with 2.7km (smooth mode) and 0.55km (fine mode) ground sampling distance. It is the first satellite to provide night view and more specifically designed for cloud detection enlightened by moon light thus it has brought certain deficiencies (e.g., coarse spatial resolution, on-board calibration deficiencies, six-bit quantization, etc.) (Web1). These deficiencies could be improved to a certain extent by the usage of Visible Infrared Imaging Radiometer Suite (VIIRS) instrument. The VIIRS was designed by NASA and NOAA and launched from Suomi National Polar Partnership (SNPP) satellite in 2011. Although the VIIRS also provides low-light data by panchromatic images (0.5 μm – 0.9μm) similar to the DMSP/OLS, it has several advantages over the DMSP/OLS data with improved spatial resolution (0.742km), higher quantization level (14-bit), on-board calibration, and availability of spectral bands to identification of thermal sources. Therefore, the VIIRS images can be utilized to view urban areas more

DOI: 10.15320/ICONARP.2022.221

effectively than DMSP/OLS images. Other sources of night-time images, space photographs, produced from International Space Station (ISS) taken by astronauts from spacecrafts are categorized as moderate resolution (≈ 60m) images in terms of viewing night lights. The color astronaut photos make city lights more visible especially in nadir viewing and can be access freely since 2003. However, velocity of the spacecraft can affect optimal exposure times and spatial resolution of the images besides the lack of calibration parameters (Elvidge et, al., 2013). The only commercial satellite platform providing high resolution night-time images is EROS-B launched in 2013 by ImageSat International. It provides color images to obtain city lights with less than 1 m spatial resolution at nights (Levin et.al., 2014). In addition to satellite-based high-resolution EROS-B images, some aerial platforms (e.g., Cirrus (1.5m spatial resolution at 16-bit quantization level) integrated to NASA's ER-2 aircraft) also provide high resolution night-time photographs (Elvidge et, al., 2013).

An extensive review paper describing the nightsat mission concept was written in 2007 by Elvidge et.al. In this paper, products of satellite and airborne sensors were examined with their advantages and limitations based on their spatial, spectral, and temporal resolutions. It was concluded in the paper that night-time images provide valuable capability to observe human activities both in global and regional scale as opposed to conventional earth observing systems (Elvidge et.al., 2007). Other recent review paper examining DMSP/OLS night-time images was conducted in 2017 (Li and Zhou, 2017). In this paper, blooming effect due to the deficiency of spatial resolution, lack of intercalibration parameters is shown main restrictions of the use of DMSP/OLS data. Authors offer a major suggestion about the integration of DMSP/OLS and nighttime data of VIIRS and developing new methods to reduce uncertainty and provide more reliable data for the future.

One of the earliest attempts of offering night-time data (DMSP/OLS) was published to produce a global population database for estimating populations at risk in the scope of Landscan' project (Dobson et.al, 2000). It was concluded that remote sensing sources of images and night-time lights are requisite to produce more effective population models. Other valuable study conducted at the beginning of the year 2000 (Henderson et.al, 2003) was about delineation of urban boundaries of three different cities (San Francisco, Beijing, and Lhasa) with DMSP/OLS and Landsat Thematic Mapper (TM) data. After co-registering the images, three different classification thresholds were applied to the DMSP data to recognize urban boundaries. Analysis demonstrates that each city requires different thresholds to delimit urban extents.

The first detailed study of night-time light characteristics (DMSP/OLS) regarding to local economic activity was performed by Doll et.,al., 2006. Relations were searched between the night-time radiance and gross regional products of cities and potentials of using night-time data were revealed in the paper. A method that provided the first detailed analysis to estimate global economic activity from night-time DMSP/OLS data was presented (Doll et. al., 2006). Maps showing relationships between nigh-time lights and local economic activities were produced to 11 European Union countries and United states in the study. Results showed the importance of night-time images to provide flexibility of producing spatial maps of countries. Urbanization dynamics of India, China, Japan, and the United States were investigated using multi-date DMSP/OLS night-time data for two-year intervals between 1992 and 2000 (Zhang and Seto, 2011). Unsupervised Isodata classification algorithm was applied iteratively to the night-time images and final urbanization maps were produced as steady growth and urban growth zones. This study showed the potential use of night-time images for monitoring the local and global scale urbanization activities. Same year a different study was published that examines the relationship between night-time lights and population density of Hong Kong with pixel-based and polygon-based approaches (Liu, et. al., 2011). Two data types (DMSP/OLS and ISS space photographs) were used as night-time images in the study to evaluate the performance of ISS space photographs over the performance of DMSP/OLS. Results displayed that better correlations were observed between the DMSP/OLS and population data although the ISS night-time photographs have higher spatial resolution.

An extensive multitemporal night-time research of 271 China's cities during 1992-2012 were performed to categorize urban forms of the cities as 5 classes (low, low-medium, medium, medium-high, and high) (Ma, et.al., 2014). The method used was based on constructing gradients and spatio-temporal analyses of nighttime images. Successful results were obtained with the methods. It was anticipated that the use of high-resolution images (e.g., VIIRS) minimized the over glow effect and produced closer results to the real lightening areas.

A new multitemporal (2000-2009) method was presented by integrating DMSP_OLS and MODIS data to monitor large-scale settlement areas of Yangtze River Delta-China (Shao and Liu, 2014). A spatially adaptive regression model was developed instead of using a linear regression model to estimate urban dilatation. Promising results were acquired compared with the linear regression model estimation. An evaluation study was conducted to reveal the application areas (estimation of socioeconomic parameters, spatialization of population, regional development, light pollution etc.) of nighttime images (Li et.al., 2016). A different multitemporal study was performed based on DMSP/OLS data series from 1992-2013 to evaluate changes of urbanization intensity of China (Yu et.al., 2017). Urbanization dynamics were categorized by an unsupervised image classification method.

Spatial pattern of urbanization change was examined by Moran's I in local and global scale. Capacity of spectral night viewing capability of Landsat 8 OLI image was evaluated for multiple large urban areas

DOI: 10.15320/ICONARP.2022.221

(Berlin -Germany, Las Vegas -USA, Nagoya - Japan and Tel Aviv – Israel) and gas flare locations (Basra – Iraq and Kuwait) (Levin and Phinn, 2016). Results were compared with VIIRS products and astronaut photos of the test sites. Analyses demonstrated that visible channels of the Landsat 8 OLI data have capability of detecting nighttime lights of urban areas and gas flare locations although it was not designed for this purpose. Authors stated that Landsat 10 should be designed in advance to detect nighttime lights more effectively. Poverty estimation was done for the counties of China by average light index (ALI) of VIIRS data (Yu et.al., 2015). Results were validated using integrated poverty index (IPI) including 10 different socioeconomic variables. Linear regression and comparison of class ranks were utilized in the evaluations. High correlations (R2 of 0.8554) were computed between night-time lights and poverty of China's counties. It was stated that night-time images of VIIRS could be reliably used in poverty estimation. A recent extensive research paper that analyzes the factors affecting the VIIRS nighttime data at global scale were published by Levin and Zhang (Levin and Zhang, 2017). Correlations of multiple variables (Landscan data, NDVI, snow cover etc.) and VIIRS nighttime data of 4153 urban areas were examined in the study. Results showed that phenological cycles of vegetation and snow cover is as important as other variables like GDP and road network and it should be taken into consideration.

In the light of the above mentioned literature, it could be observed that although there are several different types of research efforts on night time imagery such as; determination of location and size of settlements, urban macro forms, producing spatial maps of countries, comparison of the gross domestic/national products (GDP/GNP), estimation of socioeconomic parameters, specialization of population, regional development, spatial pattern of urbanization change, light pollution etc.), the proposed research is considered to have a value in terms of its aim and the proposed methodology. In this research, authors wanted to draw attention to another possible usage of night-time data in urban and regional planning discipline for the purpose of determining location, size, and hierarchy of the attraction zones in urban scale which are mostly composed of central business districts (CBD), commercial zones, touristic corridors and/or concentration areas etc., as these regions are more illuminated areas compared to other zones of a city. Therefore, a methodology (Figure 1) based on GIS and RS integration is presented in this study to determine the location and size of the attraction zones and their hierarchical levels by using the night-time photos. The research is expected to provide up-to-date, precise, and more detailed information about the distribution of attraction zones in urban area with their location, boundary, size, and hierarchical levels in a fast and reliable manner. The outputs of the model could create an important decision support for the decision makers working on urban and regional planning discipline for better understanding of the attritional dynamics of a city and its important

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

zones and locations. The proposed methodology has been applied in the city of Istanbul to able to demonstrate the efficiency of the proposed model. The presence of many city centers of Istanbul metropolitan city with different hierarchical levels, played an important role in this selection.

The rest of the paper is organized as follows: The methodology part of the paper (Section 2) describes the details about the proposed model, Section 3 describes basic results and conclusions about the research, provides general evaluation of the obtained results, gives possible usage areas of the model in the field of urban planning, and explains possible future works.

METHODOLOGY

The proposed methodology consists of five main steps: (i) data collection and preparation, (ii) unsupervised stepwise classification, (iii) spatial analysis of the classified data based on GIS and RS integration, (iv) validation and (v) evaluation of the results (Figure 1).

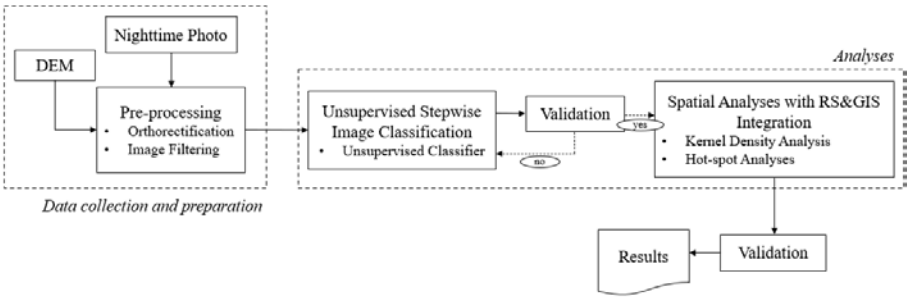


Figure 1. Methodology of the proposed study

In RS part of the research, the PCI Geomatica software of PCI Geomatics company and in GIS part of the research, the ArcMap software of ESRI company was used. However, many other software and freeware are also available in the technology market to perform GIS and RS based analysis.

DATA COLLECTION AND PREPARATION

Istanbul is a metropolis with over 15 million populations, and it has a very fast changing scene. These characteristics makes easy to access night-time astronaut photographs and therefore Istanbul were chosen as study area by the authors. The astronaut photographs are freely available in the web site called "Gateway to Astronaut Photography of Earth" (Web2). An astronaut photograph of Istanbul dated 2012 were acquired from that site (Figure 2). For the acquisition of the photo (15.08.2012) Nikon D3S Electronic Still Camera with 155mm (camera tilt: 37 degrees) has been used. The spacecraft altitude of the photograph has been recorded as 396 km with 41.8 oN and 31.6 o E spacecraft nadir point. Cloud cover percentage of the image is 10% (Web 3). Unfortunately, the photo has not a certain radiometric process to correct radiometric errors, thus authors have used original pixel values in the analysis.

DOI: 10.15320/ICONARP.2022.221

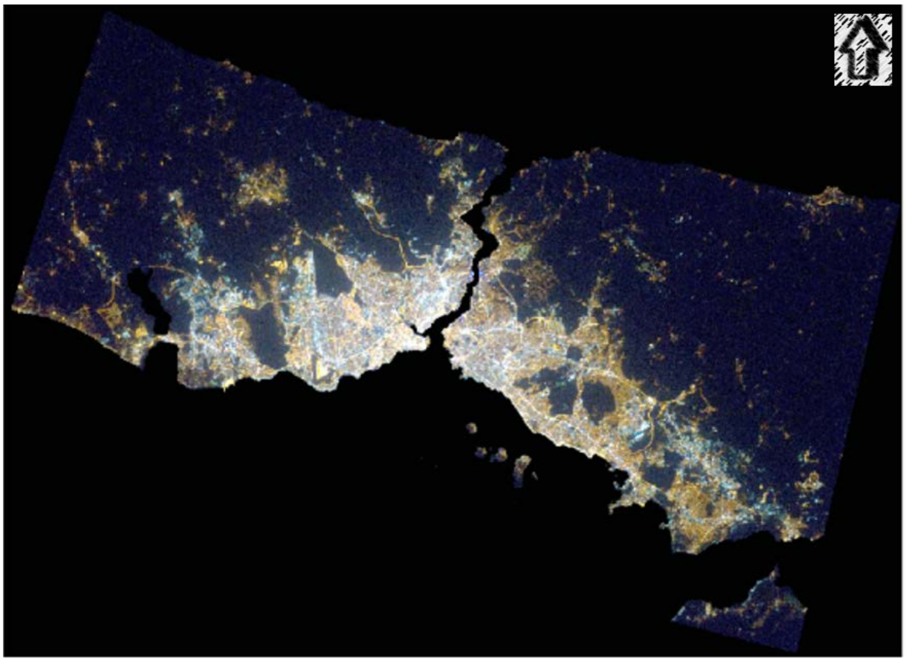


Figure 2. Astronaut photo of Istanbul city taken in 2012

Available images with the highest resolution were downloaded from the web site and orthorectified first using approximately 10 ground control points (GCPs). In the orthorectification process GCPs were selected from distinctive light sources of the astronaut photos and selectable points from the corrected Landsat ETM image (acquisition date: 23.07.1999) of the test site. ASTER GDEM was utilized for the orthorectification process (Web 4). At the end of the orthorectification process, root mean square error was computed to be less than 1 pixel, which is a sufficient error rate to continue the analysis phase.

The orthorectified night-time astronaut photographs were then filtered using Savitzky Golay (SG) filter to eliminate noise from the data. The SG filter is a low-pass filter that smooths noisy data by linear least squares fit via a moving average window by a desired polynomial degree. The characteristic that distinguishes it from the other moving average filter is its efficiency of preserving higher moments of the peaks (Press et.al, 2002).

Unsupervised stepwise image classification

A stepwise image classification strategy was adopted to the orthorectified astronaut photograph to group night-time lights. Isodata unsupervised image classification method was utilized for that purpose. First, the image was grouped into 100 classes based on the Isodata classifier. Next, illuminated, and non-illuminated classes were aggregated to two classes based on an expert knowledge and a mask area was produced for the illuminated regions. Next, pixels inside the mask were reclassified again to obtain 10 new classes. After the aggregation process, four main classes (low-level light, moderate level light, high level light, and others) were obtained. A new mask was produced again for the areas classified as strong light and those areas were reclassified to access the central business regions. It was observed that this strategy was sufficient to characterize urbanization dynamics. First step results were evaluated using Google Earth images of the study area with 100 random points and image classification accuracy over 85% was observed.

Spatial analysis of the classified data based on GIS and RS integration

Three sequential processes; visual evaluation of the classified data, kernel density analysis, hot spot analysis, were performed for the determination of attraction zones within the metropolitan area of Istanbul by using the classified image.

VISUAL EVALUATION OF THE CLASSIFIED DATA

As the attraction zones of a city which are mostly composed of "central business districts (CBD), commercial zones, touristic corridors and/or people's concentration areas etc." are more illuminated compared to other zones of a city, visual exploration of the classified night-time images could give some significant clues to the decision maker about the distribution of the locations of important attraction zones. For example, darker regions and corridors in the figure demonstrated below represent highly illuminated areas and could be visually noticed as some of the representatives of attraction locations (Figure 3).

On the other hand, there are hundreds of different levels of illuminated areas with fragmented scattered structures, it is not possible to differentiate the location, size, and hierarchy of these illuminated areas by just visual evaluation process. Thus, determination of the location, size and hierarchy of the attraction zones must be supported by further spatial and statistical data analysis processes.

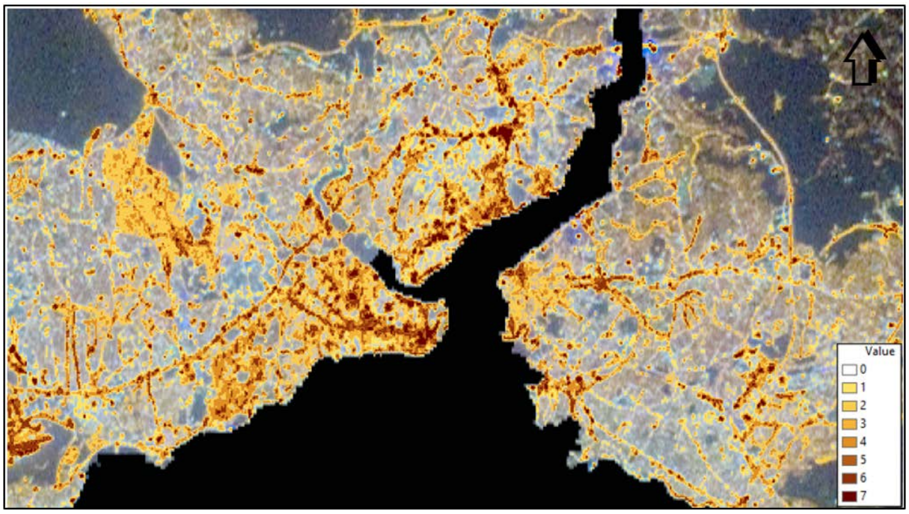


Figure 3. Visual exploration phase of the classified images (darker cell means more illumination score)

DOI: 10.15320/ICONARP.2022.221

KERNEL DENSITY ANALYSIS

Kernel Density determines the concentration of points in the area surrounding each raster cell in the final output. In this conceptual model, a smoothly rounded surface is superimposed over every single point. The surface value is greatest at the point itself and decreases outwards, eventually becoming zero at the search radius distance (Web 5).

Kernel density analysis was performed in the research to understand the distribution density of the illumination zones within the city and to better clarify especially the attraction zone's concentration location (at where) and the hierarchy (in which degree/importance) which is difficult to perceive visually in the previous phase. However, an important problem in this phase is that; the kernel density analysis in GIS environment requires point-based illumination distribution datasets in vector format. To solve this problem; 2 different types of comparative approaches were tried; one of which is "polygon centroids approach" (a) and the other is the "pixel centroids approach" (b)

Polygon centroids approach

In this approach, the night-time illumination data in raster format, in which the light reflection values were classified in 0-7 range classes, were firstly converted into vector data in polygon format by using the "raster to vector conversion function" of GIS. The approximate position and size of the light reflection values for each of the 0-7 class range were transformed into an attribute table which enabled the illumination values to be spatially and statistically analyzed by decision-makers and provide more effective decision support.

In the next step, the centroids of the vector data in polygon format (the point location that represent the center of gravity in a polygon object) was converted into point format by using the "centroid function" of GIS to able to benefit from kernel density function of GIS which helps better understanding the location and hierarchy of the illumination concentration zones. During the conversion process, both pixel value and the total area information were transferred (Figure 4).

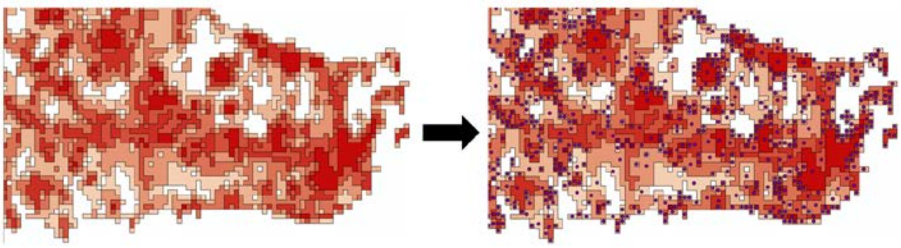


Figure 4. Conversion of the vector data in polygon format into point format as polygon centroids

To ensure a healthy comparison between the illumination scores (pixel values) and their size (total area), all values in the attribute table were normalized/standardized in the range of 0-100 (for pixel values), and in the range of 0-1 (for total area values).

Kernel density analysis function in GIS environment was performed by considering "multiplication of the standardized pixel values with their standardized total area values". It means that both the illumination scores and their size were represented in the results.

As the attraction zones which were mostly composed of central business districts (CBD), commercial zones and touristic corridors and/or people's concentration areas etc. were expected to be more illuminated areas compared to other zones of a city, kernel density analysis was performed by considering the illumination scores in the range of 5 to 7 (the top 3 the most illuminated ranges).

The obtained kernel density scores for the study area by "polygon centroids approach" was presented below in 5 classes according to Jenk's natural breaks classification (which seeks to reduce the variance within the classes and maximize the variance between classes) with the illumination scores and their size (see figure 5).

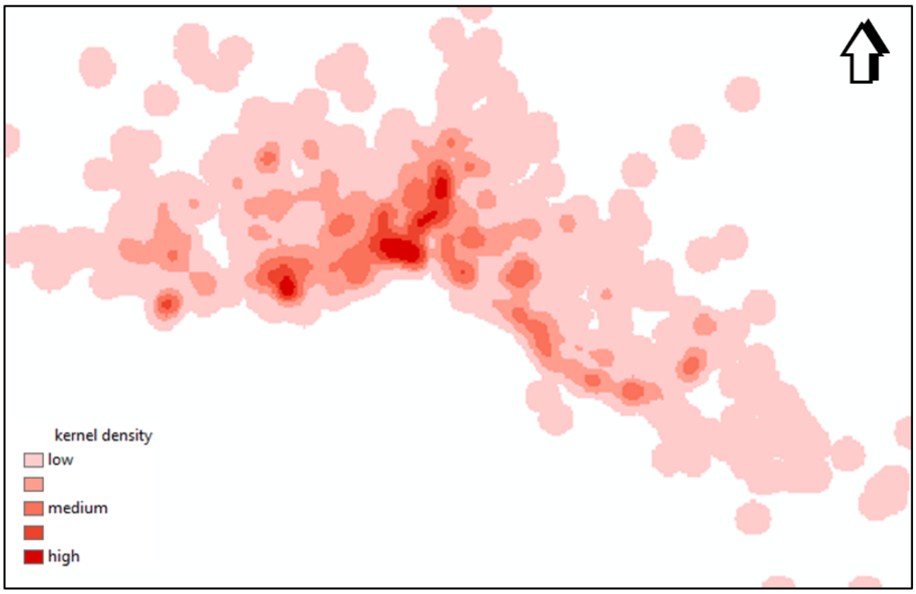


Figure 5. The results of the kernel density analysis by using the polygon centroids approach with illumination scores and their size

Although "polygon centroids approach" was considered to be faster and less processed approach compared to "pixel centroids approach" to convert illumination scores into point format, it's disadvantage is that; representation of illumination scores as polygon centroids could be misleading for decision makers in terms of positional accuracy of illumination zones especially in the case of where there are large and non-uniform shaped polygons after raster to vector conversion process (Figure 6). The mentioned disadvantage could be overcome by the pixel centroids approach.

DOI: 10.15320/ICONARP.2022.221

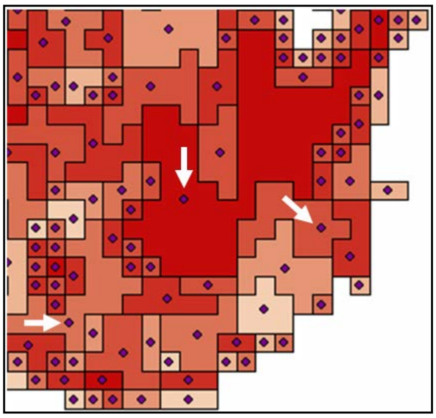
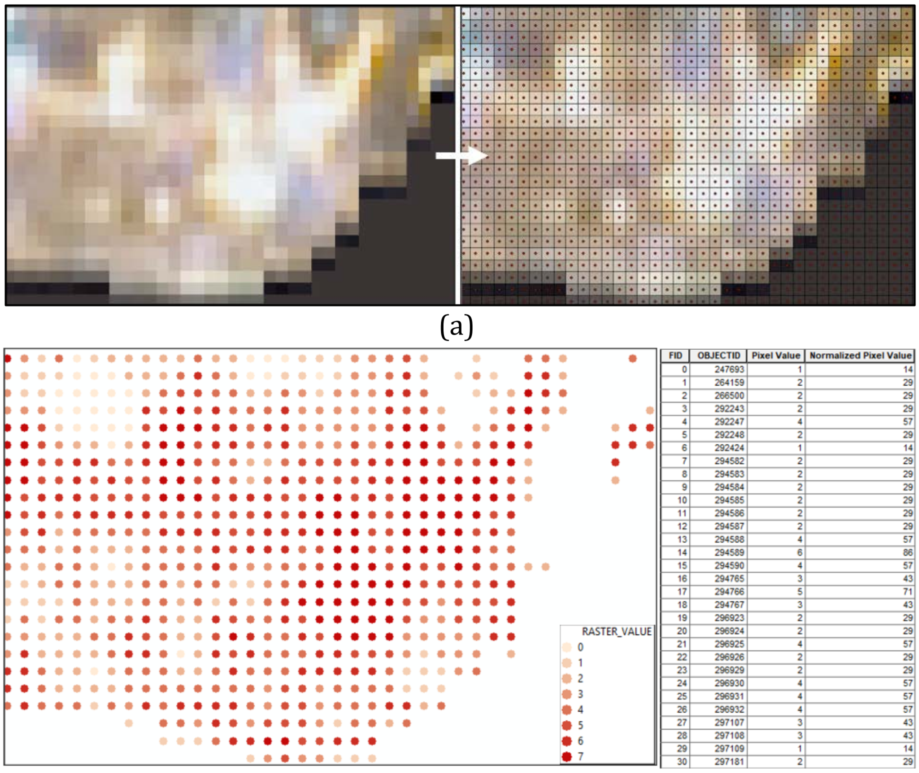


Figure 6. The centroids of large and non-uniform shaped illumination polygons

Pixel centroids approach:

In pixel centroids approach, using the same extent and pixel resolution of the night-time data in raster format, the study area was converted into vector-based grids in polygon format by using the "fishnet function" of GIS, which could basically divide a defined region into grids according to a defined extent and resolution/grid size.



FID	OBJECTID	Pixel Value	Normalized Pixel Value
0	247693	1	14
1	264159	2	29
2	266500	2	29
3	292243	2	29
4	292247	4	57
5	292248	2	29
6	292424	1	14
7	294582	2	29
8	294583	2	29
9	294584	2	29
10	294585	2	29
11	294586	2	29
12	294587	2	29
13	294588	4	57
14	294589	6	86
15	294590	4	57
16	294765	3	43
17	294766	5	71
18	294767	3	43
19	296923	2	29
20	296924	2	29
21	296925	4	57
22	296926	2	29
23	296929	2	29
24	296930	4	57
25	296931	4	57
26	296932	4	57
27	297107	3	43
28	297108	3	43
29	297109	1	14
30	297181	2	29

Figure 7. Vector-based grids in polygon format by using the "fishnet function" of GIS (a) and transferring process of raster-based light reflection values into point-based fishnet/grid centroids (b)

In the next step, the light reflection scores stored in raster format were transferred into vector-based grid centroids in point format. Thus, as an advantage of the pixel-based approach, it was ensured that all information about illumination scores in the raster data were transferred into the attribute table of fishnet centroids in point format without any loss of information and spatial accuracy. To ensure a reliable comparison between the illumination scores (pixel values), again all pixel values in the attribute table were standardized in the range of 0-100. That time there was not any "size" column in the database as every illumination pixel in the raster data was represented by a point feature in the database (Figure 7).

Although "pixel centroids approach" is process intensive approach compared to "polygon centroids approach", its main advantage is that; all information about illumination scores in the raster dataset could directly be transferred into the attribute table of fishnet centroids without any loss of information and spatial accuracy.

In the next step, all obtained points by pixel centroids approach were again analysed by kernel density function of GIS by considering the standardized illumination scores in the attribute table. As the attraction zones were expected to be more illuminated areas compared to other zones of a city, kernel density analysis was performed for the illumination scores in the range of 5 to 7 (the top 3 the most illuminated ranges). The obtained kernel density scores for the study area by "pixel centroids approach" was presented below in 5 classes according to Jenk's natural breaks classification with and without considering the illumination scores (Figure 8). According to the figure, the obtained kernel density scores with considering the illumination scores was more informative (more clear/sharp/plain boundaries for the illuminated areas) in terms of determination of concentration zones of illumination zones and their hierarchical levels as expected.

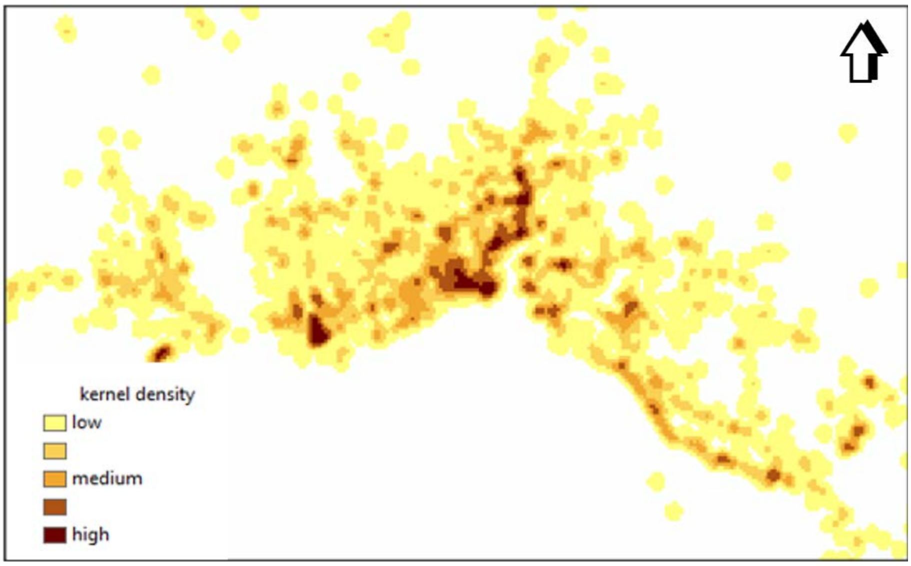


Figure 8. Kernel density analysis scores by using the fishnet/grid centroids (pixel centroids approach) considering the illumination scores

As the kernel density scores could be more clearly understood by the decision makers in vector environment, the classified kernel density scores in raster format (considering the illumination scores) were converted into vector format. By using the database query opportunities in vector environment, decision makers could obtain significant clues about the location (at where), the hierarchy (in which degree/importance) and the size (at what size) of the attraction zones

DOI: 10.15320/ICONARP.2022.221

which was difficult to perceive visually in the previous phase of visual exploration.

HOT SPOT ANALYSIS

Kernel density analysis tells the decision maker where clusters in the area exist, but do not tell if clusters are statistically significant. Therefore, after analyzing the distribution of vector-based illumination points by kernel density analysis, another point-based spatial data analysis was performed by the help of the hot spot analysis which created a map of statistically significant hot and cold spots using the Getis-Ord Gi statistic.

The Hot Spot Analysis could calculate the Getis-Ord Gi statistic for each of the feature in a point dataset by looking at each feature within the context of neighboring features. A feature with a high illumination value could be interesting but may not be a statistically significant attraction zone (hot spot). To be a statistically significant hot spot, a point feature must have a high illumination value and must be surrounded by other features with high illumination values as well. The Gi statistic returned for each feature in the dataset is a z-score. For statistically significant positive z-scores, the larger z-score is, the more intense clustering of high values (hot spot). The smaller z-score is the more intense the clustering of low values (cold spot) for statistically significant negative z-scores (Web 6) (see Equations 1-3).

The Getis-Ord local statistics is given as:

$$G_i^* = \frac{\sum_{j=1}^{n} w_{i,j} x_j - \bar{X} \sum_{j=1}^{n} w_{i,j}}{S \sqrt{\frac{\left[n \sum_{j=1}^{n} w_{i,j}^2 - \left(\sum_{j=1}^{n} w_{i,j} \right)^2 \right]}{n-1}}} \quad (1)$$

Where x_j is the attribute value for feature j, $w_{i,j}$ is the spatial weight between feature i and j, n is equal to the total number of features and:

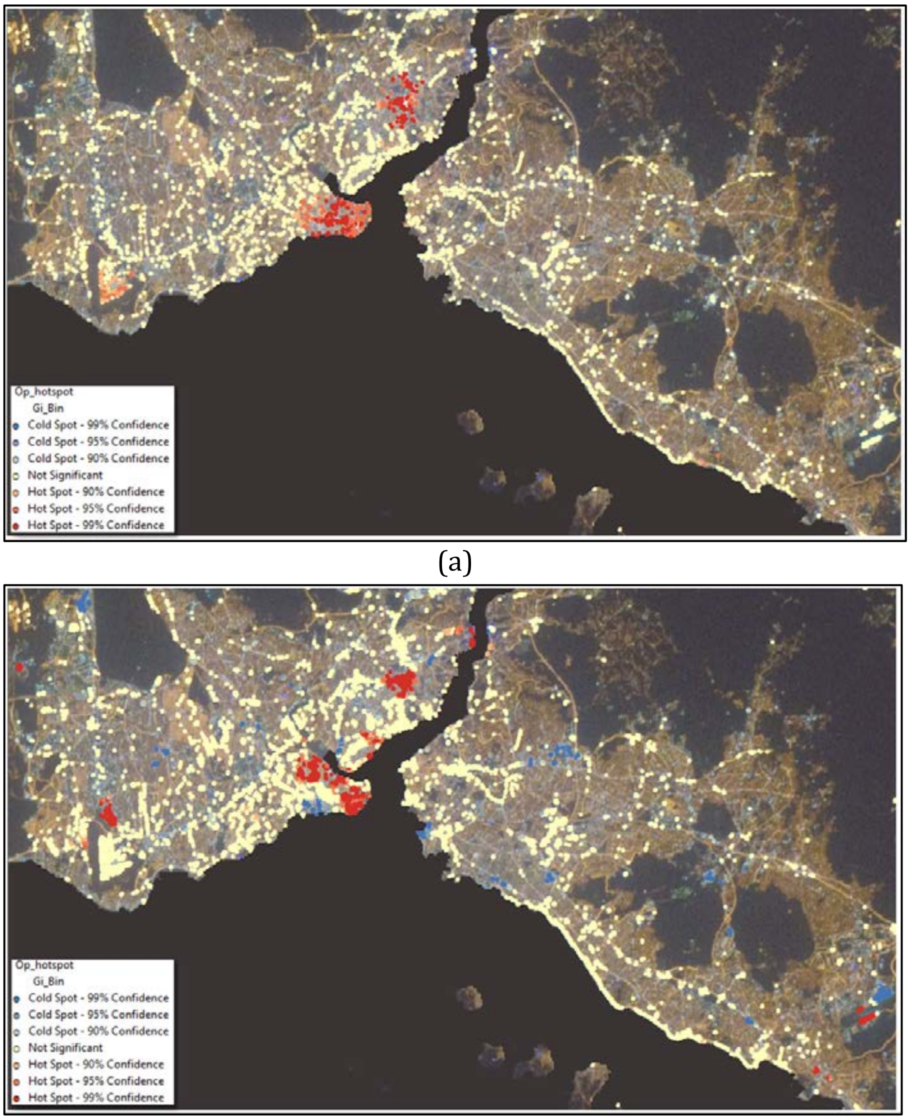
$$\bar{X} = \frac{\sum_{j=1}^{n} x_j}{n} \quad (2)$$

$$S = \sqrt{\frac{\sum_{j=1}^{n} x_j^2}{n} - \left(\bar{X}\right)^2} \quad (3)$$

The Gi* statistic is a z-score, so no further calculations are required.

The illumination locations obtained by “polygon centroids” approach and “pixel centroids” approach were both analyzed in a comparable manner by the help of the hot spot analyzes and the results were given below (Figure 9).

The results obtained by pixel centroids approach could be considered as more accurate and realistic compared to polygon centroids approach as all information about illumination scores in the raster dataset could directly be transferred into the attribute table of fishnet centroids without any loss of information and spatial accuracy.



(a)

(b)

Figure 9. Hot spot analysis of the illumination locations obtained by polygon centroids approach (a) and pixel centroids approach (b)

In the next step, the results of the hot spot analysis of the illumination locations obtained by pixel centroids approach were transferred into the polygons of fishnet grids and a dissolve operation was performed based on Gi_bin scores to provide better understanding of the size of the hot spot zones (Figure 10).

The performed dissolve operation of the fishnet grids could help decision makers to have more information about the size and location of the hot spots. For example, analysis of the illumination hot spots with higher confidence level (e.g., higher than 95%) and larger than a defined threshold in size (e.g., larger than 5 hectare) could be analyzed by the decision makers in a comparable manner (red polygons in Figure 10). Detailed explanation about the interpretation of the results is given in Section 2.4.

DOI: 10.15320/ICONARP.2022.221

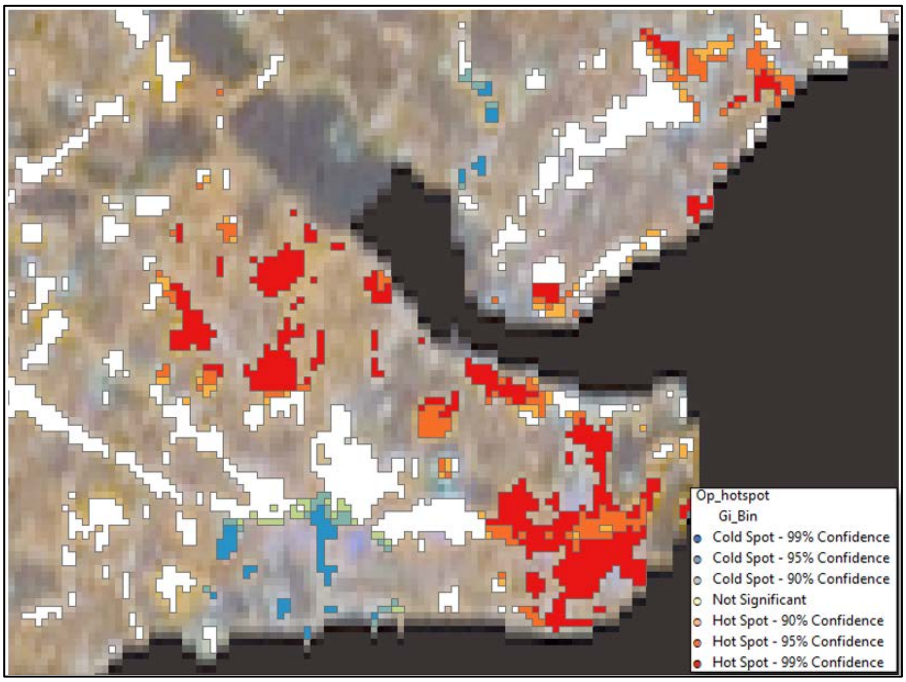


Figure 10. Hot spot locations on fishnet grids

VALIDATION OF THE RESULTS

The validation process consists of two stages; in the first stage, the widely known attraction zones in urban scale both in Anatolian and European parts of Istanbul was marked on the map and the extent of the overlap with the attraction zones obtained by the proposed methodology was investigated.

The well-known attraction zones in the European side of the city are; 1- The historical semi-island zone (Istanbul's major historic central attraction zone: The Grand Bazaar and its surrounding Tahtakale, Sultanhamam, Sirkeci region, 2- Galata, Taksim, Beyoğlu and İstiklal street zone 3-Nişantaşı and Ortaköy zone 4-Şişli and Mecidiyeköy zone and 5- Levent and Maslak zone and its surroundings (the new central attraction zone of the city attracting modern business centers, shopping malls and foreign companies). The widely known attraction zones in the Anatolian side of the city are 6-Altunizade zone 7-Kadıköy zone 8-Bağdat Street zone and its surroundings including Küçükyalı, Maltepe and Kartal districts and 9) Ataşehir zone (Figure 11) (see IMP 2009, Web 7).

The historical semi-island zone (Istanbul's major historic central attraction zone; the Grand Bazaar and its surrounding Tahtakale, Sultanhamam, Sirkeci region); the Galata, Taksim, Beyoğlu and İstiklal street zones; and the Mecidiyeköy and Levent zones (the new central attraction zone of the city attracting modern business centers, shopping malls and foreign companies) are widely accepted as the major/primary attraction zones or in other words 1st degree hot spots of İstanbul city.

In this context, the widely known attraction zones were overlaid by the results of kernel density analysis and hot spot analysis which are obtained by the help of the pixel centroids approach (see related part for details) and the results were discussed in order to provide a guidance for the decision makers to be able to understand how the proposed methodology provide a success in determination of the location and size of the attraction zones and their hierarchical levels relative to each other.

As the attraction zones of a city which are mostly composed of central business districts (CBD), other commercial zones, service zones, touristic corridors and/or other types of people's concentration areas etc., they are more illuminated areas compared to other zones of a city. Hence their location, size and hierarchical information related details were significantly improved by the help of the proposed methodology.

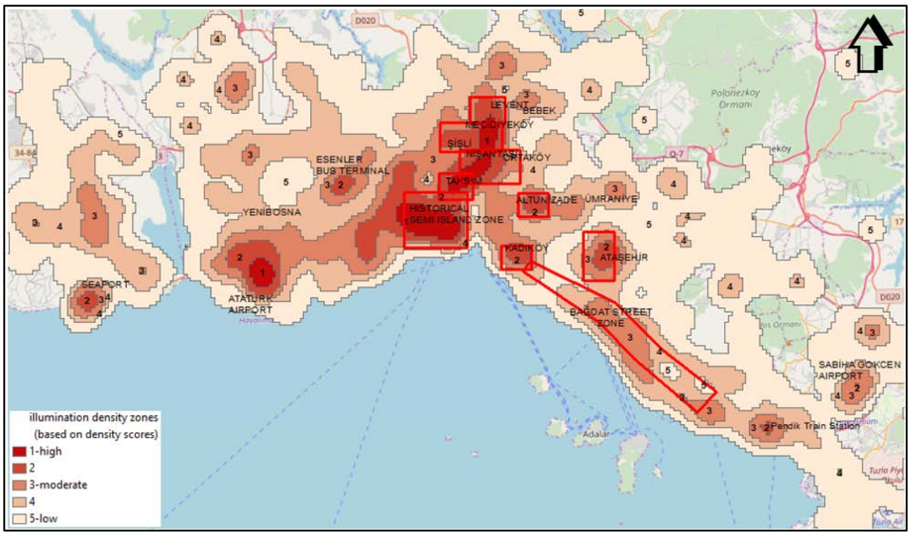


Figure 11. The widely known attraction zones, overlaid by the results of kernel density analysis (widely known attraction zones are represented in red rectangles)

The overlay of the widely known attraction zones by the results of kernel density analysis demonstrated that the zones obtained by the proposed model were significantly coincides with the approximate location of the widely known attraction zones (Figure 11). For example, the 1st degree illumination density zones mostly overlapped with the attraction zones of the city such as the Historical Semi-Island zone, Taksim zone, Nişantaşı zone, Mecidiyeköy zone etc., and their surroundings. Similarly, the 2nd degree illumination density zones also overlapped with the widely known attraction zones of the city such as the west part of the Historical Semi-Island zone, Kadıköy zone, Ataşehir zone, Altunizade zone, Şişli zone, Levent zone etc., and their surroundings. The Bağdat street zone, starting from Kadıköy zone and spread throughout the Pendik zone, which is also one of the widely known attraction corridor in Istanbul was represented between 3rd and 5th degree illumination density zones in the model. Moreover, the overlooked, unknown or unpredictable attraction zones could also be detected by the proposed model which are the Ambarlı Seaport (2nd degree illumination density zone), Atatürk International Airport (1st degree illumination density zone), Esenler Bus Terminal (2nd degree illumination density zone) and their surroundings in the west part of the Istanbul city, and Sabiha Gökçen Airport (2nd degree illumination

DOI: 10.15320/ICONARP.2022.221

density zone), Pendik Train Station (2nd degree illumination density zone) and their surroundings in the east part of the Istanbul city.

It is also possible for the decision makers to extract hierarchical differences among widely known attraction locations by using the mean value of the illumination density scores within each of the approximate attraction zone boundaries. In that respect, the hierarchical differences within each of the widely known attraction zone boundaries (which was previously an unknown parameter) was calculated and presented below (Figure 12).

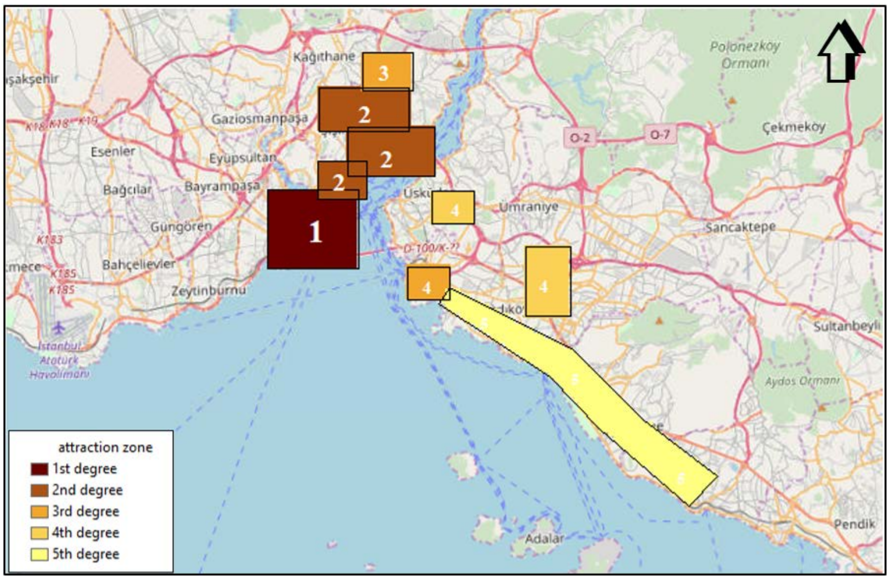


Figure 12. The hierarchical differences among the well-known attraction locations extracted by using the mean value of the illumination density scores within each of the approximate attraction zone boundaries

According to figure 12; the Historical Semi-Island zone and their surrounding is the 1st degree attraction zone, the Taksim zone, Şişli zone, Nişantaşı zone, Mecidiyeköy zone and their surrounding is the 2nd degree attraction zone, the Levent zone and their surrounding is the 3rd degree attraction zone, the Kadıköy zone, Ataşehir zone, Altunizade zone and their surrounding is the 4th degree attraction zone, and finally the Bağdat street zone, starting from Kadıköy zone and spread throughout the Pendik zone is the 5th degree attraction zone.

In the next step, the widely known attraction zones overlaid by the hot spot locations on fishnet grids (after dissolve operation were presented. Based on the figure, although there are many partial (minor) hot spot zones in the study area, there were 5 dominant (major) hot spot zones observed in the study area which mostly (4 of 5) overlap with the 1st degree illumination density zones (Figure 13).

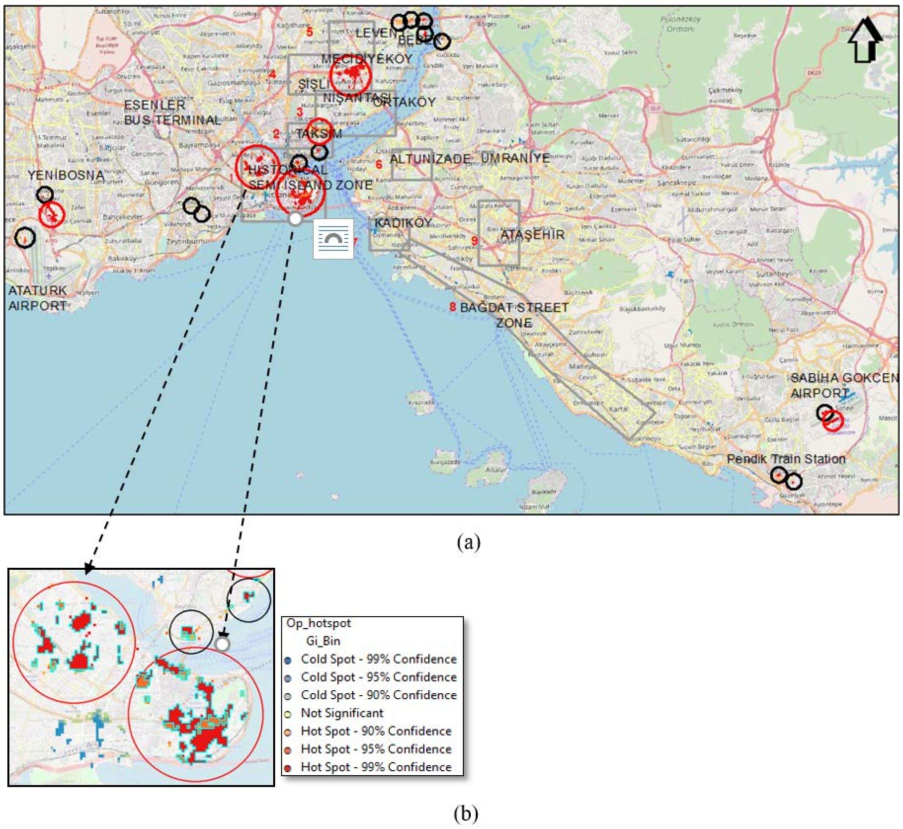


Figure 13. The widely known attraction zones (grey rectangles), overlaid by the results of hot spot locations boundaries of major and minor hot spot zones (major ones are represented with the red circles and minor ones are represented with the black circles) (The hotspots with higher than 95% in confidence level and that are relatively the largest in size are considered as major) (a), and an example of representation of hot spot boundaries in detail (b)

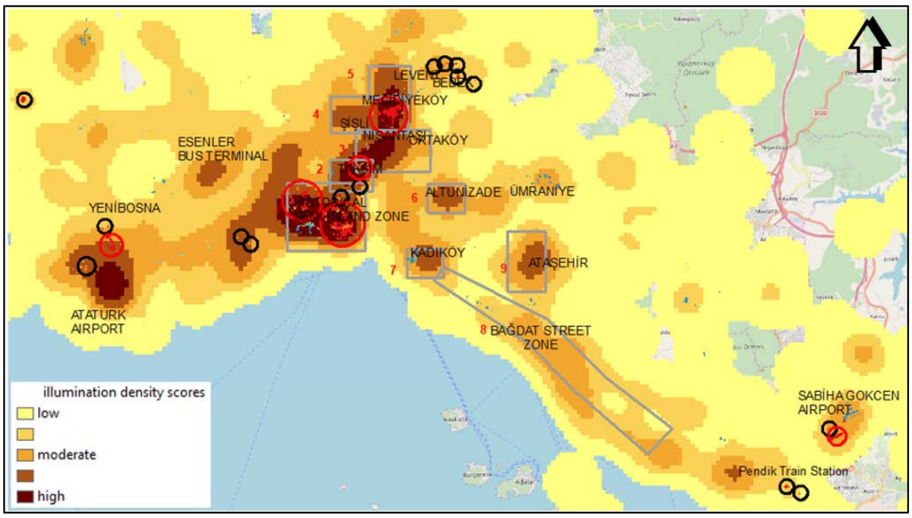


Figure 14. Overlay of density maps and hot spot maps with the well-known attraction locations (the well-known attraction locations are represented as grey rectangles; major hot spots are defied as red circles, and minor hot spots are represented as black circles)

According to Figure 14; the four dominant hot spot zones determined by the model are the Historical Semi-Island zone, Taksim zone, Nişantaşı zone, Mecidiyeköy zone etc., and their surroundings. The overlay of the well-known attraction zones by the hot spot analysis demonstrates that 4 of the hot spots obtained by the model coincides with the well-known locations. The only exception is the 5th hot spot located in the Yenibosna zone which is one of the previously unknown hot spots in the north of the Atatürk International Airport (in the west part of the study area).

Similarly, it is also possible for the decision makers to extract the hierarchical differences among hotspots by using the size and

DOI: 10.15320/ICONARP.2022.221

confidence level of the hotspot polygons. Classification of the hotspots according to their confidence level (e.g., 90%, 95%, 99%) and according to their size (e.g., larger than 5 hectares, 10 hectares, 15 hectares) could provide important clues to the decision makers about the hierarchy of the hotspot locations in a comparable manner. With the use of GIS's ability to calculate geometry, the hierarchical differences within each of the hotspot boundaries was calculated and presented below (Figure 15).

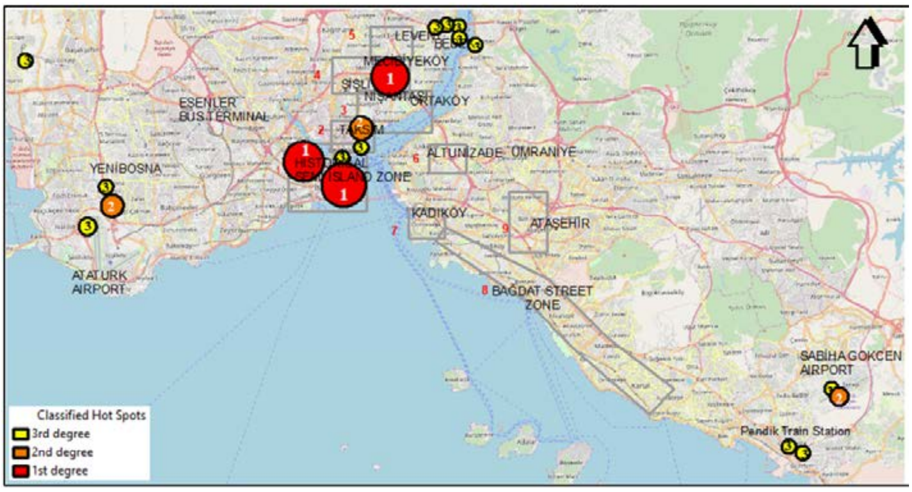


Figure 15. The hierarchy of hot spots locations according to their confidence level and size (the well-known attraction locations are represented as grey rectangles)

According to Figure 15, Historical Semi-Island zone (2 hot spots), Şişli, Nişantaşı, Mecidiyeköy and their surroundings are inside the 1st degree hot spot locations, Taksim, Yenibosna, Sabiha Gökçen airport zone and their surrounding are inside the 2nd degree hot spot locations, Bebek, Karaköy, Pürtelaş Hasan Efendi, Rumeli Hisarı, Anadolu Hisarı zone, Atatürk airport zone, Pendik train station zone and their surrounding are inside the 3rd degree hot spot locations. Although there are slight differences among the results obtained; it was observed that the results obtained by the model were generally compatible both with each other and with the well-known attraction locations. Moreover, the overlooked, unknown, or unpredictable attraction zones could also be detected by the proposed model in a significative manner.

In the second stage of the validation part, the obtained results were tested with the help of the Geofabrik's free download server; open street map dataset (Web 8) which extracts spatial distribution of all types of desirable or useful amenity/facility/service data (building or place) such as cafes, restaurants, shopping centers, pharmacies, malls, terminals, supermarkets, fast food shops, universities, schools, place of worships, monuments etc. (normally updated every day) of cities. The amenity database composed of nearly 24.000 features in point format was used for the validation process to understand percentages of the extracted attraction zones obtained.

As pixel centroids approach could be considered as more realistic compared to polygon centroids approach, the validation process was applied for the pixel centroids approach. In this context, the count/frequency ratio of the amenities within each of the attraction zones obtained by pixel centroids approach were extracted by the help of the spatial join/zonal statistics function of GIS both for the attraction zones obtained by the kernel density analysis and for the Gi_bin locations obtained by the hot spot analysis (Figure 16). Nearly 1.000 of the 24.000 amenities were not taken into consideration as they were outside of the study area.

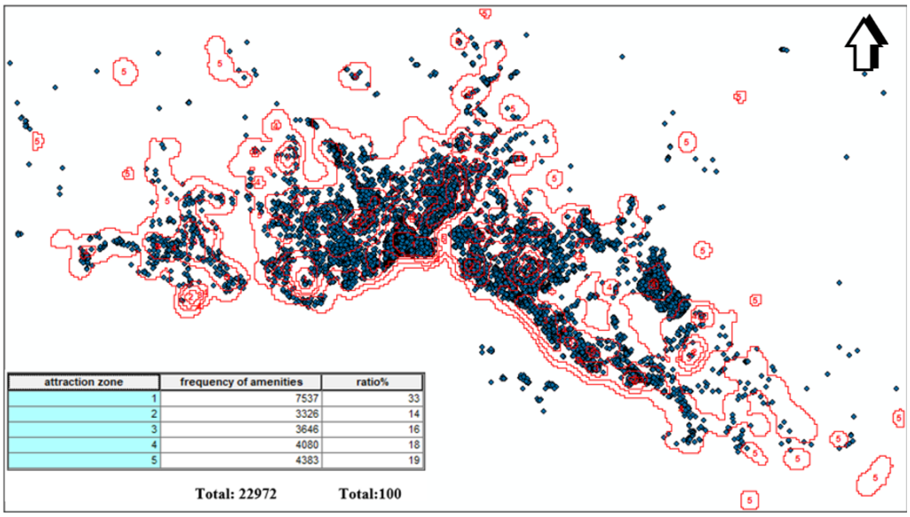


Figure 16. The count/ frequency ratio of the amenities within each of the obtained kernel density-based attraction zones (black points represent the location of amenities; red zones represent the kernel density analysis-based boundaries of the illumination zones)

According to Figure 16 it could be said that; nearly %33 (the highest percent) of the total amenities (7.537 of 22.972 amenities) fell into 1st degree attraction zones and %50 of the total amenities (10.863 of 22.972 amenities) fell into 1st and 2nd degree attraction zones which also supported the findings of this paper. On the other hand, %19 of the amenities (4276 of 22972) fell into hot spot analysis-based boundaries of the Gi_bin zones. %34 of these amenities (1453 of 4276), or %6 of the total amenities (1453 of 22972) fell into hot spot boundaries where Gi_Bin scores are greater than 1 (in other words; confidence level of hotspots is equal to 90%, 95%, 99%). When the Gi_bin scores of "0" and "below 0" was composed of statistically "not significant" locations called "cold spot" locations, the highest percent of the amenities could be seen to coincide with the hot spot locations.

RESULTS & CONCLUSION

In this manuscript, possible usage of night-time data was proposed in urban and regional planning discipline for the purpose of determination of the location, size, and hierarchy of the attraction zones in urban scale. In the context, a methodology based on GIS & RS integration and spatial and statistical analysis capabilities of GIS was proposed in the study to determine the boundary and size of the attraction zones and their hierarchical levels by using the night-time photo. The proposed methodology was applied in the city of Istanbul. Authors expected to provide up-to-date, precise, and more detailed information about the distribution of attraction zones in urban scale with their location, size and hierarchical level in a fast and reliable manner and could create an

DOI: 10.15320/ICONARP.2022.221

important decision support for the decision makers working on urban and regional planning discipline. As the attraction zones of the cities need to be planned in a more specific and detailed way, detailed and realistic manners could provide an important decision support for the decision makers especially working in urban and regional planning discipline.

Although there are several different types of research efforts on night time imagery such as determination of location and size of settlements, urban macro forms, estimation of socioeconomic parameters, etc., the proposed research could be considered to be unique to Turkey in terms of its possible usage in urban and regional planning discipline.

In the light of the above-mentioned facts, a few major findings of the research could be summarized as in below.

- Higher resolution nighttime photos (e.g aerial photograps) could be more representative and give more reliable results to that kind of studies, thus it should be examined in detailed in the feature.
- Stepwise unsupervised image classification is an effective way to categorize the illuminated cells in nighttime data.
- Visual exploration of the classified night-time images could give some significant clues to the decision makers about the spatial distribution of the important attraction zones. However, since there are hundreds of different levels of illuminated areas with fragmented scattered structures, it is not possible to differentiate the location, size, and hierarchy of these illuminated areas by just visual exploration process.
- Kernel-density method with pixel-centroid approach provided more reliable results than polygon-centroid approach.
- Alternatively, hot spot analysis could be performed as supportive analysis to understand the location of statistically significant hot spots, where a point feature has a high illumination value and surrounded by other points with high illumination values as well.

To understand the efficiency of the proposed methodology, two-stage validation process was performed in the study; one of which is by using the widely known attraction zones in urban scale, and the other is the Geofabrik's free download server; open street map datasets (Web 8). As a result, both validation process supported the reliability and usability of the proposed methodology. In this way up-to-date, precise, and more detailed and reliable information about the distribution of attraction zones in urban area with their location, size and hierarchical level could provide an important decision support for the decision makers especially working on urban and regional planning discipline. Besides all these advantages, authors also suggest that further research are necessary to evaluate the nighttime photos in a detailed manner.

ACKNOWLEDGEMENT

ASTER GDEM is a product of METI and NASA. Authors thank Başarsoft Information Technology Inc. to provide digital district map of Istanbul.

REFERENCES

Dobson, J.E., Bright, E.A, Coleman, P.R., Durfee, R.C., and Worley, B.A. (2000). Landscan: A Global Population Database for Estimating Populations at Risk, Photogrammetric Engineering and Remote Sensing, Vol. 66, No.7, pp. 849-857.

Doll, C.N.H., Muller, J-P., Morley, J.G. (2006). Mapping regional economic activity from night-time light satellite imagery, Ecological Economics, vol.57, pp. 75-92.

Doll, C.N.H. (2010). Proceedings of the Asia-Pacific Advanced Network, Population detection profiles of DMSP-OLS night-time imagery by regions of the world, v. 30, p. 190-206.

Elvidge, C.D., Cinzano, P., Pettit, D.R., Arvesen, J., Sutton, P., Small, C., Nemanı, R., Longcore, T., Rich, C., Safran, J., Weeks, J., and Ebener, S. (2007). The Nightsat mission concept, International Journal of Remote Sensing, Vol. 28, No.12, pp. 2645-2670.

Elvidge, C. D., Baugh, K., Zhizhin, M., Chi Hsu, F. (2013). Why VIIRS data are superior to DMSP for mapping nighttime lights, Proceedings of the Asia-Pacific Advanced Network v. 35, p. 62-69. http://dx.doi.org/10.7125/APAN.35.7 ISSN 2227-3026.

Henderson, M., Yeh, E.T., Gong, P., Elvidge, C., Baugh, K. (2003). Validation of urban boundaries derived from global night-time satellite imagery, International Journal of Remote Sensing, vol. 24, No.3, pp.595-609.

IMP. (2009). 1/100.000 ölçekli İstanbul Çevre Düzeni Planı ve Plan Raporu, Bimtaş, IMP- İstanbul Metropolitan Planlama ve Kentsel Tasarım Merkezi, Tepebaşı, Istanbul

Ju Y., Dronova I. , Ma Q., Zhang X. (2017). Analysis of urbanization dynamics in mainland China using pixel-based night-time light trajectories from 1992 to 2013, International Journal Of Remote Sensing, Vol. 38, No. 6047–6072.

Levin, N., Johansen, K., Hacker, J. M., Phinn, S. (2014). A new source for high spatial resolution night time images — The EROS-B commercial satellite, Remote Sensing of Environment, Vol. 149, page.1–12.

Levin N., Phinn, S. (2016). Illuminating the capabilities of Landsat 8 for mapping night lights, Remote Sensing of Environment, vol.182, pp. 27–38.

Levin N., Zhang, Q. (2017). A global analysis of factors controlling VIIRS nighttime light levels from densely populated areas, Remote Sensing of Environment, Vol. 190, pp. 366–382.

Li, D., Zhao, X., Li, X. (2016). Remote sensing of human beings – a perspective from nighttime light, vol.19, pp.69-79.

Li X., Zhou, Y. (2017). Urban mapping using DMSP/OLS stable night-time light: a review, International Journal of Remote Sensing, VOL. 38, pp. 6030–6046.

Liu, Q., Sutton, P.C., Elvidge, C.D. (2011). Relationship between nighttime imagery and population density for Hong Kong, Proceedings of the Asia-Pacific Advanced Network, v.31, pp.79-90.

Ma, T., Zhou, C., Pei, T., Haynie, S., Fan, J. (2012). Quantitative estimation of urbanization dynamics using time series of DMSP/OLS nighttime light data: A comparative case study from China's cities, Remote Sensing of Environment, vol. 124, pp.99-107.

Ma, T., Zhou, Y., Zhou, C., Haynie, S., Pei, T., Xu, T. (2014). Night-time light derived estimation of spatio-temporal characteristics of urbanization dynamics using DMSP/OLS satellite data, Remote Sensing of Environment, vol. 158, pp.453-464.

DOI: 10.15320/ICONARP.2022.221

Press W.H., Teukolsky S.A., Flannery B.P. (2002). Numerical Recipes in C, The Art of Scientific Computing Second Edition, Cambridge University Press Cambridge New York Port Chester Melbourne Sydney pp. 644-645, (ISBN 0-521-43108-5).

Shao, Z., Liu, C. (2014). The Integrated Use of DMSP-OLS Nighttime Light and MODIS Data for Monitoring Large-Scale Impervious Surface Dynamics: A Case Study in the Yangtze River Delta, Remote Sensing, vol.6, pp. 9359-9378.

Yu, B., Shi, K., Hu, Y., Huang, C., Chen, Z., Wu, J. (2015). Poverty Evaluation Using NPP-VIIRS Nighttime Light Composite Data at the County Level in China,IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, vol. 8, pp.1217-1228.

Zhang Q, Seto K. C. (2011). Mapping urbanization dynamics at regional and global scales using multi-temporal DMSP/OLS nighttime light data, Remote Sensing of Environment, vol. 115, pp. 2320-2329.

Web1. (2022, November 10). *(date of last controlled).* https://ngdc.noaa.gov/eog/sensors/ols.html

Web 2. (2022, November 10). *(date of last controlled).* https://eol.jsc.nasa.gov/SearchPhotos/photo.pl?mission=ISS006&roll=E&frame=42606

Web 3. (2022, November 10). *(date of last controlled).* https://eol.jsc.nasa.gov/SearchPhotos/photo.pl?mission=ISS032&roll=E&frame=23534

Web 4. (2022, November 10). *(date of last controlled).* https://asterweb.jpl.nasa.gov/gdem.asp

Web 5. (2022, November 10). *(date of last controlled).* https://desktop.arcgis.com/en/arcmap/10.3/tools/spatial-analyst-toolbox/how-kernel-density-works.htm

Web 6. (2022, November 10). *(date of last controlled).* http://pro.arcgis.com/en/pro-app/tool-reference/spatial-statistics/h-how-hot-spot-analysis-getis-ord-gi-spatial-stati.htm

Web 7. (2022, November 10). *(date of last controlled).* https://download.geofabrik.de/

Web 8. (2022, November 10). *(date of last controlled).* https://www.goktugbeser.com/istanbul-merkezi-is-alanlarinin-gelisimi

Resume

Asli Ozdarici-Ok received her Ph.D. degree in 2012 from Middle East Technical University in Ankara, Turkey. She is currently an associate professor at the Academy of Land Registry, Ankara Hacı Bayram Veli University. Her research interests include "object detection in airborne and spaceborne images", "image classification for remote sensing", and "applications for land and mass evaluation".

Kivanc Ertugay received his Ph.D. degree in 2012 from Middle East Technical University in Ankara, Turkey. He is currently an associate professor in the Faculty of Architecture, Urban and regional planning department of Akdeniz University. Some of his research interests include "usage of GIS technologies in urban and regional planning processes", "urban transportation planning", "physical accessibility modeling" and "spatial data analysis in GIS".

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

ICONARP
International Journal of Architecture and Planning
Received: 24.09.2022 Accepted: 08.12.2022
Volume 10, Issue 2/ Published: 20.12.2022
Research Article *DOI: 10.15320/ICONARP.2022.222 E- ISSN:2147-9380*
ICONARP

Tracking Morphological Agencies in the Alienated Fringe Belt Plots of Istanbul

Ezgi Küçük Çalışkan*
Ayşe Sema Kubat**

Abstract

Fringe belts, founded on the peripheries of the city and thereafter being embedded in urbanized areas, can transform in time. They may either modify without losing the fringe belt character or alienate by being absorbed in residential or commercial growth. Especially in large cities with strong and rapid dynamics of change, the concept of fringe belt alienation can be a focal node for monitoring the transformations. Besides the morphological aspects, it is significant to examine the agencies that play roles behind these transformations. This paper intends to make contributions to the fringe belt literature in terms of morphological agencies by analyzing the alienated fringe belt plots in Istanbul that has the characteristics of both an ancient historical city and a megacity of today. The research deals with three major subjects: Istanbul's fringe belt development, alienated fringe belt plots by morphology, configuration and property, and agencies involved in the alienation processes. Firstly, inner, middle, and outer fringe belts of Istanbul are identified. Their formation phases are observed to put forth a typical narrative of Istanbul's urban development. Then, alienated fringe belt plots are analyzed with four case studies. The plot development cycles are examined to reveal the relationship between the plot and the building in each case. This examination addresses the phases of the formation and the first cycle of plot development. Second cycles are observed as the result of the transformations both in form and utilization. Finally, morphological agency networks of the cases are displayed by elaborating the active agents in transformation phases. They are categorized into five groups and analyzed by a network analysis. The motivations behind the agent behavior which reflect the periodization of urban development in Istanbul are also unveiled in this paper.

Keywords:
Fringe belt, fringe belt alienation, Istanbul, morphological agency, plot transformation

*Urban and Regional Planning Ph.D. Program, Graduate School, Istanbul Technical University, Istanbul, Türkiye (*Corresponding author*)
Email: ekucuk@itu.edu.tr
ezgikucukcaliskan@gmail.com

**Faculty of Architecture, Istanbul Technical University, Istanbul, Türkiye
Email: kubat@itu.edu.tr

To cite this article: Küçük Çalışkan, E., & Kubat A. S. (2022). Tracking Morphological Agencies in the Alienated Fringe Belt Plots of Istanbul. *ICONARP International Journal of Architecture and Planning*, 10 (2), 711-734. DOI: 10.15320/ICONARP.2022.222

INTRODUCTION

Concept of fringe belt within the scope of the historico-geographical perspective can be accepted as the keystone of analysis in urban morphology. As Whitehand (1966, p. 233) states, the concept provides a way to arrange and comprehend the complexity of urban morphology. It also suggests consistent rather than superficial generalizations in the urban form literature, and being more than a geographical explanation, the concept represents a kind of social value connected to the historical development of urban areas and the societies in them (Whitehand, 1966, p.233; Whitehand & Morton, 2003, p.822).

However, as in Lefebvre's (2009) discourse on the historical processes; societies, modes, and production relations are the main subject for urban space. In the built environment, the production relations result in different kinds of property relations, such as usus, fructus, and abuses, or dualities such as public and private (Günay, 1999). Therefore, property turns out to be a concept that should be regarded along with urban morphology. In particular, urban blocks -sometimes termed as street blocks (Conzen, 1960, p.5) or building blocks (Scheer, 2016, p.14)- consisting of plots, buildings, and streets, as being the basic building units of the urban form, are highly affected by property use and ownership, as well as actor relations. Urban actors are those who demand, plan, design, regulate, own, use, and support or protest the changes. These are defined as morphological agents (Larkham & Conzen, 2014) in this article and, we propose, can be clarified through the fringe belt concept and monitoring the plot development cycle. So, the aim of this study is to reveal the morphological agents of alienated fringe belt plots. The paper combines different levels of analysis on fringe belts through a historical investigation both at the metropolitan scale and specific case studies, incorporating a conception of property relations with the development cycles of plots and the roles of agents.

The city of Istanbul is recognized as an authentic case due to its ancient historical structure and being a megacity of today. Istanbul is also a part of a unique geography with critical population dynamics. In a city with such dynamics, change is inevitable. The morphological and property-based transformations in Istanbul, are concerned as a means of a field to monitor the changing dynamics of urban lands.

Conceptual Background

Fringe belts are described as peripheral urban forms with larger plots and less dense street patterns, and are recognized as larger and far more diverse land use types, unlike residential and commercial urban areas (Conzen, 1969). The land uses commonly found in the fringe belt are open space, industry, institutions, residential, and recreation (Conzen, 2009). The concept was worked on by Herbert Louis in Berlin, in 1936 prior to the Alnwick study of M. R. G. Conzen (1960) which developed the concept and major terminologies (Conzen, 1969). Whitehand (1972) and Barke (1982) defined the evolution process of the concept with an economic

DOI: 10.15320/ICONARP.2022.222

model based on the housing cycle and site selections. Fringe belts tend to be developed on cheaper lands at the fringes of the cities during economic slumps when the rate of housing production decreases (Whitehand, 1972), but they embed in the city as the city grows in time and transform in terms of land use and configuration (Conzen, 2009). The fringe belt areas are observed to be found in three different zones: inner fringe belt (IFB), middle belt (MFB), and outer fringe belt (OFB) (Barke, 1974; Conzen, 2009). Figure.1 shows the illustrated images derived by Conzen (2009), the fringe belt analysis of Berlin studied by Louis in 1936, and the fringe belt model developed by Whitehand in 1994.

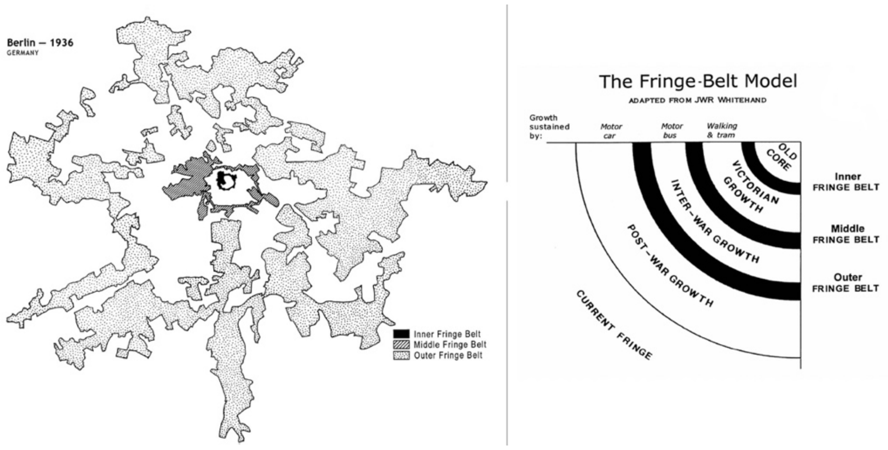


Figure 1. Fringe belts of Berlin in 1936 (left) and the fringe belt model (right) (derived from Conzen, 2009, p.32 and p.38).

The evolution phases of fringe belts are fixation, expansion, and consolidation. Modification processes are briefly categorized as alienation, reduction, and translation (Barke 1990; Conzen, 2009). If the land use of a fringe belt area changes into another fringe belt use, this signifies the persistence of the fringe belt character. However, if the fringe belt area alienates, this means the fringe belt character disappears and the land utilization turns into residential or commercial use. Reduction means losing a part of the fringe belt area by transforming it to any other use, and translation signifies the transfer of a particular use (say, a hospital or stadium) to another fringe belt zone (Conzen, 2009).

Fringe belts are researched by different researchers from several perspectives namely spatial, economic, social, and planning (Ünlü, 2013). The studies of Whitehand and Morton (2003, 2005, 2006) and Ducom (2005, 2008) mainly focused on planning actors and decision-making processes. Ducom (2005) addressed the dynamics in the formation and transformation process of fringe belt generations on the axis of actors and change processes. In his paper on the fringe belts of Auckland and Wellington, Gu (2014) elaborated on decision-making processes through key urban planning and design documents for those areas. Although these exemplary studies deal with the agency, they do not offer a systematic reading in terms of fringe belt transformations.

Kropf (2014) claims that the agent can be represented by the individual, the corporate, the charity, or the government. He, with his conceptual model based on Leighton Buzzard experience, touches on the decision-making processes with the emergence and the transformation of the urban form (Kropf, 2014). Larkham and Conzen (2014) also underline that the discipline of urban morphology is functional to work on the agents who have roles in the transformation of urban form, from small scale to large scale. Hence, a network analysis of morphological agents that affects the fringe belt transformations integrated with Kropf's (2014) framework of agency, in which he groups the agents into four based on the aspect of the interest; individual, corporate, charity, and government (p.307). And he explains the agents within five groups, namely motive, generative, regulatory, resistive, and sensory agents in this paper. Although the relationship between these agent roles seems predictable, examining these relationships through case studies enables us to discuss the factors of plot transformation with evidence (Kropf, 2014, p.320). His perspective on morphological agency attests to fundamental and comprehensive indications for observation. An actor-based network analysis constitutes a practical method to reveal the reasons behind the changing form of the city by various agents, since it deals with the social relations between the actors in the network (Emirbayer & Goodwin, 1994).

EXPLORATION

The methodology contains three major parts. First, fringe belts of Istanbul were determined throughout the city, by using historical and current documents and data. Within these fringe belts, sub-case areas were selected in connection with the theoretical framework and the plots were identified for the case study that are four examples of fringe belt alienation. The four case areas, currently known as *Yedi Mavi*, *Maslak 1453*, *Torun Center*, and *Zorlu Center*, were examined through the fringe belt formation and transformation phases. Plot development cycle graphs were drawn for the case areas by focusing on morphological transformations, configurational changes in the parcel, and property relations. Finally, Kropf's categorization of agents was applied to the cases, and agent relations were evaluated through network analysis.

Identifying Fringe Belt Development in Istanbul

Turkish cases of fringe belt analysis were carried on with a Mediterranean perspective by Ünlü and Baş (2013, 2017) confirming the umbrella fringe belt model for multi-nuclei cities. Several studies focusing on the IFB development in the nucleus of Istanbul were discussed by Hazar and Kubat (2016) in the context of green urban corridors, and later by Kubat (2019) concerning the central business district (CBD) development of the city. MFBs and OFBs of Istanbul were also overviewed by Küçük Çalışkan and Kubat (2020) on the extent of mega projects.

Fringe belt areas of Istanbul were previously illustrated within a comparative study of the fringe belt developments in Istanbul and Barcelona, without evaluating the morphological periods of the city and mostly focused on the IFBs of the city by Hazar and Kubat (2015). This

DOI: 10.15320/ICONARP.2022.222

study presents a more rigorous and comprehensive fringe belt analysis to demonstrate the latest situation in Istanbul after 2015.

Urban Growth in Istanbul

Istanbul was first shaped on the Historical Peninsula and the other two coasts facing it, known as Kadıköy and Galata, then developed linearly on the south axis of the city and expanded to the north with new centers over time. In ancient Istanbul, which was founded in the 7th century BC and called Byzantium and remained the capital city of both Roman and Ottoman empires (Kubat, 2019), the urban land was governed as the property of the emperors, in line with the socio-cultural system of that period until modern times. Istanbul was shaped around the forum in the Roman period and continued to be developed around the bazaar during the Ottoman period under the influence of Islamic culture (Kubat, 2019). Spreading over two continents, half of which is on the European side and the other half on the Asian side, Istanbul was modernized with the revolutions of the Republic period which became official in 1923. The city developed as a port city up to the early Republican period. As a result of cautious steps for economic recovery after the First World War, the city grew more slowly in the first two decades of the Republican period. It started to develop rapidly after the 1950s, since the rural population start to intensely migrate to the cities due to increasing economy by the Marshall Plan and modernist movement (Şengül, 2001). Istanbul's urban development has spread both horizontally and vertically since the 1980s (Tekeli, 2013), with a period of strong intervention by the military regime, which paved the way to privatization in the city, especially in the field of infrastructure (Şengül, 2001). The city continued to expand after the 2000s by the joining of non-residential areas, along with critical urban transformation projects, and growing international investment in Istanbul.

IFBs, MFBs, and OFBs of Istanbul

In the identification of fringe belts, the morphological development and land utilization of Istanbul have been given primary consideration. Therefore, IFBs, MFBs, and OFBs of Istanbul were recognized more accurately and in more detail. The fringe belt concept brings with it the comparative examination of a set of historical data (Conzen, 2009). Data used in the analysis include insurance maps, namely Pervititch maps created between 1934-1938, satellite images from 1946 to 2022, and land utilization maps from the city plan dated 1980, 1994, 2006, and 2018. Figure.2 shows the current fringe belts of Istanbul.

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

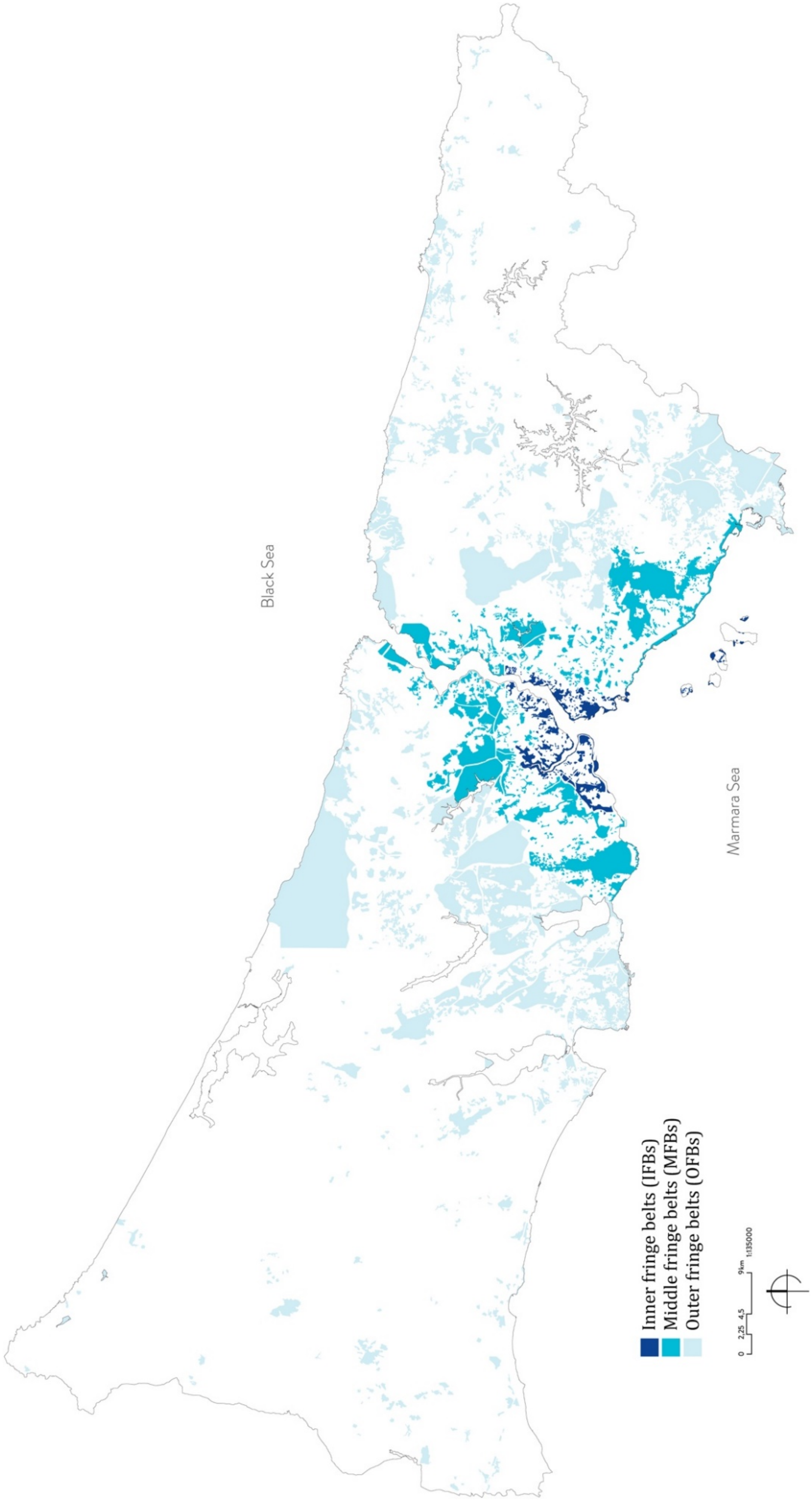


Figure 2. Inner, middle, and outer fringe belts of Istanbul in 2022.

DOI: 10.15320/ICONARP.2022.222

IFBs of Istanbul were formed around man-made and natural fixation lines. Some of these are the Theodosian Walls surrounding the Historic Peninsula and the Galata walls built in Byzantine and Roman periods, and natural ones like the Marmara Sea, the Golden Horn, and the Bosporus, which divide the city into three parts. IFBs consisted mostly of gardens and orchards (Kubat 2019; Hazar & Kubat, 2015). While many neighborhoods of Istanbul were destroyed by fires and rebuilt in the 18th century, new IFBs and MFBs were formed, especially with the construction of railways in the 19th century (Kubat, 2019). Henry Prost's plan for Istanbul in 1937 had significant effects on the spatial structure of Istanbul by developing medium and large-scale industries on the shores of the Golden Horn and the construction of state-owned factories and warehouses on the shores of the Bosporus, besides other conservative proposals toward the cultural heritage and natural landscape of the city (Kubat, 2019).

Most of IFBs expanded until 1945. This period indicates the stagnation of urban development in Istanbul. Between 1945 and 1980, IFB areas consolidated and MFBs of the city were fixed in accordance with the fixation lines such as boulevards, highways, and railways. In addition to population growth, developments in transportation systems, and increasing housing supply, urban development accelerated with new legal regulations in the field of urban management and zoning (Tekeli, 2013). In particular, the regulations regarding the choice of industrial location indicate that the fringe belts that emerged in this period were formed through urban planning. The urban form has become problematic by means of illegal housing, inaccessibility, destruction of traditional urban patterns, and unrestrained building act on urban openings. It was not surprising since the urban pattern has changed rapidly with the migration from the rural to the urban, the condominium rights inured in 1965, creating apartment buildings and the build-and-sell construction system since the 1970s (Şengül, 2001; Tekeli, 2013). The plot sizes shrunk, the industries spread out, the number of illegal housing units increased, and Istanbul reached another dimension with the construction of the Bosporus bridges connecting the two sides of the city (Tekeli, 2013). This process can be explained as continuous urban growth. During this period, the first airport of Istanbul, Atatürk Airport, was established as part of MFBs in the west of the city.

Since the 1980s, when privatization intensified, new legal regulations on squatting, urban transformation projects and gentrifications, as well as ongoing apartment constructions, gated community projects, and residences have been raised. Throughout the city, shopping malls spread, and new CBDs were planned on the northern axis (Kubat, 2019). Organized industrial areas, complexes and techno-parks emerged, and with increasing momentum, automobiles and alternative public transportation like the subway and metrobus began to be seen in the field of transportation (Tekeli, 2013). Istanbul has become globalized since it became a national and international center of economy, culture,

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

education, and industry with its ever-increasing population (Küçük Çalışkan & Kubat, 2021). While Istanbul continued to develop on the railway and D-100 highway line (part of the Trans-European Motorway) parallel to the coast in the east, the urbanization pressure on the northern forest and the transformation of historical and cultural areas within the city increased. During this period, which lasted until the 2000s, MFBs were strengthened and OFBs appeared in Istanbul.

Whitehand (2019) asserted that the continuous fringe belts formed through fixation lines like green belts or other land use are mostly recognized in IFBs while the discontinuous ones, such as industrial areas are affected by fluctuations in urban development. Conzen (2009) highlighted that the industrial fringe belts include the formation of the middle and outer fringe belts based on the cases he investigated. Both propositions are also acceptable for the case of Istanbul. However, the difference is that Istanbul experienced a serious number of fringe belt alienations with configurational changes especially during last two decades, compared to classic European towns. The reasons for these changes include industrial decentralization processes of the city (Tekeli, 2013), rent-oriented urbanization policies, frequently updated legal regulations including zoning amnesty, increasing flexibility in the Turkish planning system (Türk, 2008), and re-determination of the city center and sub-centers within urban plans such as the Environmental Plans of Istanbul for the years of 2006 and 2009.

Many fringe belt areas, embedded within the city, started to change after the 2000s. Some of the IFB areas expanded by filling areas on the coasts. The natural assets, where the northern forests of Istanbul are located, began to be a part of urbanization during the last decade, since North Marmara Highway, the third Bosporus bridge, and Istanbul Airport were built in the northern part bordering the Black Sea. Such mega-urbanization, constantly on the agenda of discussions by different urban actors in socio-political and ecological terms, is the consequence of a period in which public lands were intensively privatized in terms of the property's location, and Istanbul became a city region (Küçük Çalışkan & Kubat, 2020).

Scrutinizing Alienated Fringe Belt Plots

The transformation of the fringe belt by alienation means the loss of fringe belt characteristics because growth causes them to become redeveloped as residential and commercial. For this study of Istanbul, the morphological and property-based transformation of plots with fringe belt alienation are selected as samples according to a set of primary and secondary criteria (Table.1). For morphological transformation, criteria are arranged in two separate focuses. In *morphological transformation–A*, fringe belt alienation is primary and differentiation in the initial land uses of the plots is secondary criteria. For *morphological transformation-B* which is based on configurational changes, the compact transformation among plot, building, and street is the primary criterion, while a high level

DOI: 10.15320/ICONARP.2022.222

of building coverage on the plot is secondary. As the indicators of *property transformation*, the transition of property from public ownership to private ownership is a primary condition, and objections to the transformation process by any agent are secondary criteria. Finally, cases were selected based on their centrality and their *location* in IFBs and MFBs of Istanbul, where the change was intense.

Table 1. Criteria for case selection

Axes of criteria	**Morphological transformation - A (based on land utilization)**	**Morphological transformation - B (based on configurations)**	**Property transformation**	**Location**
Primary criteria	Fringe belt utilization to alienation	Among street, plot and building	From public property to private property	In IFBs or MFBs
Secondary criteria	Different initial land uses	High building coverage	Objection to the process by agents	In the CBD

Four case studies were ultimately selected (Figure.3). Case-1 reveals the transformation of *the meat and fish factory* from the IFB area to the *Yedi Mavi* project area. It is an example of the transformation to residential use from an industrial area. Case-2 is the transformation of an open area, which was a *forest area* within the MFB, and became *Maslak 1453* residential project. Case-3 represents the transformation of a recreational area, *Ali Sami Yen Stadium*, to a commercial area, *Torun Center*. This case is also from the MFB and planned CBD of Istanbul. And case-4 shows an example of the transformation of an institutional area to commercial use, which is the transformation of *the 17th Regional Directorate of Highways* into *Zorlu Center*. Arguably, these cases are crucial since they have created a debate in the public eye as "megaprojects" that affect a set of dynamics, from urban identity to urban economy (Megaİstanbul, 2021), as well as Istanbul's urban form.

The plot has always been the most significant unit in Conzenian morphology. According to Conzen (1960), the plot itself should be examined with definitive terminologies such as plot head, plot tail, or plot division, besides the concepts of plot series, plot cycles, or plot pattern. Scheer (2016) draws attention to the morphological approaches to the changes in the urban form by claiming that the evolution, transformation, and distribution of the existing forms reveal the concepts of typological or evolutionary cycles in shaping cities. She (2016) highlights common consequences of the time factor and location in the concepts on urban change to verify the role of the persistence of morphological elements in the urban form. Plot pattern is generally recognized as the most persistent element among other urban block elements (Conzen, 1960). However, this general assumption may fail to explain the burgeoning transformation process accelerated with regulations or implementations in the rapidly changing big cities of today. Planning praxis, policies, and socio-cultural dynamics behind the transformation of the urban form assure closer scrutiny of the plot together with related agents.

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

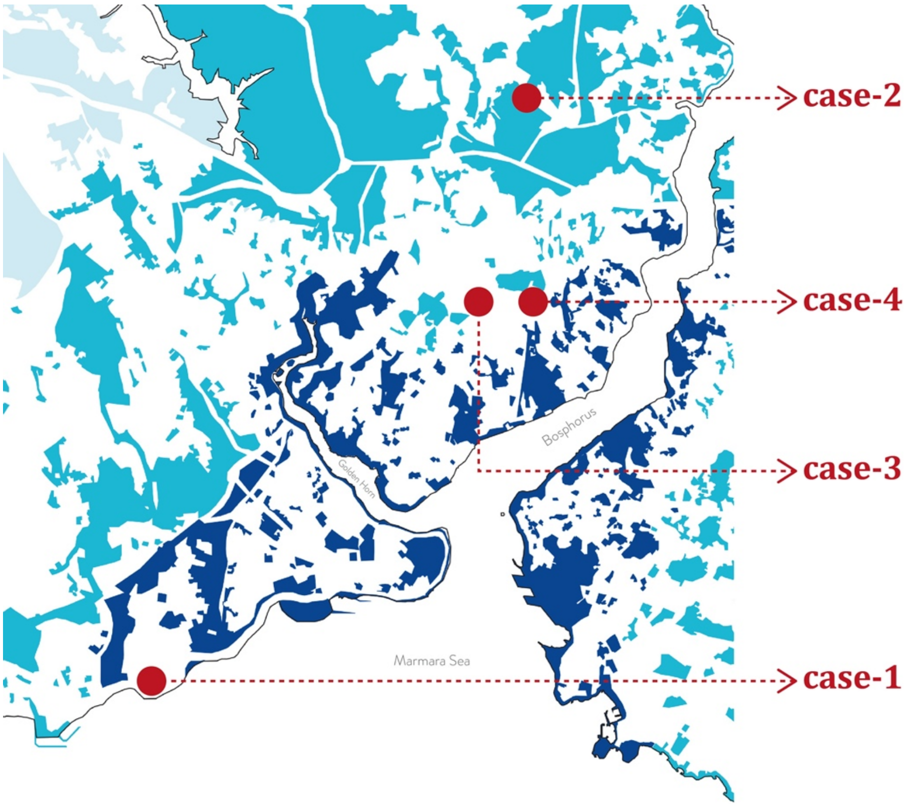


Figure 3. Location of selected cases in a closer scale, from the map of Istanbul's fringe belts.

The development cycle of the plot series, which Conzen (1969) puts forward with the concept of burgage cycle, is at the forefront of the studies that prove this by revealing all the changes in the plot (Ünlü & Baş, 2017). Most studies produced within the scope of urban morphology literature reveal plot-based cycles. Zhang (2014) explored morphogenetic types in Guangzhou, considering social and economic facts. Le Font and De Visscher (2020) questioned how typo-morphological features affect durability in heterogeneous urban fabric. Ünlü and Baş (2017), in their study on Mersin, examined the dynamics of the formation and transformation of residential plots in Turkish cities through morphogenetic types. Especially, the density of buildings on the plot has been regarded in many morphological studies held in the light of different methods (Topçu & Southworth, 2014; Çalışkan & Mashhoodi, 2017; Remali & Porta, 2017).

This paper considers the transformation cycle of fringe belt plots, not in the plot series but on the cycle within the plot itself. Plot development cycles are graphed as a percentage of building coverage (floor area ratio or "FAR") by year. The beginning year of each land utilization is also indicated in the chart. Building coverage is defined as in the "repletive phase" when the plot starts to add more buildings, the "climax phase" when it reaches its limits, and the "recessive phase" when the construction in the parcel starts to decrease with demolitions (Conzen, 1969).

Development cycles of case-1 (Figure.4), case-3 (Figure.6), and case-4 (Figure.7) connote a similar pattern. Since case-2 (Figure.5) transforms from an open space to a built area, only the recessive and climax phases

DOI: 10.15320/ICONARP.2022.222

can be observed. In addition, the area of case-2 compared to the other cases is larger. While the recessive and second repletive phases of case-1 and case-4 are more parallel, case-3 and case-4 are more than the others when it comes to building coverage. The location of these two building blocks in the city and the fact that they are in the main commercial center indicated on Istanbul's zoning plans are the reason behind this situation.

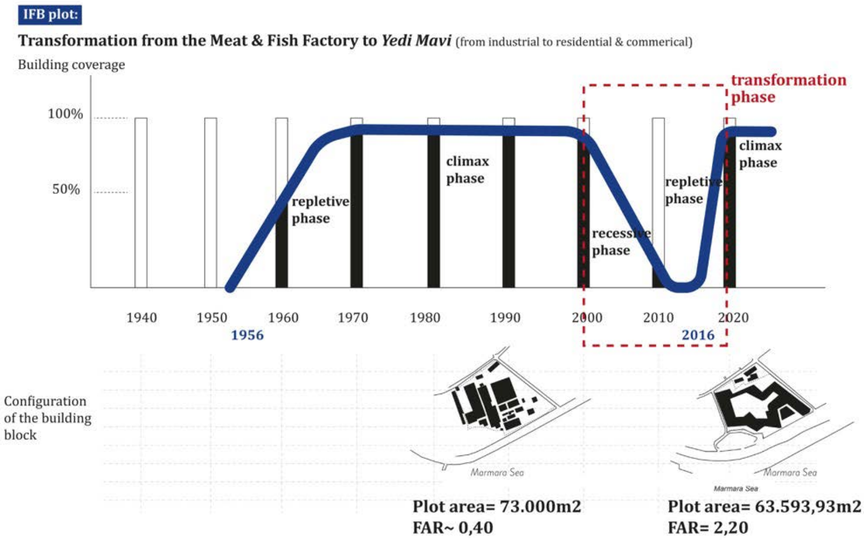


Figure 4. Plot development cycle of case-1.

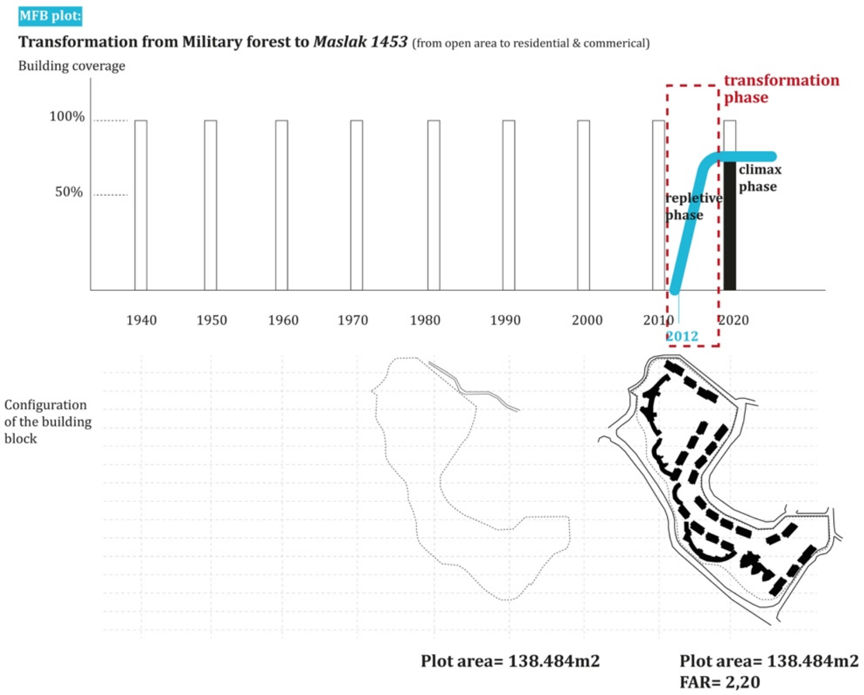


Figure 5. Plot development cycle of case-2.

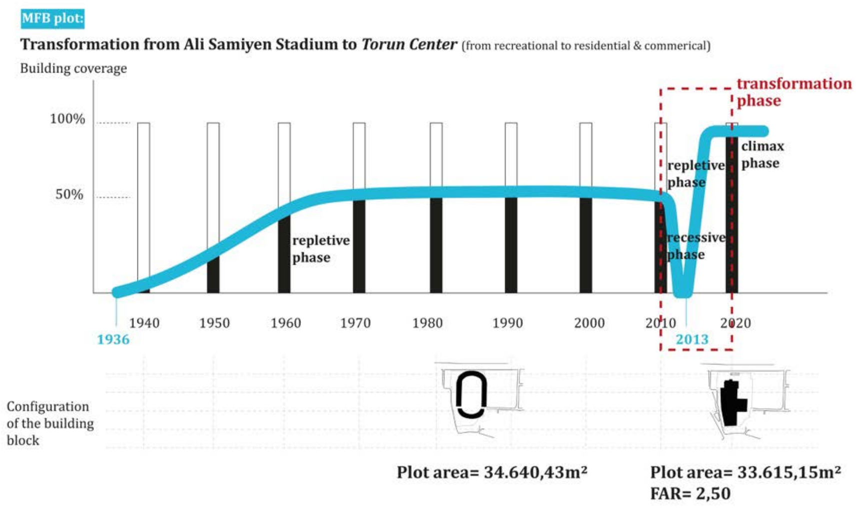


Figure 6. Plot development cycle of case-3.

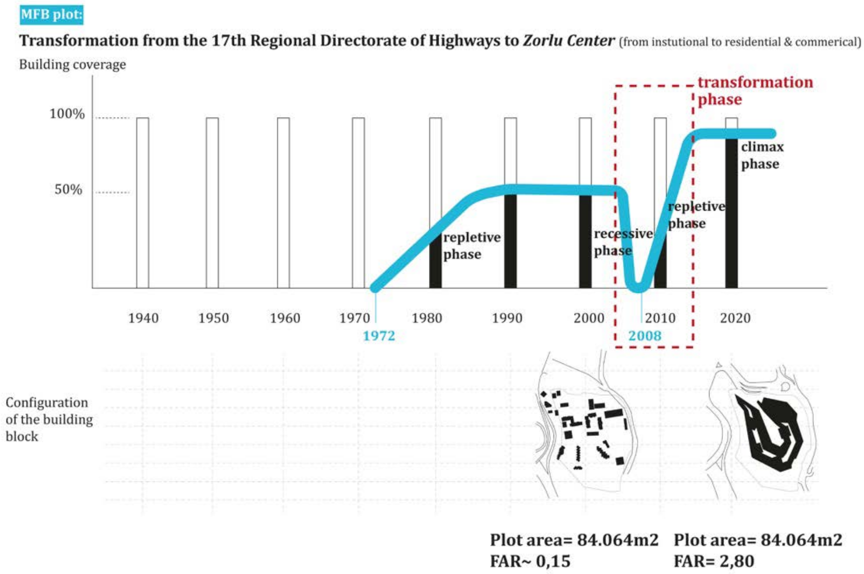


Figure 7. Plot development cycle of case-4.

In the next analysis, the case files of the professional chambers that objected to the process and the archives of the newspapers were used. Each of the cases is represented within four steps: The first two reveal morphological transformations based on land utilization and configuration. The last two steps explore property transformations and agent relations in the transformation phase. By implication, cases were compared according to the main selection criteria.

Case-1: Transformation from Meat & Fish Factory to Yedi Mavi

Change in land utilization: Case-1, located on the coast of the Marmara Sea in the southwest of the Historical Peninsula, was a part of IFBs. The area, which started its activities as a meat and fish factory in 1956, was sustained until 2003 as an industrial fringe belt plot. After losing its old function in 2003, Case-1 was alienated from the fringe belt to a residential area, namely Yedi Mavi in 2016 (Figure.7). *Configurational changes*: The area is a medium-sized plot surrounded by streets on three sides. In the transformation process, the plot has been divided. A smaller part of the

DOI: 10.15320/ICONARP.2022.222

plot remained as an institutional area. Thus, Case-1 also represents the fringe belt reduction. The plot became dominated by towers with a FAR of 2,20 increased from ~0,40. *Property transformation*: The area remained in public ownership until its transformation. It changed to private property with multiple owners after alienation. *Agent relations in the transformation phase*: In this process, the Union of Chambers and Commodity Exchanges of Turkey, which owns the land, put the land up for sale in 2011 (Megaİstanbul, 2021). In 2014, the Ministry of Environment and Urban Planning (MoEU) suspended the zoning plan amendment for this area. The Union of Chambers of Turkish Engineers and Architects (UCTEA) Chamber of Urban Planners Istanbul Branch sued for violation of public interest. Although it was canceled by the Istanbul 1st Administrative Court, the Istanbul 4th Administrative Court canceled the plans. However, the construction continued and it was announced for sale in 2016. In 2018, the project was decided to be canceled by the Istanbul 4th Administrative Court again, but in 2021, the cancellation decision was canceled by the Istanbul Regional Administrative Court. The case is significant as being the transformation of a public industrial area as being a part of the periphery of the historical city, located on the shores of the Marmara Sea. In addition, another critical issue that has been addressed is the damage to Istanbul's silhouette caused by the height of the buildings (Court Case File-3; Kundakçı, 2014).

Figure 7. Meat & Fish Factory, 1966 satellite image (left), Yedi Mavi, 2022 Google earth image (right).

Case-2: Transformation from military forest to Maslak 1453

Change in land utilization: Case-2 differs from the other cases examined because of being a fringe belt alienation of an ecological land. Founded in the MFBs of Istanbul, it basically represents a transformation from the open area to the residential area (Figure.8). *Configurational changes*: The plot is still surrounded by streets. The plot was built with a FAR of 2,20. *Property transformation*: Case-2, the largest parcel area among other case studies, was transferred to private ownership with multi-proprietor through the sale of public ownership as single-proprietor. *Agent relations in the transformation phase*: The land was first owned by the Ministry of Forestry and Water Management and was forestry as part of a military area. The area was being used as a recreation area and there was no construction in that period. The Mass Housing Development Administration of Turkey (TOKİ) proposed a residential area with some commercial use for the area in 2010 and the plan that TOKİ prepared was approved by MoEU. Although the annulment action filed by the UCTEA Chamber of Urban Planners Istanbul Branch over the 6th Administrative Court was rejected, it was overturned by the 6th Chamber of the Council of State in 2014. In 2015, the UCTEA Chamber of Urban Planners Istanbul Branch filed a lawsuit against Sarıyer Municipality through the 12th Administrative Court, since the plot was within the borders of the district of Sarıyer. In 2017, the appeals were dismissed. Meanwhile, construction continued by Emlak Konut Real Estate Investment Company and Ağaoğlu Group of Companies. Since the district boundaries were changed in the process, the UCTEA Chamber of Urban Planners Istanbul Branch filed a lawsuit against Şişli Municipality through the 4th Administrative Law Office of the Istanbul Regional Court in 2018 (Court Case File-2; Biçer, 2013). The project started in 2012 and was completed in 2016 (Megaİstanbul, 2021).

Figure 8. Military area, 2006 Google earth image (left), Maslak 1453, 2021 Google earth image (right).

Case-3: Transformation from Ali Sami Yen Stadium to Torun Center

Change in land utilization: Case-3, located in MFBs of Istanbul, presents an example of the transformation of a recreational fringe belt plot into a commercially-dense residence area. That fringe belt plot, whose fixation line was the highway following first Bosporus bridge of the city, has been used as a football field since 1936 as public land. Galatasaray Sports Club stadium was built on the land in 1964. This case is an example of fringe belt migration aside from alienation, since the existing fringe belt use has been transferred, or migrated in another say, to another place within the same city. *Configurational changes*: The building coverage of the plot increased to FAR 2.50. After the presence of a sports arena, the height of the new construction changed the plot and building relationship radically. *Property transformation*: The plot of the stadium was public land and rented to the sports club until 2007. It was sold to Torun REIC during the construction process of the new project

DOI: 10.15320/ICONARP.2022.222

(Figure.9). It turned from sole proprietor to multi-proprietor. *Agent relations in the transformation phase*: TOKİ purchased the land in return for a new stadium to be built in another location of the city for the land whose usage rights were leased until 2007 (Megaİstanbul, 2021). The first plan made in the same year was canceled in 2009, upon the objections of reducing the precedent in the plan from 3 to 2.5, and the UCTEA Chamber of Architects Istanbul Branch, upon objections that the proposed functions were provided in Mecidiyeköy. TOKİ prepared the zoning plans in 2010 and went out to tender. The tender, which started with the partnership of two construction companies, was transferred to Torun REIC, which was later included. The UCTEA Chamber of Urban Planners Istanbul Branch filed an action for an annulment through the 7th Administrative Court, but it was not accepted. Construction of the new project started in 2012 and was completed in 2016. Although the UCTEA Chamber of Urban Planners Istanbul Branch applied to the 6th Chamber of the Istanbul Council of State to reverse the decision, it was not accepted (Court Case File-1; Gürkan Yılmaz, 2014).

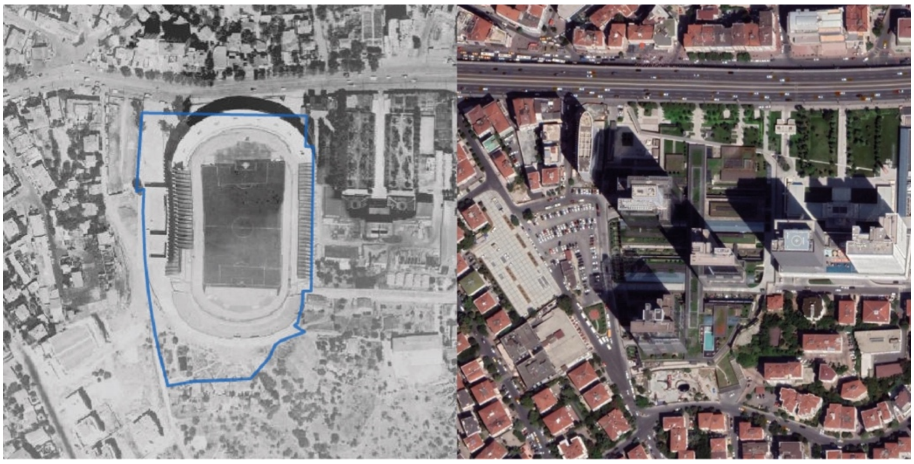


Figure 9. Ali Sami Yen Stadium, 1966 satellite image (left), Torun Center, 2022 Google earth image (right).

Case-4: Transformation from the 17th Regional Directorate of Highways to Zorlu Center

Change in land utilization: Case-4 refers to the alienation of a fringe belt plot in institutional land use by changing it into a commercial-dominated residential area. The land began to be used as the General Directorate of Highways in 1972 and transformed into a commercial center with residences and business centers (Figure.10). *Configurational changes*: This plot, which is surrounded by the street on two sides, points to a medium-sized but amorphous form like the other examples. It is seen that the parcel has reached the maximum level in terms of building occupancy compared to before the transformation. In the field, FAR has increased to 2.80 from ~0,15. *Property transformation*: It was public land which is changed into a private one with the multi-proprietor. *Agent relations in the transformation phase*: The area ceased its initial function in 2004 and was put out to tender by the Privatization Administration in 2007 on behalf of the General Directorate of Highways. Zorlu Property won the tender (Megaİstanbul, 2021). Architecture and urban design competitions were opened for the project to be built on the land. Emre Arolat Architects and Tabanlıoğlu Architects won the competition. As a result of the lawsuit filed in 2008 by the UCTEA Chamber of Surveying Engineers, the UCTEA Chamber of Civil Engineers, and the UCTEA Chamber of Architects with a request for cancelation of the plan on the grounds that protecting the historical values of the Bosphorus and limiting the structures that will increase the population density in this area, the construction was stopped for a while. However, the stay of execution decision was revoked by the Council of State Administrative Litigation Departments as a result of the objection of Zorlu Property. The UCTEA Chamber of Urban Planners Istanbul Branch also filed lawsuits against Beşiktaş Municipality due to both unlawful practices and also the annulment of the zoning plan amendment. In 2007, the UCTEA Chamber of Urban Planners Istanbul Branch filed a lawsuit against the Privatization Administration for the cancellation of the zoning plan, through the 6th Chamber of the Council of State, and an annulment decision was made. Although the plan was decided to be canceled, the Council of State Administrative Litigation Chambers reversed that decision on the grounds that it was not inconsistent with the public interest (Court Case File-4; Sudaş, 2014). Hence, Zorlu Center was opened in 2013 (Megaİstanbul, 2021).

Figure 10. The 17th Regional Directorate of Highways, 1982 satellite image (left), Zorlu Center, 2022 Google earth image (right).

The flow of agent relations examined in the transformation process includes many back-and-forth processes. This attests to the conflict of many agents' pressure on the transformation in urban lands and the particular extent of resistance from the side of the chamber of professions. All case studies have some common features. The first of these is that the ownership changes from public to private companies or individuals. Central government bodies, like ministries and TOKİ, became the facilitator of the changing demand for urban land. The second is that local authorities were not strong enough to manage the transformation processes in their cities if the decision was made by the central government, who is the primary agent of the processes. While professional chambers seek the public interest and planning ethics, in most cases court decisions seem to be far away from the right to the city.

DOI: 10.15320/ICONARP.2022.222

Case studies also indicate that the constructions were completed despite the appeal cases filed and even the stay of execution in most of the cases. Third, due to the housing types appealing to the high income groups, the FAR of the plots increased and land ownership has changed with the sales transactions carried out through the revenue-sharing model.

Unveiling Morphological Agency Networks

As Healy (1994) states the private sector has needed the public sector as a developer and planning regulator to ensure development opportunities in the United States since the 1980s (Healy, 1994). This also applies to Turkish practices. In Istanbul since the 2000s, negotiations with land developers create obligations for large-scale projects to provide off-site infrastructure areas directly on-site and to legalize or resolve legal issues associated with mega projects in Türkiye (Türk, 2018). In the case studies, negotiable-developer obligations are a common characteristic. Nevertheless, all processes between cases are not the same. The transformation process in case-1 is longer than in the other cases. Case-2 differs by the occupation of an area where there was no construction before and not predicted to be found. In case-3, migration of the initial use of the fringe belt plot is a specific situation.

In this part, the agents in the cases are examined first by grouping the agent roles and then by creating an agency network analysis. In a series of studies edited by Larkham and Conzen (2014), morphological agencies as enlarging the cause-effect relationship in urban form problems were discussed within the historical periods from the pre-modern to the postmodern era. Especially, Kropf (2014) underlines the theoretical frame of the agency in the built environment considering its relationality and sociality. He grouped the roles of the agents as follows: motive agents who drive the proposal for transformation, generative agents who make proposals for change, regulatory agents who control the proposal, resistive agents who oppose the proposal, and sensory agents who have affected by or have the rights on the property (Kropf, 2014). Though there is a permeability between them, not an absolute sharpness, the agent profile in this research range from central to local governments as generative and regulatory agents, private property owners and developers as motive agents, NGOs and professional chambers as resistive agents, and eventual land owners and urbanities as sensory agents. Each of the four examples is classified according to Kropf's categorization of agencies (Table.2).

The analysis indicates that motivated and resistive agents are practically the same for each case. Generative agents are similarly private companies with different identities. The central government is among the regulatory agents in case-1 and case-2, while municipalities seem more operative in case-3 and case-4. Sensory agents show the initial and latest owners of the properties.

Table 2. Agent roles in case studies, prepared by the authors

Agent Roles	Case Codes			
	Case-1	Case-2	Case-3	Case-4
Motive agents	The Union of Chambers and Commodity Exchanges of Turkey, Mass Housing Development Administration of Turkey (TOKİ)	TOKİ	TOKİ	The Privatization Administration of Turkey
Generative agents	Kalkavan Construction, Hasan Sever Construction, Gül Construction	Ağaoğlu Group of Companies, Sarıyer Municipality, Emlak Konut Real Estate Investment Company	Aşçıoğlu Construction, Torunlar REIC, Kapicioglu Construction, Emre Arolat Architect	Zorlu Property, Aktürk Consturciton, Emre Arolat Architects, Tabanlıoğlu Architects
Regulatory agents	Ministry of Environment and Urban Planning (MoEU), the 4th Administrative Court	MoEU, the 6th Administrative Court, the 12th Administrative Court, the 4th Administrative Court	TOKİ, Sarıyer Municipality, Şişli Municipality, the 6th Chamber of the Council of State, 7th Administrative Court	Istanbul Metropolitan Municipality, Beşiktaş Municipality, the 6th Chamber of the Council of State, the Council of State Administrative Litigation Chambers
Resistive agents	The UCTEA Chamber of Urban Planners Istanbul Branch	The UCTEA Chamber of Urban Planners Istanbul Branch	The UCTEA Chamber of Urban Planners Istanbul Branch	The UCTEA Chamber of Urban Planners Istanbul Branch, the UCTEA Chamber of Architects, the UCTEA Chamber of Civil Engineers, the UCTEA Chamber of Surveying Engineers
Sensory agents	Meat and Fish Institution, the Union of Chambers and Commodity Exchanges of Turkey	Ağaoğlu Group of Companies, Military administration, New house and shop owners	Torunlar Construction, Galatasaray Sports Club, New house and shop owners	The General Directorate of Highways, Zorlu Property, New house and shop owners

In addition to similarities and differences in the cases, a network analysis was applied to understand the intra-case relationships and to discover the connection among same agents in different cases. Network analysis is a tool for observing social structure and relations. The theory also contains terminologies such as the “range” which represents the number of connections of an agent, the social circle in which each of the agencies is linked to others, and the “content”, which means the type of connections (Emirbayer & Goodwin, 1994). All agents involved in the cases were expressed in their roles as outlined. Nevertheless, the interventions of non-governmental organizations or banks that funded the transformation processes are not included in the analysis.

Agents with multiple roles were also displayed. While creating a classification and network analysis according to the agent roles for

DOI: 10.15320/ICONARP.2022.222

discussed cases, three types of actor statuses are also considered. They are public bodies, private companies, and associations. The relationship within each case was expressed by a separate legend, as connection lines. Figure.11, clarifies the relations among the agents discovered for each case. Considering all the cases together, the Environment and Urban Ministry, TOKİ, the UCTEA Chamber of Urban Planners Istanbul Branch, and 4th and 6th administrative courts, which were active in more than one case, were identified as the agencies with the highest range.

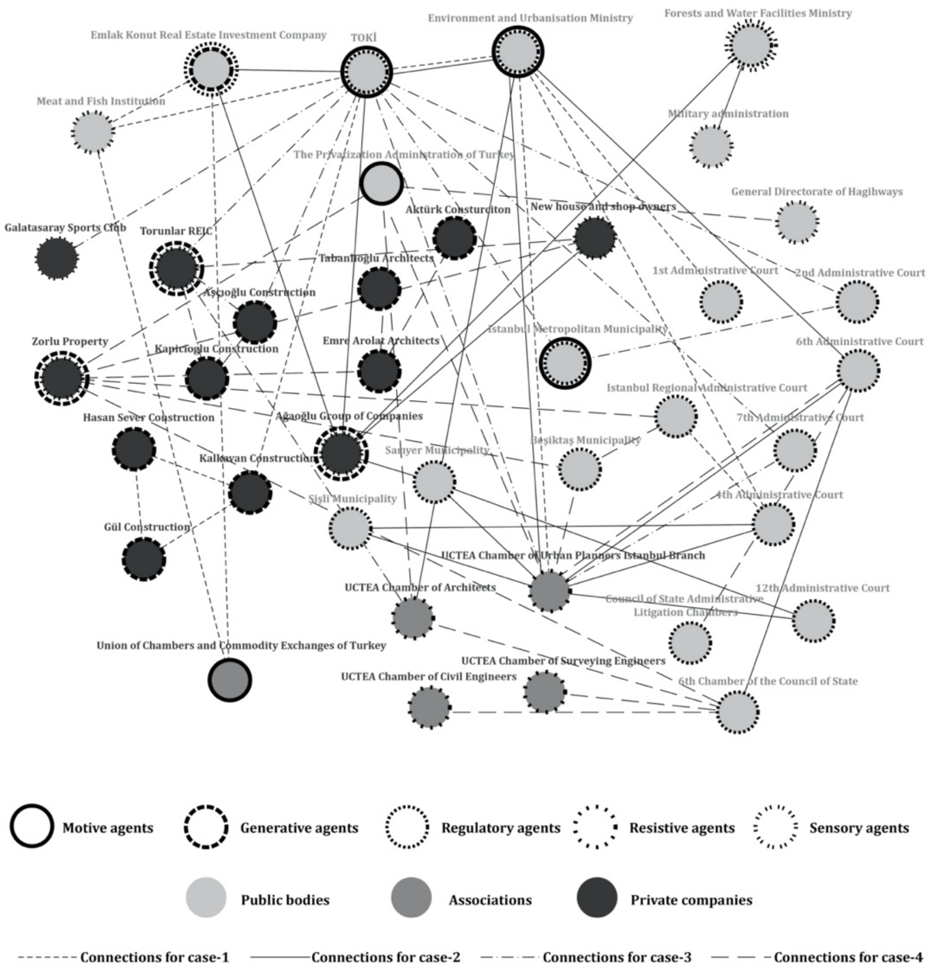


Figure 11. Agency network of the case studies.

In cities managed with a rent-oriented approach, the high land values stemming from their central location cause the transformation of urban land into housing areas for high-income classes, business centers or chain stores by pushing and even breaking the limits of the existing zoning plan decisions. This proposition is confirmed in the Istanbul study, which shows that fringe belt alienation eliminates even the agents who struggle to take legal actions against the violation of planning principles and legislation.

CONCLUSION

Transformations are unavoidable in the cities. However, why and how the urban land transforms can be examined through perspective on urban morphology including the agency conceptualizations. This study is carried out to shed fresh light on the understanding of the role of morphological agents in the process of urban change, fringe belt alienation in particular. The outcomes can be summarized in the following three points. First, the city of Istanbul was revealed to have inner, middle, and outer fringe belt areas. Some of these areas were alienated as expected from a continuously developing megacity. The analysis clarified that despite its constant and rapid change dynamics, the fringe belt areas remain in Istanbul. Most of the IFB areas have been modified without losing their fringe belt character. The historical structure of the city was significant for decision-makers in that situation. Therefore, residential or commercial-oriented development is considered for the new centers planned in the MFBs of Istanbul rather than the IFBs. Nevertheless, this is not true for all cases, as can be seen from case-1.

Second, the plot development cycle for alienated fringe belt areas is an indication of the second development cycle of the plots. The second plot development cycle will last much longer than the first cycle, as the property structure changes into both private ownership and multi-proprietor, unless, of course, various disasters with devastating consequences occur. This raises the issue of whether the permanence of morphological elements can be determined as typical to the city when development cycles of plot series in residential areas and in fringe belt plots are considered together.

Finally, agent motivations appear as one of the debatable results of this research. In Istanbul, the period between 1980 and the middle of the 2000s can be interpreted as the period when capital gained strength with spatial production. Decision-makers focused on the rise of land value for economic development in the cities. Although privatizations intensified in this period, the urban plans and the case studies prove that, especially after 2008, following the economic crisis, the neoliberal practices, where the urban land became more easily marketable for more rent, became more severe. The international capital's strong interest in Istanbul, especially in the periphery plot transformations that took place in the period until the economic crisis between 2004-2008, resulted in the cooperation of local and central administrations, which were the supporters of the transformation and led by the same political backgrounds. The government agents play the same roles in the selected cases. This situation is theoretically acceptable. However, while the role that the government agents take can be converted to the benefit of the entire public, the plan and privatization of the residential areas that appeal to commercial or high-income segments are made by the private sector. If the change is not resistible, public lands should be regenerated to serve all citizens equally and in a sustainable way. Clearly, the struggles and interventions of semi-governmental institutions or non-governmental organizations that monitor urban practices did not yield results. The solution may be to be more demanding on legal processes and those who carry them out. Urbanities should be more active in asking

DOI: 10.15320/ICONARP.2022.222

about their rights to all institutions responsible for providing services to them in the city where they live, especially in publicly-owned areas that they have the right to use equally.

The study has the potential to provide more comprehensive inferences with different analyzes that will reveal the relationship of alienated plots with the surrounding urban texture. For instance, inventions and assessments on multi-nuclei cities (Ünlü & Baş, 2017; Kubat 2019); space syntax method, in which accessibility and integration values to the CBD, or to fixation lines such as the shores can be examined at the street network (Topçu & Kubat, 2009); or morphological regionalization as a major concept of Conzenian tradition, that is based on the relation among homogenous urban forms (Küçük & Kubat, 2014) can be used to discuss the correlation between the explored transformations on plot and the urban pattern in which the plot belongs. Moreover, this research presents a representative response to who shapes the city, and who changes it. The question of why the identified agents shape and change the city requires additional analyses of the agent motivations. A more complete explanation of agent behaviors would denote the reasons behind all the back-and-forth in court decisions during the transformation process in fringe belt plots. The methodology designed for this study can be the first step for further investigations.

ACKNOWLEDGEMENTS/NOTES

This paper was produced from the Ph.D. thesis of Ezgi Küçük Çalışkan, under the supervision of Prof. Ayşe Sema Kubat at Istanbul Technical University, Urban and Regional Planning Ph.D. Program.

We would like to offer our special thanks to Prof. Tolga Ünlü and Prof. Şevkiye Şence Türk for their valuable contributions to this study. We would also like to express our gratitude to the referees who shared their meaningful suggestions and corrections and to Burcuhan Şener and Damla Özden for proofreading the manuscript.

REFERENCES

Barke, M. (1976). Land use succession: a factor in fringe-belt modification. *Area, 8*, 303-6.

Barke, M. (1990). Morphogenesis, fringe belts and urban size: an exploratory essay. In T. R. Slater (Eds.), *The built form of Western cities Leicester* (pp. 279-99), University Press, Leicester.

Biçer, S. (2013, January 10). Mücella Yapıcı Maslak 1453 Projesi'ni Anlatıyor. Arkitera. Retrieved from https://www.arkitera.com/haber/mucella-yapici-maslak-1453-projesini-anlatiyor/

Conzen, M. R. G. (1960). *Alnwick: Northumberland: a study in town-plan analysis*. Institute of British Geographers Publication 27. London.

Conzen, M. R. G. (1969). *Alnwick, Northumberland: a study in town-plan analysis*. Institute of British Geographers Publication 27, 2nd edn (Institute of British Geographers, London).

Conzen, M. P. (2009). How cities internalize their former urban fringes: a cross-cultural comparison. *Urban Morphology, 13*(1), 29-51.

Court Cases File-1. TMOBB Şehir Plancıları Odası İstanbul Şubesi. Ali Sami Yen Dava Dosyası, 2010-1444. Accessed: 27.07.2021.

Court Cases File-2. TMOBB Şehir Plancıları Odası İstanbul Şubesi. Maslak 1453 Ayazağa GÖB Ruhsat İptali 2015-1354 – Suç Duyurusu Dosyası, 2015-149584. Accessed: 27.07.2021.

Court Cases File-3. TMOBB Şehir Plancıları Odası İstanbul Şubesi. Zeytinburnu 774 Ada 51 Parsel Dava Dosyası. Accessed: 27.07.2021.

Court Cases File-4. TMOBB Şehir Plancıları Odası İstanbul Şubesi. Zincirlikuyu Karayolları Arazisi Dava Dosyası, 2007-4056. Accessed: 27.07.2021.

Çalışkan, O., Mashhoodi, B. (2017). Urban coherence: a morphological definition. *Urban Morphology, 21*(2), 123-141.

Ducom, E. (2005). Fringe belts in French cities: Comparative study of Rennes, Nantes, Tours. Approaches in Urban Geography, Newcastle Upon Tyne, Northumbria University Publication.

Emirbayer, M. & Goodwin J. (1994). Network analysis, culture, and the problem of agency. *American journal of sociology, 99*(6), 1411-54.

Gu, K. (2014). Morphological Process, Planning, and Market Realities: Reshaping the Urban Waterfront in Auckland and Wellington. In P. J. Larkham & M. P. Conzen (Eds.), *Shapers of Urban Form: Explorations in Agency* (pp. 267-284), Routledge, New York.

Günay, B. (1999). *Property Relations and Urban Space*. Ankara: METU Faculty of Architecture Press.

Gürkan Yılmaz, E. T. (2014, September 8). Torun Center: Bir Kent Suçu Örneği. Arkitera. Retrieved from https://www.arkitera.com/haber/torun-center-bir-kent-sucu-ornegi/

Healey, P. (1994). Urban policy and property development: the institutional relations of real-estate development in an old industrial region. *Environment and Planning A, 26*, 177-198.

Hazar, D., Kubat, A. S. (2015). Fringe belts in the process of urban planning and design: Comparative analyses of Istanbul and Barcelona. *ITU A|Z, 12*(1), 53-65.

Kubat, A. S. (2019). Exploring the Fringe-Belt Phenomenon in a Multi-Nuclear City: The Case of Istanbul. *ICONARP, 7*, Special Issue, 95-134.

Kundakçı, O. (2014, September 30). Siluete yeni hançer yargıda. Birgün. Retrieved from https://www.birgun.net/haber/siluete-yeni-hancer-yargida-69304

Küçük, E. & Kubat A. S. (2014). Transformation of Urban Blocks and Property Relations: Cases from Historical Peninsula. In Oliveira V, Pinho P, Batista L, Patatas T and Monteiro C (Eds.). Proceedings of the 21st International Seminar on Urban (ISUF), Our common future in Urban Morphology. Vol.2, FEUP, 466-483.

Küçük Çalışkan & E., Kubat, A. S. (2021). Policies and facts for mega-urbanization: middle and outer fringe belt developments of Istanbul. ISUF 2020 Virtual Conference Proceedings, 1. Retrieved from https://epubs.utah.edu/index.php/ISUF2020/article/view/4266

Kropf, K. (2014). Agents and Agency, Learning and Emergence in the Built Environment: A Theoretical Excursion. In P. J. Larkham & M. P. Conzen (Eds.), *Shapers of Urban Form: Explorations in Agency* (pp. 303-322), Routledge, New York.

Larkham, P. J. & Conzen, M. P. (Eds.). (2014). *Shapers of Urban Form: Explorations in Agency*. Routledge, New York.

DOI: 10.15320/ICONARP.2022.222

Lefebvre, H. (2009). *State, Space, World: Selected Essays*. (N.Brenner & S.Elden Eds.). University of Minnesota Press, Minneapolis.

Le Fort, B. & De Visscher, J. P. (2020). Typo-morphological diversity and urban resilience: a comparative study of three heterogeneous blocks in Brussels. *Urban Morphology, 24*(1), 70-94.

Megaİstanbul. (2021, June 19). https://megaprojeleristanbul.com/

Remali, A. M. & Porta, S. (2017). Street networks and street-blocks in the city centre of Tripoli. *Urban Morphology, 21*(2), 161-179.

Scheer, B. C. (2016). The epistemology of urban morphology. *Urban Morphology 20*(1), 5-17.

Sudaş, İ. (2014, August 20). Zorlu Holding Metrekareye Doymadı!. Arkitera. Retrieved from https://www.arkitera.com/haber/zorlu-holding-metrekareye-doymadi/

Şengül, H. T. (2001). *Kentsel Çelişki ve Siyaset – Kapitalist Kentleşme Süreçleri Üzerine Yazılar*. WALD, İstanbul.

Tekeli, İ. (2013). *İstanbul'un Planlamasının ve Gelişmesinin Öyküsü*. Tarih Vakfı Yurt Yayınları, İstanbul.

Topcu, M. & Kubat, A. S. (2009). The Analysis of Urban Features that Affect Land Values in Residential Areas. Proceedings of the 7th International Space Syntax Symposium. Stockholm.

Topçu, M. & Southworth, M. (2014). A comparative study of the morphological characteristics of residential areas in San Francisco. *ITU A|Z, 11*(2), 173-189.

Türk, Ş. Ş. (2018). Comparison of the impacts of non-negotiable and negotiable developer obligations in Turkey. *Habitat International, 75*, 122-130.

Ünlü, T. (2013). Thinking about Urban Fringe belts: A Mediterranean Perspective. *Urban Morphology, 17*(1), 5-20.

Ünlü, T. & Baş, Y. (2017). Multi-nuclear growth patterns in a rapidly changing Turkish city: a fringe-belt perspective. *Urban Morphology, 20*(2), 107-21.

Whitehand, J. W. R. (1988). Urban fringe belts: development of an idea. *Planning Perspectives, 3*(1), 47-58.

Whitehand, J. W. R. & Morton, N. J. (2003). Fringe belts and the recycling of urban land: an academic concept and planning practice. *Environment and Planning B: Planning and Design, 30*, 819-39.

Whitehand, J. W. R. & Morton, N. J. (2004). Urban morphology and planning: the case of fringe belts. *Cities, 21*(4), 275-289.

Whitehand, J. W. R. & Morton, N. J. (2006). The fringe belt phenomenon and socioeconomic change. *Urban Studies, 43*, 2047-66.

Whitehand, J. W. R. (2019). Green space in urban morphology: a historico-geographical approach. *Urban Morphology, 23*(1), 5-17.

Zhang, J. (2015). Urban morphological process in China: a Conzenian approach. *Urban Morphology, 19*(1), 35-56.

Resume

Ezgi KÜÇÜK ÇALIŞKAN completed her undergraduate education in the Department of City and Regional Planning at Izmir Institute of Technology between 2007-2011, and then received her master's degree in Urban Design at Istanbul Technical University (ITU) in 2014. She is currently working towards her doctorate degree in Urban and Regional Planning Ph.D. Program at ITU. In her thesis, she focuses on property relations in Istanbul's fringe belt areas. She continues her academic research in the Turkish Network of Urban Morphology (TNUM). Küçük Çalışkan has been working as the Urban Planning Coordinator at

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

the Marmara Municipalities Union (MMU). She is also the Director of the MMU Urban Policy Center and the editor of Şehir & Toplum journal.

Prof. Dr. Ayşe Sema KUBAT has degrees of B. Arch, M. Arch, and Ph.D. in Urban Design & Urban Planning from Istanbul Technical University (ITU). She worked as a Professor in the Faculty of Architecture, Department of City and Regional Planning of ITU between 1996 and 2022. Her assistance and cooperation to the research project entitled 21st Centre of Excellence for Sustainable Urban Regeneration (cSUR) (2003-2008) is appreciated as "Honorary Fellow of Global Center of Excellence'' at Tokyo University. Dr. Kubat is the Chair of the Turkish Network of Urban Morphology (TNUM). She has been serving on the Steering and Refereeing Committees of the Space Syntax Symposiums since 2003. She was the chair of the 6th International Space Syntax Istanbul Symposium in June 2007, and the chair of the 2nd Local Conference of TNUM in 2018 at ITU, Istanbul. She continues to contribute to various urban studies as a professor emerita.

DOI: 10.15320/ICONARP.2022.222

Research Article

ICONARP
International Journal of Architecture and Planning
Received: 19.10.2021 Accepted: 05.10.2022
Volume 10, Issue 2/ Published: 20.12.2022
DOI: 10.15320/ICONARP.2022.223 E- ISSN:2147-9380

ICONARP

Determining UHI Effect by Remote Sensing Method in Bolu City Centre, Turkey

Kıymet Pınar Kırkık Aydemir*
Gamze Kazancı Altınok**
Ömer Ünsal***

Abstract

Urban Heat Island (UHI) has been described by authors as the UHI effect is among the most common forms of human origin (anthropogenic) local climate change. The increasing UHI effect with the differences in land use and landscape pattern varies depending on surface soil, watery field presence and vegetation. In this study, using Landsat 5 TM of 1994 and Landsat 7 ETM+ images of 2019, the ArcGIS 10.6.1 program and the remote sensing methods have identified surface temperature and vegetation distribution. Surface temperature values of the land-use in Bolu province of 2019, 1/5000 Urban Development Plan land uses and average temperature values were determined. The study revealed the change between urban development and the effect of land surface temperature over the course of 25 years, and discussed the UHI effect in the Bolu province. The effects of the historical process in Bolu city center on land surface temperature (with LST differences) and vegetation distribution (Normalized Difference Vegetation Index; NDVI) have been surveyed. The constraints of this study are that the spatial resolution in orthophotos of 1994 is low, and the type of land-use temperature data cannot be compared to 2019. For this reason, LST and NDVI analyzes were conducted in 1994 orthophotos, classifying all parcels with structure and related area in the form of manually constructed areas (built Environment). One of the findings of this study are surface temperatures of areas used as farmland in the year 1994 data reached higher values after they quickly began to urbanize in Bolu. The main reason for the high surface temperature in the Bolu province over the 25-year period is that agricultural areas are impurized and increasing population density and the albedo effect. It has been concluded that the lack of green space and lack of vegetation in the continuous urban area has increased the UHI effect.

Keywords:
Urban Heat Island (UHI), LST, NDVI, GIS, Bolu.

*Faculty of Architecture, Bolu Abant İzzet Baysal University, Bolu, Türkiye (*Corresponding author*)
Email: kiymetpinar.aydemir@ibu.edu.tr

**Faculty of Architecture, Istanbul Technical University, Istanbul, Türkiye
Email: kazancig17@itu.edu.tr

***Social Sciences Institute, Istanbul University, Istanbul, Türkiye
Email: oomer.unsal@gmail.com

To cite this article: Kırkık Aydemir, P., & Kazancı Altınok, G. (2022). Determining UHI Effect by Remote Sensing Method in Bolu City Center, Turkey. *ICONARP International Journal of Architecture and Planning,* 10 (2), 735-758. DOI: 10.15320/ICONARP.2022.223

INTRODUCTION

The Urban Heat Island (UHI) is defined as a condition that prevents the view of the sky during the day, resulting from the absorption of overnight wavelength radiation and the retention of sun heat in the ground surface and structure (Oke, 1973; Montávez et al., 2000). The concept of urban heat island was first identified by Luke Howard in London, England in 1820 (Streutker, 2003). From 1900 onwards, the surface temperature discussed by various researchers and defined as the UHI is based on changes in land cover in cities. The UHI effect is among the most common forms of human-origin (anthropogenic) local climate change (Oke, 1973; Montávez et al., 2000). It differs depending on the construction of the layout in each city. In particular, the increased built-up areas, the excess conductivity and heat storage of the building materials used in recent years increase the visibility of temperature differences. Therefore, the temperature in dense-residential areas is observed several degrees higher than in rural areas (due to local atmospheric aeorosol concentration rise) (Oke, 1988; Wilby, 2007; Parker, 2010; Peker & Aydın, 2019).

The increased UHI effect with the differences in land-use and landscape pattern varies depending on surface soil, water content, and vegetation (Owen et al.,1998; Jianjun et al., 2005; Wu et al., 2014; LIN & LIN, 2016). The Intergovernmental Climate Change Panel (IPCC), which was held on 2014, the fifth report states that the main reason for the rising temperature since the beginning of the 20th century is the increase in emissions and greenhouse gas concentrations from human activity, emphasizing the relationship between population growth and propagating urban understanding with energy consumption patterns (Peker & Aydın, 2019). Therefore, there are many factors in cities that increase the UHI effect. The UHI and the components that affect the urban climate as indicated by Oke (1988) can be seen below:

•Urban geometry (the geographical location of the layout, distance, street widths and areas between the building dimensions,)

• Urban cover/surface cover (structured/tiled surfaces, vegetable surfaces, soil surfaces, water surfaces, bare surfaces)

• Urban fabric/building materials (construction and natural materials)

• Urban metabolism (heat, water and contamination due to human activity).

The urban geometry, expressed in the form of occupancy-spaces, formed by the surrounding area directly influences wind corridors and energy flow in the city (Oke, 1988). For example, the proximity between uncontrolled growth and structures in a dense, built-up environment with high-rise structures increases surface temperature (UHI effect) as it reduces atmospheric heat dissipation by changing wind speed and direction due to lack of green space. In addition, anthropogenic heat as the sum of the excess energy used in the transportation service and industry in heating and cooling activities in the urban area, may vary

DOI: 10.15320/ICONARP.2022.223

depending on the city's population and local climate conditions (Munn, 2002). The geographical location of the settlement directly affects local climate, and the sun determines the heat reaching the surface in the interaction between wind and cloud cover making an impact on the UHI (Zhao et al., 2016).

In terms of urban cover/surface cover the excess of built-up areas is impermeable and the coated surface ratio is higher than rural causing more solar radiation in urban areas to accumulate more heat than the natural ground of tar-covered or asphalt surfaces and the UHI effect in cities to rise (Chatzidimitriou & Yannas, 2017; Gómez et al., 2013). Therefore, the main reason for high temperatures in urban centers compared to periphery is the specified energy flow change (Graves et al., 2001; Wilby, 2007).

The texture of urban fabric/building materials that affect the formation of UHI in cities directly affects the proportion of thermal radiation, reflection and heat capacity of the preferred materials in urban areas as well as the storage and reflection of solar energy on the surfaces (Heyer, 1992). In this case, known as the Albedo effect, surfaces ranging from 0-1 include the capacity to reflect solar energy. As the albedo value approaching 1 increases the amount of energy stored on the surfaces, the UHI effects can decrease (EPA, 2008). Therefore, surfaces with a low albedo value increase the surface temperature in urban areas.

Table 1. Factors affecting UHI

Researchers	Factors
Jianjun *et al.,* 2005; Wu *et al.,* 2014; Lin & Lin, 2016; Owen *et al.,* 1998	Soil, slope, water sources, vegetation
Oke (1988)	Urban geometry, urban cover, urban metabolism
Oke, 1973; Montávez *et al.,* 2000	Land-use change
Liu *et al.,* 2015; Ullah *et al.,* 2022	Urban landscape
Kohl, 1999; Hais & Kucera, 2009; Beltrami, 2005; Luhar, 2006; Yılmaz *et al.,* 2016; Yıldız *et al.,* 2019	Industrial development, population density, topography and meteorology
IPCC, 2014; Peker & Aydın, 2019	Anthropogenic factors, population growth, urban growth

The urban canyon, which is created a morphology of the city, affects heat loss by reducing the view factor of the sky in it. Some researches shows that long structures and narrow canyons reduce the sky aspect factor creating high hot concentrations due to cool day and energy storage at night (McPherson et al., 1994; Bosselmann et al., 1995, Yang et al., 2016; Tonyaloğlu, 2019). Due to low evaporation rate, the UHI effect is increasing as the temperature concentration of cities and regional temperature is affected (Parry et al., 2007). Further research highlights that there is a versatile link between landscape pattern and UHI from the ground to the global scale (Liu et al., 2015; Ullah et al., 2022). Built-up areas and barren terrain increase the UHI effect while green areas and water surfaces reduce the UHI effect (Zhong et al., 2017; Sannigrahi et al., 2017; Ullah et al., 2022). Therefore, the industrial development of a city, population size, topographic status, meteorological conditions and physical macroform have a significant impact on the UHI effect (Kohl, 1999; Hais & Kucera, 2009; Beltrami, 2005; Luhar, 2006; Yılmaz et al., 2016; Yıldız et al., 2019). The factors affecting the UHI are covered by many researchers (Table 1).

As stated in Table 1, the physical structure of cities (such as soil, slope, water sources, vegetation), urban geometry, urban cover/land-use, population density and human activity are key factors that increase the UHI impact. The concepts such as urban climate, urban ecology, urban geography, landscaping and planning are also the focus of research due to the unfavorable effects of cities on urban ecosystems (Amberber et al., 2019). The UHI effect is directly related to the urban temperature and the perceived temperature, affecting urban life as well. The use of energy sources due to the need for additional heating and cooling systems causes the UHI effect to increase (Tomlinson et al., 2011). This also prepares the environment for the formation of high radiation fields, described as "concrete forests". The low wind speed in these areas also increases the temperature differences between urban and rural (Landsberg, 1981; Wilby, 2007). This is the main reason that the temperature felt during the summer months is above the seasonal values (Parry et al., 2007). Due to the high temperatures felt, the city's thermal comfort is deteriorating and poses serious threats to the health of the urban population (Frumkin & McMichael., 2008). The UHI also has negative effects on vegetation development, air and water quality (Zhao et al., 2016). There are many environmental problems in cities that are caused by the UHI effect (Table 2).

Table 2. UHI effects in urban areas

Researchers	UHI impacts
Parry et al., 2007; Landsberg, 1981; Wilby, 2007; Guoxiang vd., 2010; Zhao et al., 2016	Increasing temperatures
Landsberg, 1981; Wilby, 2007	The temperatures differences between urban and rural areas
Tomlinson et al., 2011	Increasing energy consumption
Guoxiang et al., 2010; Zhao et al., 2016	Negative impacts on vegetation, air and water quality
Frumkin and McMichael, 2008	Public health deterioration

As can be seen in Table 2, the rise in temperature leads to temperature differences in urban and rural areas increased energy use and demand, reduced environmental quality and deterioration of public health. Clean energy and zero carbon applications are essential in the energy-intensive workplace (industry, manufacturing, etc.) for reducing the UHI impact (Hunt et al., 2007). The presence of trees and vegetation

DOI: 10.15320/ICONARP.2022.223

in the urban areas helps reduce surface temperatures with the ability to create shadows and reduce the amount of sunlight felt (Gallo et al., 1999; Akbari, 2002).

There are different methods for measuring the UHI effect based on observations grouped as atmospheric and surface heat islands. In the urban cover layer and heat layer, thermometers and air temperature measurements (fixed air stations/mobile stations) are performed, while in the determination of surface heat islands, surface temperature measurements (thermal images) take place using remote sensing methods and thermal images (EPA, 2008). The UHI measurement on the top layer is made from fixed meteorology and mobile stations 2 meters above the ground, heat islands on the boundary layer measured at more than 2 meters, and through measuring towers and balloons instead of mobile stations (Voogt & Oke, 2003). The remote sensing technique, which is learned about lands and sea surfaces covers images from an aerial perspective using beam in one or more areas of the electromagnetic spectrum, in addition to radiated or reflected rays from the earth's surface. This method allows the computational data for the UHI effect resulting in a large number of thermal data at a time (Campbell & Wynne, 2011).

This study identified the change between urban development and the effect of land surface temperature over the course of 25 years by using Landsat 5 TM and Landsat 7 ETM+ images from 1994 and Landsat 2019 to deduct the UHI effect in the Bolu province. The effect of the historical process in Bolu city center on land surface temperature (with LST differences) and vegetation distribution (with Normalized Difference Vegetation Index (NDVI)) has been determined. Accordingly, the objectives of the research are to evaluate the surface temperature and to reveal the relationship between urban development and surface temperature using the remote sensing method.

MATERIAL

Bolu is located 262 km from Istanbul and 191 km from Ankara on the side of the D-100 (E-80) highway connecting Istanbul to Ankara in Turkey. Bolu’s border neighbors are Düzce and Sakarya in the western direction, Çankırı in the east and in the north of Zonguldak and Karabük. Geographically, Bolu is located between the 30°32' and 32°36' east longitude and the 40°06' and 41°01' north latitude (Kaya, 2019). The city center is set up in the Bolu plain, and is limited to two major mountain lanes in the north and south (DPT, 2002).

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

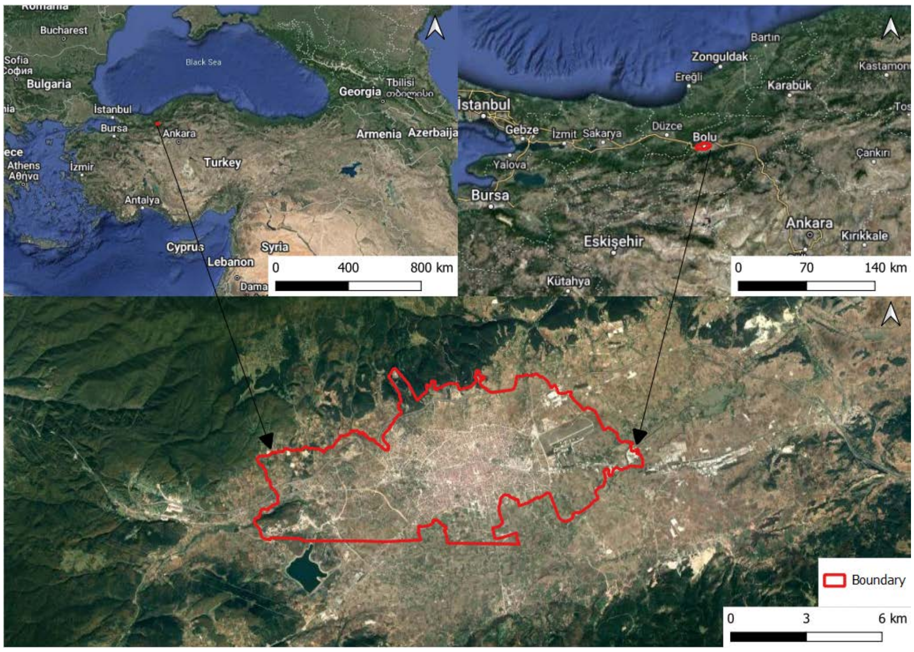


Figure 1. The Case study border and the geographical location of Bolu.

Topographically, the rise in rural settlement is 1460m and falls to 690m in the city center (Figure 2).

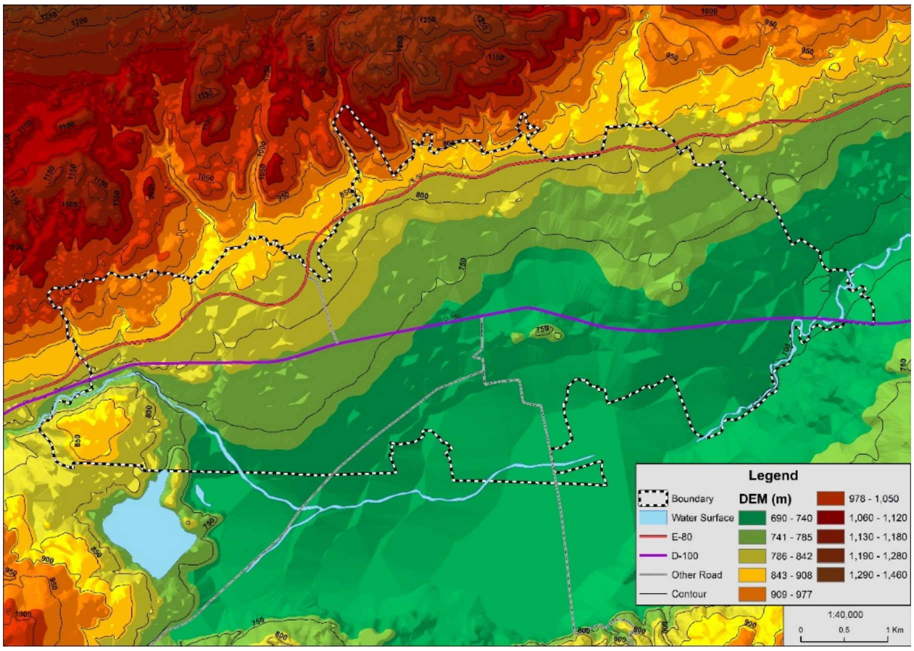


Figure 2. Topographical map of Bolu.

Between 1929 and 2019, the annual temperature in the Bolu city center is known to be the highest 39.8°C in summer and the lowest -31.5°C (Çağlak et al., 2019). In the Bolu province which characteristically reflects the Black Sea climate transitions are seen with the Central Anatolian continental climate. The spring and autumn months are cool and the summer months are under warm stress in Bolu, which has been precipitation almost every year. Between 1929 and 2019, the average temperature in the city was 10.5°C and the wind speed measured in meteorological data was 1.3 m/h (Çağlak et al., 2019). After these general topographic and climatic information about

DOI: 10.15320/ICONARP.2022.223

Bolu, some figures and maps were prepared to understand the relationship between surface temperature and urban development. When preparing these figures and maps, base maps were used. The sources of base maps have indicated here. Figure 1, base maps are obtained from Google. Figure 2, the contours are obtained from General Directorate of Mapping, Ministry of National Defence, Republic of Turkey. From Figure 3 to Figure 11, the satelite images are obtained from Landsat and aerial imagery are obtained from General Directorate of Mapping, Ministry of National Defence, Republic of Turkey.

METHODOLOGY

Firstly, the images of Landsat 5 TM in 1994 (28.07.1994) and Landsat 7 ETM+ from 2019 (10.08.2019) were downloaded in the study. Urbanization process of Bolu, the effects of land surface temperature and vegetation distribution have been determined. To determine surface temperature, the calculation was performed in three stages, expressed in digital values (DN) or brightness values for satellite images by using ArcGIS 10.6.1 and its spatial analyst extension have used to all LST extraction, mapping and analysis processes (Gerçek et al., 2014; Alkan et al., 2017).

*Digital values (DN) are converted to spectral radiance (Lλ) values measured by the satellite. The equation set up for converting pixel values for satellite images to spectral radians is given below.

L λ='gain'*DN+'bias'

That is; Lλ = MLQcal + AL

Lλ= Spectral radians (Watts/(m2 * srad * μm))

ML= Band specific scaling multiplier factor

AL= Band specific scaling summation factor

Qcal = Quantize and calibrated standard pixel values (DN). In order to use the equation, it must be formulated as specified in the equation below.

"Lλ= (LMAXλ - LMINλ Lλ/ Qcal max - Qcal min)*Qcal max - Qcal min + LMINλ"

*In the second phase, after calculating the Spectral radiance value, these values must be converted to the brightness temperature (Kelvin). The equation required for this conversion is given below (Gerçek et al., 2014; Alkan et al., 2017).

"C=K -273.15"

Using the above equation, the LST difference between 2019 and 1994 was revealed. Data containing LST differences is classified in 10 classes according to the Natural Breaks (Jenks) method. Accordingly, hot zones (3.7 to 12.8°C), as the top class have been detected.

The Normalized Difference Vegetation Index (NDVI) maps for both two years were produced for the difference in vegetation in the study. The NDVI index has been developed using the high reflections of vegetations for the energy form of the near infrared wavelength and the high absorption of energy at the red wavelength in the visible region (Doğan et al., 2014). Therefore, NDVI analysis is a proportional expression of the linear relationship between close infrared and red spectral bands. IN the LANDSAT-7 ETM+ satellite, BAND 3 refers to visible red while BAND 4 refers to close infrared. The vegetation gives high reflectance in the close infrared band and low reflectance in the red band. The formula which is given below is used for NDVI value of Landsat TM images (Bonneau et al., 1999; Edwards et al., 1999; ERDAS 2003).

NDVI = (Band 4 - Band 3) / (Band 4 + Band 3)

In the scope of the study, urban and rural/periphery areas were observed using satellite images from both two periods to explain the land-use change between urban development and the effect of land surface temperature during the 25-year period between 1994 and 2019. In this context, orthophotos of two years were provided by the Ministry of National Defense Map General Directorate (2022) including the earliest 1994 years before the 1999 earthquake, which is a breaking point for shaping Bolu city center macroform. Because the 1994 orthophotos was taken with an analogue camera there are no RGB bands and the spatial resolution is lower. Image classification tools were not available due to the resolution difference. After the current cadastral maps of the working boundary are provided as a solution, all parcels with the built environment in 1994-2019 are classified by manually. The rest of the unstructured areas are classified as "Agriculture & Forest, Other" and the types of land, such as agricultural parcels and forests, are mapped. Thus, land use changes have been identified over the last 25 years (Figure 3).

The average temperatures of the land-use classification have been determined by the LST difference data in 2019-1994 and the Urban Atlas classes (Table 2). For this operation, the LST difference map is divided into one degree (such as 22-23 degrees). The data (raster) has been converted to raster data with a decimal value and a raster integer value. The decimal point range values (such as 22.5 degrees) are printed instead of the code values. The re-classification LST difference layer is converted to vector data format via raster to polygon. At the final stage, the Urban Atlas and vector LST differential layer are colliding through union.

DOI: 10.15320/ICONARP.2022.223

FINDINGS AND RESULTS

In order to understand the UHI effect, it is necessary to examine the topographic and morphological structure and spatial formation of Bolu city center as a case study area. The city center is located in the plain between the two mountains and the north and south of the Bolu plain (see Figure 2). Moreover, that the city is located in plain and peripheries are completely surrounded by built-up areas, causing the cooling air in the valley peaks to descend to the center over the slopes. In the city, where wind speed is insufficient, polluted air is accumulated above the city (Bolu ÇŞİM, 2020; Çağlak et al., 2021). The temperature differences between the city center and the periphery also seen in the Bolu city (Çalışkan & Türkoğlu, 2014; Tonyaloğlu, 2019; Toy et al., 2019). The temperature in the city in August, the hottest month in summer, is 30°C, although the temperature in the country is 19°C, the average of 10 years of data from the 17070- Bolu Central meteorological station (at 763 m altitude) and the 17637-Bolu Mountain meteorological station (at 948 m altitude). The temperature difference between the urban and rural areas is also measured at 11°C (Çağlak et al., 2021).

The land surface temperature in the city center varies between 21.5 and 43.3°C as indicated in satellite images (Figure 3) in 1994.

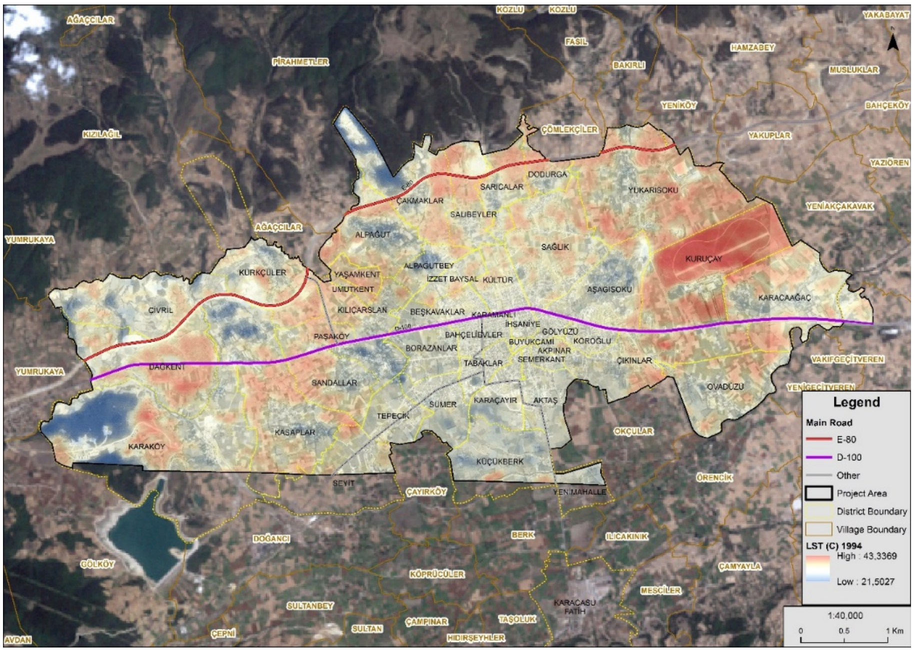


Figure 3. LST map in 1994.

In the 1994 LST MAP, the temperature varies between 22-30 °C in Büyükcami, Gölyüzü, Akpınar, Semerkant, Karamanlı, Karaçayır, Tabaklar, İhsaniye and Aktaş neighborhood forming in the Kuruçay neighborhood, east of the city, the surface temperature reaches 43°C due to agricultural areas and military airports. In the neighborhood of Karaköy, where Bolu Abant İzzet Baysal University was located in 1994, it is seen that the surface temperature is low due to the presence of forestry areas. The temperature rises above 30°C in some places due to increased farmland in the periphery. The surface temperature effect is reduced by the rise in the northwest and south parts of the city, as the green forest cover increases there. Therefore, the LST effect has increased in agricultural areas in 1994. On the other hand, when looking at surface temperature in 2019, it is seen that temperatures rise above 30°C in the Büyükcami, Gölyüzü, Akpınar, Semerkant, Karamanlı Aktaş neighborhood and their peripheries, but surface temperatures change between 25 and 30°C in the Tabaklar, İhsaniye, Karaçayır neighborhoods (Figure 4).

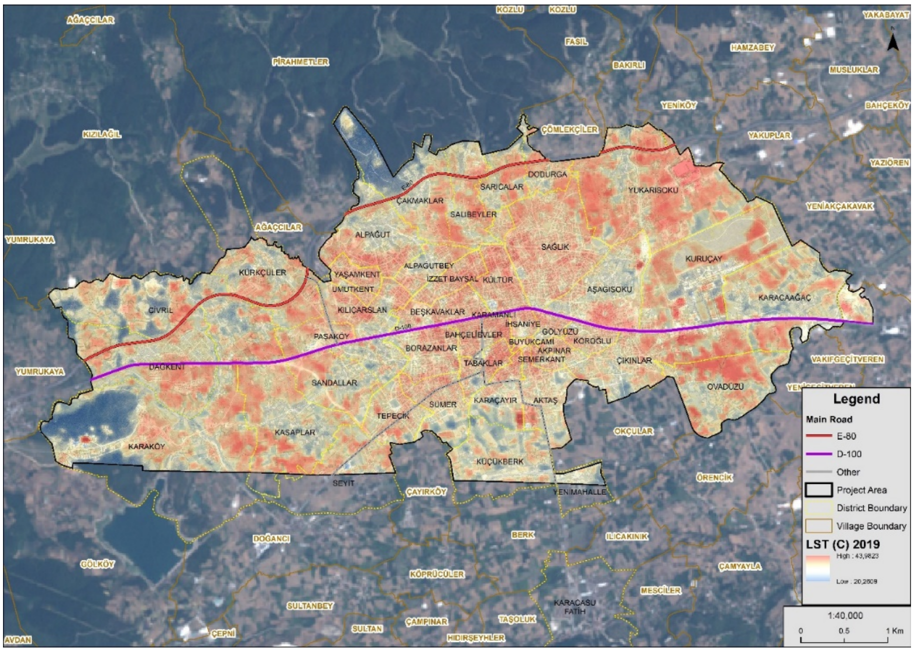


Figure 4. LST map in 2019.

Compared to 1994, the surface temperature in the city center tends to increase. The effect of surface temperature is generally between 25-32°C in the city, given the type of land-use in 2019. In the city, the industrial zone is 32°C, sports and entertainment areas are 31.5°C with the highest surface temperature. In addition, the temperature ranges from 29 to 30°C in agricultural areas south and west of the city. Compared to orthophotos in 1994, forestation and surface temperature at the military airport east of the city tend to decrease. The maximum surface temperature is 29.7°C at the military airport in 2019. The land has been forested in the last 25 years.

In order to track urban development and dense construction in Bolu, and to better understand their impact on urban warming, there is a need for comparison between the past and the present period. The development plan, which is important and effective in the city's spatial development, is dated 1985 (Taner, 2014). According to this plan, the city maintained its agricultural growth until 1990 and expanded with the opening of Abant Izzet Baysal University in 1992 and the construction of housing areas following the 1999 Gölcük-Düzce earthquakes (Taner, 2014). It is emphasized that two major earthquakes -- 1944 and 1999 -- were found in the south, and that they did not show a spread in accordance with the conditions of safe-resilient construction

DOI: 10.15320/ICONARP.2022.223

(Bayar et al., 2017). The most important factor for developing Bolu's macroform is the 1999 earthquake (Bayar et al., 2017). In addition, low-density housing areas increased with construction of Bolu Tunnel on D100 roads and E80 Anatolian Highway in transportation, so the city expanded north, causing urban sprawl (Bayar et al., 2017). The built-environment areas in 1994 are shown in below (Figure 5).

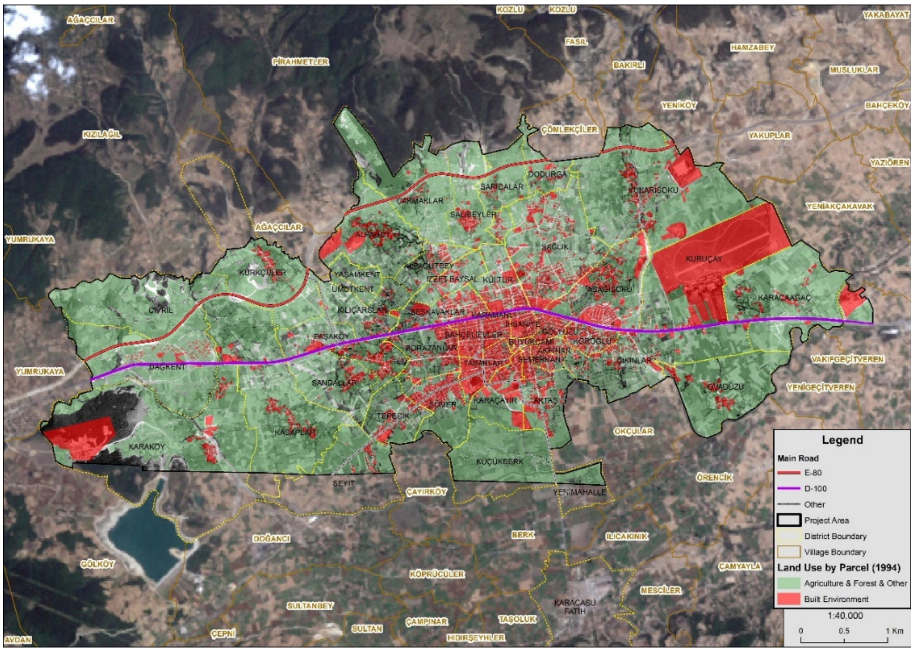


Figure 5. Built environment in 1994.

According to the TUREF TM33 (EPSG 5255) system, the areas that have been constructed for 1994 are 10.96 km2 Figure 5). when the orthophotos of 2019 is examined, the built-up areas have taken up 19.61 km2 areas in total. The built-up areas cover a 30.45% area within the city of Bolu (Figure 6).

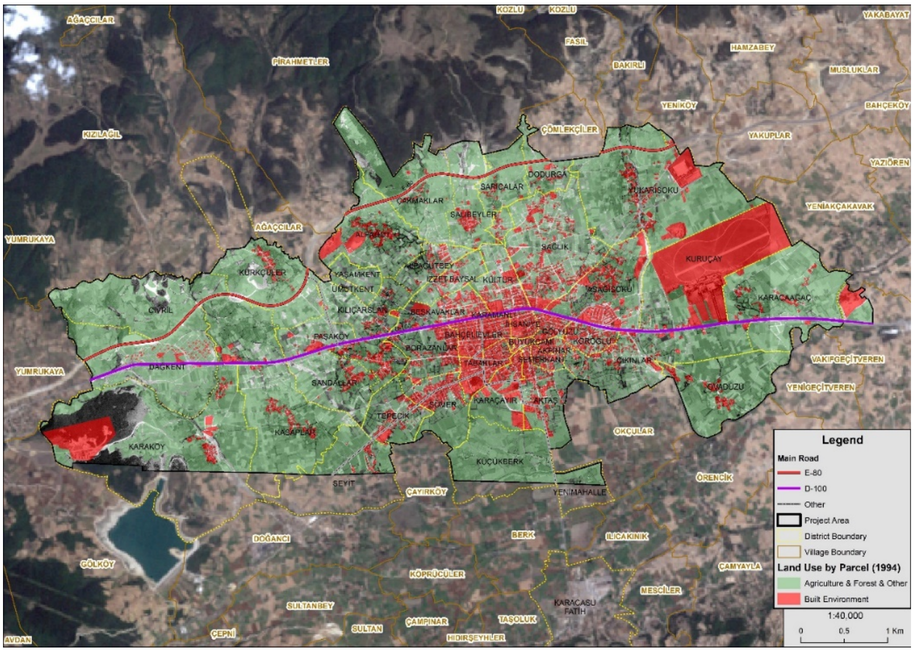


Figure 6. Built environment in 2019.

Areas of built-up expanded during the 25-year growth process are north and west, as seen in Figure 7.

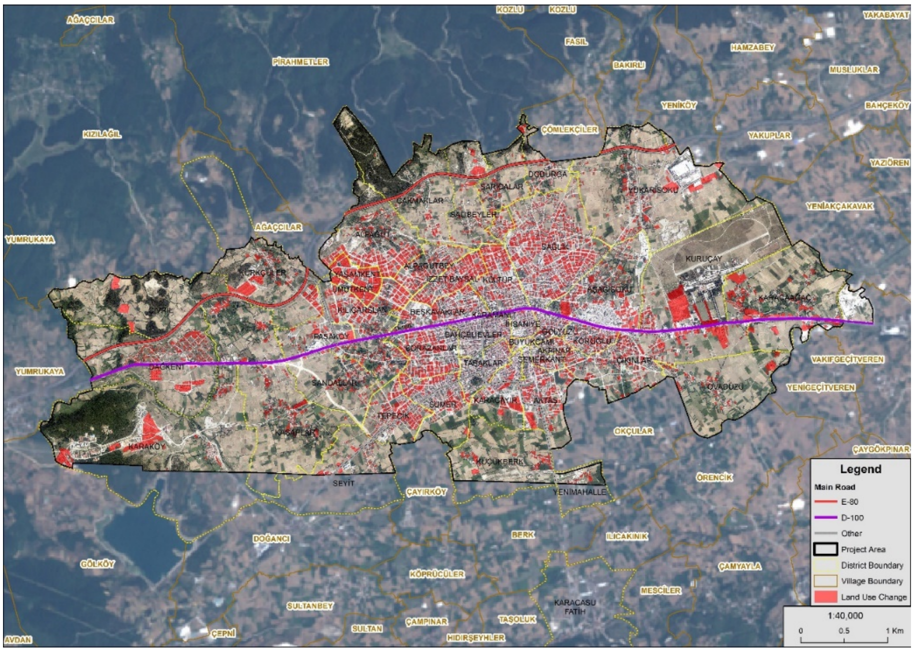


Figure 7. Built up are changes between 1994 and 2019.

The 1/5000 Urban Development Plan and the data obtained by the Ministry of Environment, Urbanization and Climate change were evaluated together and prepared the urban land-use map (Figure 8) of 2019, provided by the Bolu Municipality to highlight the urban growth between 1994-2019.

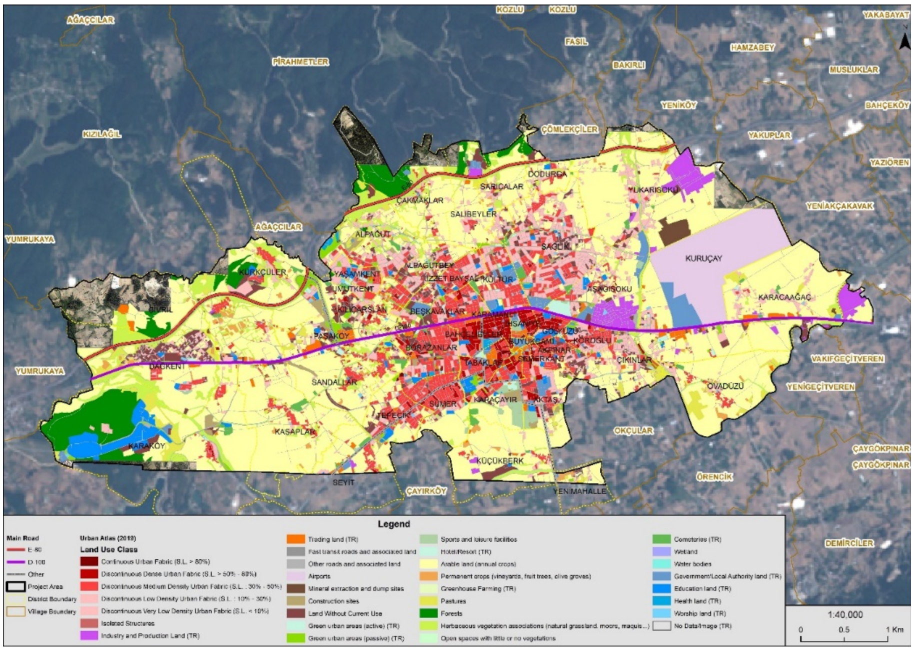


Figure 8. Urban land-use map (Urban Atlas, 2019).

Continuous urban area; 38,243m2, high density discontinuous urban area; 1,006,152 m2, discontinuous urban area in medium density; 4,700,654m2, discontinuous urban area at low density; 472.0743.4m2; very low density urban area; 256.092m2 in orthophotos used to

DOI: 10.15320/ICONARP.2022.223

determine the surface temperature effect. Passive green areas within the city are 947,362 m2, farmable outdoor areas; 25,248 m2, forest; 2,274,856 m2. The green spaces in Bolu are 960,000m2 (Bolu Municipality Park and Gardens Directorate, 2021), which are active green areas.

Table 3. Average temperatures related with the land-use functions in 2019, Bolu

Land-use functions	Average temperatures °C
Industry and production area	32.0
Sports and entertainments area	31.4
Continuous urban area (> 80%)	31.2
Discontinuous urban areas (high density) (50% - 80%)	31.2
Mine and Discharge Areas	31.1
Construction area	30.9
Hotels	30.9
Commercial area	30.8
Urban green area (passive)	30.5
Health Facilities	30.5
Discontinuous urban areas (medium density) (30% - 50%)	30.4
Religious Facilities	30.3
Fast transit roads and related fields	30.3
Discontinuous urban areas (very low- density) (< 10%)	30.3
Urban green area (active)	30.2
İdle space	30.2
Public Administrations	30.2
Roads	30.1
Discontinuous urban areas (low- density) (10% - 30%)	29.9
Graveyard areas	29.8
Airports (Military)	29.7
Arable land	29.7
Education facilities	29.4
Pastures	29.3
Isolated buildings	28.8
Water Surfaces	28.6
Herbaceous plant	28.6
Greenhouses	28.0
Unknown area (No image)	27.9
Forest	26.3

In terms of urban land use in discontinuous urban areas with a high-density surface temperature (having a base floor area between 50% to 80%) is 31°C, while the in discontinuous areas with medium-density (having a base floor area between 30% to50%) surface temperature of

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

30°C. On the other hand surface temperature is 29.9 °C in discontinuous low density urban areas (having base floor area between 10% to 30%). As the building storey heights increase and as decreases gap between the buılding and space surface temperature is increased in Bolu. The lowest surface temperature has seen forests area and water surfaces. İndustry and production areas has the highest surface temperature. İn active green spaces the surface temperature is 30.2°C. This is due to the small crown diameter of the tree. The surface temperature values according to the type of land-use for 2019 are discussed in detail in Table 3.

Compared to 1994, the surface temperature in the Kuruçay neighborhood located east of the city has decreased although surface temperature has also increased in peripheries like Yukarı soku, Sağlık, İzzet Baysal and Kültür neighborhoods located in the north of the city, and Dağkent, Karaköy in the west of the city. When comparing the urban density and surface temperature values in the city center, it can be seen temperature differences such as 0.1- 0.5 °C. Surface temperature in densely populated areas is 31.2°C while medium and low density residential areas is 29.7°C. The areas with the most heat reflections are the urban center with a temperature of 32.9°C, industrial areas with 32.6°C, technical infrastructure areas with 32°C, bus stops with 32°C, city-region trade center with 31°C and city center with 30.3°C. Surface temperature in urban parking areas is 30°C. The lowest surface temperature reflections are located on the campus of Bolu Abant Izzet Baysal University, with a surface temperature effect of 28.7°C covered by forest. The surface temperature values for land-use under the 1/5000 Urban Development Plan (Figure 9) are as specified in Table 4.

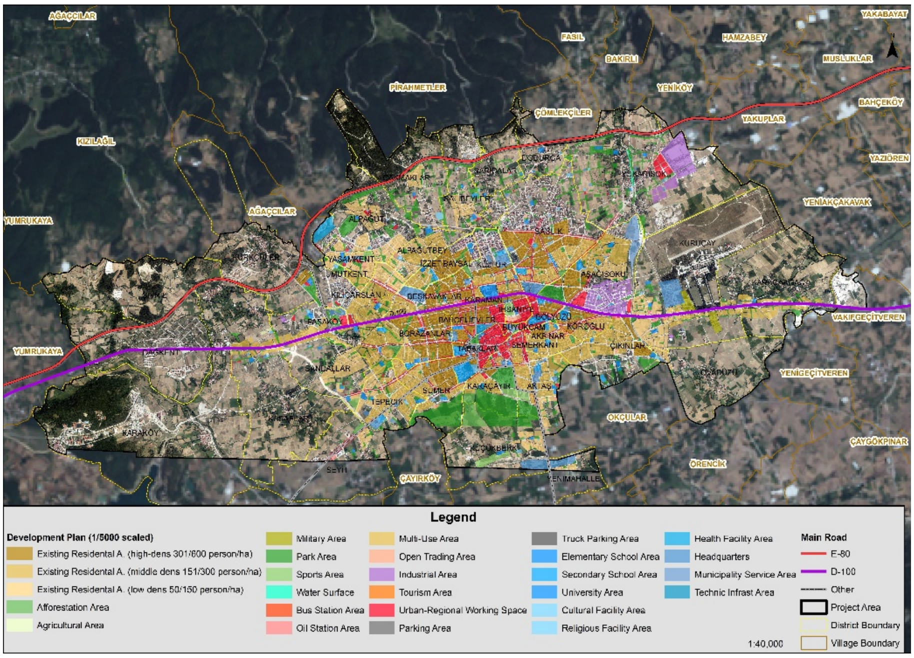


Figure 9. 1/5000 Urban development plan.

DOI: 10.15320/ICONARP.2022.223

Table 4. Land-use functions and average temperatures in 1/5000 urban development plan

Land-use functions in urban development plan	Average temperatures °C
No intersection with plan	29.3
Afforestation area	29.3
Agricultural Area	32.9
Bus Station Area	32
Cultural Facility Area	29.7
Elementary School Area	30.1
Existing Residential Area (high-density/ 301-600)	31.2
Existing Residential Area (low-density/ 50-150 p/ha)	29.7
Existing Residential Area (middle-density/ 151-300 p/ha)	29.7
Headquarters	30.3
Health Facility Area	30.4
Industrial Area	32.6
Military area	29.3
Multi-Use Area	30.4
Municipality Service Area	30.96
Oil Station Area	30.6
Open Trading Area	30
Park	30.1
Parking Area	30.5
Religious Facility Area	30.7
Secondary School Area	29.6
Sports Area	29.2
Technical Infrastructural Area	32
Tourism Area	31.1
Truck Parking Area	27.8
University Area	28.7
Urban-Regional Working Space	31
Water Surface	29.8

Figure 9 and Table 4 shows various land-use functions. When calculating the existing residential population (low-medium-high), gross population was used. As with many studies, the surface temperature map is evaluated in this study with the normalized difference vegetation index (NDVI) (Yüksel and Yılmaz, 2008; Şimşek and Şengezer, 2012; Alkan et al., 2017; Balçık and Ergene, 2017; Mercan, 2020; Polat, 2020). NDVI analysis uses range -1, +1 for vegetation density. Areas where the vegetation is dense are observed as pixel values close to +1, depending on the biomass, and in places where the vegetation decreases in the form of a pixel value close to the range -1. When the surface of the field is covered with rare vegetation, NDVI values are covered in dense vegetation in the range 0.2 to 0.5, and in the range 0,5-1, it is approximately 0 on rock, concrete and asphalt surfaces (Gerçek et al.,

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

2014; Alkan et al., 2017). Buildings, roads, etc. in the urban area the albedo value measured in areas covered with non-permeable surfaces, tar coated or asphalt surfaces accumulate more heat than the natural ground, increasing the surface temperature effect. In addition, agricultural areas are also exposed as surfaces with a high surface temperature effect because there are no trees and vegetation around them.

In the NDVI map of 1994, the values range from -0.3 to +0.7, showing a rare and moderate variation. In 2019, NDVI values range from -0.4 to +0.5. There has been a reduction in vegetation-cover density over the past 25 years. İf the areas where the NDVI difference is high is shown in green, the areas where the NDVI difference is low is shown in red (Figure 10).

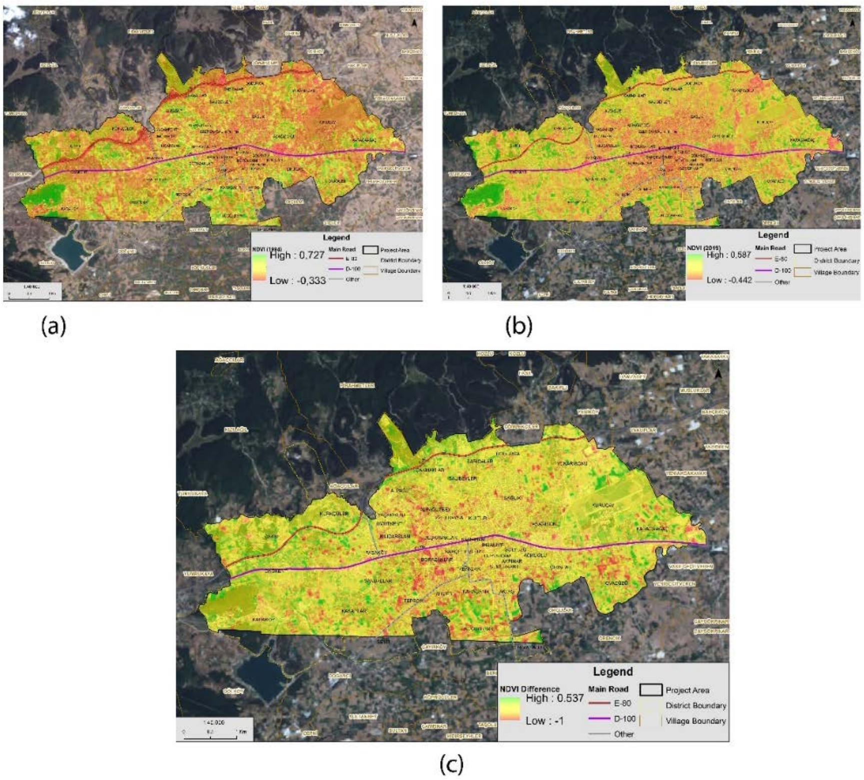


Figure 10. a) 1994-NDVI values b) 2019-NDVI values c) Between 1994 and 2019- NDVI differences values.

As it can be seen Figure 10, there were decreased vegetation density between 1994-2019. The NDVI map has dropped by -1, with the increase in construction in the neighborhoods of Beşkavaklar, Borazanlar, Bahçelievler, Tepecik and Alpagutbey. In the map of 1994, the green vegetation is dense, in Yaşamkent, Umutkent, Kılıçaslan, Çakmaklar, Sarıcalar, Kürkçüler, Dağkent, Küçükberk, Tepecik, Aktaş, Sağlık neighborhood, which have been a decrease in vegetation density between -0.5 and -1 due to urban growth that has expanded from center to peripheries. However, periphery areas with decreased NDVI values in the range of 0 -0.5 have increased vegetation density between 0 and 0.5 especially after the forestation of the military area, which is the Eşref Bitlis Komando Brigade around Kuruçay and around it.

DOI: 10.15320/ICONARP.2022.223

When examining the orthophoto images from 1994-2019, it was observed that in 1994, the agricultural sites around the city were exposed to high temperature effects due to their opening to urban development. Agricultural areas are opened to urban growth/ new developing area in Sağlık, Salıbeyler, Sarıcalar, Çakmaklar, Alpagutbey neighborhoods located in the north side. In the southern part, it is seen that construction in the Sümer and Tepecik neighborhoods has increased and surface temperature increases. NDVI flora density values have been significantly reduced since Borazanlar neighborhood has also been converted from agricultural areas to residential areas. The urban land-use map shows that the Eşref Bitlis Komando Brigade area, used as a military airfield in the east of the city, has increased its NDVI vegetation density over time with forestry.

In the LST difference map between 1994-2019, it is observed that the forestry in the military field, which is the Eşref Bitlis Komando Brigade in the east of the city, have a cooling effect on the surface between -7 and -16°C. The lowest surface temperature values in the city are forest areas covered with trees, parking spaces, university campus area, fields with green vegetation and military areas (Figure 11). It is known that the northern part of the city has risen around +2°C in the Alpagutbey, Alpagut, Izzet Baysal neighborhoods. There have been cooling on the surface of -1 or -2.4°C due to parks in the neighborhoods of Kültür, Sağlık, Yaşamkent and Umutkent. However, the ground has been heated between 0.1 and 3.7°C in Kasaplar, Sandallar, Kürkçüler neighborhoods. During the 25-year period, temperatures increased from 3.7 to 12.8°C due to agricultural areas in Küçükberk neighborhood in the south of the city. Surface temperatures can be seen at high temperatures due to the absence of green space around the area of agricultural areas, which are partly guarded in the northwest and south of the city.

Figure 11. Bolu city center a) 1994- LST values b) 2019- LST values c) between 1994 and 2019 LST differences values.

The surface temperature of the Gölköy campus of Bolu Abant Izzet Baysal University, located in the west of the city, has increased between 0 °C and +2°C. Similarly, it is noted that the surface temperature rises between 1.5 and 3.7°C in Bahçelievler, Borazanlar, Semerkant, İhsaniye, Karamanlı, Sümer and Aktaş neighborhoods which are located near the city center. Increasing particularly non-permeable surfaces in the center has increased the LST effect. When both LST and NDVI maps are reviewed, surface temperature decreases as vegetation density increases in the Bolu city. Therefore, the negative correlation observed between surface temperature and vegetation density in Bolu which is known for its green identity.

CONCLUSION AND DISCUSSION

The measurement of land surface temperature (LST) is an important assessment tool for global climate change studies, urban land use, urban land cover change, urban heat island and urban climate. In this study, Landsat 5 TM of 1994 and Landsat 7 ETM satellite images and orthophotos of 2019 were intended to assess the change of the urban heat island in Bolu city center during the spatial development process.

The geographical location of cities, morphology, land-use changes, cultural and socio-economic structure etc. are factors that affect the UHI. In the study, the average temperatures of the land-use classes were determined by evaluating the Urban Atlas classes together with the 2019-1994 LST difference data to associate the land-use cover with the surface temperature. The distribution of surface temperature values for each land-use has been determined via the existing 1/5000 Urban Development Plan. NDVI maps are also prepared to define vegetation density. After the 1999 earthquake in Bolu, the changes in land usage structure due to the rapid urbanization of the city with the north and west axes have increased the surface temperature. In Bolu, it is observed that a 38.39% field has been constructed when 2019-year-structured areas are proportional to the total parcel area. The built-up area presence has increased by 78.9% between 1994-2019.

1994 orthophoto images show that surface temperatures reach higher values after the transformation of agricultural land to urban areas. Air circulation is blocked in central neighborhoods due to the valley structure of the city center, surrounded by mountains and located on the flat plateau. Compared to 1994-2019 orthophotos, it is now seen that agricultural areas are used for transportation and residential usage. It can be agreed that urban growth has increased vehicle use by spreading uncontrolled from the center to the periphery areas, causing carbon emissions and the albedo effect raising the reflection temperature on the surface. In the last 25 years, the NDVI difference has resulted in a reduction in NDVI values in the Borazanlar and Beşkavaklar neighborhoods within walking distance of the urban center. As it expanded from the center to the periphery, the NDVI value has also decreased in Alpagutbey, Kılıçarslan and İzzet Baysal neighborhoods in the north of the city and Tepecik, Sümer, Karaçayır, Küçükberk, Ovadüzü in the south of the city.

In addition, forest/green areas increased in Bolu during the 25-year period and surface temperature has decreased at the military airport, the Esref Bitlis Comando Brigade in the east of the city. Therefore, the effect of the green surfaces seen in many studies about cooling the urban climate (Şimşek and Şengezer, 2012; Yüksel and Yılmaz, 2008; Emecen et al., 2019; Shishegar, 2013) also seen in Bolu. The process of sweating and evaporation of plants is known to have a cooling effect in urban areas. In Bolu, the Gölköy campus and surrounding forests and the Gölköy dam have a reduced reflectance temperature effect. Land-use

DOI: 10.15320/ICONARP.2022.223

types in 1/5000 scale urban development plan are evaluated with 2019 urban atlas data, the 101.818m2 parking space in low-density discontinuous urban area (area with a 10% to 30% build-up ratio), the 45.514m2 parks in the medium-density discontinuous urban area (area with a build-up ratio of 30% to 50%), 2207 m2 areas in a sustained urban area, there are 7553 m2 parks in the high density, non-continuous urban area (area with a built-up ratio of 50% and 80%), 10,687 m2 parks with very low intensity, non-continuous urban area (area with a built-up ratio of 10%). Bolu Municipality has also stated that they are working to increase green space in the city.

However, the main reason for the high surface temperature rise in Bolu province is the opening of agricultural areas for development and increase in population density. The choice of materials on large asphalt and flooring surfaces in new development areas with building forms and textures reduces evaporation and stores heat under the surface. In addition, the lack of green space in the continuous in urban settlement and high-density discontinuous urban settlement has caused an increase in the city's surface temperature. In the Conference of Livable Cities (2016), it has been emphasized that the global temperature has increased by approximately 1°C in the last 150 years. In addition, the increase in global temperatures between 1951 and 2010 along with the rise in average surface temperatures of 2°C and the impact of urbanization on the UHI are explained (Kurnaz, 2016).

Accordingly, in order to reduce the existing urban heat island effect in Bolu and to prevent urban heat island effect in the urban development areas solutions should be produced by taking some precautions such as promoting ecological material selection, walkability and bicycle use, creating wind corridors, supporting green roofs and green building applications, using smart mapping systems. In particular, when planning in new development areas, creating spatial decisions in such a way that it does not create barriers to dominant wind direction, wind corridors and speed, taking into account built-up area-green field ratios will have an impact on reducing the UHI effect. In addition to the important metropolitan area today (such as London, Paris, Madrid, Sydney, Tokyo and New York), it is known that the Local Climate Change Action Plans were prepared in Turkey, which reflected climate action from region scale to architectural scale in large-medium-sized cities such as Gaziantep, İstanbul, İzmir (Peker et al., 2019). In Bolu, increasing efforts to produce and implement plan decisions that address the overall green infrastructure will be an important step toward protecting the green identity and to decrease UHI effect or to decrease surface temperatures.

REFERENCES

Akbari, H. (2002). Shade Trees Reduce Building Energy Use and CO2 Emissions from Power Plants. *Environmental Pollution, 116*, 119-126. http://dx.doi.org/10.1016/S0269-7491(01)00264-0.

Alkan, A., Adıgüzel, F., & Kaya, E. (2017). Batman Kentinde Kentsel Isınmanın Azaltılmasında Yeşil Alanların Önemi (The Importance of Green Places in Decreasing the Urban Temperature in Batman). *Coğrafya Dergisi*, *34,* 62-76.

Amberber, M., Argaw, M., Feyisa, G. L., & Degefa, S. (2020). Status, approaches, and challenges of ecosystem services exploration in Ethiopia: A systematic review. *Chinese Journal of Population, Resources and Environment*, *18*(3), 201-213.

Balçık F. B. and Ergene E. M., (2017), Yer yüzey Sıcaklığının Termal Uzaktan Algılama Verileri ile Belirlenmesi: İstanbul örneği, Türkiye Ulusal Fotogrametri ve Uzaktan Algılama Birliği 9. Teknik Sempozyumu Bildiri Özetleri Kitabı (Turgut B. vd., Ed), Afyonkarahisar, Türkiye, ss 21.

Bayar, R. & Doğandor, E. (2017). Arazi Örtüsü İçerisinde Bolu Kentsel Değişiminin İzlenmesi(1987-2016) (Monitoring of Bolu Urban Change in a Land Cover (1987-2016). International Congress on the 75th Anniversary of TGS, 494-504. Retrieved September 9, 2021 from: https://www.researchgate.net/profile/Rueya-Bayar/publication/323185623_Arazi_Ortusu_Icerisinde_Bolu_Kentsel_Degisiminin_Izlenmesi1987-2016/links/5a852d0aa6fdcc201b9f1ed2/Arazi-Oertuesue-Icerisinde-Bolu-Kentsel-Degisiminin-Izlenmesi1987-2016.pdf.

Bolu Belediyesi Park ve Bahçeler Müdürlüğü, 2021.

Bonneau, L. R., Shields, K. S., & Civco, D. L. (1999). Using satellite images to classify and analyze the health of hemlock forests infested by the hemlock woolly adelgid. *Biological Invasions*, *1*(2), 255-267.

Bosselmann, P., Arens, E., Dunker, K., & Wright, R. (1995). Urban form and climate: case study, Toronto. *Journal of the American Planning Association*, *61*(2), 226-239.

Beltrami, H., Ferguson, G., & Harris, R. N. (2005). Long‐term tracking of climate change by underground temperatures. *Geophysical Research Letters*, *32*(19).

Campbell, J.B. and Wynne, R.H. (2011) *Introduction to Remote Sensing Fifth Edition*. The Guilford Press, New York.

Chatzidimitriou, A. and Yannas, S. (2017). Street canyon design and improvement potential for urban open spaces; the influence of canyon aspect ratio and orientation on microclimate and outdoor comfort, *Sustainable cities and society, 33,* 85-101.

Çağlak S., Aydemir KPK. & Kazancı G. (2021). Effects of urbanization on bioclimatic comfort conditions; Bolu example. *City Health Journal, 2*(2), 47-55.

Çalışkan, O., & Türkoğlu, N. (2015). Ankara'da termal konfor koşulların eğilimi ve şehirleşmenin termal konfor koşulları üzerine etkisi. *Coğrafi Bilimler Dergisi*, *12*(2), 119-132.

Doğan, H. M., Kılıç, O. M., & Yılmaz, D. S. (2014). Tokat ili bitki yoğunluk sınıflarının LANDSAT-7 ETM+ uydu görüntüleri ve Coğrafi Bilgi Sistemleri ile araştırılması. *Gaziosmanpaşa Üniversitesi Ziraat Fakültesi Dergisi*, *2014*(1), 46-53.

Edwards M.C., Wellens J., Al-Eisawi, D. (1999). Monitoring the grazing resources of the Badia region, Jordan, using remote sensing. *Applied Geography, 19,* 385–398.

Emecen, Y., & Erdem, N. (2019). Kent İklimi Üzerinde Yeşil Alanların Etkileri. *Peyzaj Araştırmaları ve Uygulamaları Dergisi*, *1*(2), 24-30.

EPA. (2008). Reducing Urban Heat Islands: Compendium of Strategies, Draft, *Climate Protection Partnership Division in the U.S.* Retrieved August 15, 2021 from https://www.epa.gov/heat-islands/ heat-island-compendium

DOI: 10.15320/ICONARP.2022.223

ERDAS (2003). Erdas Field Guide, 7th Edn. Leica Geosystems, GIS and Mapping LLC: Atlanta, Georgia.

Frumkin, H., & McMichael, A. J. (2008). Climate change and public health: thinking, communicating, acting. *American journal of preventive medicine, 35*(5), 403-410.

Gallo, K.P., Owen, T.W., Easterling, D.R. and Jamason, P.F. (1999) Temperature trends of the U.S. Historical Climatology Network based on satellite-designated land use/land cover. *Journal of Climate, 12*, 1344-1348.

Graves, H., Watkins, R., Westbury, P. & Littlefair, P. (2001). *Cooling Buildings in London: Overcoming the Heat Island*. London: BRE and DETR.

Gerçek, D., & Türkmenoğlu Bayraktar, N. (2014). Kentsel Isı Adası Etkisinin Uzaktan Algılama İle Tespiti ve Değerlendirilmesi: İzmit Kenti Örneği (Remote Sensing Detection and Evaluation of the Urban Heat Island Effect: The Example of Izmit City). 5. *Uzaktan Algılama-CBS Sempozyumu (14-17 Ekim 2014),* İstanbul https://www. kongresistemi. com/root/dosyalar/uzalcbs2014/360. pdf.

Hais M. and Kučera T. (2009). The influence of topography on the forest surface temperature retrieved from Landsat TM, ETM and ASTER thermal channels, *ISPRS Journal of Photogrammetry and Remote Sensing,64*(6):585-591.

Heyer, W. (1992). *Witterung und Klima (Weather and climate).* Bauverlag GMBH, 274 s. Stuttgart.

Hunt, A., & Watkiss, P. (2007). *Literature Review on Climate Change Impacts on Urban City Centres: Initial Findings; ENV/EPOC/GSP (2007) 10/Final*. OECD.

Jianjun, J., Jie, Z., Hong'an, W., Li, A., Hailong, Z., Li, Z., & Jun, X. (2005). Land cover changes in the rural-urban interaction of Xi'an region using Landsat TM/ETM data. *Journal of Geographical Sciences*, *15*(4), 423-430.

Kaya, D.S. (2019). 21. Yüzyılda Bolu Şehri'nin Tarihi Coğrafyası (Historical Geography of Bolu City in the 21th Century), *İstanbul Üniversitesi Sosyal Bilimler Enstitüsü*, İstanbul.

Kohl, T. (1999). Transient thermal effects below complex topographies, *Tectonophysics, 306*(3–4), 311-324.

Kurnaz, L. (2016). Küresel İklim Hedeflerine Ulaşmak – İklim Değişikliği Eylem Planları. *Yaşanabilir Şehirler Sempozyumu*, 26 Ekim 2016, Sapanca.

Landsberg H.E.,1981: *The Urban Climate.* New York: Academic Press.

Lin, B. S., & Lin, C. T. (2016). Preliminary study of the influence of the spatial arrangement of urban parks on local temperature reduction. *Urban Forestry & Urban Greening*, *20*, 348-357.

Liu, K., Su, H., Zhang, L., Yang, H., Zhang, R., & Li, X. (2015). Analysis of the urban heat island effect in Shijiazhuang, China using satellite and airborne data. *Remote Sensing*, *7*(4), 4804-4833.

Luhar, A. K., Venkatram, A., & Lee, S. M. (2006). On relationships between urban and rural near-surface meteorology for diffusion applications. *Atmospheric Environment*, *40*(34), 6541-6553.

McPherson, E. G. (1994). Cooling urban heat islands with sustainable landscapes. *In: Platt, Rutherford H.; Rowntree, Rowan A.; Muick, Pamela C.; eds. The ecological city: preserving and restoring urban biodiversity. Amherst, MA: University of Massachusetts Press: 151-171*, 151-171.

Mercan, Ç. (2020). Yer yüzey sıcaklığının termal uzaktan algılama görüntüleri ile araştırılması: Muş ili örneği. *Türkiye Uzaktan Algılama Dergisi*, *2*(2), 42-49.

Montávez, J. P., Rodríguez, A., & Jiménez, J. I. (2000). A study of the urban heat island of Granada. *International Journal of Climatology: A Journal of the Royal Meteorological Society*, *20*(8), 899-911.

Munn, R. E. (Ed.). (2002). *Encyclopedia of global environmental change*. Chichester: Wiley.

Oke, T. R. (1973). City size and the urban heat island. *Atmospheric Environment, 7*(8), 769-779.

Oke, T. R. (1988). Street design and urban canopy layer climate. *Energy and Buildings, 11*, 103–113.

Owen, T. W., Carlson, T. N., & Gillies, R. R. (1998). An assessment of satellite remotely-sensed land cover parameters in quantitatively describing the climatic effect of urbanization. *International Journal of Remote Sensing, 19*, 1663–1681.

Parker, D. E. (2010). Urban heat island effects on estimates of observed climate change. *Wiley Interdisciplinary Reviews: Climate Change*, *1*(1), 123-133.

Parry, M. L., Canziani, O., Palutikof, J., Van der Linden, P., & Hanson, C. (Eds.). (2007). *Climate change 2007-impacts, adaptation and vulnerability: Working group II contribution to the fourth assessment report of the IPCC* (Vol. 4). Cambridge University Press.

Peker, E. & Aydın, C.E. (2019). Değişen İklimde Kentler: Yerel Yönetimler İçin Azaltım ve Uyum Politikaları (Cities in Climate Change: Mitigation and Adaptation Policies for Local Governments). *İPM Sabancı Üniversitesi* Retrieved September 2, 2021 from http://www.troyacevre.org/wpcontent/uploads/2019/09/DegisenIklimdeKentler.pdf

Polat, N. (2020). Mardin ilinde uzun yıllar yer yüzey sıcaklığı değişiminin incelenmesi. *Türkiye Uzaktan Algılama Dergisi, 2* (1), 10-15.

Sannigrahi, S., Bhatt, S., Rahmat, S., Uniyal, B., Banerjee, S., Chakraborti, S., ... & Bhatt, A. (2018). Analyzing the role of biophysical compositions in minimizing urban land surface temperature and urban heating. *Urban climate*, *24*, 803-819.

Shishegar, N. (2013). Street design and urban microclimate: analyzing the effects of street geometryand orientation on airflow and solar access in urban canyons. *Journal of clean energy technologies*, *1*(1).

Streutker, D. R. (2003). *A study of the urban heat island of Houston, Texas* (Doctoral dissertation, Rice University.

Şimşek, Ç. K., & Şengezer, B. (2012). İstanbul metropoliten alanında kentsel ısınmanın azaltılmasında yeşil alanların önemi. *Megaron,* 7 (2), 116-128.

Taner, İ. (2014). Bolu Kentinin Mekansal Gelişimi (Spatial development of Bolu City). *AİBÜ Sosyal Bilimler Enstitüsü Dergisi,* 14(1), 377-411.

T.C. Başbakanlık Devlet Planlama Teşkilatı (DPT). (2002). Bolu İli Raporu (Bolu Province Report). Retrieved September 4, 2021 from (https://sbb.gov.tr/wp-content/uploads/2018/11/Bolu-Ili_Raporu%E2%80%8B.pdf

Tomlinson, C. J., Chapman, L., Thornes, J. E., & Baker, C. J. (2011). Including the urban heat island in spatial heat health risk assessment strategies: a case study for Birmingham, UK. *International journal of health geographics*, *10*(1), 1-14.

Tonyaloğlu, E. E. (2019). Kentleşmenin kentsel termal çevre üzerindeki etkisinin değerlendirilmesi, efeler ve İncirliova (Aydın) örneği. *Türkiye Peyzaj Araştırmaları Dergisi*, *2*(1), 1-13.

DOI: 10.15320/ICONARP.2022.223

Toy, S., Kayıp, D.B. & Çağlak, S. (2019). Eskişehir'de (biyo) İklime Duyarlı Kentsel Tasarım Örneği (Example of (bio)Climate Sensitive Urban Design in Eskişehir). *GÜFBED/GUSTIJ*, 9(2), 353-361.

Ullah, N., Siddique, M. A., Ding, M., Grigoryan, S., Zhang, T., & Hu, Y. (2022). Spatiotemporal Impact of Urbanization on Urban Heat Island and Urban Thermal Field Variance Index of Tianjin City, China. *Buildings*, *12*(4), 399.

Voogt, J.A. and Oke, T.R. (2003). Thermal Remote Sensing of Urban Areas. *Remote Sensing of Environment, 86,* 370-384.

Yang, L., Qian, F., Song, D. X., & Zheng, K. J. (2016). Research on urban heat-island effect. *Procedia engineering*, *169*, 11-18.

Yılmaz, H., Yılmaz, S., Yavaş, M., Mutlu, E., & Koç, A. (2016). Climate-sensitive pavement modelling for pedestrian ways. *Procedia Engineering*, *169*, 408-415.

Yıldız, N.D., Avdan, U., Avdan, Z. (2019). Kentsel Mekân Farklılıklarının Isı Adası Oluşumuna Etkisinin Belirlenmesi: Erzurum Kenti Örneği, SETSCI Conference Proceedings, *4 (3):* 220-224.

Yüksel, Ü. D., & Yılmaz, O. (2008). Ankara kentinde kentsel ısı adası etkisinin yaz aylarında uzaktan algılama ve meteorolojik gözlemlere dayalı olarak saptanması ve değerlendirilmesi (Determination and evaluation of urban heat island effect in Ankara city in summer based on remote sensing and meteorological observations). *Gazi Üniversitesi Mühendislik Mimarlık Fakültesi Dergisi*, 23(4), 937-952.

Wilby, R. L. (2007). A review of climate change impacts on the built environment. *Built environment*, *33*(1), 31-45.

Wu, H., Ye, L. P., Shi, W. Z., & Clarke, K. C. (2014). Assessing the effects of land use spatial structure on urban heat islands using HJ-1B remote sensing imagery in Wuhan, China. *International Journal of Applied Earth Observation and Geoinformation*, *32*, 67-78.

Zhao, W., Li, A. N., & Zheng, J. (2016). A study on land surface temperature terrain effect over mountainous area based on Landsat 8 thermal infrared data. *Remote Sensing Technology and Application, 31*(1), 63-73.

Zhong, S., Qian, Y., Zhao, C., Leung, R., Wang, H., Yang, B., ... & Liu, D. (2017). Urbanization-induced urban heat island and aerosol effects on climate extremes in the Yangtze River Delta region of China. *Atmospheric Chemistry and Physics*, *17*(8), 5439-5457.

Resume

Kıymet Pınar Kırkık Aydemir received MSc degree in Urban Design from İstanbul Kültür University in 2010. She received her Ph.D. degree in Landcape Architecture from Bartın University in 2018. She currently works at Bolu Abant İzzet Baysal University, Department of Urban and Regional Planning, as an Associate Prof. She has worked livability space/cities.

Gamze Kazancı Altınok is graduated from Middle East Technical University as an honor bachelor degree of City and Regional Planning Department in 2017. After graduation, she did her master's education in Istanbul Technical University (ITU), Urban Planning the years between 2017-2019, and she has been working at ITU as a research assistant since 2018. Now, she has been doing her Ph.D in Urban and Regional Planning Department. Moreover, she is a Ph.D Erasmus student at University of Lisbon, Department of Urbanism for one year (2022-2023).

Ömer ÜNSAL received bachelor's degree at Geography and MSc degree at Remote Sensing and GIS. He has worked smart city, geodatabase model, maturity

assessment models in Istanbul University, Department of Geography PhD program.

DOI: 10.15320/ICONARP.2022.223

Research Article

ICONARP
International Journal of Architecture and Planning
Received: 14.06.2021 Accepted: 14.09.2022
Volume 10, Issue 2/ Published: 20.12.2022
DOI: 10.15320/ICONARP.2022.224 E- ISSN:2147-9380

ICONARP

An Application of Consistency Testing for Spatial Plans: Case of Trabzon, Türkiye

Mihriban Öztürk Saka*
Aygün Erdoğan**

Abstract

The starting point of this study is the problematic perspective of focusing only on the final product in spatial planning, while ignoring the planning process, and a lack of certain standards/criteria of the evaluation stage for the internal and external consistencies of spatial plans. Although it has recently attracted significant interest in the field, the methodological use of evaluation is not widespread in planning practice. Evaluation, which is considered to be a simple checking duty in the Turkish planning system (TPS), is not considered in the related literature and legislation. Focusing on the "evaluation stage" of spatial planning, this paper aims to demonstrate the contribution of the previously developed Guideline for Evaluation of Spatial Plans (GESP) in testing and ensuring the consistency of different scale and types of plans prior to their approval. The first phase of the study focuses on the concept of evaluation, reviews a series of related literature for the evaluation of plans, and discusses the evaluation stage in the TPS. In the second phase, the consistency of the selected case area plansafter addition of new resources that comply with the input of the previously developed evaluation framework GESPis examined. This guideline, which is an analytical method proposal, is applied over the selected cases, involving the upper-scale plans that cover Trabzon province and lower-scale plans for some settlements that were selected from within this province. Consistencies of all the plan components (plan sheets, plan report, plan notes, plan legend) of plans with different scales for the case area were tested in terms of the criteria of the developed guideline. Most of these plans were found to be inconsistent, both internally and externally. In the study, it was determined that the plans in fact contained many inconsistencies on their approval without being subjected to such evaluation. Although the study did not focus on the frequency of evaluation of spatial plans, the parties that will make those evaluations, and how to use their output, it provides basis for future studies. The "evaluation stage", an important theoretical issue in the international literature, is exemplified for both how it would be handled and tested in practice. Identifying the needs, processes, and problems related to the evaluation stage, mainly for its ex-ante stage, will allow the TPS to intervene in the preparation of plans before their approval. This may have a positive impact on the production of final plans that are more comprehensive, and do not require continuous changes during the planning process. The introduced use of the guideline will contribute to the limited number of studies, concerning the evaluation stage of the spatial plans in Türkiye, besides guiding the related possible legal regulations regarding the TP.

Keywords:
Spatial planning, evaluation, guideline for evaluation of spatial plans, Trabzon

*Department of Urban and Regional Planning, Karadeniz Technical University, Trabzon, Türkiye.
Email: mihribanoztrk1@gmail.com

**Department of Urban and Regional Planning, Karadeniz Technical University, Trabzon, Türkiye.
(*Corresponding author*)
Email: aygun@ktu.edu.tr

To cite this article: Öztürk Saka, M., Erdoğan, A. (2022). An Application of Consistency Testing for Spatial Plans: Case of Trabzon, Türkiye. *ICONARP International Journal of Architecture and Planning,* 10 (2), 759-799. DOI: 10.15320/ICONARP.2022.224

INTRODUCTION

The rapid development and change of population and environmental, social, and economic structure of the regions and the settlements they cover cause a continuous change in land-uses with different paces by means of spatial plans, i.e., tools for intervention into the space. "Spatial planning is complex and forms a dynamic process. Various parties make spatial plans from different spatial perspectives (local, regional, national)." (Vullings et al. 2007, p. 1). In this variety, control that provides a sound base for planning becomes important. In the international literature this control was especially included as an evaluation of spatial plans, in order to measure their success (Alterman and Hill, 1978; Calkins, 1979; Alexander and Faludi, 1989).

In the spatial planning process, the evaluation stage may form a basis for the accomplished works to reach a determined standard, by enabling for plans to be systematically evaluated, for their strong and weak aspects to be determined, and by questioning their integrity with respect to the current plans (Berke and Godschalk, 2009). According to Erdem and Meşhur (2005, p. 341) "[u]rban planning is a process of successive decisions, and the consistency between these decisions determines the level of success of planning." Defective aspects of the plan and unexpected developments can be closely monitored and supported by revisions of the plan, when needed. However, despite being part of the urban planning process, and becoming important in monitoring the direction of plan decisions towards targeted urban development, the stages that include the evaluation were not considered in the field of planning until the last few decades (Lichfield et al. 1975; Berke et al. 2006). Accordingly, the evaluation of urban planning (Roeseler, 1982; Talen, 1996) only gained importance after the mid-1980s. As Soria and Valenzuela (2013, p. 945) point out:

> *[v]arious studies highlight the appropriateness, and even the necessity, of incorporating evaluation systems in planning ... The main benefit derived from such systems is their power to legitimate and improve the planning process in the eyes of citizens, policy-makers and planners.*

In the history of planning practice, a common opinion has been established that the evaluation of plans can be undertaken in three stages: 1) during plan preparation (ex-ante), 2) during plan implementation (on-going), and 3) after plan implementation (ex-post) (Oliveira and Pinho, 2008; Alexander, 2006; Laurian et al. 2010).

Testing the compatibility of plans with plan objectives, especially during the implementation stage, has been discussed in many studies (see Oliveira and Pinho, 2010; Bunnell and Jepson, 2011; Segura and Pedregal, 2017). In this respect, three types of studies were observed. The first study type, reveals how the plan decisions differ from the targeted or the observed future land-use (see Tian and Shen, 2007; Laurian et al. 2004). The second study type seeks answers to questions about the extent to which the upper- and lower-scale plan decisions of

DOI: 10.15320/ICONARP.2022.224

the same place are consistent with each other (see Gölbaşı, 2014; Bacău et al. 2020; Olazabal and De Gopequi, 2021). The third study type, that takes the temporal perspective into account in the evaluation, determines whether the plan decisions of a settlement that were given in different periods are consistent with each other (see e.g., Alterman and Hill, 1978). Those who evaluate the plans by creating a systematic method, deal with the plans, which differ by scale and type, in terms of their inconsistency and interpretation of incompatibilities, according to the variety of evaluation criteria guidelines or scoring within the scope of the survey questions created. According to these evaluation results, various definitions are made, such as low-rated plans, inconsistent plans, or incompatible plans.

However, the above-mentioned studies have limitations, mainly due to the uncertainty in the concrete concept of evaluation and the lack of measurable criteria. Ultimately, there is a lack of consistent guidance for different policy scales, on how to ensure the internal consistency within the plans of a settlement, and horizontal-external consistency between similar-scale neighbouring plans, vertical-external consistency between upper- and lower-scale plans of the same settlement, and how to evaluate spatial development/improvement. Especially in developing countries, before the implementation of plans, evaluation criteria for their internal control and for their conformity with respect to other existing plans (i.e., preliminary evaluation) should be specified in planning systems, which is important for practitioners.

With the increase in concerns regarding the accountability of local governments to the central government and to citizens in the mid-1990s, an increase in interest regarding monitoring and evaluation practices is observed (Bernstein, 2001). An example in Türkiye is the evaluation of development plans by the related commissions and by the municipal council, prior to their approval. However, Ersoy (2005, p. 139) explains this situation by stating,

> *[t]he majority of members of the municipal council examine development plans, which they have never seen before, after the proposal of the commission and explanations of the mayor by a so-called review they assure it to pass a "political control". What is actually done is the control of parcel-based interests.*

This forms the starting point in the setting of the research question for the present study. The focus on the final product in spatial planning studies, and the fact that the evaluation stage is carried out under processes and conditions which include many limitations, such as not being based on standards and defined technical criteria, subjectivity, etc., cause irreversible physical, social, and economic problems in the implementation of the plan. This paper presents two basic discussions, by taking the problem of consistency among different scales one step further. The first is the examination of the above-mentioned internal consistency within the components of plans of a settlement, that is, within plan sheets, plan report, plan notes, and plan legend. The second is the horizontal-external consistency between the same-scale neighbouring plans, and vertical-external consistency between the different scale plans of a settlement.

In addition, according to the Evaluation Report on the Spatial Planning System (2018, p. 46) of the former Ministry of Development;

> *the success of the upper-scale plans will be determined by the effectiveness of the inter-scale decision transfer system and the consistency and complementary relationships between the plans. However, in our country, the decision transfer system between scales does not function fully and monitoring, evaluation and control mechanisms cannot be operated effectively for plans of any scale.*

In this context, this paper takes the interscale inconsistency problems one step further. Therefore, in addition to these problems, it discusses the lack of consistency between the plan's own components–plan sheets, plan report, plan notes, and plan legend–and inconsistencies between the same-scale neighbouring plans.

As an example of addressing these basic problems within the framework of Türkiye, planning processes of different scales and types of plans have been selected for Trabzon province. The purpose of the study is to demonstrate the contribution of previously developed Guideline for Evaluation of Spatial Plans (GESP) (Öztürk, 2018; Öztürk Saka and Erdoğan, 2021; 2022) in ensuring the consistency of the decisions of those plans prior to their approval. This guideline is composed of a series of criteria, to test spatial plans for their internal consistency in addition to their horizontal consistency, with respect to the neighbouring and vertical consistency with its the upper- and lower-scale plans, in terms of the plan hierarchy. Thus, it involves two basic tests that search for consistencies of spatial plans: (1) internal and (2) external. While internal consistency is examined within the plan itself, externally it is two-fold; firstly, in a horizontal manner with the same scale neighbouring settlement plans and, secondly, in a vertical manner with different (upper- and lower-scale) plans for the same settlement. There are sub-criteria under these basic criteria. They were based on the requirements of the related legislation and/or professional doctrines/tenets regarding the respective types and scales of plans. They involve process consistency, information flow consistency, plan decisions consistency, methodology consistency, and plan language consistency.

The research questions of this study are listed in the following. The first is related to setting a theoretical/ empirical/ legal-administrative/ professional background while the second is related to the application of the GESP.

- What does evaluation and consistency mean for spatial plans?
- How can internal, horizontal-, and vertical-external consistency tests be performed in ex-ante evaluations of spatial plans?

The present application-based study provides important results, in that, ex-ante evaluation of spatial plans serves as a guideline for the

DOI: 10.15320/ICONARP.2022.224

means that will provide input into scientific research, and even legal regulations on how effective and viable local and regional plans are before their decisions are accomplished, in the long term. This guideline, which is discussed through the case of Türkiye, raises legitimate questions, with which to investigate the application of the consistency tests for spatial plans. In this sense, the novelty of the study is due to the way these problems, which are expressed by everyone in some way, are handled with a scientific basis.

The study consists of two basic phases. In the first phase, attention is paid to the concept of evaluation, which constitutes the basic theoretical/ empirical/ legal-administrative/ professional framework of the research, a series of key studies were reviewed, and the evaluation stage in the Turkish planning system was discussed. In the second phase, new sources, compatible with the input for the proposed guideline (GESP) in Öztürk (2018) and Öztürk Saka and Erdoğan (2021; 2022), were examined and the consistency of the selected case area plans were tested as if they were evaluated before their approval. With this guideline, which is an analytical method proposal, the upper-scale plans that cover the City of Trabzon and the lower-scale plans for some settlements from within this city were evaluated.

LITERATURE AND LEGISLATION

Concept of Evaluation and its Evolution in Planning Approaches

Akçay (2009, p. 85) refers to the concept of evaluation as "measuring the implementation results in comparison to the goals and objectives and analysing the consistency and suitability of such goals and objectives". According to Güredin (2000, p. 5) "... it is a systematic process that collects and evaluates objective evidence in order to investigate the degree of conformity with predetermined criteria, and to inform those interested in the results." Based on these definitions, it can be said that evaluation is closely linked to concepts of conformity or consistency. As Bacău (2020, p. 1) states, "[i]n an urban region, plans should be externally consistent, enhancing integration across policy domains (e.g., housing, transport, agriculture) at different spatial scales".

Since the early 1970s, many studies have been conducted on the effects of a programme or policy, and how and why the implementation takes place. While the essence of political research projects on concept and method consisted of an emphasis on economic, social, and health-related policies (Mazmanian and Sabatier, 1989; Goggin et al. 1990), they refrained from entering the field of physical, spatial planning areas (e.g., handling of land use and the built environment). The evaluation, which was not adequately addressed within the scope of spatial planning at the beginning, has attracted attention within the scope of current problems over the last decade, and has also tended towards the special fields of planning, and thus evaluation of plans, including sustainability, climate change, natural disasters reduction, watershed

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

and coastal resource protection under criteria established with reference to various international conventions or agreements.

In recent periods, with the advent of strategic planning, the emphasis on procedural aspect of planning involved a need for an integrated approach for simultaneous handling of the evaluation stage with the planning process (Öztürk Saka and Erdoğan, 2022). According to Oliveira and Pinho (2008, p. 33), there are three types of evaluations:

> *Ex-ante evaluation occurs in the beginning of the planning process and it promotes the comparison of possible alternatives, in order to choose the best solution for further development. On-going evaluation takes place during plan implementation and its conclusions can lead to shifts in the planning process. Focusing on the plan results and on the use of resources, this kind of assessment requires a set of information that should be provided by an adequate data system. Ex-post evaluation occurs in the end of the plan implementation process and it focuses on the impacts of the plan. This type of evaluation reviews the whole process of preparation and implementation of the plan, and formulates a judgment about its success.*

These three types of evaluation correspond to three common stages of planning: preparation, implementation, and revision of plans (Lichfield and Prat, 1998). Baer (1997, p. 330) defines five stages of the planning process, while relating the determination of the appropriate criteria for plan evaluation to those distinct stages of planning: "(1) plan assessment, (2) plan testing and evaluation, (3) plan critique, (4) comparative research and professional evaluation, and (5) post hoc evaluation of plan outcomes". On the other hand, Connell and Daoust-Filiatrault (2018, p. 266) make an emphasis on the timing of stages, rather than defining them, and state that

> *[r]egardless of how the stages may be defined, the timing of the evaluation is strongly associated with the object of study, whereby one might focus on comparing possible alternatives during plan preparation, on results and use of resources during plan implementation, or on whether and to what degree plan policies are carried out (conformance) or their role in effecting change when the plan is implemented (performance).*

It is not possible to think of the root cause of such changes in spatial planning separately from the evolutionary nature of planning approaches. Initially, only the final product (plan) was the focus in the approaches towards the content/essence of planning, and subsequently the planning process and the approaches, based on communicative rationality, began to gain importance. That is, in the words of Demirci (2004, p. 309);

> *premises on which the idea that sees plans as ideal policy decisions (such as plan's introduction of the technical, rational, non-political, neutral, long-term, and comprehensive best-term solution, where knowledge is complete and precise, homogeneous society and unitary public interest) are now controversial.*

DOI: 10.15320/ICONARP.2022.224

This situation has affected the handling of the evaluation, in practice. While there was no concrete progress for the evaluation stage in the late 19th century, in the period of 1930-1960, characterised by prevailing rational comprehensive planning, this stage was defined within the planning process, despite the fact that the focus had been on the plan itself, that is, the final product (Oliveira and Pinho, 2010; Ayrancı, 2013). In this approach, “rational” assessments prevail in urban planning decisions. These evaluations, as Ersoy (2007, p. 118) point out, “emphasize objectivity rather than subjective, emotional attitudes; instead of highlighting and addressing social contradictions, it is the adoption of a public interest approach that defends the interests of the broadest segments of society.” Between the 1960s and 1980s, pluralistic, advocacy, and participatory approaches were raised in planning, and by supporting participation in society, and the plans began to be questioned and evaluated by this provision of a negotiation environment (Ersoy, 2007). In this respect, participation in urban planning, became “institutionalised” with an active and communication-based tendency, and the evaluations in this process have gained importance. However, since the challenge for different scale plans did not dominate, the plans are mostly handled on a singular scale as part of internal evaluations, that test the consistency of decisions that are made. In the period from the 1990s to the present day, the gain in importance of participatory mechanisms and developments in the evaluation stage of the process gave rise to the strategic planning approach (Camillus and Datta, 1991). However, with the importance of market-oriented movements in planning during this period (Ersoy, 2007), evaluations for “investment priority” began to prevail in urban planning. Thus, the evaluation took on a different dimension and the fact that it was an “intervention tool for the market economy”, which is one of the most important arguments in ensuring the legitimacy of planning (Ekiz and Somel, 2005, p. 2), resulted in the transformation of the plan, into an intervention tool, that mainly considers investment priorities. With this changing approach in planning, the plan hierarchy, which are diversified on the regional, sectoral, and local scale, and also appeal to different administrative levels, required a different type of evaluation; thus, external evaluations that address the consistency of decisions between plans have gained importance. “Nonetheless, these instruments do not exist in isolation, but as a part of a wider context, interacting with others.” (Bacău et al. 2020, p.1).

It can be said that the planning periods, described above, correspond to the general planning paradigms that Ataöv (2007, p. 141) grouped as "[n]ormative planning, rational planning, and participatory planning", respectively. Subsequently, the strategic planning approach, which maintained its validity from the 1990s to the present day, is discussed, together with global trends (Ataöv, 2007). Accordingly, it is seen that “[c]ollectively, the different perspectives of and within plan evaluation have evolved considerably over the past fifty years during what is often

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

described as a shift from a positivist to constructivist paradigm" (Alexander, 2002 and Oliveira and Pinho 2010, as cited in Connell and Daoust-Filiatrault, 2018, p. 266) in addition to the current period where the global trends have an impact on the planning process (Ataöv, 2007). Due to the necessity of accountability for the plan decisions that were made in the period when communicative planning approaches have been on the agenda, the importance of the evaluation stage in planning increased the number of discussions on planning theory. However, in the Turkish planning system, for which "comprehensive planning approaches and principles form the bases of implementation" (Eraydın, 2017, p. 564), focus on final planning and implementation stages under rational comprehensive planning, has led to the evaluation of the plans being kept implicit. Therefore, even if planning is carried out by means of a holistic approach with its principles, problems such as irregular construction, building density, continuous intervention in natural areas, and disconnections between the decisions made and the implementation, are constantly on the agenda. Within the scope of eliminating this deficiency in the Turkish planning system, the theoretical background of the evaluation of spatial plans and their handling in practice are discussed in this study.

Theoretical and Practical Framework on the Evaluation of Plans

Since urban planning has become a part of the agenda, and especially covered by comprehensive planning approaches, the number of studies that are related to the quality of plans increased in the international literature. Berke and Godschalk (2009) stated that, at least sixteen studies related to plan quality were carried out in different regions of America, New Zealand, and the Netherlands, between 1997 and 2007. Five years after that work, Lyles and Stevens (2014, p. 439) conducted a descriptive and critical review of the methods in 47 peer-reviewed studies (articles, book chapter, etc.), published between 1994 and 2012, in which the unit of analysis was the plans and the provided quantitative plan quality data.

> *Building on ... distinction between the normative aspect of defining quality and the methodological aspect of generating replicable and reliable data, [the authors] ... address ... three questions ... First, why has there been so much growth in plan quality evaluation studies over the last twenty years? Second, are plan quality evaluation studies adequately relevant to practice and theoretically informative to merit such growth? .... The third question [they] ... seek to answer asks are the methods of plan content analysis being applied such that the data used to measure plan quality are replicable and reliable?*

As a result, the need to develop/improve theories for plan quality was emphasised, by defining the benefits and limitations of the increase in such studies (Lyles and Stevens, 2014).

In particular, in the post-2010 period, studies concerning plan quality evaluations have focused on specific areas of planning (Öztürk

DOI: 10.15320/ICONARP.2022.224

Saka and Erdoğan, 2021). These involve, but are not limited to, ecological systems (Brody et al. 2004), resilient cities (Pickett et al. 2004; Yaman Galantini, 2018), housing (Hoch, 2007), protection of open spaces and smart growth (Norton, 2008), climate change (Bassett and Shandas, 2010), and natural hazards (Baker et al. 2012). Moreover, items such as (9) industry, innovation and infrastructure, (10) reduced inequalities, (11) sustainable cities and communities, (12) responsible consumption and production, from among the 17 Sustainable Development Goals set by the UN under the 2030 Sustainable Development Agenda, may form some of the criteria that should be addressed as part of the evaluation of spatial plans, since they are directly related to cities (Hoşkara, 2020).

In the literature, there are both international and national (Turkish) studies that examine urban planning processes, and provide input to the formation of evaluation criteria.

International Literature Review

Alterman and Hill (1978) conducted an empirical study based on observational analysis of the implementation of the land use plan in the Krayot City of Israel. In the study, building permits were compared with detailed plans and plan notes. In the comparison made in the first stage, a 34% nonconformance was found between the outline plan and detailed plans involving plan changes, over an 11-year period. In the second stage, 25% incompatibility was found in the comparison of detailed plan notes with building permits.

Baer (1997) focused on the evaluation criteria proposed in the literature, and their relationship to various stages of planning, in the context of that author's criticism that few criteria were developed to evaluate the overall plan quality of the planning profession. The criteria from the literature are grouped into eight main groups as "adequacy of context", "rational model considerations", "procedural validity", "adequacy of scope", "guidance for implementation", "approach, data, and methodology", "quality of communication", and "plan format" (Baer, 1997, p. 338-339). Under these groups, sixty criteria were determined to introduce a theoretical framework, yet no sample plans were evaluated on the basis of this framework.

In the study by Laurian et al. (2004), on the degree to which land-use plans are implemented, the conformance-based Plan Implementation Evaluation (PIE) method is proposed for the evaluation of plans and permits. This method is based on the evaluation of the links between policies and implementations for improving the spatial quality. In the area case study the stormwater management and the impact of development on urban amenities in New Zealand's six land use plans of the same scale is examined. These plans were evaluated through the PIE process, defined in five steps. An important contribution of the method is to propose general indicators in measuring the two aspects of the implementation of the plan, including the implementation breadth (the variety of policies implemented during the permitting process), and its depth (the ratio of policies implemented using the techniques specified in the plan in each permission document). As a result, it was determined that the implementation of approved plans, generally remained low (measured in percentage), that there were big differences between the plan objectives and its decisions, and that the plans did not achieve high scores from width and depth measurements, at any stage (Laurian et al. 2004).

Prompted by a lack of studies on the determination of the importance of planning in urban development, Tian and Shen (2007) conducted an empirical study for China's largest provincial capital, Guangzhou, to compare its 2001 and 2007 existing land-uses with its 2001 land-use plan. In the study, which combines quantitative and qualitative analyses, and focuses on evaluating the implementation of the plan, the aim was to determine the impact of the plan on urban growth, and the content of the factors describing the implementation of the plan. Plans were examined in the context of each land-use, in terms of the defined indicators suggested; such as "type of accordance", "type of unfulfillment", and "type of deviation". Evaluations of existing land-uses and the plan, indicated that the Guangzhau land-use plan has limited impacts on the development of the city, where both the level of conformance with the master plan was low, except for open and green areas, and the fact that the deviation rate from the 2001 land-use plan was as high as around 50%. In addition to this quantitative evaluation of the plan implementation, Tian and Shen (2007, p. 15) investigated the qualitative impacts of the plan. In explaining these, they utilised Alterman and Hill's (1978, p. 277-278) implementation trio of "political-institutional factors", "attributes of the plan", and "urban system factors". Thus, unlike Laurian et al. (2004), they included quantitative as well as quantitative evaluations.

In their 2008 study, Oliveira and Pinho aimed to design and demonstrate the applicability of a plan evaluation method in which the urban form is analysed, based on the need for an integrated development of evaluation and planning processes. In this context, while developing the method known as Plan-Process-Results (PPR), which allows quantitative and qualitative testing for the evaluation of urban plans, they identified its main elements as general and specific criteria, evaluation questions, evaluation techniques and resources. Application of the method to a plan requires the utilisation of components of the plan, including its physical characteristics, other plans made, newspapers, interviews with key actors of planning, and statistical data. As a result, despite challenges and complexities, it was observed that it was possible to systematically evaluate urban planning, and it was determined that the plan for Portugal's second largest city, Porto, was successfully completed and implemented (Oliveira and Pinho, 2008).

As a continuation of their 2008 work, Oliveira and Pinho focused on the Lisbon plan in their 2010 empirical study, using the PPR method, which they developed further. In their study, in which they demonstrated the

DOI: 10.15320/ICONARP.2022.224

possibility of evaluation of plan implementations, they argued that a method for this purpose should be clearly related to the theory, and compatible with the evaluation concept. Accordingly, these authors (2010), who developed the method that was applied for Porto in 2008 by integrating rationality, conformance- and performance-based plan evaluation types, evaluated the Lisbon plans based on nine criteria. These are;

> *internal coherence needs and ambitions, interpretation of the planning sys public participation in plan-making and implementation, making, commitment of human and financial resources, effectiveness (plan results), and finally, direction for the urban development process (Oliveira and Pinho, 2010, p. 316).*

Of these evaluations, rationality, that is "ex-ante evaluation", covers the 1st, 2nd, 3rd, and 4th criteria, performance covers the 5th and 6th, and conformance evaluation covers the 7th, 8th, and 9th criteria. Compared to earlier approaches, the method, which focuses on physical decisions and planning implementations and allows the use of many quantitative-qualitative data, is such that it facilitates the plans to be examined in physical dimensions (with criteria such as urban form, housing, land use, environment, and transportation systems). As a result, it was determined that there was more than 50% conformance between the main proposals and the results of the Lisbon plans (Oliveira and Pinho, 2010).

Approaching the evaluation with the concept of reliability, Olazabal et al. (2019), tested the adequacy of de facto plans for their adaptation to climate change in four cities that were selected from developed and developing countries having a population of over one million (Copenhagen, Durban, Quito, and Vancouver) with the Adaptation Policy Credibility (APC) framework they developed (Olazabal et al. 2019). The framework is composed of seven components under two major areas. These are "Policy and Economic Credibility", consisting of (1) Resources, (2) Reliability, and (3) Institutional, Public and Private Support, and "Scientific and Technical Credibility" consisting of (1) Usable Knowledge, (2) Monitoring, Evaluation and Reporting, and (3) Adaptive Management, in addition to the "Legitimacy" component, that is found in each of the major areas (Olazabal et al., 2019, p. 281).

Seventeen (17) indicators and 53 evaluation criteria were developed to address these components, and the sample tests in their contexts were found to be Quito, Vancouver, Copenhagen, and Durban as the best result rankings with Quito being the first. It has been concluded that the framework which succeeded in pilot regions is qualified and necessary to ensure good plan making for solving regional, national, and global problems, and to provide effective use of allocated funds. Based on a more extensive application of APC in their 2021 work, Olazabal and De Gopequi, selected only 59 of 136 largest port cities with in-force adaptation planning, and tested them at the local level for their adaptation planning documents (Olazabal and De Gopequi, 2021). In concluding their evaluation of large cities worldwide, they (2021, p. 10) state that "[a]ccording to available documents, planned adaptation is overall not likely to be effectively implemented, nor does it show sufficient capacity to reduce vulnerability, increase resilience, or to sustain action in the long term."

Bacău et al. (2020) emphasise the need to evaluate external consistency, based on the lack of studies addressing of how different types of plans for the same region interact. It was concluded that "most studies consider plans as single cases" and that studies covering multiple cases addressed the same types of plans from different areas and, however, that different plans for the same area were not examined (Bacău et al. 2020, p. 2).

These authors (2020), in examining external consistency, by using social network analysis (SNA) among ten plans for Bucharest, Romania, and the surrounding region, have based their examination on: "(1) references to other plans (direct and indirect), (2) issues, (3) general planning intentions and (4) spatialized planning intentions." (Bacău et al. 2020, p. 2). The results show that the Bucharest plans were quite consistent in terms of problems and overall planning intentions, and "[t]he SNA allowed us to identify which plans are prestigious (i.e., the most referenced by others), which are central (i.e., the most connected in the networks) and which are peripheral to the networks" (Bacău et al,. 2020, p. 9).

National (Turkish) Literature Review

Ayrancı (2013) aimed to propose a monitoring-evaluation-feedback model to strengthen the relationship between planning and urban development, and comparatively examined the monitoring-evaluation process of different types and scales of plans for London, Paris, and Berlin. "[I]t was seen that plans were constantly monitored and evaluated and revised periodically in all three cities ... it was concluded that the monitoring and evaluation stages show different characteristics depending on the management and planning system and the type and scale of the plans" (Ayrancı, 2013, p. 107). In their study, the planning process of Istanbul, Türkiye's largest metropolitan city was also examined; and it was found that the city's plans were implemented by making numerous changes after their preparation, although they were not evaluated by any means, and in fact there was no model for this in the Urban Planning Law No. 3194 or in the plan reports. In summary, regarding ignoring monitoring and evaluation in planning, it has been emphasised that problems exist, such as an absence of control of plan implementation, arising inconsistencies, and the breakdown of the plan hierarchy (Ayrancı, 2013).

The Istanbul Historical Peninsula Management Plan (HPMP) Monitoring and Evaluation Model, proposed in the study, was examined in two topics as the regulation of the units in the model and the definition of the process. The main indicators that were discussed for the monitoring of the plan were presented, together with the plan

DOI: 10.15320/ICONARP.2022.224

objectives and 24 basic performance indicators that were established in the monitoring of 37 targets. The model for HPMP evaluation consists of three stages: preliminary, annual, and general evaluation. The model proposal was focused on the organisation of the units involved in the process, and the definition of the process, while the monitoring and evaluation results of the plans were not dealt with.

As a result, the author (2013, p. 198) pointed out that the criteria that will be determined for the monitoring and evaluation stages will vary according to the scale cities and their administrations, and they will also vary depending on the types and scales of the plans.

Considering deficiencies in the planning process and implementation stages, Gölbaşı (2014) compared Provincial Territorial Plan (PTP) of Istanbul with the planning experiences of metropolitan cities that have similarities to this city, with reference to the criteria for plan success. Using the PPR method of Oliveira and Pinho (2010), theses authors (2014) compared the plans of İstanbul, London, New York, Lisbon, Montreal, and Paris, based on the 1st, 2nd, 4th, 5th, 7th, and 8th of those criteria, since it is not possible to apply all of the nine criteria in the method to the planning process, in the circumstances of Türkiye. The results obtained were scored and converted to quantitative data, but the way in which the scoring is undertaken was not detailed. As a result, it is stated that with reference to the criteria, Istanbul PTP always lags behind according to the city plans examined, and the spatial examination of İstanbul-specific results will provide a guideline for subsequent studies (Gölbaşı, 2014).

Zoral and Varol (2016) discussed the development of a Sustainability Assessment Approach (SAA), that can be implemented in two of the few strategic territorial plans (TPs) (Bursa 2020 1/100,000 scale TP (1998) and Bilecik 2030 1/100,000 scale (2008) TP) in Türkiye, using SAA, pre-conformity analysis, determination of the method (stakeholders, control list and scoring, Analytical Hierarchy Process (AHP), optimisation and economic models, etc.), determination of sustainability criteria and weighting of criteria by the selected AHP method. In the study, the SAA, which was created "with reference to the sustainability principles and criteria of the Czech Republic" (Zoral and Varol, 2016, p. 60) is used in plan comparison. Finally, Bursa's PTP received a score of 1.26, while Bilecik's PTP, which is ahead in participation and consensus, organizational and administrative capacity and environmental resources protection, scored 1.91.

Evaluation Stage in the Turkish Planning System

Türk and Erkan (2018, p. 219) state the importance of the necessary technical tools and methods for systematic evaluation of spatial plans as "it is risky to plan without the use of technical tools and methods developed to accurately evaluate objective reality and external factors as much as possible". It can be stated that in the Turkish spatial planning process, the evaluation stage is managed in two ways, both of which are in the form of controlling. The first involves the consideration of the principle of hierarchical integrity between the administrative units with different levels. The second involves the examination of plans by the commissions formed within the local administrations.

In areas where local authorities are authorised, the review of Land Use Plans (LUPs) and 1/1000 scale Implementation Plans (IPs) was carried out in the related commission of each municipality. According to Yıldız (1995, p. 129), the following principles are taken into account in these commissions:

- *Whether regional data is taken into account in the plan,*
- *The possibility of the plan with reference to natural, social, and economic data,*
- *Whether future needs can be met with existing urban infrastructure and technical equipment,*
- *Whether the land use, zoning and settlement arrangement is planned in accordance with the needs of the town,*
- *The possibility of realising a plan, and its capacity to be implemented,*
- *Whether the plan is organised in accordance with the technical norms determined by the regulation,*
- *Conformance with the principles of upper-scale plan decisions (territorial plan, land-use plan, etc.) in the organisation of the implementation plan.*

It is a fact that these principles remain inadequate and highly coarse for a wide-context regulative process such as planning.

In the simplest way, the proclamation of plans after their preparation is also a kind of public evaluation process. In addition, in accordance with the traditional planning approach in Türkiye, the determination of the success of the plans is only discussed in the context of the degree to which the plan decisions are implemented. However, there is no guarantee that even a fully implemented plan will or has achieved its goal (Demirci, 2004), because planning is a such as multidimensional and multi-stakeholder order area, in which the process must be operated in a holistic manner. The perspectives of the actors participating in the implementation stage may vary from the perspective of the decision makers during the planning process (Demirci, 2004). Therefore, it is important to evaluate the capacity of the plans to achieve the goals set by certain criteria. Evaluation discussed in a small number of national studies at the spatial level (see Ayrancı, 2013; Gölbaşı, 2014; Aşgın and Yaman, 2018, Değerli and Erbaş, 2021) are also used in many different areas such as the evaluation of participation activities of municipalities, workplace performances, and assessment of education policies (see Akpınar and Özer, 2008; Akman and İpek, 2019; Üngüren and Koç, 2015).

In the development of a framework for evaluation, the legal and administrative instruments of the relevant country (laws, regulations, specifications, etc.) should also be considered (Segura and Pedregal, 2017). Accordingly, there is no explanation in the effective Urban

DOI: 10.15320/ICONARP.2022.224

Planning Law No. 3194, and in the Regulation on the Principles of Planning, which was effective for thirty years, that will improve the planning process or emphasise the evaluation stage under such titles as planning hierarchy, base maps and zoning plans, preparation and implementation of plans. Although the Regulation on the Principles of Planning was found to be important for its emphasis on the integrity of the plan and plan report, its involvement is no provision or guarantee that might be an input for a concrete evaluation criterion.

With the introduction of the Regulation on Spatial Planning (RoSP), that went into effect with Official Gazette dated 14.06.2014 and numbered 29030, the "Regulation on the Principles of Planning" (RoPP) and the "Regulation on Territorial Plans" were repealed. The RoSP, which brings various reforms to planning, includes explanations that improve the planning process, and emphasise the evaluation stage (Öztürk, 2018; Öztürk Saka and Erdoğan, 2021; 2022). In sum, the RoSP is the first regulation to indicate that plan reports should provide important information on planning, in detail, rather than by using general explanations. Moreover, the public facility standards of the previous regulation have been revised and especially facilities such as green area, education, and health services have been detailed.

The Technical Specifications of the Bank of Provinces for Urban Planning (TSBPfUP) support the evaluation stage in the planning process. Although it is important in this regard, it has no details that specify the objective criteria for this stage. However, it is important in emphasising the need to have plan, sheet-plan, report-plan, notes-plan, and legend in the final product, i.e., the settlement plans.

MATERIAL AND METHODOLOGY

The Case Area and Its Plans

Trabzon is not independent of the problems in the Turkish planning system, in terms of its planning practice, which is the central province and settlement of the Eastern Black Sea Region. Due to topographic thresholds, the value of scarce lands of their settlements, which are located in an adjacent form in a narrow band on the shore, is high. Trabzon Municipality became Trabzon Metropolitan Municipality in 2014, when law no. 6360 came into force, and the small municipalities were closed and connected to the relevant district municipalities. Currently, the area of the province, consisting of 19 municipalities (1 metropolitan and 18 district) and 692 neighbourhoods, is 4,671 km^2, (1/50,000 scale Trabzon PTP Report, 2017) and has a population of 811,901 as of 2020 (TURKSTAT ADNKS, 2020).

Trabzon has been selected as a case area because it has two important criteria that are determined in this study. These are: 1) there was a need to ensure that the city would have nearly all of the spatial plans defined in legislation from the upper-scale to the lower-scale, and 2) there would be plans for the neighbouring settlements.

In application of the GESP, upper-scale plan data involve: 1/100,000 scale, Ordu, Giresun, Gümüşhane, Trabzon, Rize, Artvin Territorial Plan (TP) and 1/50,000 scale Provincial Territorial Plan of Trabzon (PTP) and lower-scale plan data involve 1/5000 scale, Land Use Plans (LUPs), and 1/1000 scale, Implementation Plans (IPs), which were all made for revision and extension purposes for three neighbouring settlements. These earlier approved plans, which belong to currently closed town municipalities, are Akyazı neighbourhood in the District of Ortahisar, and Yıldızlı and Söğütlü neighbourhoods in the District of Akçaabat (Figure 1).

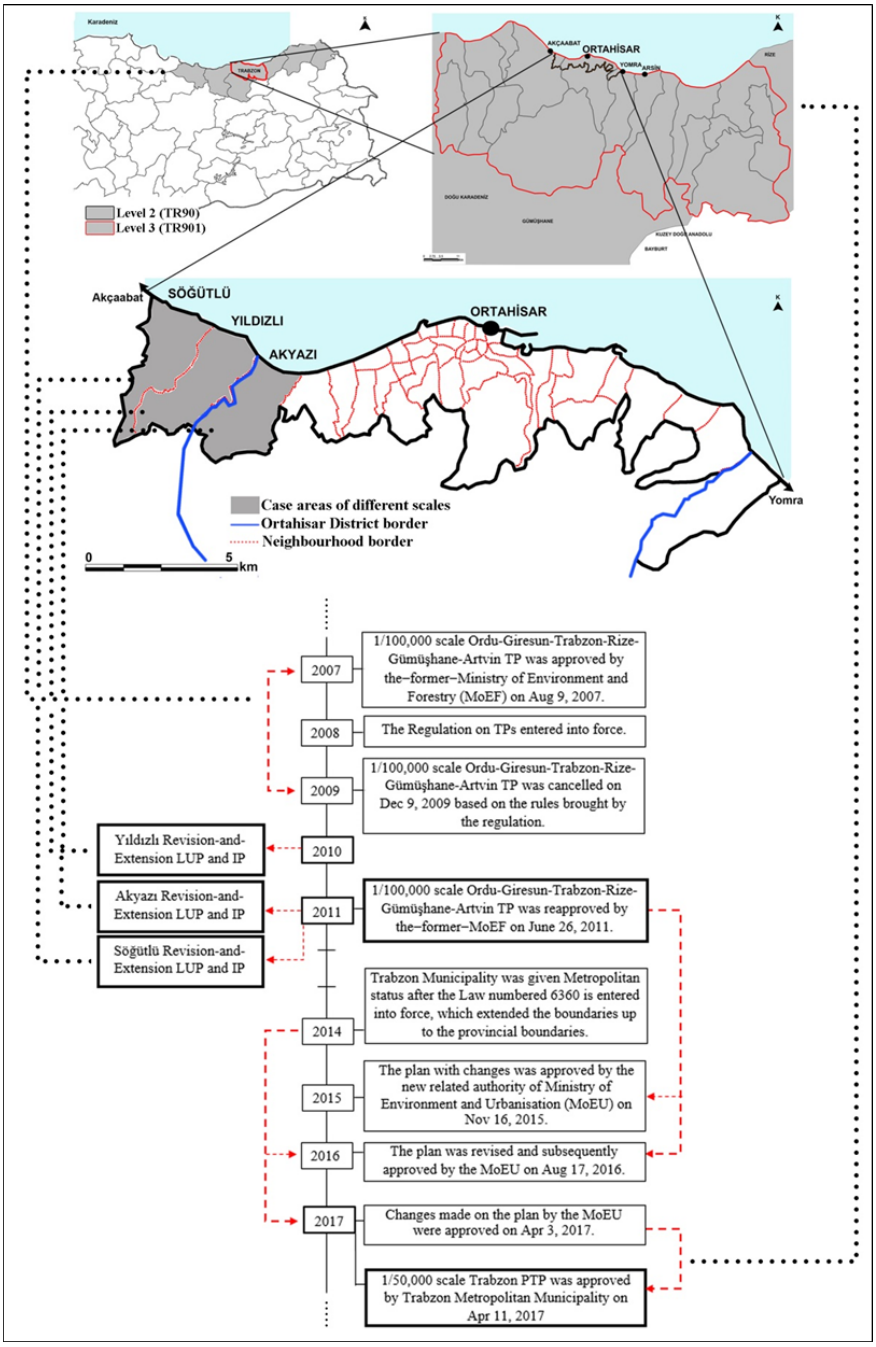


Figure 1. Location of upper- and lower-scale case areas. (Text reorganised from Öztürk, 2018, p. 57, maps from Öztürk, 2018, p. 51 and were originally prepared by using the 1/50,000 scale Trabzon Provincial Territorial Plan data, 2014.)

DOI: 10.15320/ICONARP.2022.224

The following limitations for the consistency tests were identified for the plans of case areas.

- Within the scope of this study, the evaluation of plans using consistency tests was regarded as a technical work. Political and bureaucratic processes are not examined.
- Due to the limits defined for the study area boundaries, it was not possible to test 1/100,000 scale TP and 1/50,000 scale PTP for horizontal-external consistency with their similar-scale neighbouring plans.
- In the consistency tests of lower-scale plans, since new lower-scale plans that were prepared after their recent upper-scale plans were not finalised according to the objections made, the earlier revision and extension plans of the three settlements, mentioned above (before Trabzon became a metropolitan municipality in 2014), were used. In the following sections, for purposes of simplicity and flux, the wordings of "revision and extension" are not repeated in the names of those plans.
- Since a single plan report (PR) has been prepared without differentiating plan scales between 1/5000 scale LUP and 1/1000 scale IP for Akyazı settlement, this report was assumed to be the report for the IP. Accordingly, internal consistency tests for 1/5000 scale LUP for Akyazı was made by using plan sheets (PSs), plan notes (PNs), and plan legend (PL). For the same reason, in the horizontal-external consistency test of this settlement with 1/5000 scale LUPs and vertical-external consistency tests with both 1/50,000 scale PTP above and 1/1000 scale IP below, the same plan components (PSs, PNs, and PL) were evaluated.
- Similarly, horizontal- and vertical-external consistency tests for Yıldızlı were also limited to the use of PSs, PNs, and PL.
- For Söğütlü settlement, since PR was available only for the 1/1000 scale IP, in consistency tests, the report examination was possible only at this scale. Thus, for a similar reason, all the limitations stated for Akyazı were also valid for Söğütlü. In addition, since there were no PNs for 1/5000 scale Söğütlü LUP, it was not possible to examine this plan component for internal, horizontal- and vertical-external consistency tests applied at this scale.

Guideline for Evaluation of Spatial Plans

Within the scope of the GESP, the developed conformity-based approach (Baer, 1997; Faludi, 2000; Tong and Zhang, 2016) was taken into account in evaluating plans, input from the reviewed literature, and legislation, which were instrumental in establishing the criteria of the guideline (Table 1) (see Öztürk Saka and Erdoğan, 2022).

The common features of the analytical approaches described for the evaluation of plans, is that they focus on examining the implementation stages after their approval. In each of the related studies, it was seen that different methods were developed and used. What makes the GESP different from other studies, is the order of the stage in which it takes part in the planning process. In this respect, the GESP makes recommendations that are not on the implementation of the plans, but

Table 1. The way in which the reviews in the literature contributed to the proposed GESP; and their context (Taken from Öztürk Saka and Erdoğan (2022, p. 349) after making addtions mentioned in the table footnote above, and some briefings in the utilisation part of the 3rd literature review, and briefing of some repeating conjunctions)

Reviews	What part is utilised	How it is utilised/Which additions were made		
		Internal consistency	External Consistency	
			Horizontal-external consistency	Vertical-external consistency
Literature	The first and the fourth criteria of Oliveira and Pinho (2008; 2010)	The first criterion (internal consistency) is directly used as **basic test type.**	The fourth criterion (external consistency) is detailed as **horizontal-external consistency** and used as **basic test type.**	The fourth criterion (external consistency) is detailed as **vertical-external consistency** and used as **basic test type.**
	Bacău et al. (2020)*	–	It complies with the **basic test type**, that is created for the need to address different types of plans decisions as a whole for the same area.	
	The **qualitative evaluation** criteria in the works of Ayrancı (2013) and Tian and Shen (2007)	**Qualitative data type** from Ayrancı (2013): Face-to-face communications, review of reports and documents, subjective observations **Qualitative data type** fromTian and Shen (2007): Political-institutional factors, characteristics of the plan, and factors of the urban system		
Legislation	The requirement for the integrity and consistency of the plan components (sheets-report-notes-legend)	The main and sub-criteria of "**consistency of plan decisions**" were created.	–	The main and sub-criteria of "**consistency of plan decisions**" were created.
	The factors that need to be undertaken, to detail the analyses and syntheses in plan reports, by emphasising the planning process	The main and sub-criteria of "**process consistency**" and "**information flow consistency**" were created, in which the transfer of planning processes was investigated.	–	The main and sub-criteria of "**process consistency**" were created, in which the transfer of planning processes was investigated.
	The need for differentiation of detail levels among different scale plans	–	–	The main and sub-critera of "**plan language consistency**" were created.
Professional doctrines/tenets		–	The main and sub-critera of "**consistency of plan decisions**" were created.	–
		–	The main and sub-criteria of "**process consistency**" and "**information flow consistency**" were created, in which the transfer of planning processes was investigated.	–
		The main and sub-criteria of "**methodology consistency**" were created.		

* Added as new resource that complies with the input of the previously proposed evaluation framework of GESP in Öztürk (2018) and Öztürk Saka and Erdoğan (2021).

rather on the determination of the issues that will need to be re-focused, with feedback, when the plan-making process is being completed, combined with plan evaluation prior to plan approval.

Qualitative evaluation criteria in the studies of Ayrancı (2013) and Tian and Shen (2007) were developed with quantitative data (population and public facility computations), and with these criteria of the guideline, the integrity of plan components was evaluated (Table 1).

DOI: 10.15320/ICONARP.2022.224

The first and fourth of the nine criteria, determined by Oliveira and Pinho (2008, 2010) in their PPR method for plan evaluation, were used as the two basic tests of the GESP (Öztürk, 2018; Öztürk Saka and Erdoğan, 2021; 2022) (Table 1).

External consistency, which includes the need to address different types of plan decisions, as a whole for the same area, as highlighted by Bacău et al. (2020), is also complied with, in the input of one of these two main tests (Table 1). These tests, which are considered as internal and external consistency (further detailed as horizontally and vertically within it) aim to guide the criteria to be created, in order to evaluate the plans for each city and the region in Türkiye, within the context of the specified scale.

The guideline's basic test for internal consistency addresses the examination of different scales and types of plans, in a "singular" manner within themselves; the horizontal-external consistency test addresses the holistic consideration of a plan, together with its same scale "neighbouring border" plans; and the vertical-external consistency test addresses holistic consideration of a plan together with its all upper- and lower-scale plans, in line with the principle of hierarchical integrity (Figure 2).

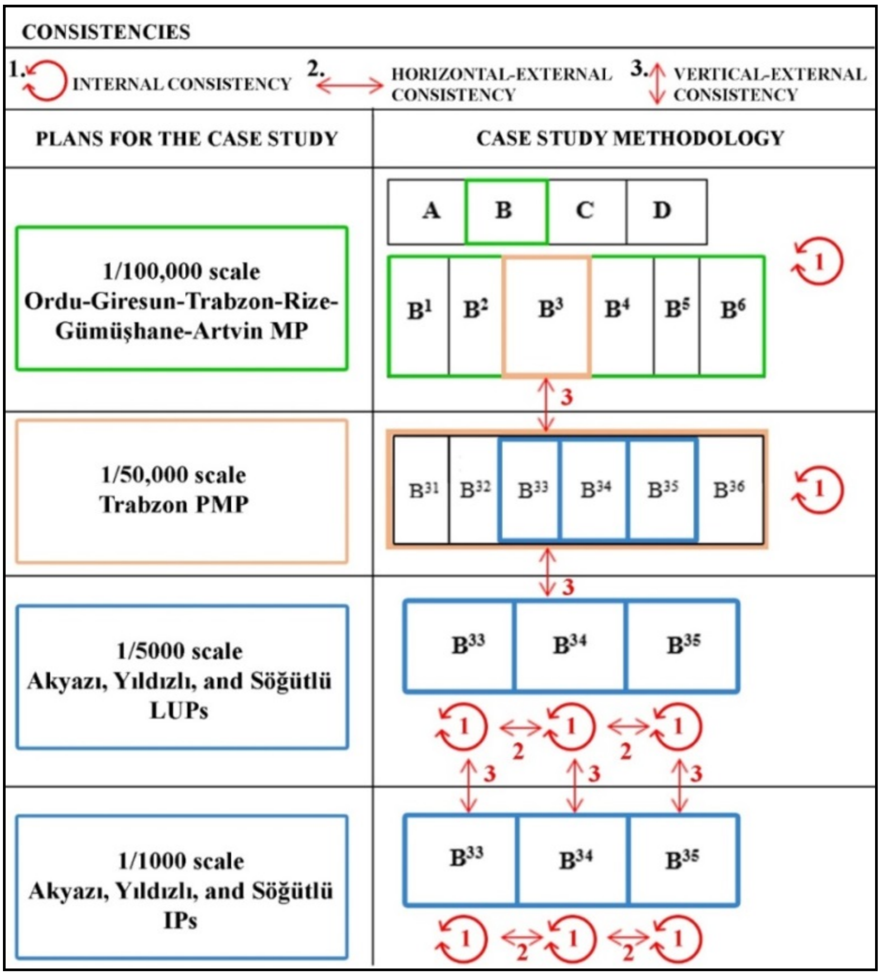


Figure 2. Visualisation of the application of the consistency tests on the case area plans (Reorganised from Öztürk, 2018, p. 9.)

With the criteria that make up the tests; no results are presented in terms of probability, error margin, or measure of consistency, but a conclusion is made on the existence/non-existence of consistency within the context of the specified criteria. In this regard, it can be said that the proposed guideline produces deterministic results. Input from the legislation into the GESP is outlined below (Öztürk Saka and Erdoğan, 2021, p.1720-1721).

> *Although the contents of the Urban Planning Law No. 3194, the Regulation on the Principles of Planning (RoPP), and the Technical Specifications of the Bank of Provinces for Urban Planning (TSBPfUP) differ from general to particular, in all of them, it is clearly stated that the plan components (sheets-report-notes-legend) are integrated and must be consistent with each other. This resulted in the need for "internal consistency" in the plans, which is one of the basic tests of the GESP, and as a result, this basic test and the "consistency of plan decisions", which is one of the main criteria of this test was developed within the GESP, and detailed with sub-criteria. In this context, the consistency of plan decisions can be investigated through the plan and plan reports, by means of the test based on the public facility standards in the RoPP and RoSP. RoSP highlights the planning process and specifies what is required for undertaking the analyses and syntheses to be detailed in the plan reports. Accordingly, the main criteria of "process consistency" and "information flow consistency" and their sub-criteria were introduced into GESP, in which the transfer of these processes was investigated. In addition, the provisions of this regulation for controlling the suitability of lower-scale plans to the upper-scale plans, formed the basis of the "vertical-external consistency" basic test in the GESP, in which the hierarchical integrity of the plans was investigated. One of the main criteria of this basic test, which is included in the legislation for the first time with RoSP, despite being a professional teaching, has been established in the MPDK as the main criteria of "plan language consistency", and its sub-criteria in relation to the need for differentiation of the level of detail between scales.*
>
> *From the literature and legislation review, no finding came out for the GESP that would directly constitute its input for the basic test of "horizontal-external consistency" and its criteria, which address the consistency of neighbouring plans. Nevertheless, such a requirement was extracted from the general rules of professional doctrines/tenets on the importance of ensuring the consistency with the neighbouring plans, as well as the consistency of the plans with the upper- [and lower-] scale plans. Similarly, for "methodology consistency", which is one of the main criteria of all the basic tests of the GESP, no finding came out from the literature and legislation review, that will generate an input in this regard. On the other hand, this criterion is also based on the need to use the correct techniques and methods for population and employment projections, and to harmonise … [their] results between the neighbouring plans [of nearby settlements] and upper- [and lower-] scale plans for the same settlement.*

In the context of the GESP, the three-step consistency tests (i.e., internal, horizontal-external, and vertical-external) are applied for the components of the plan (i.e., plan sheets, plan report, plan notes, plan legend), and the same components for its upper- and/or lower-scale and neighbouring settlement(s) plan(s). The consistency tests mainly involve criteria that have been developed in relation to the "process", "information flow", "method", "plan decisions", and "plan language" (Figure 3).

DOI: 10.15320/ICONARP.2022.224

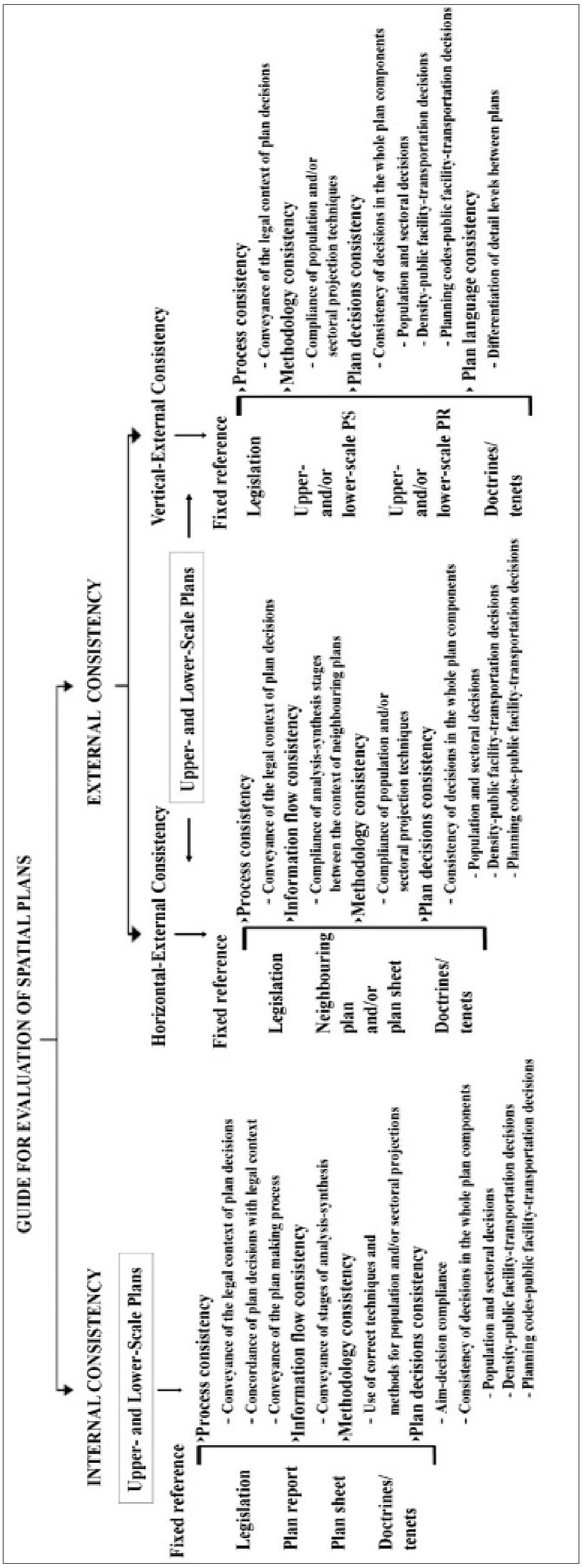


Figure 3. Criteria of GESP. (Öztürk, 2018, p. 49; Öztürk Saka and Erdoğan, 2021, p. 1725; Öztürk Saka and Erdoğan, 2022, p. 353)

RESULTS

Each of the consistency tests for the application of the GESP, are examined individually, in terms of the criteria given in Figure 4 (internal), Figure 6 (horizontal-external), and Figure 9 (vertical-external) in the related sub-sections from upper- to lower-scale planning, in line with planning hierarchy.

The results of this examination are summarised in Table 2. It was concluded that the plans of the case study displayed inconsistency, regarding their respective criteria in many evaluation tests. In particular, it is noteworthy that the upper-scale evaluation, i.e., the 1/100,000 scale TP, and the lower-scale evaluation 1/5000 scale LUPs displayed inconsistency for all the relevant internal criteria (Table 2). Similarly, as expected, the horizontal-external inconsistencies also dominate, in between the same scale plans and vertical-external inconsistencies, between different scale plans for almost all criteria evaluated (Table 2).

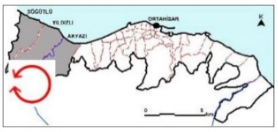
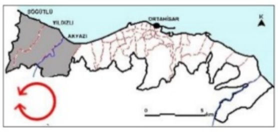
Table 1. The results of the application of GESP to the selected case area plans (NA: Not Applicable)

Basic Tests	Internal Consistency				External Consistency				
					Horizontal		Vertical		
Plans / Main-criteria	1/100.000 scale Ordu-Giresun-Trabzon-Rize-Gümüşhane-Artvin TP	1/50.000 scale Trabzon PTP	1/5000 scale Akyazı, Yıldızlı and Söğütlü LUPs	1/1000 scale Akyazı, Yıldızlı and Söğütlü IPs	1/5000 scale Akyazı, Yıldızlı and Söğütlü LUPs	1/1000 scale Akyazı, Yıldızlı and Söğütlü IPs	Between 1/100.000 scale Ordu-Giresun-Trabzon-Rize-Gümüşhane-Artvin TP and 1/50.000 scale Trabzon PTP	Between 1/50.000 scale Trabzon PTP and1/5000 scale Akyazı, Yıldızlı and Söğütlü LUPs	Between 1/5000 scale Akyazı, Yıldızlı and Söğütlü LUPs and 1/1000 scale Akyazı, Yıldızlı and Söğütlü IPs
Process consistency	–	–	–	–	NA	NA	–	NA	NA
Information flow consistency	–	+	–	NA	–	–	NA	NA	NA
Plan decisions consistency	–	–	–	–	–	–	–	–	–
Methodology consistency	–	–	–	NA	NA	NA	NA	–	NA
Plan language consistency	NA	NA	NA	NA	NA	NA	NA	NA	+

Internal Consistency Tests

Internal consistency tests were applied to different scales and types of plans that involve 1/100,000 scale TP, 1/50,000 scale PTP, and 1/5000 scale Akyazı, Yıldızlı, and Söğütlü LUPs and their IPs, which were all made for the purposes of revision and extension under the aforementioned limitations (Figure 4).

DOI: 10.15320/ICONARP.2022.224

Plans	Tests	Fixed reference (**)	Examined components (**)
1/100,000 scale Ordu-Giresun-Trabzon-Rize-Gümüşhane-Artvin TP	Process consistency Conveyance of the legal context of plan decisions Concordance of plan decisions with legal context Conveyance of the plan making process	 Legislation Legislation Legislation	 PR PR PR
	Information flow consistency Conveyance of stages of analysis-synthesis	Legislation-Doctrines/ tenets	PR
	Methodology consistency Use of correct techniques and methods for population and/or sectoral projections	Doctrines/ tenets	PR
	Plan decisions consistency Aim-decision compliance Population and sectoral decisions	 PR-PS PR-PS	 PR-PS-PN-PL PR-PS-PN-PL
1/50,000 scale Trabzon PTP	Process consistency Conveyance of the legal context of plan decisions Concordance of plan decisions with legal context Conveyance of the plan making process	 Legislation Legislation Legislation	 PR PR PR
	Information flow consistency Conveyance of stages of analysis-synthesis	Legislation-Doctrines/ tenets	PR
	Methodology consistency Use of correct techniques and methods for population and/or sectoral projections	Doctrines/ tenets	PR
	Plan decisions consistency Aim-decision compliance Population and sectoral decisions	 PR-PS PR-PS	 PR-PS-PN-PL PR-PS-PN-PL
1/5000 scale Akyazı, Yıldızlı, and Söğütlü LUPs (*)	Process consistency Concordance of plan decisions with legal context Conveyance of the plan making process	 Legislation Legislation	 PR PR
	Information flow consistency Conveyance of stages of analysis-synthesis	Legislation-Doctrines/ tenets	PR
	Methodology consistency Use of correct techniques and methods for population and/or sectoral projections	Doctrines/ tenets	PR
	Plan decisions consistency Density-public facility-transportation decisions	PR-PS	PR-PS-PN-PL
1/1000 scale Akyazı, Yıldızlı, and Söğütlü IPs	Process consistency Concordance of plan decisions with legal context Conveyance of the plan making process	 Legislation Legislation	 PR PR
	Plan decisions consistency Planning codes-public facility-transportation decisions	PR-PS	PR-PS-PN-PL

(*) Based on the identified limitations of the study, having all the plan components only at the 1/5000 scale LUP, Yıldızlı settlement was examined at this scale. However, for a complete and detailed sample expansion for the scheme seen in Figure 3, here the names of those plans are also included in this table.
(**) Plan Components: PS: Plan Sheet, PR: Plan Report, PN: Plan Notes, PL: Plan Legend

Figure 4. Internal consistency tests of GESP within the context of the spatial plans for the study area. (Reorganized from Öztürk, 2018, pp. 54-55.)

1/100,000 scale Ordu-Giresun-Trabzon-Rize-Gümüşhane-Artvin TP

In order to exemplify application of internal consistency test to a 1/100,000 scale plan, tests for the main criteria of process, information flow, methodology and plan decision consistencies and their sub-criteria were carried out.

In process consistency, it was observed that the legal context of plan decisions is not conveyed and the process of plan making is not included in the PR. In information flow consistency, it was identified that the necessary analyses and syntheses were not made in preparation of the plan report, and even if they had been made, they were not included in the report. When methodology consistency is examined in terms of the use of correct techniques and methods for population and/or sectoral projections; it was observed that techniques other than simple extrapolation methods were not used in determining the future population and the results found were averaged, when they should not be. Furthermore, only the total value of five districts could achieve almost the projection value determined by TSI for the whole province of Trabzon in year 2025, a period that is very close to the projection year of the plan. The reasons for this are non-questioning of the population capacities that were determined for the former town municipalities in the TP and ignorance of the necessary details in the projection computations. Similarly, the sectoral projections at the provincial and regional levels were left incomplete in the PR. Hence, it was seen that it was not possible to determine what this upper-scale plan forecasted for the region. Finally, with respect to plan decisions consistency, when aim-decision conformance was examined, it was found that the population projection values, sectoral and planning decisions were not compatible with the plan's aim. The main criterion on population and sectoral decisions requires that population forecasts must include future employment figures. To get those figures, employment capacities of sectoral decisions that involve land-uses such as organised industrial zones and airports need to be given. In this respect, in the plan it was observed that those capacities for the province or region that would be brought mainly by the land-uses for industry and tourism were not given and thus the forecasts were not based on concrete data. In addition, it was found that the decisions made for industrial areas and the protection of water basins were not covered on the PSs, but were limited to the explanations made in the PR, and there were no data and plan decisions in PR for tourism. In this context, in PSs, it was seen that only the areas for tourism centres were shown, but without any explanation of how those borders were drawn and without any specification of the required details for those decisions in the PNs, which were also left incomplete in the PL.

1/50,000 scale Trabzon PTP

The example for the application of the internal consistency test to a 1/50,000 scale plan, similar to 1/100,000 scale tests for the main criteria of process, information flow, methodology and plan decision consistencies and their sub-criteria were carried out. In the introduction section of the PR for the plan revision made in year 2017, where scale, scope and legal grounds of the plan are stated, it is seen that the legal basis was taken as the Regulation on Territorial Plans dated 2008 that has ceases to have effect by way of the Regulation on Spatial Plan Making dated 2014. As a result of reference to a legal context that is not in effect, an inconsistency was found in the examination of this upper-scale plan in terms of process consistency. In addition, even if such a legal context would be up-to-date, it was observed that the concordance of the plan decisions with respect to legal context and the planning process is not included in PR. Regarding the information flow consistency, it was observed that the analyses and syntheses were conveyed using up-to-date data in PR. In terms of methodology, consistency in PR, including the use of correct techniques and methods for population and/or sectoral projections, it was seen that the projection year of the plan was taken as 2040, which turned out to be 2026 in its upper-scale 1/100,000 scale TP. In PR, where there is no explanation for this difference, it was also found that there was no computation for the rural population, and that sectoral and spatial decisions are not included in the computations for urban population and

DOI: 10.15320/ICONARP.2022.224

the lower-scale plans were used without questioning the population capacities. Moreover, the computation for the future population was determined by taking average of the results of extrapolation methods, but they should not have been. Similarly, when plan decisions consistency is examined in terms of aim-decision conformance, it was found that the aim of the plan is not compatible with the computed population values, sectoral and planning decisions. When plan decisions consistency is examined with respect to population and sectoral decisions, it was seen, as in the upper-scale plan, that employment capacities for the province or region that would be brought mainly by the land-uses for industry and tourism were not given and thus the population forecasts were not based on concrete data. In terms of plan decisions, it is further observed that the decisions on sub-zoning, transportation and tourism were not drawn on the plan, the required details were not given in PNs, and there are also inadequacies in the PL.

1/5000 scale Akyazı, Yıldızlı, and Söğütlü LUPs

Due to the limitations of the study regarding the data, in the application of internal consistency tests applied to 1/5000 scale plans, examination of 1/5000 scale LUPs of Akyazı and Söğütlü settlements were limited to PSs, PNs and PLs.

In the examinations made on Akyazı 1/5000 scale LUP, not being included in PNs, deficiencies were found in for plan decisions on public facilities and transportation while the integrity of PP and PL was ensured. As for the examination made on Söğütlü 1/5000 scale LUP, it was observed that the plan did not have PNs. Based on these shortcomings, it was not possible to discuss the internal consistency of a plan. The internal consistency test was applied on 1/5000 scale LUP of Yıldızlı settlement based on the criteria shown in Figure 5. With a population size of 11,640, obtained by using the average of the results of extrapolation techniques given in PR and population size of 15,250 accepted as a result of forecasts made, were also calculated from the plan by using density decisions that were specified in the report for testing of related internal consistency, which was found to be 14,480. Since all the required analyses for settlement were not made in detail, the plan could not go beyond meeting the minimum standards for public facility decisions. In terms of the accepted standards for public facility areas in the plan presented in the related table of its report, which takes the year 2030 as a basis, it was observed that the sizes of those areas defined in the report were found to be similar with those that were calculated using the plan, yet both remained below the standards for almost all types of public facilities.

In the analysis of internal consistency in terms of transportation, particular focus is given to road widths. As seen in Figure 5, varying widths of the same road on the plan affected the result of the test. In addition to a lack of explanations on the pedestrian roads in the PR, the

PNs do not contain any explanation of the transport connections described in the PR and specified in the PL.

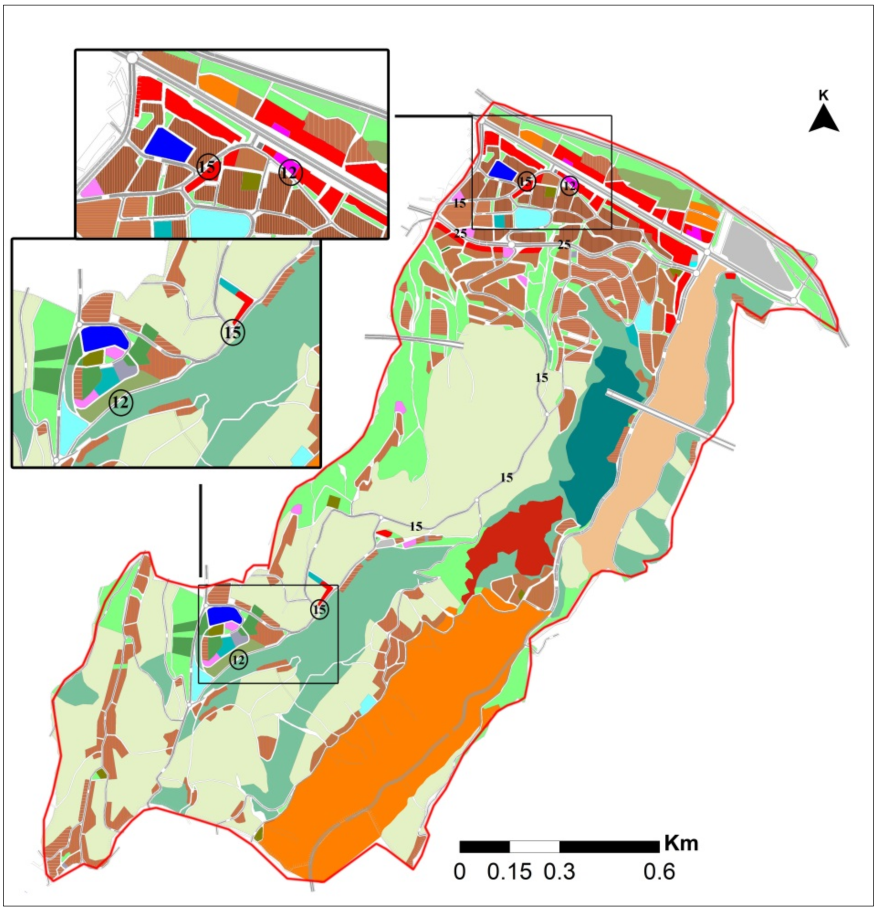


Figure 5. Example of the change of the vehicle road in Yıldızlı LUP. (Öztürk, 2018, p. 69, maps originally prepared by using 1/5000 scale Yıldızlı LUP, 2010.)

1/1000 scale Akyazı, Yıldızlı, and Söğütlü IPs

Internal consistency tests were applied on the 1/1000 scale IP of Akyazı, Yıldızlı, and Söğütlü based on the criteria seen in Figure 4. Firstly, the population capacity was calculated using the planning codes seen in the PSs for comparing and testing the size of the population specified in the PR. In examining the public facilities, plan components were considered as a whole. Areas of public facilities were measured using the PSs and they were compared with those given in the PR. In the context of internal consistency regarding transportation connections, the focus was given to road widths and, similar to 1/5000 scale Yıldızlı LUP, the varying widths of the same road on the plan affected the result of the test.

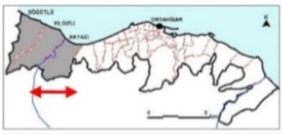
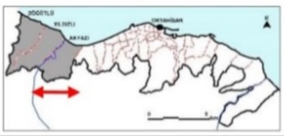
In the examination made to exemplify the application of the internal consistency test on a 1/1000 scale plan in terms of process consistency, it was observed that in all of the three plans there was no conveyance of the plan making process in respective PRs. For plan decisions consistency criterion regarding planning codes, differences were found between those stated in PRs of all the three plans and their populations calculated from PSs. Under this criterion, in terms of public facilities, it was observed that for Akyazı some public facilities were not found in PR despite their presence in PSs and that detailed explanations concerning

DOI: 10.15320/ICONARP.2022.224

public facility areas seen in PSs were not presented in detail in PNs. Furthermore, regarding public facilities, it was observed that there was no integrity among PSs, PR, PNs, and PL in Yıldızlı and Söğütlü plans. Concerning transportation decisions, in Akyazı and Yıldızlı plans, it was found that the widths of vehicle roads are different in their respective PSs and PRs, the pedestrian roads were not explained in their PRs, there was no information on transportation in their PNs and the pedestrian roads were not shown in their PLs. Additionally, in the PR of the Söğütlü plan, it was seen that there was no information on widths of vehicle roads, and also there was no explanation of the pedestrian roads, whereas they were shown in the PL.

Horizontal-External Consistency Tests

As the second basic test of GESP, horizontal-external consistency tests, due to the scope of the study, were not applied to 1/100,000 scale TP and to 1/50,000 scale PTP (i.e. the first two parts in Figure 6) and due to the above constraints were partially applied to 1/5000 scale plans (i.e. the third part in Figure 7). However, the guideline containing the horizontal-external consistency criteria seen in the fourth part of Figure 7, were applied with no problem to the 1/1000 scale IPs of the three neighbouring settlements (Akyazı, Yıldız and Söğütlü).

Plans	Tests	Fixed reference (**)	Examined components (**)
Between 1/100,000 scale Ordu-Giresun-Trabzon-Rize-Gümüşhane-Artvin TP and the neighbouring TPs(*) 	Process consistency Conveyance of the legal context of plan decisions	Legislation	PR
	Information flow consistency Compliance of analysis-synthesis stages between the context of neighbouring plans	Legislation-Doctrines/ tenets	PR-PS
	Methodology consistency Compliance of population and/or sectoral projection techniques	Doctrines/ tenets	PR
	Plan decisions consistency Population and sectoral decisions	Neighbouring PS-PR	PR-PS-PN-PL
Between 1/50,000 scale Trabzon PTP and the neighbouring 1/50,000 scale PTPs(*) 	Process consistency Conveyance of the legal context of plan decisions	Legislation	PR
	Information flow consistency Compliance of analysis-synthesis stages between the context of neighbouring plans	Legislation-Doctrines/ tenets	PR-PS
	Methodology consistency Compliance of population and/or sectoral projection techniques	Doctrines/ tenets	PR
	Plan decisions consistency Population and sectoral decisions	Neighbouring PS-PR	PR-PS-PN-PL
Between 1/5000 scale Akyazı, Yıldızlı, and Söğütlü LUPs 	Information flow consistency Compliance of analysis-synthesis stages between the context of neighbouring plans	Legislation-Doctrines/ tenets	PS
	Plan decisions consistency Compliance of population density-public facility-transportation decisions between the context of plan components	Neighbouring PS-PR	PR-PS
Between 1/1000 scale Akyazı, Yıldızlı, and Söğütlü IPs 	Information flow consistency Compliance of analysis-synthesis stages between the context of neighbouring plans	Legislation-Doctrines/ tenets	PR-PS
	Plan decisions consistency Compliance of planning codes-public facility-transportation decisions between the context of plan components	Neighbouring PS-PR	PR-PS-PN

(*) Based on the identified scope of the study, horizontal-external consistency tests were not applied to the two upper-scale plans.
(**) Plan Components: PS: Plan Sheet, PR: Plan Report, PN: Plan Notes, PL: Plan Legend

Figure 6. Horizontal-external consistency tests of GESP within the context of the spatial plans for the study area. (Reorganized from Öztürk, 2018, p. 85.)

Between 1/5000 scale Akyazı, Yıldızlı, and Söğütlü LUPs and their 1/1000 scale IPs

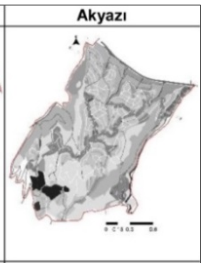
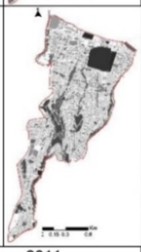
Based on the related planning legislation in Türkiye, the principle of hierarchical integrity is directly related to external consistencies in terms of vertical tests. Horizontal tests also need to comply with this scale ordering in between the same scale plans. In other words, these latter consistency tests should first be examined in the context of ordering of 1/5000 scale LUPs and 1/1000 scale IPs that should be prepared according to LUPs. However, since the planning process especially focuses on the implementation dimension of the plans in the last decades, in general 1/1000 scale IPs are prepared first and then based on the legislative requirements, their upper-level 1/5000 scale LUPs are mainly produced, from 1/1000 scale plans by using information technologies. For this reason, in a sense, plans are similar in each of the other's enlargement and reduction, which certainly should not be the case. Although the horizontal examinations in two scales need to be done separately, since it was observed that the LUPs of the three settlements were prepared in this manner, in order not to fall into repletion, the horizontal consistency tests of these two scales are discussed together.

Planning decisions are expected to form a holistic vision/perspective for settlements having similar economic, social and demographic characteristics in the same geography. In this context, examinations for horizontal-external consistency tests of neighbouring settlements of Akyazı and Söğütlü at 1/5000 scale were limited to PP, PH and PL due to their limitations for PRs (Figure 6). However, horizontal-external consistencies of all the components of 1/1000 scale Akyazı, Yıldızlı, and Söğütlü IPs were tested for the evaluation criteria given in Figure 6.

In order to perform this test, firstly, it is required to compile and tabulate the information that will facilitate the evaluation of plans. The examinations made using the information given in Figure 8 that was created for this purpose and over the plan showed that the plan-making years of the three settlements are very close to each other. Differences in planning teams have also changed the features that are taken into account for plan preparation in the planning process. In the examinations made for 1/5000 scale density decisions on PSs, it was determined that these decisions are not compatible between the neighbouring settlements of Yıldızlı and Söğütlü. While low density residential development decisions were given as 90 people per hectare, the low density in existing settlements is given as 107 people per hectare. Nevertheless, the corresponding former value in Söğütlü is found to be 50-100 people per hectare and also found to be not given for the latter value (Figure 7). When scaled down to 1/1000, the differences in planning teams changed the features that were taken into consideration, not only in the planning process, but also the plans and their reports, such that there is a notable difference in household sizes between the two plans (Akyazı and Söğütlü) that were made in the same

DOI: 10.15320/ICONARP.2022.224

period and approved in the same year. Moreover, the explanations given for population forecasts in the reports revealed that there is a difference of 26,024 (84%) between the computed population projection and the population forecast for Akyazı, while in its immediate neighbour (Yıldızlı) this difference is 3,610 (23%) and 23,772 (59%) in Söğütlü (the neighbour of Yıldızlı). In addition to the problem of deviances of forecasts from the projections, the level of those differences between the neighbouring settlements, without disclosing the rationale behind them and without considering the nearby settlement, add further complications to the case.

Features		Söğütlü(*)	Yıldızlı	Akyazı
Plan Type: Revision-and-Extension Plans 	LUP			
	IP			
Plan Approval Year		2011	2010	2011
Plan Projection Year		2030-2035	2030	2030
Planning area (ha) LUP IP		 481 481	 612 612	 800 800
Household size		4.5	4.5	3
Average flat size		150 m²	110 m²	150 m²
Density decisions (people/ha) in residential areas Low Medium High		Development: 50-100 / 150-200 / 250-300 Existing: - / 150-200 / 250-300	Development: 90 / 200 / 287 Existing: 107 / 200 / 287	-
Population In the report Computed Forecasted as in LUP and/or IP		 16,228 40,000	 11,640 15,250	 4,958 31,000
Calculated from LUP Calculated from IP		45,867 79,747	14,480 35,830	- 40,115

(*) Since the density decisions on residential areas in 1/5000 scale Söğütlü LUP were not given in integer numbers but in ranges, the highest value of this range was used in the population calculation.
Source: Reorganised from XXX, 2018, pp. 88-92, original data source for planning area, plan approval year, plan projection year, average flat size, household size, and populations forecasts of the plans are PRs of 1/5000 and/or 1/1000 scale LUP and/or IP, i.e. Akyazı report(s), 2011; Yıldızlı report(s), 2010; Söğütlü report(s), 2011); and the calculated populations values obtained from the calculations made using related PSs

Figure 7. Features of 1/5000 scale LUPs and 1/1000 scale IPs in relation to horizontal-external consistency test.
(Reorganised from Öztürk, 2018, pp. 88-92, original data source for planning area, plan approval year, plan projection year, average flat size, household size, and populations forecasts of the plans are PRs of 1/5000 and/or 1/1000 scale LUP and/or IP, i.e. Akyazı report(s), 2011; Yıldızlı report(s), 2010; Söğütlü report(s), 2011); and the calculated populations values obtained from the calculations made using related PSs.)

The reasons for population forecasts for the three settlements are indicated in the PRs of 1/5000 and/or 1/1000 scale plans. In these reasons, it needs to be explained how the decisions given within their own borders will actually be affecting the plans for their neighbouring settlements. However, in the final population decisions, such differentiations emerged as if they were the settlements of three different and even non-neighbouring provinces.

In examining 1/5000 scale LUPs in terms of the decisions for public facilities and transportation, it is expected that plan decisions for neighbouring settlements will affect each other and, therefore, those decisions should have been given after undertaking the related work for analyses and syntheses. However, in the examination made on PSs, it was observed that administrative boundaries are taken into account for public facility locations and there are inconsistencies on intersecting boundaries, for example, while one side of the boundary is planned as park and agricultural area, the other side is planned as a medium density residential area. In addition, it was observed that analyses for public facilities in terms of accessibility, catchment distances, and served populations were not conducted, and related decisions for those facilities such as primary schools and healthcare are given in very close proximities at the intersections of administrative borders of neighbouring settlements (Figure 9). In short, as with the public facility decisions in the plans, which seemed to adhere to the administrative boundaries, the differentiations for the settlements were observed that would give the impression that they were located in three different and even non-neighbouring provinces. Similarly, in neighbouring settlements, while the width of the main vehicle roads between settlements should not change and their continuity should be ensured, it was seen that the main road that connects the neighbouring settlements of Söğütlü and Yıldızlı was planned as 25 m in width and that the same road passing through Akyazı in the continuation of Yıldızlı was planned as 30 m in width (Figure 8). PSs lack a holistic proposal regarding the pedestrian roads for all of the neighbouring settlements; those roads were suggested as a single road axis within the administrative boundaries of the plans and with a discontinuous road axis in between.

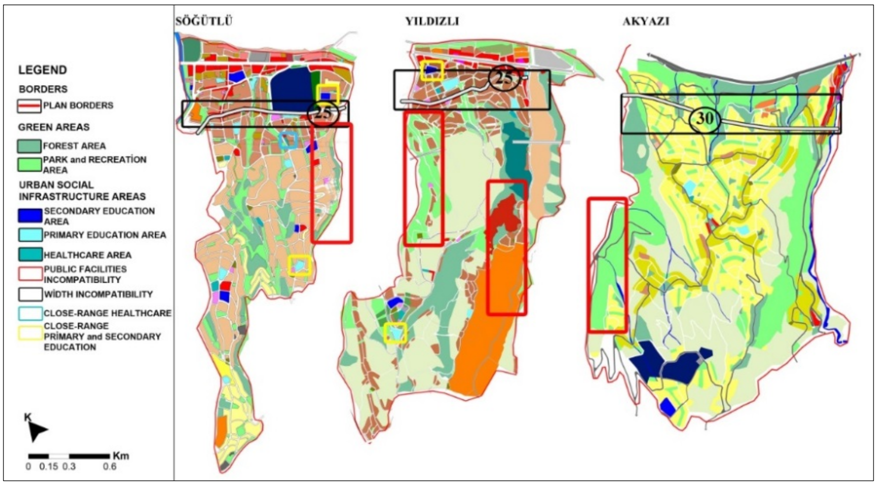


Figure 8. Comparison of planning decisions for Akyazı, Yıldızlı, and Söğütlü in the context of horizontal-external consistency test. (Öztürk, 2018, p. 89, maps originally prepared by using 1/5000 scale Akyazı (2011), Yıldızlı (2010), and Söğütlü (2011) LUPs.)

When 1/1000 scale IPs are examined in terms of public facility and transportation decisions, the inconsistencies indicated in 1/5000 scale LUPs were also found to be valid for the horizontal-external test at this scale. The examinations of 1/1000 scale PRs for public facilities in the three neighbouring settlements, despite the planning decisions such as sea-fill area, cruise port and sports complexes (including stadium), hospitals, and university campus, which can even affect regional decisions, it is seen that there are no explanations for these decisions in

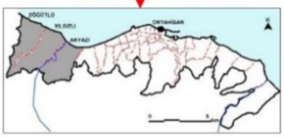
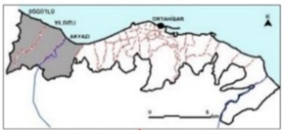
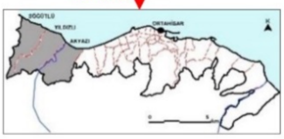
DOI: 10.15320/ICONARP.2022.224

the PR of its immediate neighbour. Since there are no analysis and synthesis stages in PRs, it is implied that the plan decisions neither define the spatial potentials nor are they given in a holistic manner with reference to the decisions given for neighbouring settlements. In PRs, it was observed that there was no explanation about integrated/holistic handling of transportation connections in three neighbouring settlements and that there were even no transportation decisions in the PR of Söğütlü. In addition, it was seen that there was no explanation of the relations between neighbouring settlements in terms of pedestrian roads and that transportation decisions were made only for vehicle transportation, as mentioned earlier.

In the examinations made on 1/1000 scale IPs, PRs and PNs were considered as a whole, and planning codes defined for the population were evaluated from PSs. From among the neighbouring settlements, variation in the planning codes of Söğütlü IP were found to be striking. Again, the highest Floor Area Ratio (FAR) in the same plan is considerably higher than those of other plans. In addition to examining the planning codes of the plans, the interventions made to population decisions through PNs were also evaluated. As a result of the support of PNs of these plans for the lot consolidation or hidden FAR, or in other terms bonus building volume, population and thus density increases were found to be highly likely in residential areas. Therefore, the necessary explanations for the population increases that emerged with those PNs were shaping the implementation after the plan approval and they were not included in the PRs, and the population differences already existing between those neighbouring settlements were further encouraged by these plan notes. These hidden FAR rights that were provided with PNs also affect the public facility decisions. In that, it is clear that the area standards for public facilities, which are currently low for the present populations of the settlements, will decrease even more for the projected population with these privileges.

Vertical-External Consistency Tests

Vertical-external consistency tests based on relationships between different scale and type plans were first applied between 1/100,000 scale TP and 1/50,000 scale PTP, then between 1/50,000 scale PTP and 1/5000 scale Akyazı, Yıldızlı, and Söğütlü LUPs, and finally between these LUPs and their 1/1000 scale IPs within the scope of the criteria in Figure 9. However, the problems experienced in practice, especially in terms of the principle of hierarchical integrity between LUPs and IPs, made it difficult to perform vertical-external consistency tests at the desired level. Moreover, regarding the dates of the used lower-scale plans of LUPs and IPs plans from within Trabzon, the necessity for upper-scale plan making, i.e. TP and then PTP, before the lower-scale plans did not become a valid process and thus, the level of consideration of the decisions from the upper scales could not have been examined in lower scales. Nevertheless, due to the necessity of the feedback stage in planning, it is also an important step to evaluate to what extent lower-scale plan decisions, settlement potentials, and population projections are taken into account in upper-scale plan decisions.

Plans	Tests	Fixed reference (*)	Examined components (*)
Between 1/100,000 scale Ordu-Giresun-Trabzon-Rize-Gümüşhane-Artvin TP and 1/50,000 scale Trabzon PTP 	Process consistency Conveyance of the legal context of plan decisions	Legislation	PR
1st test 	Plan decisions consistency Population and sectoral decisions	Upper- or lower-scale PS Upper- or lower-scale PR	PR-PS-PN-PL
Between 1/50,000 scale Trabzon PTP and 1/5000 scale Akyazı, Yıldızlı, and Söğütlü LUPs 	Methodology consistency Compliance of population and/or sectoral projection techniques	Doctrines/tenets	PR
2nd test 	Plan decisions consistency Population and sectoral decisions	Upper- or lower-scale PS	PR-PS-PN-PL
Between 1/5000 scale Akyazı, Yıldızlı, and Söğütlü LUPs and 1/1000 scale Akyazı, Yıldızlı, and Söğütlü IPs 	Plan decisions consistency Population decisions Compliance of population density-planning codes-public facility-transportation decisions between the contexts of plan components	Upper- or lower-scale PP	PR-PS-PN-PL
3rd test 	Plan language consistency Differentiation of detail levels between plans	Doctrines/tenets	PP

(*) Plan Components: PS: Plan Sheet, PR: Plan Report, PN: Plan Notes, PL: Plan Legend

Figure 9. Vertical-external consistency tests of GESP within the context of spatial plans for the study area. (Reorganized from Öztürk, 2018, p. 86.)

Between 1/100,000 scale Ordu-Giresun-Trabzon-Rize-Gümüşhane-Artvin TPÇDP and 1/50,000 scale Trabzon PTP

In the application of the vertical-external consistency test between 1/100,000 and 1/50,000 scale plans, firstly, the main criterion of process consistency was considered. According to this criterion, it was found that the legal reference is not indicated in the PR of the 1/100,000 scale plan, and in the PR of 1/50,000 scale plan an outdated legal reference is made. In testing the main criterion of consistency of plan decisions, population and sectoral decisions were considered. In this

DOI: 10.15320/ICONARP.2022.224

context, based on the examinations of PRs, at the 1/50,000 scale it was seen that no explanation of the difference in the projection year of this plan from that of the upper-scale plan, despite the fact that the plan note of the lower-scale plan required conformance with upper-scale decisions. Furthermore, the potentials specified for the settlements in PRs became important in the test of this sub-criterion. Similarly, in the application of the test, the plan decisions for settlements as given on PSs were also compared, and it was seen that the plans in two scales were incompatible in terms of various land uses. For example, it was observed that for the areas defined as forest area at the upper-scale, decisions such as areas for industry, urban amenities or agriculture were given and also that some of the land-use decisions such as irrigation areas at the upper-scale were not found at the lower-scale.

Between 1/50,000 scale Trabzon PTP and 1/5000 scale Akyazı, Yıldızlı, and Söğütlü LUPs

If an upper-scale plan is made after the lower-scale plans, it is expected that this upper-scale plan would not ignore the decisions that have been ongoing for years at the lower scales, and consequently would revise these plans if necessary. Hence, it has been stated in the PR and PNs of 1/50,000 scale Trabzon PTP that lower-scale plan decisions have been accepted. In this line, the vertical-external consistency tests that were carried out between 1/50,000 scale Trabzon PTP and 1/5000 scale LUPs, were limited to examinations of PSs, PNs, and PLs due to the limitations regarding the conformance of population and sectoral decisions and of 1/5000 scale LUP reports for Akyazı and Söğütlü settlements, as explained in Section 2.2.

In the application of this test of GESP, under the main criteria of methodology consistency, firstly, the conformance of population and/or sectoral projection techniques was tested. The projection period of the upper-scale plan is 25 years while this period turns out to be 20 years for the lower-scale plans. However, the reason for this differentiation, which also corresponds to separate years, is not specified in the PR of the upper-scale plan that was made later.

Consistency of plan decisions was tested by comparing population and sectoral decisions in terms of the components of upper- and lower-scale plans. The population and sectoral computations given in the PR of the 1/50,000 scale plan, which will affect the land-use decisions for industry and tourism in the province or region, are not based on concrete data, and the evaluation of the population and sectoral decisions from the lower-scale plans were not made in the PR. As for the sectoral decisions that were examined at the 1/5000 scale PSs, although the decision to plan the sea-fill area of Akyazı settlement as a cruise port and sports complexes (including stadium) that concern the whole city was a regional decision, and in PSs and PR of 1/50,000 scale Trabzon PTP it was expressed only in general terms and the effects of this decision on population, transportation and public facility distribution were not explained. Moreover, even if this decision is stated as one of the reasons for the population increase in the PR of 1/1000 scale IP of Akyazı settlement, it is not included in 1/5000 scale LUP PSs. On 1/5000 scale PSs of Söğütlü and Yıldızlı settlements, day-trip tourism facilities are planned and thus, the tourism potential of these settlements is highlighted. However, there are no decisions directing the tourism potential of these settlements in lower-scale plans in 1/50,000 scale Trabzon PTP. Therefore, when plan decisions are examined on PSs, PNs and PLs, since the identified 1/5000 scale plan decisions for Akyazı and Yıldızlı have changed in 1/50,000 scale PTP, inconsistencies were observed between the same components of different scales, for example between PLs and PNs of two scales.

Between 1/5000 scale Akyazı, Yıldızlı, and Söğütlü LUPs and their 1/1000 scale Akyazı, Yıldızlı, and Söğütlü IPs

While in the third test of vertical-external consistency of GESP, the practical problem concerning the principle of hierarchical integrity is valid, and especially for these scales, those tests were still applied between 1/5000 scale LUPs of Akyazı, Yıldızlı, and Söğütlü and their 1/1000 scale IPs based on the criteria listed in Figure 10. Accordingly, differences in population decisions as part of plan decisions consistency were observed in the capacity calculations that were made with reference to hectare and FAR, respectively, between 1/5000 scale LUP and 1/1000 scale IP of each settlement. When the plans were examined in terms of public facility decisions, with respect to the sub-criterion of population density-planning codes-public facility-transportation decisions, it was seen that the sea-fill area in Akyazı, which is not found in 1/5000 scale LUP but rather in 1/1000 scale IP, was planned as a cruise port and sports complexes. In Yıldızlı, between 1/5000 scale LUP and 1/1000 scale IP some of the green, residential, and commercial areas were transformed, respectively, into afforestation, commercial, and tourism areas and similarly in Söğütlü, some parks and green areas in 1/5000 scale LUP were transformed into residential areas in 1/1000 scale IP. These changes for public facilities in the plan hierarchy caused differences between PSs, PNs, PLs in Akyazı and Yıldızlı, and between PSs and PLs in Söğütlü.

Similarly, as for transportation decisions, the widths of the vehicle roads differ between the two scales of Akyazı and Söğütlü plans. Furthermore, in Akyazı, the transportation decisions for the cruise port and the sports complexes seen in the 1/1000 scale IP are not found in the 1/5000 scale LUP.

Although the main criterion of plan language was examined in the vertical-external consistency of only these two scales and types of plans (Figure 10), it should also be considered between all scales and types of plans. The examination of this criterion is exemplified for Söğütlü settlement in terms of the required differentiation of detail levels between upper- and lower-scale plans. Accordingly, it was observed that between

DOI: 10.15320/ICONARP.2022.224

1/5000 scale LUPs and their 1/1000 scale IPs, population density and planning codes were differentiated, and the required levels of detail for public facilities and roads were given in the lower-scale (Figure 10).

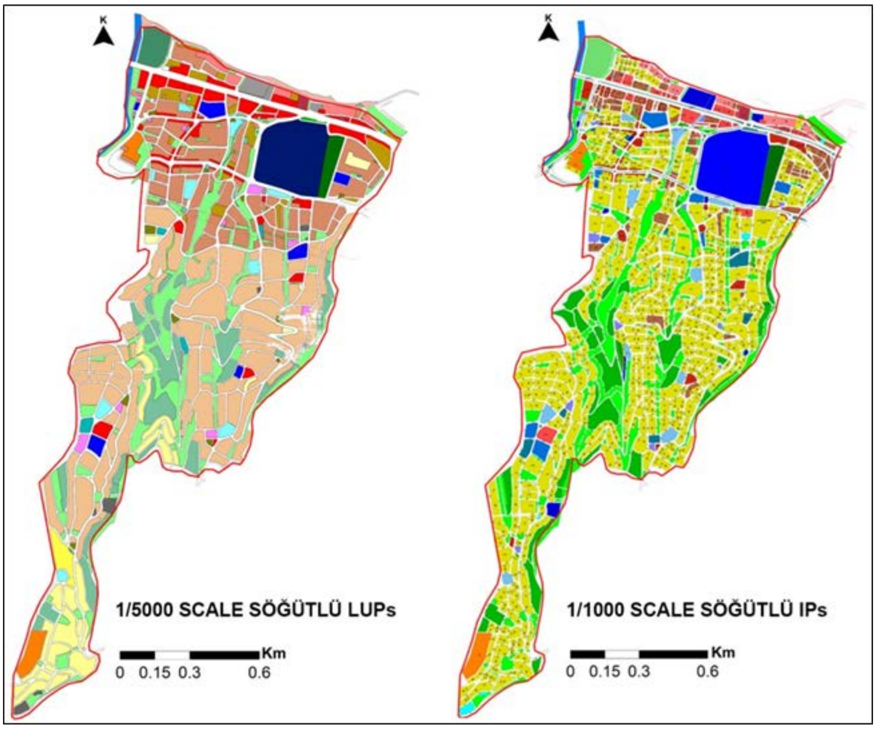


Figure 10. An example for the comparison of 1/5000 scale LUPs and their 1/1000 scale IPs in terms of plan language (For comparative purposes, the 1/1000 scale plan was reduced 5 times and reduced to the same size as the 1/5000 scale plan). (Simplified and reorganised from Öztürk, 2018, p. 104, maps originally prepared by using 1/5000 scale Söğütlü LUP and 1/1000 scale Söğütlü IP, 2011.)

DISCUSSION AND CONCLUSION

Based on the importance of the evaluation stage in the plan making process, in the present study, case area spatial plans were evaluated with concrete criteria using the Guideline for Evaluation of Spatial Plans (GESP), which was proposed in 2018 (Öztürk, 2018) and published in 2021 and 2022 (Öztürk Saka and Erdoğan, 2021; 2022).

In the first phase of this two-phase study, initially, with the focus on the evaluation of spatial plans, the research question of what the concepts of evaluation and consistency mean for spatial plans was reviewed. This phase was important for the creation of the theoretical/empirical/legal-administrative/professional background of this study. It has been mainly observed that the studies carried out for evaluation in both international and national (Turkish) studies have increased, and the evaluation phase in the spatial planning process in the legal-administrative aspect has become important, with the Regulation on Spatial Planning (RoSP). In the second phase of the study, where the GESP is applied to area plan cases, an examination of how internal, horizontal-, and vertical-external consistency tests can be performed in the ex-ante evaluation of spatial plans was made. This phase revealed how the consistency tests for spatial plans will/should be carried out regarding the application of the GESP.

Within the context of limitations that were identified at the beginning and the spatial requirements for the tests to be carried out (cities having spatial plans of different scales and types), the 1/50,000 scale plan of the study area could partially pass the internal consistency tests, while its 1/100,000, 1/5000, and 1/1000 scale plans could not. It was also observed that none of the plans could pass horizontal- and vertical-external consistency tests.

In general, it is not even possible to state that all of the stages of the planning process, in so far as they appear in the current Turkish legislation, are carried out in a complete and required manner. In this regard, it can be stated that the settlements and the regions are in a continuous vicious circle, where feedback and corrective changes are not possible. It can be suggested that “internal” inconsistencies regarding upper scales, that are not being controlled and revised, reach the lower-scale plans in the “vertical” direction, and the resulting “internal” inconsistencies in the lower-scale plans and their “horizontal” inconsistencies with their neighbours, later, cumulatively affect upper-scale decisions negatively, and the cycle is perpetuated. It is considered that the use of the proposed guideline will most probably bring an end to this unchangeable situation for the settlements and their regions for approved plans, as presented in this study, and for the renewal process of those plans, or for new plan making for other settlements, before their approval.

The outputs of the present study can be used in future studies on this subject, after they are further developed, and when the limitations are taken into consideration. The proposed guideline in this study is applied to external consistencies of neighbouring settlements in a city and for its upper-scale plans, and in between those plans, in addition to internal consistencies of individual plans at different scales. However, the guideline can also be used for testing consistencies between plans of non-neighbouring settlements of the same city, or of the upper- and lower-scale plans of neighbouring settlements of two different cities, after its development.

As a limitation, the scope of this study did not address at which frequency, and by whom, the evaluation would be made, the actors’ dimension, and bureaucratic procedures. However, in future studies, answers should be sought for the question of “what should be done after plans are evaluated?”, which may eliminate this shortcoming. Having a multi-dimensional structured planning discipline, would certainly involve many actors. For this reason, after ex-ante evaluation of plans is undertaken, the sharing of results with all relevant stakeholders, the questioning of negative outcomes, and the revising of the plan, accordingly, will constitute another important stage following this evaluation, where consistencies are tested within the process. Supporting the plans by participation, after carrying out ex-ante evaluations, may become an effective solution for avoiding the fact of this evaluation remaining solely at the technical dimension.

DOI: 10.15320/ICONARP.2022.224

ACKNOWLEDGEMENTS/NOTES

The authors give thanks to Assist. Prof. Gökhan Hüseyin Erkan (PhD) and to the anonymous reviewers for their valuable comments on this manuscript.

This paper is based on the case study and the improved version of the literature of the Master of Science thesis by Mihriban Öztürk, undertaken under the supervision of Aygün Erdoğan, which was carried out in the department of Urban and Regional Planning at Karadeniz Technical University in 2018.

REFERENCES

Akçay, A. (2009). Kamuda stratejik plan amaçlarının gerçeklestirilmesine yönelik değerlendirme ve denetim modeli, *TÜBAV Bilim Dergisi*, 2(1). 82-98.

Akpınar, B., & Bayram, Ö. (2008). Genel ortaöğretimde yapılan öğretim planlarının okul müdürü ve öğretmen görüşlerine göre değerlendirilmesi, *Mustafa Kemal Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 5(10), 121-145.

Akman, Ç., & İpek, E. (2019). Son dönemde yapılan değişiklikler çerçevesinde belediyelerde stratejik planlama süreci, *Uluslararası Yönetim Akademisi Dergisi*, 2(2), 359-373.

Alexander, E. R., & Faludi, A. (1989). Planning and plan implementation: Notes on evaluation criteria, *Environment and Planning B Planning and Design*, 16(2), 127-140.

Alexander, E. R. (2006). Evolution and status. Where is planning evaluation today and how did it get here? In: Alexander E.R. (Eds.). *Evaluation in Planning: Evolution and Prospects*. Aldershot: Ashgate, 3-16.

Alterman, R., & Hill, E. (1978). Implementation of urban land use plans, *Journal of the American Institute of Planners*, 44(3), 274-285.

Aşgın, S., & Yaman, K. (2018). Türkiye'de Bakanlıkların stratejik plan uygulamalarında mevcut yapı ve sürecin değerlendirilmesi, *International Journal of Academic Value Studies*, 4(19), 449-466.

Ataöv, A. (2007). Planlamada sosyal bilimcinin değişen rolü: Toplumdan biri olmak, *Metu Journal of The Faculty of Architecture*, 24(1), 139-152.

Ayrancı, İ. (2013). Metropoliten alanlarda planlama - kentsel gelişimin yönetimi ilişkisi ve bir izleme değerlendirme model önerisi [Relation of planning-urban development management in metropolitan areas and a monitoring and evaluation model proposal]. PhD Thesis, İstanbul Technical Universtiy, İstanbul.

Bacău, S., Grădinar, S, R., & Hersperger, A, M. (2020). Spatial plans as relational data: Using social network analysis to assess consistency among Bucharest's planning instruments, *Land Use Policy*, 92,104484.

Baer, W. C. (1997). General plan evaluation criteria: An approach to making better plans, *Journal of the American Planning Association*, 63(3), 329-344.

Baker, I., Peterson, A., Brown, G., & McAlpine, C. (2012). Local government response to the impacts of climate change: An evaluation of local climate adaptation plans, *Landscape and Urban Planning*, 107(2), 127-136.

Bassett, E., & Shandas, V. (2010). Innovation and climate action planning: Perspectives from municipal plans, *Journal of the American Planning Association*, 76(4), 435-450.

Bernstein, D. (2001). Local government measurement use to focus on performance and results, *Evaluation and Program Planning*, 24, 95-101.

Berke, P., Backhurst, M., Day, M., Ericksen, N., Laurian, L., Crawford, J., & Dixon, J. (2006). What makes plan implementation successful? An evaluation of local plans and implementation practices in New Zealand, *Environment and Planning B: Planning and Design*, 33(4), 581-600.

Berke, P., & Godschalk, D. (2009). Searching for the good plan: A meta-analysis of plan quality studies, *Journal of Planning Literature*, 23(3), 227-40.

Brody, S. D., & Highfield, W. E. (2005). Does planning work? Testing the implementation of local environmental planning in Florida, *Journal of the American Planning Association*, 71(2), 159-175.

Brody, S. D., Highfield, W., & Carrasco, V. (2004). Measuring the collective planning capabilities of local jurisdictions to manage ecological systems in Southern Florida, *Landscape and Urban Planning*, 69(1), 33-50.

Bunnell, G., & Jepson Jr, E. J. (2011). The effect of mandated planning on plan quality: A fresh look at what makes "a good plan", *Journal of the American Planning Association*, 77(4), 338-353.

Calkins, H.. (1979). The planning monitor: An accountability theory of plan evaluation, *Environment and Planning A*, 11(7), 745-758.

Camillus, J. C., & Datta, K. D. (1991). Managing strategic issues in a Turbulent Environment, *Long Range Planning*, 24(2), 67-74.

Carmona, M., & Sieh, L. (2008). Performance measurement in planning - Towards a holistic view, E*nvironment and Planning C: Government and Policy*, 26(2), 428-454.

Connell, D. J., & Daoust-Filiatrault, L.-A. (2018). Better than good: Three dimensions of plan quality, *Journal of Planning Education and Research*, 38(3), 265-272.

Demirci, M. (2004). Kent planlamada uygulama anlayışına eleştirel bir yaklaşım: Dikmen Vadisi Projesi örneği [A Critical approach to the understanding of implementation in urban planning the case Dikmen valley project]. PhD Thesis, Ankara University, Social Sciences Institute, Ankara.

Değerli, B., & Erbaş, A. E. (2021). Bütünleşik kıyı alanları planları ve mekansal planlama ilişkisi, İzmit Körfezi ve Bursa İli örneği üzerinden bir değerlendirme, *Journal of Awareness*, 6(1), 1-11.

Ekiz, C., & Somel, A. (2005, Ocak). Türkiye'de planlama ve planlama anlayışının değişimi. Ankara Üniversitesi, Siyasi Bilimler Fakültesi, Geliştirme ve Toplum Araştırma Merkezi Tartışma Metinleri (SBF-GETA), 81, 1-38.

http://politics.ankara.edu.tr/dergi/tartisma/2005/anlayis-planlama.pdf.

Eraydın, A. (2017). Planlamada yeni eğilimler. In Özdemir, S. S., Sarı, Özdemir, B. Ö., & Uzun, N (Eds). *Kent Planlama* (pp.561-581). İmge Kitapevi Yayınları, Ankara,

DOI: 10.15320/ICONARP.2022.224

Erdem, R., & Meşhur, Ç. (2005). İmar planları marifetiyle plansız gelişme. In *Planlamada Yeni Politikalar ve Stratejiler, Riskler ve Fırsatlar Bildiriler Kitabı*. 8 Kasım Dünya Şehircilik Günü 29.Kolokyumu, pp.339-344.

Ersoy, M. (2005). Türkiye'de kent planlamasının güncel sorunları [Current problems of urban planning in Türkiye]. In *9. Ulusal Halk Sağlığı Kongresi Bildiri Özet Kitabı*, Ankara, Türkiye, 3-6 Kasım 2004, pp.137-144. Ankara: Hacettepe Üniversitesi Tıp Fakültesi Halk Sağlığı Anabilim Dalı.

Ersoy, M. (2007). Planlama kuramına giriş [Introduction to planning theory]. In: Ersoy M. (Eds). *Kentsel Planlama Kuramları*. Ankara: İmge Yayınevi, pp.9-340.

Goggin, M., Bowman, A., Lester, J., & O'TooleJr, L. (1990). *Implementation theory and practice: Toward a third generation*. Glenview, IL: Scott, Foresman and Little, Brown, p.230.

Gölbaşı, İ. (2014). Kentsel planlama deneyimlerinin plan başarı ölçütleri çerçevesinde karşılaştırılması ve değerlendirilmesi-İstanbul Örneği, *Planlama Dergisi*, 24(1), 18-25.

Güredin, E. (2000). *Denetim, Beta Yayınları*. 10. Basım, İstanbul.

Hoskara, Ş. (2020, Kasım). Dünya Şehircilik Günü Mesajı. 44. Dünya Şehircilik Günü Kolokyumunda sunulan bildiri, Ankara.

Hoch, C. (2007). How plan mandates work: Affordable housing in Illinois, *Journal of the American planning Association*, 73(1), 86-99.

Laurian, L., Day, M., Berke, P., Ericksen, N., Backhurst, M., Crawford, J., & Dixon, J. (2004). Evaluating plan implementation: A conformance-based methodology, *Journal of the American Planning Association*, 70(4), 471-480.

Laurian, L., Crawford, J., Maxine, D., Kouwenhoven, P., Mason, G., Ericksen, N., & Beattiem, L. (2010). Evaluating the outcomes of plans: Theory, practice and methodology, *Environment and Planning B: Planning and Design*, 37(4), 740-757.

Lichfield, N., & Prat, A. (1998). Linking ex-ante and ex-post evaluation in British Town Planning. In N. Lichfield, A. Barbanente, D. Borri, A. Khakee, & A. Prat (Eds.). *Evaluation in planning: Facing the challenge of complexity* (pp. 283-298). Dordrecht: Kluwer.

Lichfield, N., Kettle, P., & Whitbread, M. (1975). The Urban and Regional Planning Series: Vol. 10. Evaluation in the Planning Process. Oxford, UK: Pergamon.

Lyles, W., & Stevens, M. (2014). Plan quality evaluation 1994–2012: Growth and contributions, limitations, and new directions, *Journal of Planning Education and Research*, 34(4), 433-450.

Mazmanian, D. A., & Sabatier, P. A. (1989). *Implementation and public policy*. With a new postscript, Lanham, MD: The University Press of America, Inc.

Olazabal, M., Galarraga, I., Ford, J., Sainz De Murieta, E., & Lesnikowski, A. (2019). Are local climate adaptation policies credible? A conceptual and operational assessment framework, *International Journal of Urban Sustainable Development*, 11(3), 277-296.

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

Norton, R. K. (2008). Using content analysis to evaluate local master plans and zoning codes, *Land Use Policy*, 25(3), 432-454.

Olazabal, M., & De Gopegui, M.R. (2021). Adaptation planning in large cities is unlikely to be effective, *Landscape and Urban Planning*, 206, 103974.

Oliveira, V., & Pinho, P. (2008). Evaluation in urban planning: From theory to practice. In: Pinho P. and Oliveira V. (Eds.). Proceedings of CITTA 1st Annual Conference on Planning Research: Evaluation in Planning. Porto, Portugal: The Research Center for Territory, Transports and Environment, Faculdade de Engenharia da Universidade do Porto, pp.31-49.

Oliveira, V., & Pinho, P. (2010). Measuring success in planning: Developing and testing a methodology for planning evaluation, *The Town Planning Review*, 81(3), 307-332.

Öztürk, M. (2018). Mekânsal planların değerlendirilmesinde tutarlılık tespiti üzerine bir yöntem önerisi: Trabzon örneği [A methodology proposal for detecting consistencies in the evaluation of spatial plans: Case of Trabzon], MsSci Thesis, Karadeniz Teknik Üniversitesi, Fen Bilimleri Enstitüsü, Trabzon.

Öztürk Saka, M., & Erdoğan, A. (2021). Plan tutarlılıklarının testi için bir yöntem önerisi: Mekânsal planlar değerlendirme kılavuzu, *DEÜ Sosyal Bilimler Enstitüsü Dergisi*, 23(4), 1709-1735.

Öztürk Saka, M., & Erdoğan, A. (2022). Krizler İçin Plan mı (!)? Kriz Riskine Karşı Planlama mı? In: Akşit, A., Mercanoğlu, C., Alaydın, D., Çetinkaya, H., Yeni, G. & Karasüleymanoğlu, S. (Eds.). 8 Kasım Dünya Şehircilik Günü 44. Kolokyumu Bildiriler Kitabı. TMMOB Şehir Plancıları Odası Genel Merkezi, pp. 335-356.

Pickett, S. T., Cadenasso, M. L., & Grove, J. M. (2004). Resilient cities: Meaning, models, and metaphor for integrating the ecological, socio-economic, and planning realms, *Landscape and Urban Planning*, 69(4), 369-384.

Roeseler, W. G. (1982). *Successful American urban plans*. Lexington, MA: Lexington Books.

Segura, S., & Pedregal, B. (2017). Monitoring and evaluation framework for spatial plans: A Spanish case study, *Sustainability*, 9(1706), 1-19.

Soria, A. J., & Valenzuela, L. M. (2013). A method for the evaluation of metropolitan planning: Application to the context in Spain, *European Planning Studies*, 21(6), 944-966.

Talen, E. (1996). After the plans: Methods to evaluate the implementation success of plans, *Journal of Planning Education and Research*, 16(1), 79-91.

Tian, L., & Shen, T. (2007, September). Evaluation of plan implementation in the transitional China: A case of Guangzhou city master plan. 43rd ISOCARP Congress on Urban Trialogues: Co-productive ways to relate visioning and strategic urban projects konulu kongrede sunulan bildiri. Antwerp, Belgium.
http://www.isocarp.net/Data/case_studies/928.pdf.

Türk, E., & Erkan, G. H. (2018). Gömleğin her düğmesini yanlış iliklemek: Artvin Yusufeli zorunlu yeniden yerleştirme sürecinin eleştirel incelemesi, *Planlama Dergisi*, 28(2), 218-235.

DOI: 10.15320/ICONARP.2022.224

Tong, Z., & Zhang, Q. (2016). Urban planning implementation evaluation: A multilevel fuzzy comprehensive evaluation approach, *The Open Civil Engineering Journal*, 10(1), 200-211.

TÜİK, 2020, Adrese Dayalı Nüfus Kayıt Sistemi Sonuçları Verisi

Üngüren, E., & Koç, T. S. (2015). İş sağlığı ve güvenliği uygulamaları performans değerlendirme ölçeği: Geçerlik ve güvenirlik çalışması, *SGD-Sosyal Güvenlik Dergisi*, 5(2), 124-144.

Vullings, W., Vries. M., & Borman, L. (2007). Dealing with uncertainty in spatial planning. 10th AGILE International Conference on Geographic Information Science, Aalborg University, Denmark.

Yaman Galantini, Z. D. (2018). Sürdürülebilir kent planlama ve kentsel kalkınma için bir politika paradigması olarak kentsel dayanıklılık: İstanbul örneği [Urban resilience as a policy paradigm for sustainable urban planning and urban development: The case of Istanbul]. PhD Thesis, İstanbul Technical Universtiy, İstanbul.

Yıldız, F. (1995). *İmar Bilgisi*. Nobel Yayıncılık, Ankara, p.563.

Zoral, P., & Varol, Ç. (2016). Sürdürülebilirlik değerlendirmesi yaklaşımının mekansal planlama pratiğine uyarlanması: Türkiye için yeni bir öneri. In *Seksen Sonrası Mekan ve Planlama*, pp. 51-79.

Resume

Mihriban Öztürk Saka; B.CP, M.Sc., received her bachelor's degree in Urban and Regional Planning from Karadeniz Technical University in 2015, M.Sc. degree in 2018 in the graduate program of URP, KTU. Currently is a PhD student in the same graduate program and a Research Assistant in the department of URP. Research interests include urban planning and planning process.

Aygün Erdoğan; B.CP, M.Sc., PhD. received her bachelor's degree in City and Regional Planning (1997), master's degree in Geodetic and Geographic Information Technologies (2000), and PhD degree in CRP (2007) from METU. Became an Erasmus Scholar in Dortmund University (2005-06) and a Visiting Research Scholar in University of Florida (2012-13). Currently works as an Assoc. Prof. at KTU, Department of URP. Research interests include GIS and quantitative analysis, spatial database design, environmental planning, crime mapping and its place-based prevention.

Research Article

ICONARP
International Journal of Architecture and Planning
Received: 05.03.2022 Accepted: 24.09.2022
Volume 10, Issue 2/ Published: 20.12.2022
DOI: 10.15320/ICONARP.2022.225 E- ISSN:2147-9380

ICONARP

The Assessment of the Criteria of Social Infrastructure within the Scope of Women-Friendly City Planning Approach: The Example of Çiğli

Mercan Efe Güney*
Beste Tuncay**
Sıdal Tanrıverdi***
Nurseli Şanlı****
Hacer Akbudak*****
Filiz Ay******

Abstract

There is a close parallel between the freedom, equality and socialization that the residents in a social settıng are enjoying and the openness and equal availability of the social infrastructure in this setting. When these points are taken into consideration, it is possible to get the idea that social infrastructure areas should be planned as woman-friendly city criteria. So long as the urban planning fails to accomplish this task of creating a due process and language for gender equality, the social infrastructure areas in the cities will continue to pose a serious problem to the gender equality. In this article, an attempt has been made to articulate some suggestions for evaluating the social infrastructure areas in the light of woman-friendly city planning. This article offers some guıdelines for deciding which data should be taken into consideration and how the social infrastructure areas should be examined. The study analyzes social infrastructure areas following four categories: adequacy, accessibility, safety and usability. The findings revealed that no social infrasurcture areas met these criteria, especially in the densely used areas. The lack of face-to-face interviews with women is the shortcoming of the study. The study is one of the first studies on the subject, but it is thought that it will contribute to the field literature with its review and recommendation codes.

Keywords:
İzmir, Social Infrastructure Areas, Urban Planning, Woman-Friendly City

*Academic Staff, Dokuz Eylul University, Faculty of Architecture, Department of City and Regional Planning, İzmir, Türkiye. (Principal contact for editorial correspondence.) Email: mercan.efe@deu.edu.tr

**City Planner, İzmir, Türkiye.
Email: bestetuncay99@gmail.com

***City Planner, İzmir, Türkiye.
Email: sidaltanriverdi@gmail.com

****M.Sc. Student. Dokuz Eylul University, The Graduate School of Natural and Applied Sciences, Department of City and Regional Planning, İzmir, Türkiye.
Email: sanli.nurseli@ogr.deu.edu.tr

*****M.Sc. City Planner. İzmir, Türkiye.
Email: hcr.akbdk96@gmail.com

******M.Sc. Student. İzmir Institute of Technology, The Graduate School, Department of City and Regional Planning, İzmir, Türkiye.
Email: filizay98@gmail.com

To cite this article: Efe Güney, M., Tuncay, B., Tanrıverdi, S., Şanlı, N., Akbudak, H., & Ay, F. (2022). The Assessment of Criteria of Social Infrustructure within the Scope of Women-Friendly City Planning Approach: The Example of Çiğli. *ICONARP International Journal of Architecture and Planning,* 10 (2), 800-843. DOI: 10.15320/ICONARP.2022.225

INTRODUCTION

Urban space consists of private spaces that serve individuals or limited communities and public spaces that provide unity and serve everyone, where socialization processes take place (Çubuk, 1991; Hénaff and Strong, 2001). As an urban space, public space is freely accessible to everyone; It is a democratic place where a wide variety of different political and cultural activities can be expressed (Habermas, 1991; Varna and Tiesdell, 2010). In this state, public spaces are the areas of freedom where the social structure of the city is produced (Arendt,1994; Gökgür, 2008; Habermas, 1991; Thomas, 1991). Public spaces can be grouped under three headings (Akkar, 2006) those that do not belong to a private person or institution (park, street, square etc.), those who belong to institutions and organizations and do not have user restrictions (public education center, religious facility, health facility, etc.) and are legally owned by a private person or institution, but open to public (shopping malls, cinemas, commercial areas etc.). As can be seen, public spaces as a living space are important as a place where social symbols and patterns are exhibited, as well as being a meeting and communication place for social groups (Thomas, 1991).

Social infrastructure areas, which have almost all the characteristics of public spaces, are also the areas to meet the daily needs of the citizens. Urban social infrastructure areas, which are defined as all of the public uses required for a settlement to fulfill its functions, are both a means and a goal to provide the rights of the citizens (Keleş, 1990). Facilities for administrative services in which participation and management processes in the city are developed, open green spaces and sports facilities where the citizens recreate themselves, education facility areas that meet educational needs, health facility areas where health problems are resolved, open, closed, public and semi-public spaces where social and cultural activities take place are social infrastructure areas. In other words, social infrastructure areas are the functions that determine the livability level of the city.

Communication, socialization and interaction is an important need for everyone. However, public spaces are not places where every citizen can benefit equally and/or have the same meaning for every citizen. Due to the gender inequality and the social roles emanating from it, women have always been finding themselves in a disadvantaged position. This disadvantaged position deprives women from as much benefiting from the social infrastructure as men do. This means that the right to use the city equally and fairly, which is one of the rights of citizens, cannot be ensured. The solution to this problem is to consider social infrastructure areas, which are public spaces, within the scope of a woman-friendly urban planning approach. In other words, it is the creation of the planning process and principles that will solve the problem.

Women-friendly cities, support the participation of local governments in planning and decision-making processes, as a problem-solving tool. Additionally, they provide women with access to health, education, and social services as well as employment opportunities (Kaypak, 2014, 2016; Tekinbaş, 2015). Furthermore, they support equal participation of women in all aspects of urban life (Sewell, 2011; Spain, 2014; Tekinbaş, 2015; Yon and Nadimpalli, 2017).

A women-friendly city means a city for everyone (children, old women, disabled, etc.). As it stands today in Türkiye, men and women

DOI: 10.15320/ICONARP.2022.225

experience the urban life in different ways because of their distinctive social gender roles. This distinction has reflected upon planning practices because men are assumed as "responsible for out-of-home activities"—in other words. "free"—whereas women are supposed to be "responsible for housework, entrapped at home or confined to home" (Bourdieu, 2014; UN, 2012; UN-Habitat, 2013; Buckingham, 2010; Fenster, 1999). The solution to this difference depends on the application of a woman-friendly urban planning approach. The profession of city planning propagates this erroneous attitude by forming gender and intersectionality blind, insecure areas that do not provide the feeling of belongingness in Türkiye (Efe Güney et al., 2020).

Gender equality requires women and men to have equal rights, to have the same visibility and power in all areas of public life, to have the same responsibility and participation, and to have equal access and distribution of resources between women and men. In this context, by the definition of public space, it is a matter of freedom and democracy to eliminate the discriminatory nature of the gender phenomenon in social infrastructure areas (Alkan, 2012).

In countries such as Türkiye, where gender inequality is seen, the male population has a privileged status and has given priority in public life as well in private life. This situation appears in the legal processes, the distribution of public services, and therefore in the urban space shaped by social infrastructure areas. In other words, when the data of the Turkish Statistical Institute (TUIK) are examined, it is revealed that women come behind men in access to education and health. When the issue of participation in politics at the central and local government level is examined, it is observed that the number of women is much less than men in matters such as the number of mayors, the number of deputies and the number of governors. The cause of the situation is gender inequality (Eveline and Bacchi, 2010; KSGM, 2008). City planning profession should combat gender aquality like other professions to eliminate the intersectionality blindness and gender blindness of planning (Efe Güney et al., 2020). This is a necessity because this structure keeps women at home and determines the woman's living space as the house and its surroundings (Şenol Cantek et al. 2014). In this state, women, who have to act according to their gender roles (doing housework, meeting the needs of dependents etc.), cannot spare time or get permission to use the social facilities. Moreover, this situation continues to renew itself (Demirbaş, 2012; Kaypak, 2014).

Spatial standards for social facilities in Türkiye are limited only by the size and distance per person. As an important part of urban life, social infrastructure areas should be designed in a way that is suitable for everyone's use by examining in detail not only in terms of spatial size and walking distance, but also in terms of service quality, ease of access and comfort. In this context, this study strives to be a model for eliminating gender inequality in social infrastructure areas, which are public spaces, and designing these spaces for everyone

The study states that the presence of social facilities providing access to urban services does not mean that they are used; the argues that these areas should be handled with a content that gives importance to much more than the square meter ratios per person. Consequently, this article tries to develop proposals on how to analyze and evaluate within the scope of women-friendly city, which is a way of ensuring gender equality in social infrastructure areas as public spaces. As a result, the study

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

provides a model that can be improved by proposing a dataset on how to examine social infrastructure areas for a women-friendly city.

WOMEN-FRIENDLY CITY AND SOCIAL INFRASTRUCTURE

Urban space consists of private spaces that serve certain communities or individuals on the basis of ownership, and public spaces where the socialization process takes place (Çubuk, 1991; Hénaff and Strong, 2001). The public space is a democratic space where both individuals and societies enrich themselves and meet their needs such as health education equally, create the spirit of the city and provide an opportunity for individuals to participate in society (Arendt, 1994; Gökgür, 2008; Habermas, 1991; Thomas, 1991; Varna and Tiesdell, 2010).

Interaction in public spaces is a basic requirement for everyone. Nevertheless, public spaces cannot serve equally and fairly to women who are one of the disadvantaged groups (Fox and Schuhmann, 2001; Yon and Nadimpalli, 2017) of the city as opposed to the men who have been positioned differently in society based on biological features and expectations built upon social gender. Women are disadvantaged when it comes to using social infrastructure area: they have more responsibilities due to gendered roles assigned to them (Bialeschki and Michener, 1994; Deem, 1986; Firestone and Shelton, 1988; Hutchison, 2009; Kaczynski and Henderson, 2008; Silver, 2000; Wearing and Wearing, 1988). There are also important considerations that other public spaces and social infrastructure areas are dangerous for women (Bowman, 1993; Gardner, 1995; Valentine, 1990), which limits them. In other words, it reiterates the impact of gender inequality on women (Letherby, 2003; McDowell, 1999). Therefore, the right to use the city, which is one of the urban rights, cannot be offered to everyone. For this reason, a women-friendly city-based planning language and process should be created in accordance with the meaning and content of social infrastructure areas, which have an important role in public spaces.

The provisions regarding social infrastructure areas in Türkiye are defined in the Zoning Law No. 3194 (3194 sayılı İmar Kanunu) and the Spatial Plans Designing Regulation (Mekansal Planlar Yapım Yönetmeliği) related to it.

In Article 5-i of the Regulation, social infrastructure areas are given as "educational, health, religious, social and cultural facilities, outdoor and indoor sports facilities, outdoor and green areas such as parks, children's playgrounds, playgrounds, squares, recreation areas". Article 11 of the same regulation Minimum standards and area sizes in Article 12. In the article, walking distances are presented for plans as a quantitative value (for details, see Appendix Table-2 of the Spatial Plans Designing Regulation).

When these values are examined, it is seen that the regulation does not take into account the design criteria of social infrastructure areas for everyone and only offers standards related to the size and walking distances of social infrastructure areas per capita. Therefore, this study will contribute to this deficiency defined in the regulation.

DOI: 10.15320/ICONARP.2022.225

In addition to the binding provisions of the City Planning legislation, the Turkish Standards Institute also has some standard recommendations. These are "Urban roads - Structural preventive and sign design criteria on accessibility in sidewalks and pedestrian crossings" numbered TS 12576 and "Urban roads - Design criteria on sidewalks and pedestrian areas" numbered TS 12174. One of them is the design standards produced by the Turkish Statistical Institute (Türk Standartları Enstitüsü). TS 12174 pedestrian zones have developed technical standards such as width, height and material for pedestrian areas and sidewalks. The TS 12576 standard proposes standards for landscaping applications, lighting elements, information communication boards and traffic signs for public spaces. In addition to trying to eliminate the deficiencies of the regulation as defined above, this study also tried to use the standards of these two standard documents.

In addition to the regulations and standards given for Türkiye in general, there are guidelines created by municipalities for themself. A good example of these guides is the " Barrier-Free Public Buildings Design Guide" prepared by Izmir Metropolitan Municipality. This guide also focuses on technical aspects in terms of accessibility, such as TSE standards and regulations. These elements consist of pedestrian lanes, parking lots and lighting, stairs at and inside the building entrances, ramps, toilets in public areas and surface markings in access to the building. The study also benefited from this guideline of Izmir Metropolitan Municipality. However, in all the documents it examined, the study did not reach the defined set of criteria for a women-friendly city, which means city for everyone. Because the spatial standards for social infrastructure areas in Türkiye are limited only to square meters and distance per person.

As an important part of urban life, social infrastructure areas should be designed for everyone's use by examining them in detail not only with their spatial size and walking distance, but also in terms of service quality, ease of access and comfort. This design is possible with the approach that started with the understanding of barrier-free design and is today called universal design principles. (Andanwerti, 2005; Steinfield, 2001; Story, 2001; Connell et al., 1997; Mace, 1997). The Universal Design Center defines the principles of universal design as "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design". Universal Design Principles and their descriptions are given in the Table below (Table 1).

Table 1: Universal Design Principles (Connell et al., 1997)

Principle	Meaning
Equitable Use Principle	The design is useful and marketable to people with diverse abilities.
Flexibility in Use Principle	The design accommodates a wide range of individual preferences and abilities.
Simple and Intuitive Use Principle	Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

Perceptible Information Principle	The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.
Tolerance for Error Principle	The design minimizes hazards and the adverse consequences of accidental or unintended actions.
Low Physical Effort Principle	The design can be used efficiently and comfortably and with a minimum of fatigue.
Size and Space for Approach and Use	Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility.

Universal design principles are a guide that can be applied to design at any scale. In this context, the quality deficiencies in the laws and regulations of Türkiye can be eliminated with "universal design principles". This also contributes to the establishment of the criteria for a women-friendly city approach. In other words, universal design principles are a tool in creating social infrastructure spaces that allow everyone to use them. Because one of the important determinants that show the quality of social infrastructure areas as a public space is the level of publicity of that space.

The level of publicity can be defined as the analysis of the observed quality of space and its resilience to social interactions, the limitation of human rights and the inclusion of a particular group (Benn and Gaus, 1983; Carmona, 2010; Kohn, 2004; Madanipour, 1999; Schmidt and Nemeth, 2012; Young, 1990). Therefore, the level of publicity is such that everyone can freely carry out their political and democratic actions in that space; physical and psychological opportunities (Schmidt and Nemeth, 2012; Varna and Tiesdell, 2010) and ensure social quality. The most important areas where the level of publicity can be measured in Türkiye are the social infrastructure areas. In this study, social infrastructure areas that should have a high level of publicity are designed on the basis that they should be accessible, safe and usable. Because a social infrastructure area;

- is the socialization area of all age and income groups. For example, children and young people can socialize and engage in various activities with their peers, and socializing with different genders is important in the formation of their social identities and values (Glass and Balfour, 2003; Glendinning et al., 2003; Larson and Verma, 1999). In addition, seniors socialize in social infrastructure facilities, avoid isolation, and have a positive health impact (Kelly and Ross, 1989; Tinsley et al. 2002; Glass and Balfour, 2003).
- open to all men and women. Women use social infrastructure spaces to take their children to these areas more as part of childcare, and children meet their recreational needs.

Empirical studies on social infrastructure areas are mostly based on discussions about women (e.g. Henderson et al., 2002; Hutchison, 2009); this appears to be due to gender roles, responsibilities, and women's ability to take time and time off (e.g., Bialeschki and Michener, 1994; Hutchinson, 2009; Kaczynski et al., 2008; Silver, 2000). In addition, since women cannot be in decision-making processes, their demands cannot be met and as a result, the usage rates decrease because the social

DOI: 10.15320/ICONARP.2022.225

infrastructure areas are not aimed at them (Bernard, 1981; Hutchison, 1994; Woodward, D., Green and Hebron, 1988). In order to increase these rates, in addition to the elements given above, social infrastructure areas according to the main principles adopted by the Council of Europe and defined to achieve success in public spaces (Gülen, 2006),

- give messages that it is available and/or open for use.
- must be aesthetically appealing.
- provide a transition between indoor and outdoor spaces.
- be equipped with desired and feasible activities?
- provide a safe and protected environment.
- provide natural environments for the urban dweller to reproduce himself.
- be accessible and usable for children, the disabled, the elderly and women.
- choose suitable materials for their use
- should be designed as a social environment.

Today, the limited number of social infrastructure areas in urban space and the fact that this limited number is not distributed evenly spatially, as well as being accessible and usable for all groups of society, causes the aggregation feature of social infrastructure areas to be lost. For example, women and the elderly withdraw from urban public space because they fear crime (Day, 2001; Gordon and Riger, 1991; Markson, E., and Hess, B., 1980). In addition, many studies have shown that women, the elderly, children, the disabled, and some ethnic groups experience inequality in using social infrastructure spaces (Adler and Brenner, 1992; Byrne and Wolch, 2009; Hahn, 1986; Jackson, 1987; Kennedyl and Silverman, 1985; Özdemir, 2009). For example, since the elderly cannot walk for a long time, social infrastructure areas should be close to seating areas and pedestrian access should be strong (Clarke et al., 2009; Glass and Balfour, 2003). Women feel safer and stronger because they relate to family, friends, neighbors and strangers in social infrastructure areas (Krenichyn, 2003). For this reason, gathering areas should be created in social infrastructure areas. Playgrounds are very important for children. That's why playgrounds in social infrastructure facilities should be like kids won't have as much fun as nowhere else is there, and therefore want to go there. Accessibility is very important for people with disabilities. Social infrastructure spaces should be open, inclusive and pluralistic, and value differences such as disability. Access means not only getting there physically, but also being able to enjoy all the activities there (Young, 2000).

As a result, in addition to the physical features such as walking distance or per person size, surface materials, availability of seating elements, steps and access routes, lighting elements, street layout and signs are important in reaching the desired level of publicity of social infrastructure areas (Valdemarsson et al., 2005; Burton and Mitchell, 2006). Because these features, which increase the use of social infrastructure space, provide services such as the realization of recreational activities, the utilization of health and education services, and even the creation of pedestrian-friendly walking areas (Booth et al., 2000; Föbker and Grotz, 2006; Michael et al., 2006; Patterson and Chapman, 2004; Varna and Tiesdell, 2010). In addition, regular maintenance in social infrastructure areas prevents these areas from being perceived as dangerous and unwanted areas (Low et al., 2005; Sister et al., 2010).

This study, which was conducted to examine the social infrastructure areas and to evaluate the results of the examination and to present a model proposal in order to develop solutions to the problems, evaluated the social infrastructure areas under the basic headings of competence, accessibility, safety and usability.

The principle of adequacy is determined according to the 7th article of the spatial plans designing code and universal design principles. The principle of accessibility has been determined according to the standards set by TSE, the spatial plans designing regulation, and the İzmir Metropolitan Municipality Barrier-Free Public Buildings Design Guide.
The principle of safety has been determined in accordance with the 1st, 5th and 7th articles of universal design principles and literature adopted in the study. Many elements have been defined in the literature to ensure safety in a city; priority among these elements is to provide "eye on the street" (Jacobs, 1961) and "natural surveillance" (Newman, 1996) in that area. Thanks to the eye on the street and natural surveillance, one feels safe thinking that there is always someone there to call for help. Other factors are related to the physical characteristics of the place, such as traffic regulation, street illuminations, sidewalks, misplaced warning signs (Baxi, 2003). Although the technical proposals brought to the characteristics of that place contribute, they are not sufficient to provide a sense of safety. In this context, city planning should consider adequate illumination, public telephone systems, internal public transport, safe walkways and toilets. In addition to them, rape crisis centers and counseling centers (Moser, 2012, pp. 445-447) should be established and security cameras installed (Raoul Wallenberg Institute, 2021). For the safety of users, social infrastructure areas should incorporate these necessary elements.

The principle of usability has been determined in accordance with the recommendations include qualitative studies that support the use of urban space by all individuals; good illumination of public spaces, side streets, squares, bus stops, underpasses and overpasses; installation of emergency buttons and introductory, direction signs in public spaces; creation of gathering spaces; supporting the market etc. association areas with public transportation and positioning these areas on pedestrian axes; avoidance of the formation of dead-end street, winding roads and blind walls; streets, roads and sidewalks should be designed by considering all individuals such as the elderly, children, women, disabled and bicycle users (Kadıoğlu and Toy, 2021; Baykan, 2015; Park and Garcia, 2020; Hale, 1996; Painter, 1996; Fisher and Nasar, 1992;

DOI: 10.15320/ICONARP.2022.225

Appleton, 1975). These recommendations were evaluated together with the 1st of universal design principles.

The principles adopted regarding the successful Social Infrastructure Areas to be located in a Women-Friendly City in this study, indicators and bases are shown in Table 2.

Table 2: Principles, meanings, assesments and references determined within the scope of the study

Principles	Meaning	Assesments	Referances
Adequacy	Ensuring the space is large enough and accessible to all	Adequacy in terms of spatial dimension (population and square meters)	Zoning Law 3194 and Spatial Plans Designing Regulation and Universal Design Principle 7
		Adequacy in terms of accessibility (location and transport links)	
Accessibility	Ensuring that the place is safe and accessible, creating diversity in transportation	Sidewalk related problems (width and height)	Universal Design Principle 1, 3, 4, 5, 7 and TSE standarts TS 12174 and TS 12576
		Available (Useful) ramps (slope and position)	Universal Design Principle 1, 3, 4, 5, 7 and TSE standarts TS 12174 and TS 12576 and İzmir Metropolitan Municipality's Barrier-Free Public Buildings Design Guide
		Continuity in pedestrian mobility (Sidewalk or pedestrian lane discontinuity)	The Literature of the Women-Friendly City used in the study
		Facilities for public transportation such as Taxi or Bus (Taxi Rank / Bus Stop)	The Literature of the Women-Friendly City used in the study
Safety	Creation of safe social facilities and surveillance for all users	Street illumination (illumination elements)	Universal Design Principle 1, 7 and TSE standart TS 12174 and TS 12576 and he Literature of the Women-Friendly City used in the study
		Dead-end street existence	The Literature of the Women-Friendly City used in the study
		Vandalism and the blind wall	The Literature of the Women-Friendly City used in the study
		Empty parcels	The Literature of the Women-Friendly City used in the study
		Areas such as ruins or construction	The Literature of the Women-Friendly City used in the study
		Security cameras	Universal Design Principle 5 and the Literature of the Women-Friendly City used in the study
Usability	Ensuring the realization of the design suitable for all user profiles in the space	No commercial areas nearby	Universal Design Principle 1 and the Literature of the Women-Friendly City used in the study
		No active green areas nearby	Universal Design Principle 1 and the Literature of the Women-Friendly City used in the study
		No urban furniture nearby	Universal Design Principle 1, 4, 5 and the Literature of the Women-Friendly City used in the study
		No garbage bin / container nearby	Universal Design Principle 1, 4, 5 and the Literature of the Women-Friendly City used in the study

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

The study provides a model that can be improved by proposing a dataset on how to examine social infrastructure areas for a women-friendly city.

THE METHOD

In order to develop a model for a woman-friendly urban planning approach, firstly, the Current-Ready maps for 2019, taken from Çiğli Municipality between September 24, 2021 and October 01, 2021, were updated using USGS Landsat 8 satellite images Band 10 and 11, as well as on-site inspections and observations. Then, current social infrastructure areas analysis has been prepared with on-site studies on updated and ready-made maps. The classification used here is as defined by the Spatial Plans Designing Regulation (Mekansal Planlar Yapım Yönetmeliği). In the study, social infrastructure areas were evaluated according to service qualifications and service radius (network analysis) within the scope of the legislation as existing ones and those recommended in the zoning plans. The current zoning plan has been examined in terms of service and access adequacy, under the sub-headings of adequacy depending on the area size and adequacy depending on the service radius.

For this study, TSE standards (Table 3) and Spatial Plans Designing Regulation's walking distances (Table 4) are taken.

Table 3: Pedestrian codes, pedestrian groups and Speeds (TSE TS 12174)

Pedestrian Codes		Pedestrian Groups	Pedestrian Speeds (m/s)
A	a1	Women with Children	0.7
	a2	Women over 50	1.3
	a3	Women up to age 50	1.4
B	b1	Men over 55	1.4
	b2	Men 40-55 years old	1.6
	b3	Men up to age 40	1.7
C	c1	Children 6-10 years old	1.1
	c2	Youth	1.8

Table 4: Social infrastructure areas and walking distance (Spatial Plans Designing Regulation)

Social Infrastructure Areas	Walking Distance (m)
Mosques	400
Health Facilities	500
Kindergarten	500
Primary School	500
Middle School	1000
High School	2500

Then, in order to form a model for the research and assessment of the women-friendly city on public spaces, the study area was evaluated for the social facilities and their surroundings under the headings of the quality of use, accessibility and safety of the social facilities for pedestrians. At the last stage, problems were identified in the areas of social facilities, which were examined in detail in terms of accessibility, safety and usability criteria, and solution proposals were developed in the context of a woman-friendly city.

DOI: 10.15320/ICONARP.2022.225

THE STUDY AREA AND ITS SOCIAL INFRASTRUCTURE ANALYSIS

Regarding the women friendly city approach, a 52-acre area of Köyiçi neighbourhood of Çiğli county of İzmir province, which is one of 26 districts of the county, has been studied (Figure 1). The field of study has been chosen because it has a central location. The area covers a significant part of Anadolu Street where governing units (Çiğli Municipality and the office of the District Governor) and lots of businesses are located. There is also an IZBAN station (The suburban train system of İzmir) which causes heavy vehicle and pedestrian traffic in the area (Figure 2).

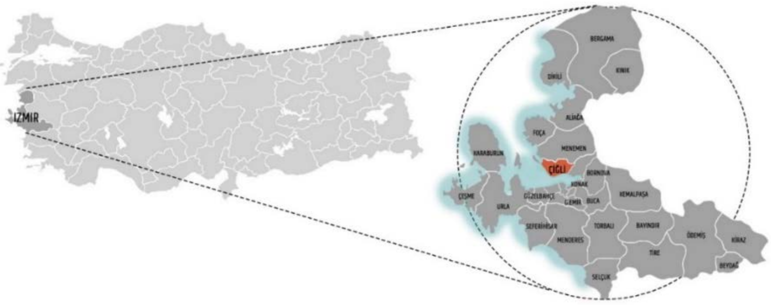


Figure 1. The location of İzmir in Türkiye and the location of Çiğli in İzmir

Çiğli hosts 4.7 % of the population of İzmir. The field of study (Figure 2.) Köyiçi neighbourhood similarly hosts approximately 4% of the population of Çiğli. Both in İzmir and in Çiğli women consist of nearly 50% of the total population.

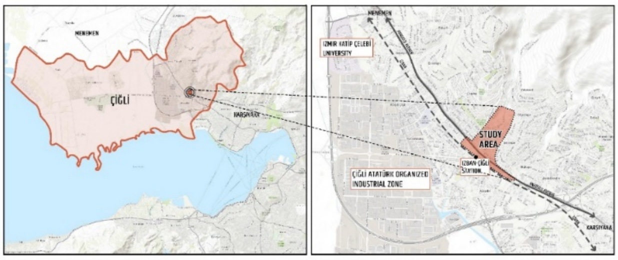


Figure 2. The field of study and its immediate surroundings

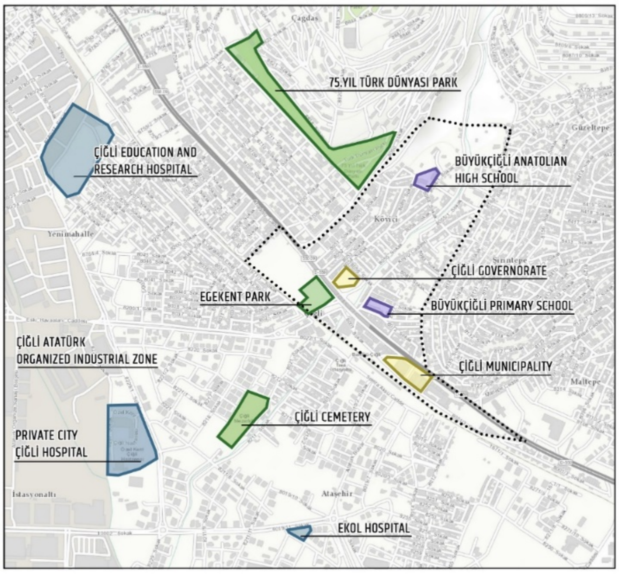


Figure 3. Second floor space relations diagram (Drawings by the Authors).

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

Social Infrastructure Areas in the Existing and Implementary Zoning Plan (Uygulama İmar Planı) in the Study Area

Social infrastructure areas in the study area; It consists of educational facilities (primary school, middle school-high school and public education center), administrative facilities (municipality etc.), religious facilities, social and cultural facilities (library and dormitory area) and open green areas. As public spaces, open green spaces from social infrastructure areas are separated from other facilities in terms of ownership, and they are excluded from the scope of the study as they need to be handled in a wide variety of contexts in the production of a woman-friendly urban planning approach. In this context, within the scope of the assessment of social infrastructure areas, the primary school, middle school-high school, public education center, governorate, headman's office, municipality, mosque, library and dormitory area are coded for examination and shown together with their transportation connections (Figure 3).

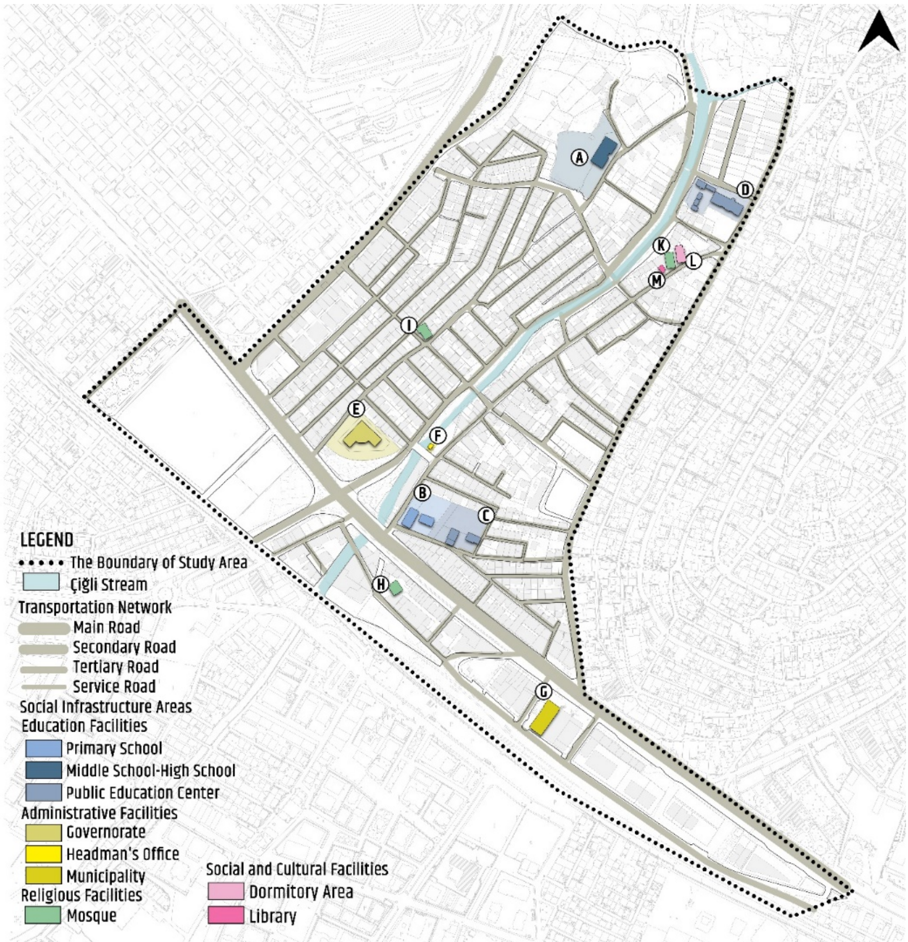


Figure 3. Social Infrastructure Areas in the Study Area

There are currently 12 social infrastructure areas in the area. One of these social infrastructure areas is middle school-high school (A), 1 is primary school (B), 2 is public education center (C, D), 1 is governorate (E), 1 is headman's office (F), 1 is municipality (G), 3 of them are mosques (H, I, K), 1 is dormitory area (L), and 1 is library (M).

DOI: 10.15320/ICONARP.2022.225

Since service radius and building sizes are in question while examining the zoning plan, the study area has been considered together with its surroundings (Figure 4).

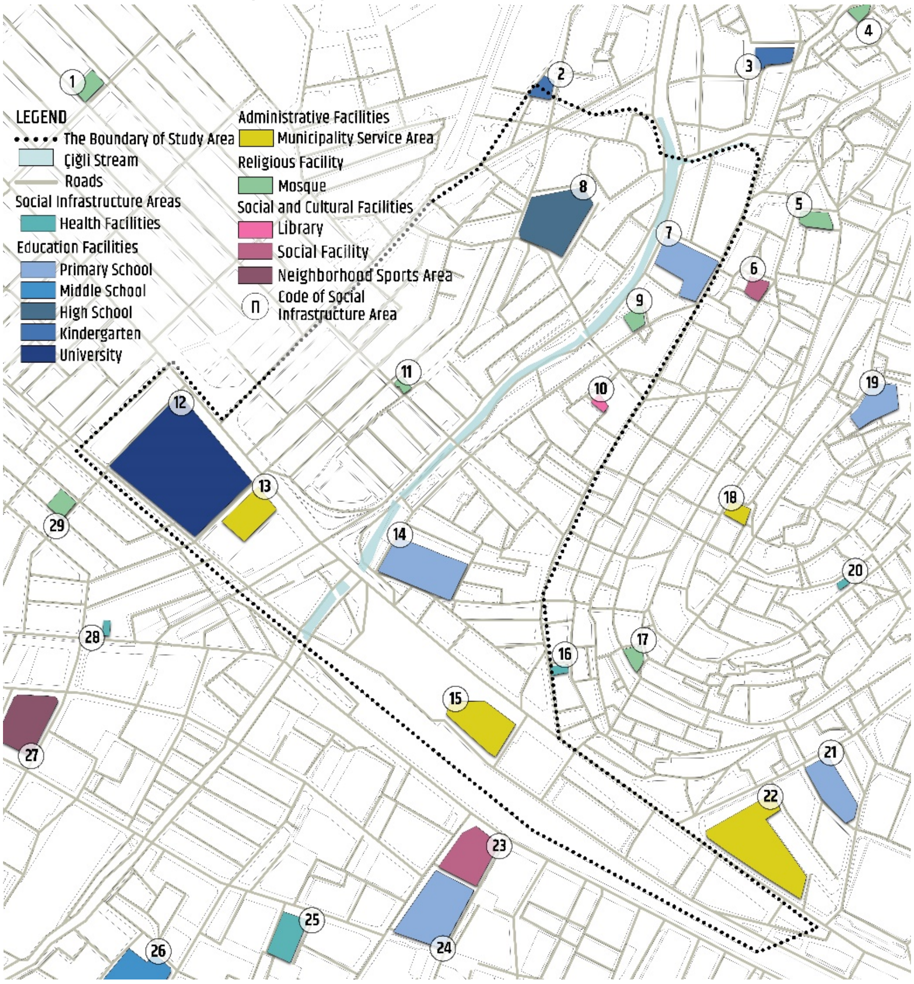


Figure 4. Social Infrastructure Areas in the Implementary Zoning Plan

In the plan, 10 of the 29 social infrastructure areas in total are within the working area and 19 are in the vicinity. Out of 29 social infrastructure areas, 5 primary schools, 3 health facilities, 1 middle school, 1 high school, 1 university, 2 kindergartens, 4 municipality service areas, 7 mosques, 1 library, 2 social facilities and 1 district sports area.

Adequacy Analysis of Social Equipment Areas According to National Legislation and Standards

In order to evaluate the social infrastructure area decisions developed in the 1/1000 Implementary Zoning Plan approved by the Izmir Metropolitan Municipality in 1984, it was necessary to calculate the population. In this context, taking into account the Zoning Law No. 3194, precedent values have been accepted according to the order forms given in the zoning plan (Adjacent Ordinance is 1.44 for 2-storey buildings, Block Ordinance 3-storey structures are 1.09 for structures with front garden, 1.20 for structures without front garden). Then, the population was calculated as 4611 by including the precedent values, parcel sizes and the average number of independent units on one floor of the residential buildings in the study area. When the total size of the social

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

infrastructure areas in the study area and the population are examined (Table 5), it is seen that the Plan has decided on sufficient social infrastructure areas to serve the population within the boundaries of the study area.

The current population of the study area was determined according to the survey conducted by Çiğli Municipality in 2021 and the data of TUIK 2020. Accordingly, the current population of the study area was accepted as 4084 people. When the total size of the various social infrastructure areas in the study area and the population are compared, it has been determined that most of the existing social infrastructure areas are insufficient according to the legislation. There is no health facility in the study area, including the Family Health Center, which is the primary health service where health needs are met, both in the current and in the zoning plan. In addition, there is no middle school area in the plan and there is no nursery, which is very important for working parents as well as education.

Table 5: Social Infrastructure Areas Per Capita in the Current Situation and Zoning Plan

Social Infrastructure Areas		Area (m^2)	Population	Area Per Capita (m^2)
High school	Current	7196.89	4084	0.57
	Implementary Zoning Plan	6958.68	4612	0.66
Middle School	Current	794.13	4084	5.14
	Implementary Zoning Plan	-	4612	-
Primary school	Current	3064.66	4084	1.33
	Implementary Zoning Plan	4474.61	4612	1.03
Kindergarten	Current	-	4084	-
	Implementary Zoning Plan	790.11	4612	5.84
Mosque	Current	797.54	4084	5.12
	Implementary Zoning Plan	1050.13	4612	4.39

The size of the social infrastructure areas is not an indicator that can be evaluated alone. It is important that the social equipment areas that are open to everyone's use are located within walking distance that everyone can access, as well as their spatial size. In this context, the service radius of the social infrastructure areas has been evaluated by considering the walking distances of the Spatial Plans Designing Regulation and the pedestrian speeds in the TSE's "TS 12174 Design Rules for Urban Roads - Pedestrian Roads and Pedestrian Areas" standard and the walking time during which the pedestrian can maintain the pace.

Network analysis service impact radius of the social infrastructure areas in the current and in the plan, as the distance as specified in the Spatial Plans Designing Regulation and as specified in the TS 12174 standard, women with children (a1), children aged 6-10 years (c1), 50 years old It was made under 9 different headings: women over the age of 50 (a2), women up to the age of 50 (a3), men over the age of 55 (b1), men

DOI: 10.15320/ICONARP.2022.225

between the ages of 40-55 (b2), men up to the age of 40 (b3) and young people (c2). . The walking time of the groups examined under each heading is based on the 7-minute walking distance (m/s) as specified in the standard TS 12174 (Table 3).

Field studies and data obtained from OpenStreetMap, an open source data provider, were transferred to the computer environment by using "ArcMap 10.3 and ArcMap 10.5" from ArcGIS Desktop Applications, one of the geographic information system software. Numerical data in vector format were used in the study. The extent to which a pedestrian or vehicle, which is also expressed as the service radius, can reach the environment from the social infrastructure areas and from the environment to these areas has been examined. Service radius assessment is examined in two different ways in the literature. The first method is called "Buffer Zone". This method is the study of Euclidean equidistants from a point placed in the geometric middle of social infrastructure areas. The other method is the "Service Area" method. In this method, pedestrian or vehicle mobility is evaluated over the roads that provide the mobility of pedestrians and vehicles, instead of the Euclidean distance, unlike the "buffer zone" method. In the study, it was seen that the pedestrian could not follow a Euclidean route due to buildings and closed areas, and the "Service Area" method was used in order to obtain more realistic results in evaluating the access to social facilities at the distances or times available in the legislation. At this point, the network analysis tool "Service Area", which is a tool of ArcMap 10.3 application, is placed on the right topography of the vehicle and pedestrian roads in the study area and in the context of the distances and times valid in the legislation and standards.

The service impact radius of the social infrastructure areas in the current and plan has been examined in detail, specific to the facilities.

Network Analysis of Health Facilities

When the 500-meter service radius of the health facilities in the current and plan is examined; With the suggestions in the plan, it is seen that a certain part of the study area can receive service, but it is still not sufficient (Figure 5).

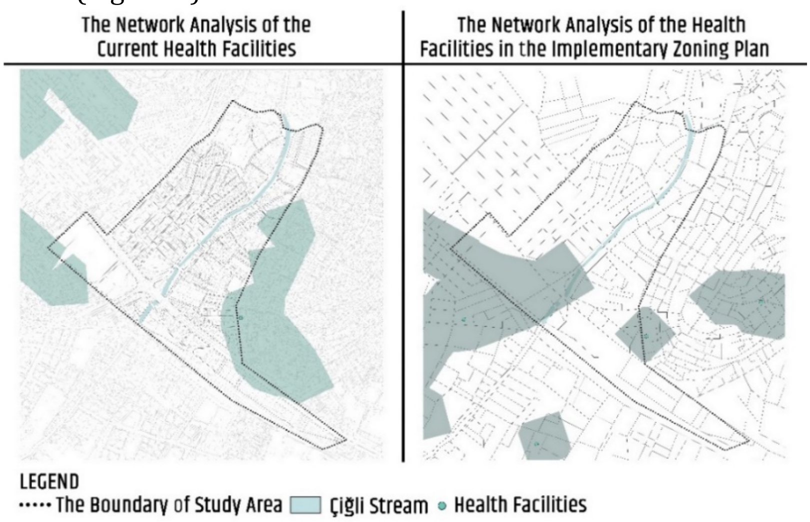


Figure 5. Network Analysis of Health Facilities with 500 Meter Radius

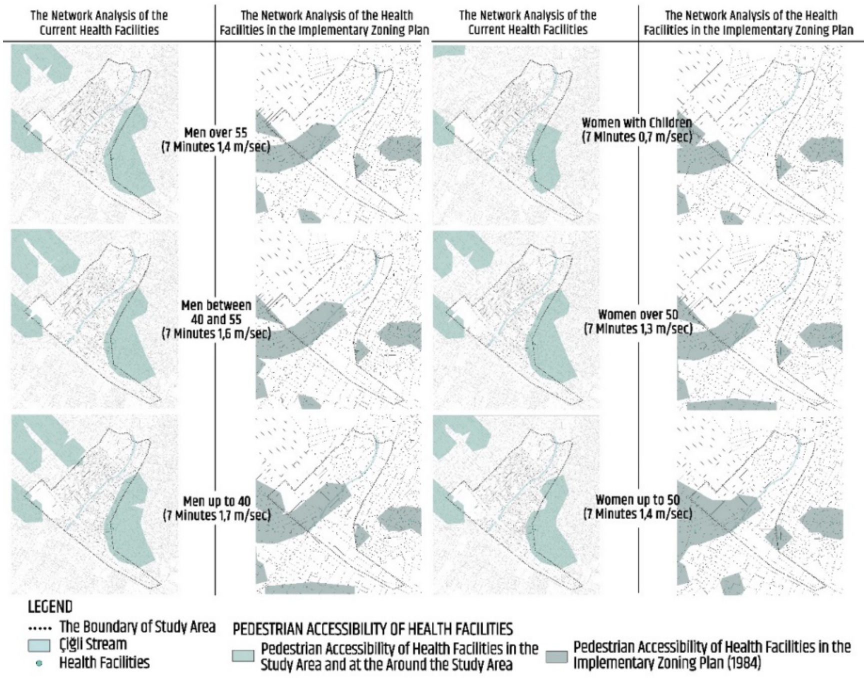


Figure 6. Network Analysis of Health Facilities for A and B

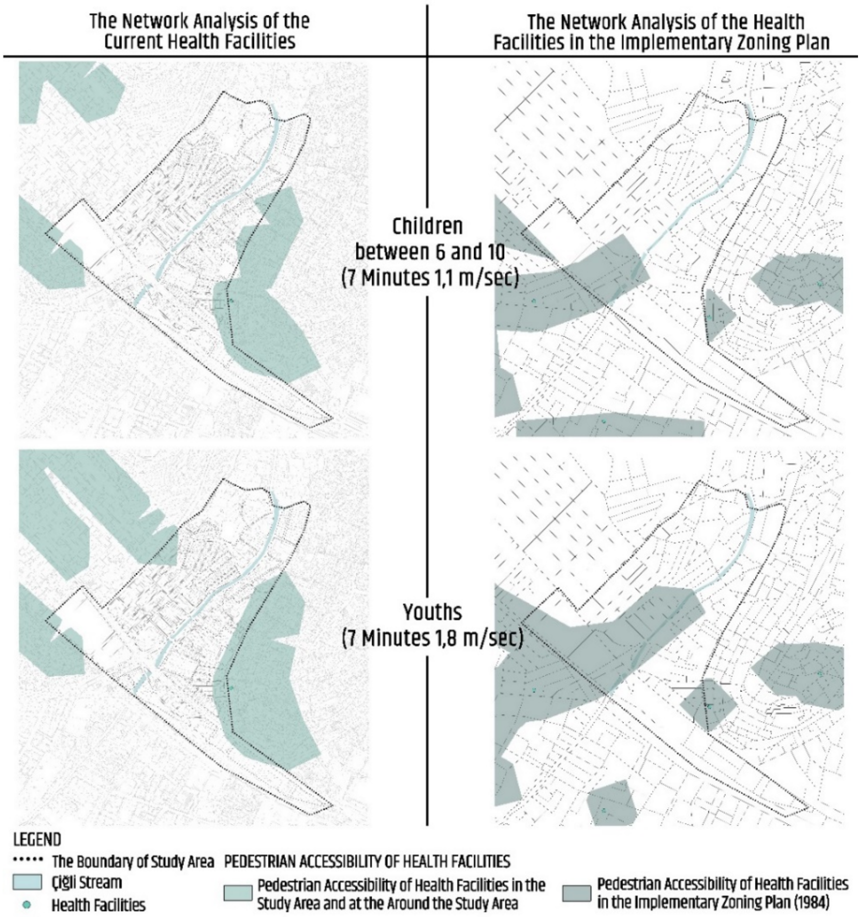


Figure 7. Network Analysis of Health Facilities for C

The service impact radius of health facilities was analyzed within the 7-minute walking distance for all categories (Figure 6).

DOI: 10.15320/ICONARP.2022.225

When the current situation is examined, it is seen that A and B group pedestrians do not receive service from health facilities. With the suggestions in the plan, it is seen that all A and B group pedestrians, except for the a1 pedestrian group, serve a certain part of the study area, but this is still not sufficient (Figure 6).

In the current and plan of the health facilities, the service impact radius of the C group pedestrians in line with the 7-minute walking distances has been examined (Figure 7).

When the current situation is examined, it is seen that C group pedestrians do not receive service from health facilities. With the recommendations in the plan, it was determined that the c2 pedestrian group received more service from the health facilities than the c1 pedestrian group, but both categories did not receive adequate service (Figure 7).

Network Analysis of High Schools

Proposal in the plan, it is seen that only the north of the study area can receive service and this is not sufficient (Figure 8).

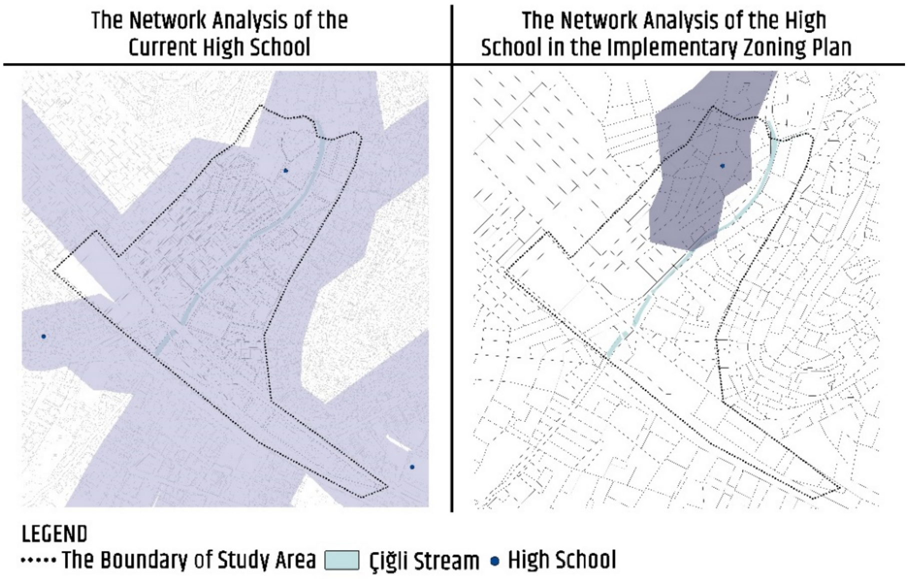


Figure 8. Network Analysis of High Schools with a Radius of 2500 Meters

The service impact radius of high schools has been examined within the scope of 7-minute walking distance in all categories determined for the existing and plan (Figure 9).

When the current situation is examined, it is seen that A and B group pedestrians receive service from high schools in the north of the study area. With the recommendations in the plan, it is seen that the a1 group pedestrians receive the least service, and all categories receive less service than high schools compared to the current situation, and this is not sufficient (Figure 9).

The service radius of the high schools within the scope of the 7-minute walking distance of the young people in the existing and plan has been examined (Figure 10).

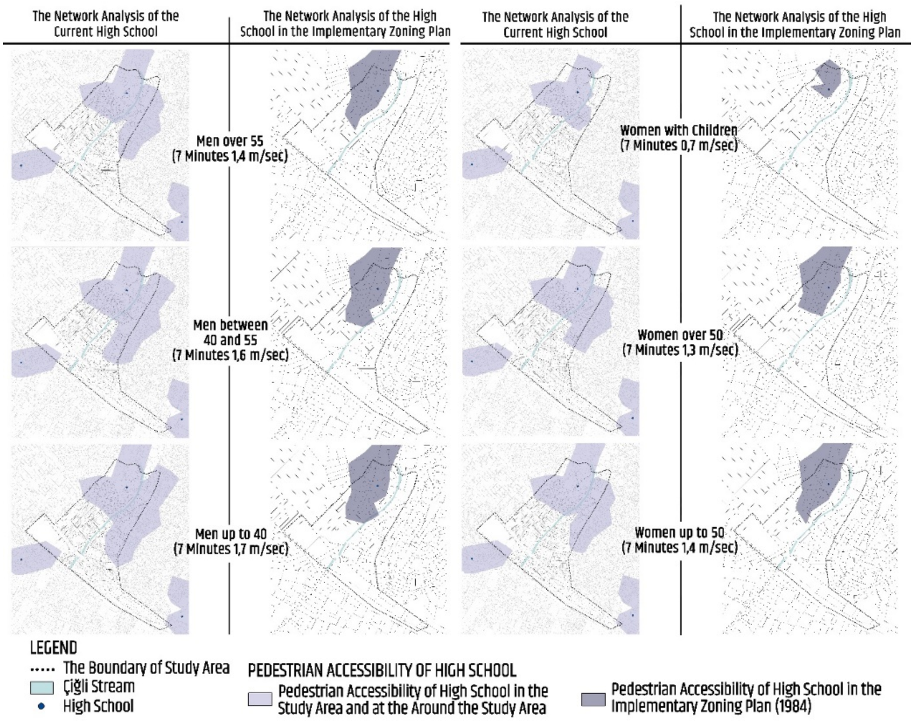


Figure 9. Network Analysis of High Schools for A and B

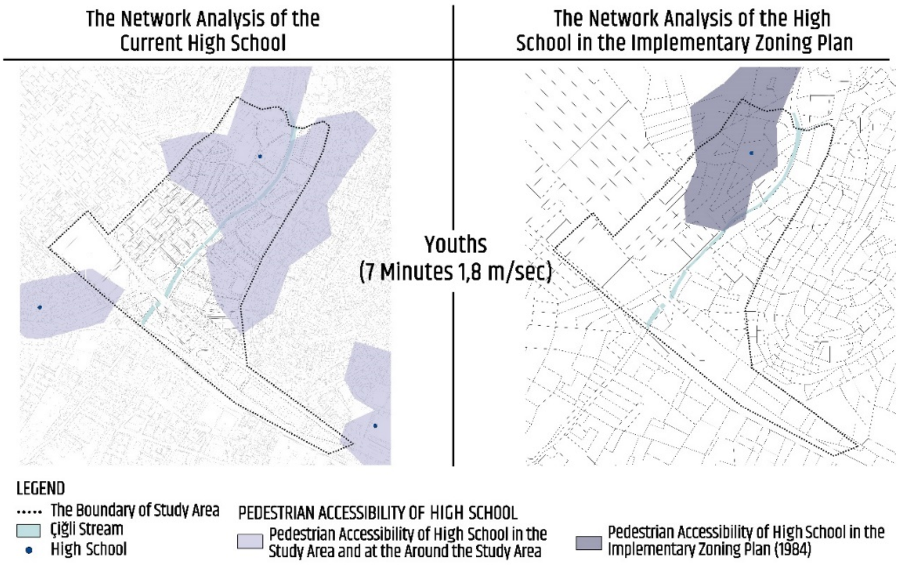


Figure 10. Network Analysis of High Schools for c2

When the current situation is examined, it has been observed that generally in the north of the study area, C2 group pedestrians receive service from high schools. With the suggestions in the plan, it is seen that the c2 pedestrian group receives less service than high schools compared to the current situation and this is not sufficient (Figure 10).

Network Analysis of Middle Schools

When the current 1000-meter service radius of middle schools is examined, it is seen that a large part of the study area receives service (Figure 11).

DOI: 10.15320/ICONARP.2022.225

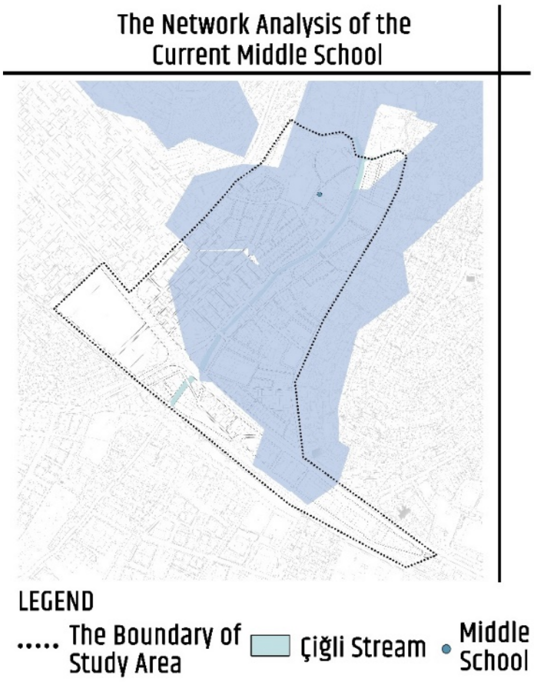


Figure 11. Middle School 1000 Meter Radius Network Analysis

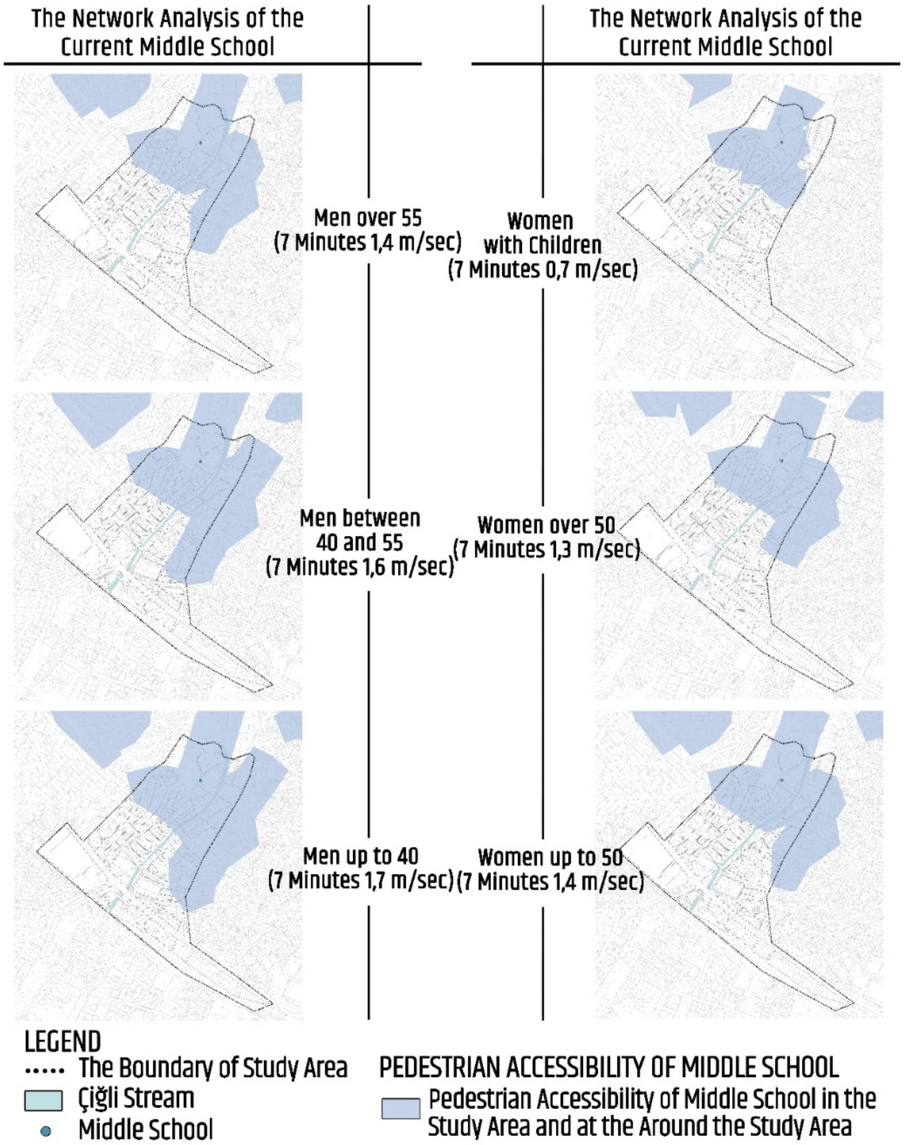


Figure 12. Network Analysis of Middle Schools for A and B

The service impact radius of middle schools has already been examined in line with the 7-minute walking distances of groups A and B (Figure 12).

When the current situation is examined, it is seen that A and B group pedestrians receive service from middle schools in the north of the study area. According to the current situation, it is seen that the a1 group pedestrians receive the least service, and the group A generally receives less service than the B group from middle schools and it is not sufficient (Figure 12).

The service impact radius of middle schools in line with the 7-minute walking distance of C2 group pedestrians was examined (Figure 13).

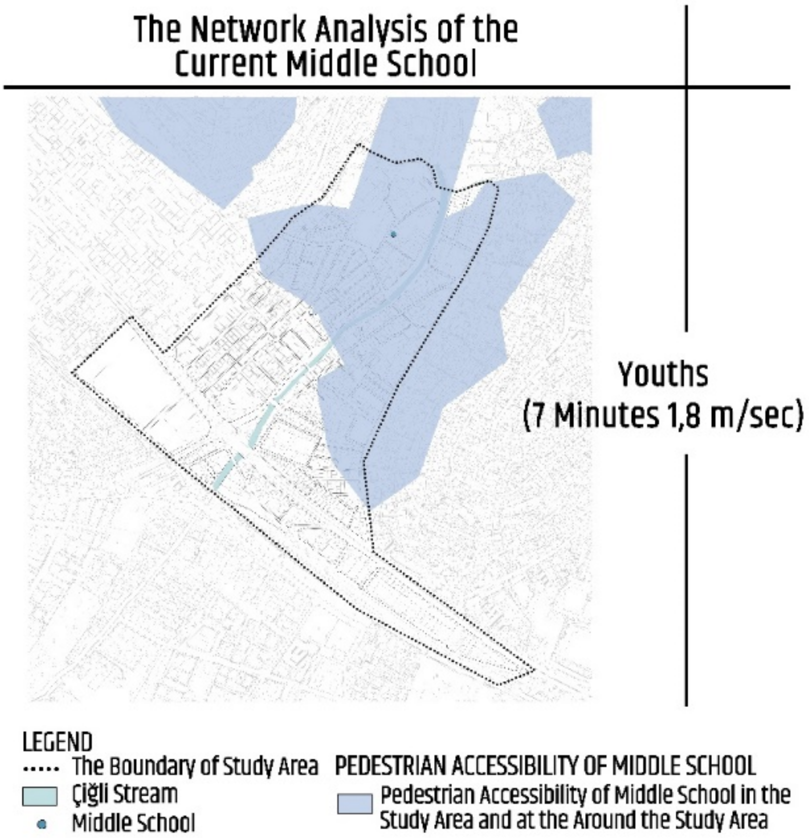


Figure 13. Network Analysis of Middle Schools for c2

The service impact radius of middle schools in line with the 7-minute walking distance of C2 group pedestrians was examined (Figure 13).

Network Analysis of Primary Schools

When the 500-meter service radius of the primary schools in the current and plan is examined, it is seen that the south of the study area is currently serving; With the proposal in the plan, it is seen that only a small area to the north of the study area can receive service and is not sufficient (Figure 14).

The service impact radius of primary schools was analyzed within the 7-minute walking distance for all categories (Figure 15).

DOI: 10.15320/ICONARP.2022.225

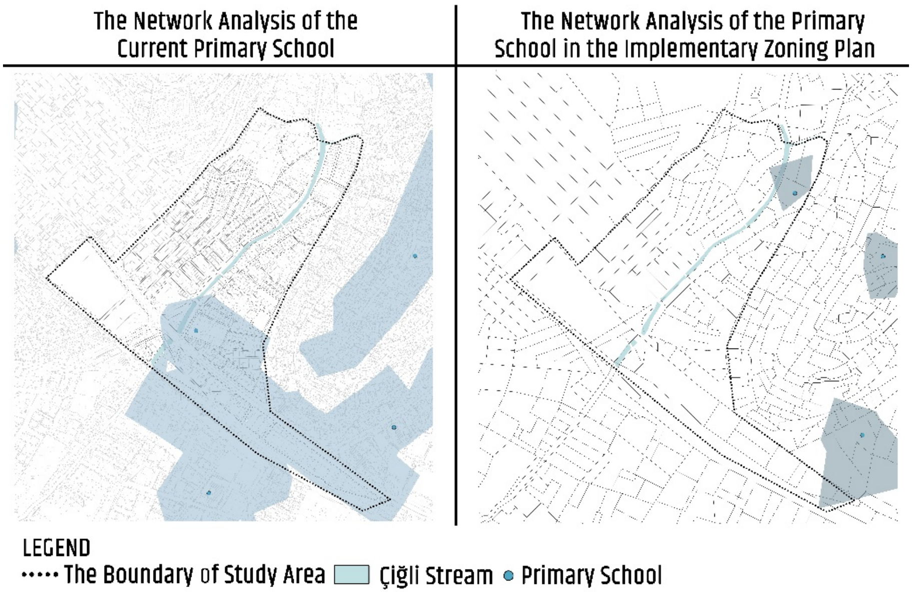


Figure 14. Network Analysis of Primary Schools with 500 Meter Radius

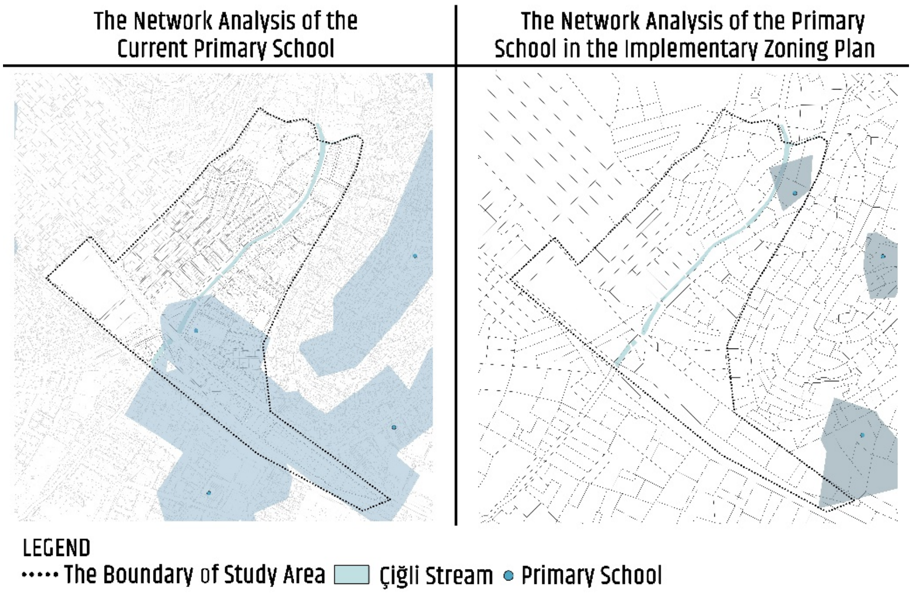


Figure 15. Network Analysis of Primary Schools for A and B

When the current situation is examined, it is seen that the A and B group pedestrians of the study area receive service from primary schools. However, currently, pedestrians in the a1 group receive less service from primary schools compared to all other categories. With the suggestions in the plan, it is seen that the a1 group pedestrians receive the least service and all categories receive less service from primary schools compared to the current situation and they are not sufficient (Figure 15). In the existing and plan of primary schools, the service radius of the c1 group pedestrians in line with their 7-minute walking distances has been examined (Figure 16).

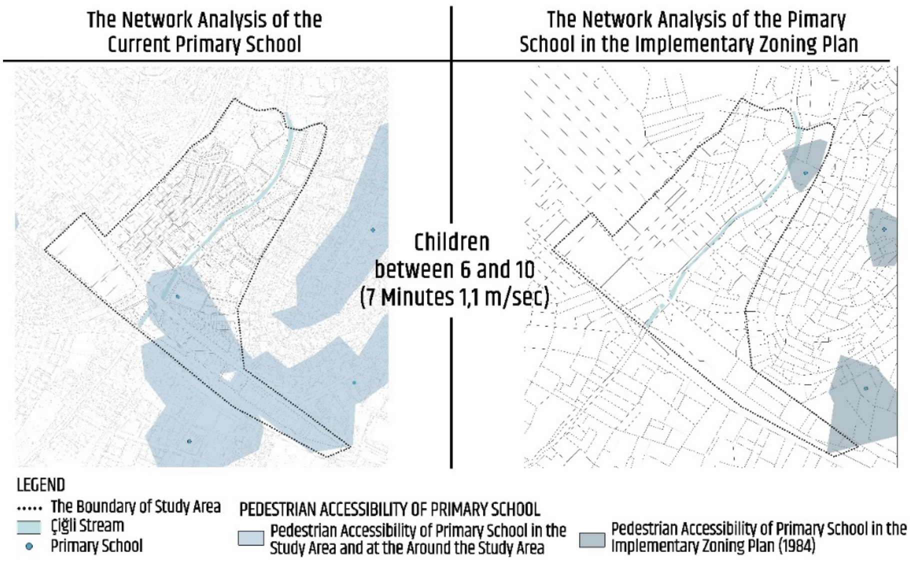


Figure 16. Network Analysis of Primary Schools for c1

When the current situation is examined, it is seen that the c1 group pedestrians receive service from primary schools in the south of the study area. With the suggestions in the plan, it is seen that the c1 group pedestrians receive less service from primary schools compared to the current situation and they are not sufficient (Figure 16).

Network Analysis of Kindergartens

There is no nursery area available in the study area and its immediate surroundings. When the 500-meter service impact radius of the kindergartens in the plan is examined, it is seen that the study area does not receive service (Figure 17).

Figure 17. Network Analysis of Kindergartens with 500 Meter Impact Radius

DOI: 10.15320/ICONARP.2022.225

The service radius of the kindergartens has been examined in the plan in line with the 7-minute walking distance of group A and B pedestrians (Figure 18).

When the plan was examined, it was seen that the A and B group pedestrians did not receive service from the nurseries (Figure 18).

Network Analysis of Mosques

When the 400-meter service radius of the mosques in the current and plan is examined; With the proposal in the plan, it is seen that only a certain area in the middle of the study area can receive service and is not sufficient (Figure 19).

The service radius of the mosques has been examined in the existing and plan in line with the 7-minute walking distances of the A and B group pedestrians (Figure 20).

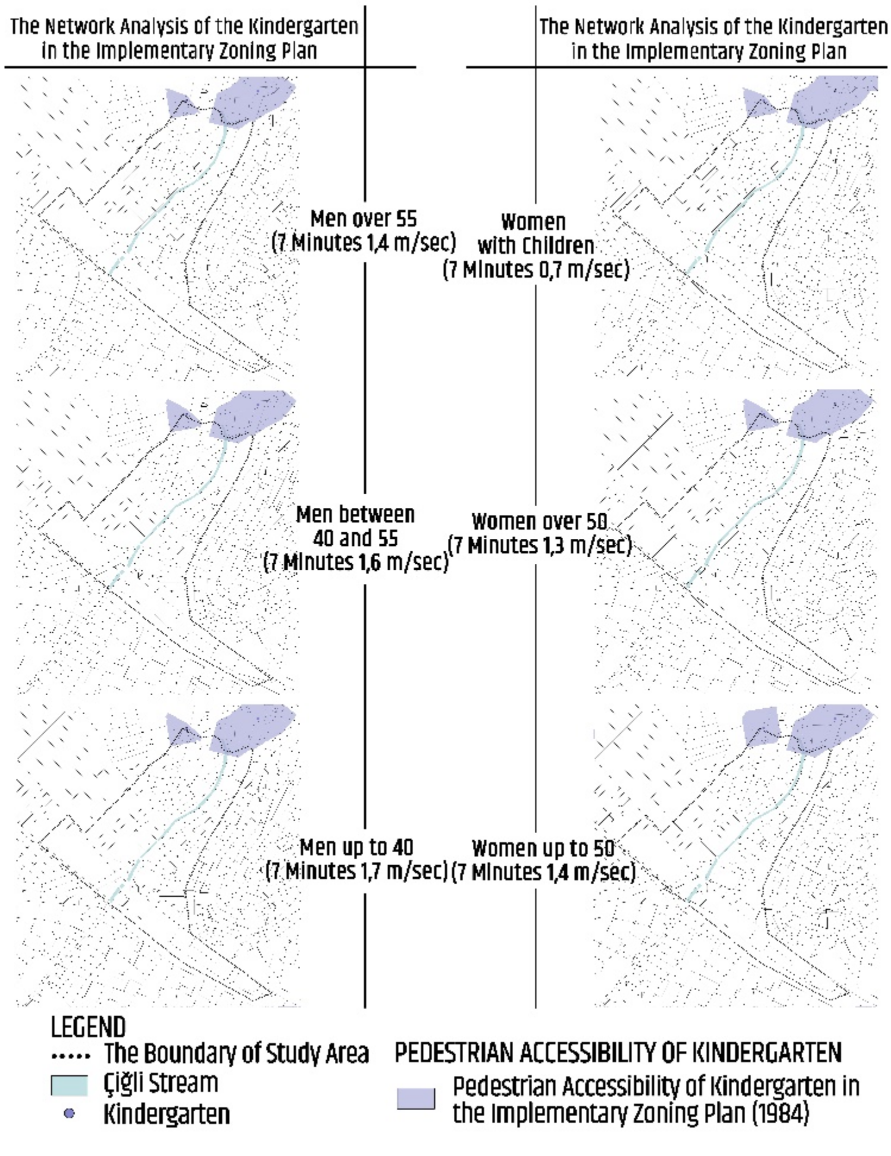


Figure 18. Network Analysis of Kindergartens for A and B

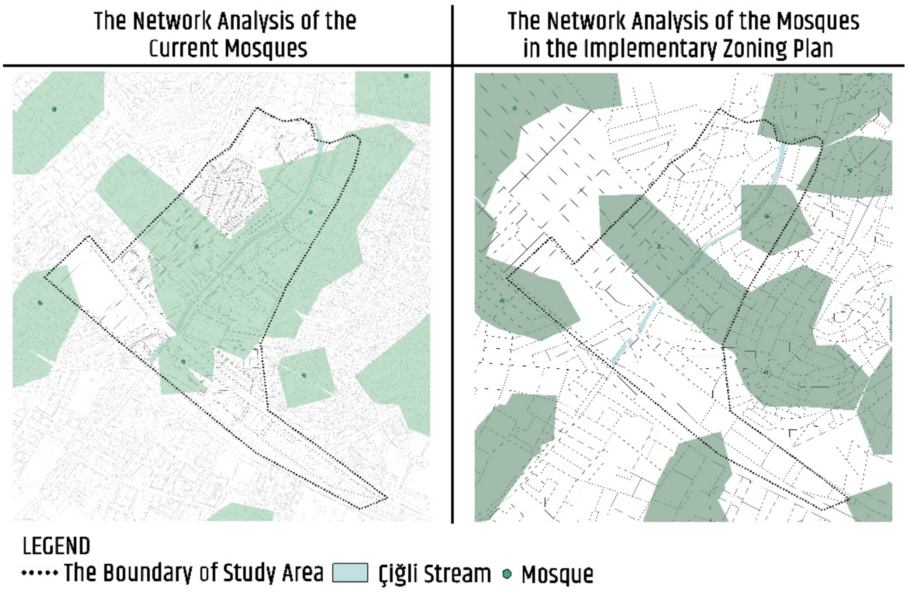


Figure 19. Network Analysis of Mosques with 400 Meter Impact Radius

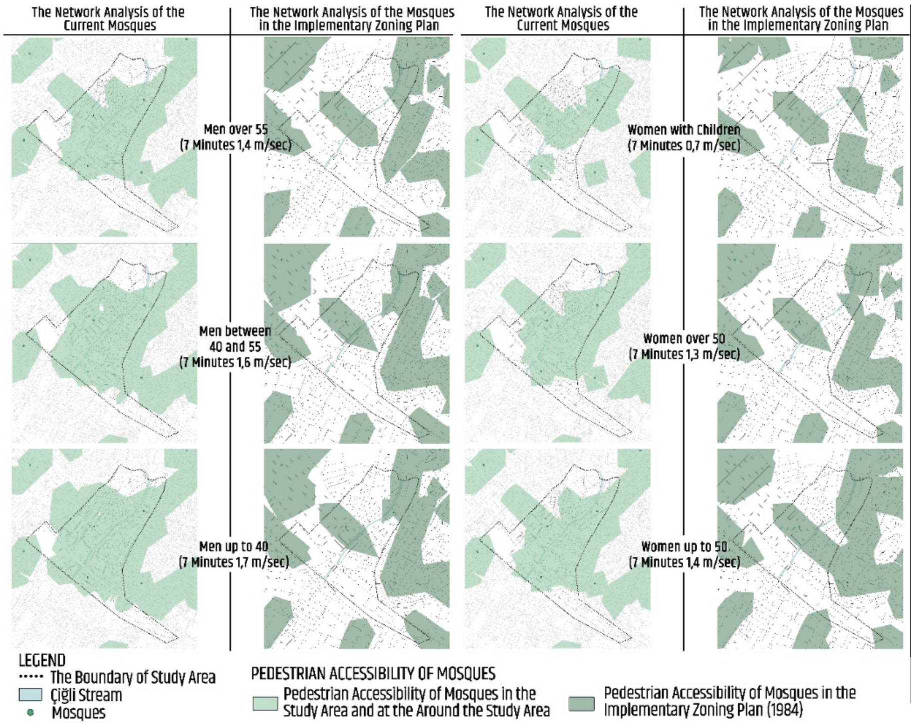


Figure 20. Network Analysis of Mosques for A and B

When the current situation is examined, it is seen that A and B group pedestrians receive service from mosques in most of the study area, except for the A1 group. However, currently, group A receives less service from mosques than group B, and group a1 compared to all other categories. With the suggestions in the plan, it is seen that the a1 group pedestrians receive the least service, while all categories receive less service than the mosques compared to the current situation and it is not sufficient (Figure 20).

The service radius of the mosques in line with the 7-minute walking distances of the C group pedestrians in the existing and plan has been examined (Figure 21).

DOI: 10.15320/ICONARP.2022.225

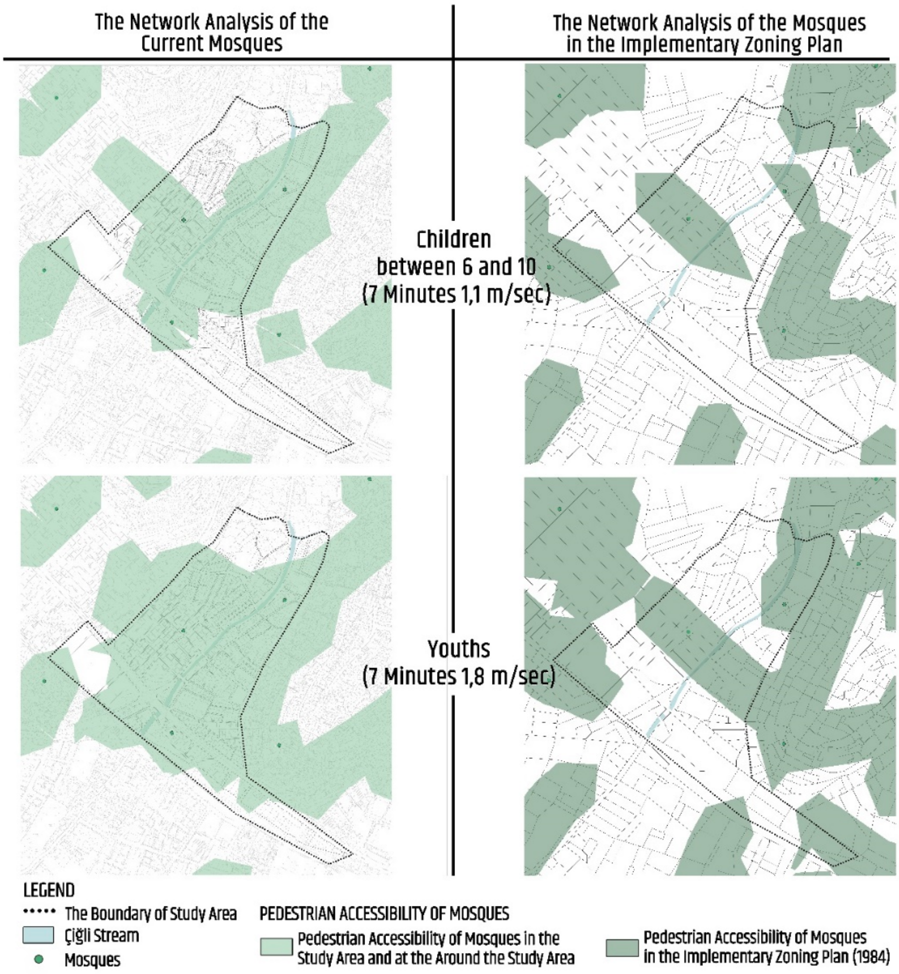


Figure 20. Network Analysis of Mosques for C

When the current situation is examined, it is seen that the c1 group receives less service from mosques than the c2 group pedestrians. With the suggestions in the plan, it is seen that the c1 group pedestrians receive the least service, while all categories receive less service than the mosques compared to the current situation and it is not sufficient (Figure 21).

SOCIAL INFRASTRUCTURE AREAS ASSESMENT WITHIN THE SCOPE OF A WOMEN-FRIENDLY CITY

The study, which was prepared to be a model for analyzing and evaluating social infrastructure areas within the scope of a woman-friendly city, developed three main titles: accessibility, safety and usability. These three main titles and sub-criteria were determined primarily according to the universal design principles and legislation (see Table 2). In addition, the physical characteristics of the area were also taken into account. The sub-analysis groups discussed under these headings are given in Figure 22.

In the study, the classification for the ramp was accepted as 6% as stated in the 1st Part A of the Design Guide for Barrier-Free Public Buildings prepared by the Izmir Metropolitan Municipality, and the ramps were handled in 2 categories as those with a slope lower than 6%

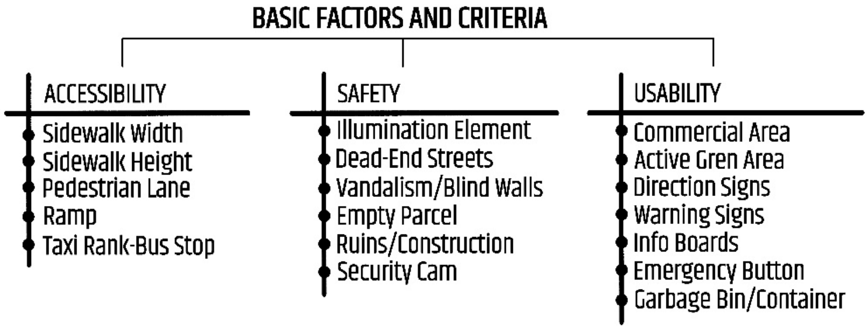


Figure 22. Social Infrastructure Areas Assessment Criteria

and higher than 6%. The basic standard for the width of the sidewalk has been determined as 150 cm, as stated in the article 5.1.1 Width of the Pedestrian Sidewalks of the Turkish Standards Institute's standard TS 12576. As a result of the field study, the current situation was evaluated in 4 categories as 0-50 cm, 51-149 cm, 150 cm (standard) and over 150 cm. The sidewalk heights are in the 5.1.2. of the Turkish Standards Institute's standard TS 12576. It is accepted as being between 3 cm and 15 cm as stated in the Height of Pedestrian Sidewalk article and the current situation is given in 3 categories as 0-2 cm, 3-15 cm (standard) and over 15 cm. Buildings commercial, construction and ruin; social infrastructure areas, educational facilities, administrative facilities, religious facilities, social and cultural facilities and open green spaces; urban furniture illumination element type1/type2, garbage bin/container, direction sign, info board and bus stop; roads and their elements pedestrian lane, roadway and dead-end street; others are classified as blind wall/vandalism, empty parcel and taxi rank.

Assessment of social infrastructure areas in the examination,

• Social infrastructure areas are scattered in the area;

• Of the social infrastructure areas, administrative facilities (E, F, G) are located in the south, social and cultural facilities (L, M) are located in the north, while educational facilities (A, B, C, D) and religious facilities (H, I, K) are located in the area. positioned in such a way;

• When the accessibility to social infrastructure areas is examined, 10 of them (A, B, C, D, E, F, I, K, L, M) in terms of sidewalk width, 7 of them (A, B, C, D, E, F, I) there is a problem in terms of sidewalk height; The discontinuity of the pavements surrounding the 9 social infrastructure areas (A, B, C, D, F, I, K, L, M);

• Ramps are missing in 4 of the social infrastructure areas (B, I, K, M);

• There are no taxi and bus stops in the immediate vicinity of 6 social infrastructure areas (A, B, I, K, L, M);

• Looking at the lighting elements, 7 of the social infrastructure areas (B, C, E, F, G, H, I) have type1 illumination elements, and 5 of them (A, D, K, L, M) have type2;

• There is a dead end in the immediate vicinity of one of the social infrastructure areas (A);

DOI: 10.15320/ICONARP.2022.225

• While there are empty parcels in the immediate vicinity of 4 of the social infrastructure areas (A, C, D, I), blind wall and vandalism in the immediate vicinity of 8 (A, C, D, E, F, I, K, M) and 4 (A), D, E, I) near ruins/construction;
• There are no security cameras in 9 of the social infrastructure areas (A, B, C, D, F, H, I, K, M);
• There are no commercial areas near 4 of the social infrastructure areas (D, K, L, M), and there is no open green area near 7 of them (A, D, G, I, K, L, M);
• Considering the urban furniture, there are no emergency buttons and info boards in the social infrastructure areas; in 7 of the social infrastructure areas of the warning sign (A, B, E, F, G, H, I); the guiding plate has 1 (I);
• It is seen that garbage containers and garbage bin are not found in 3 of the social infrastructure areas (C, H, I).

The map created within the scope of social infrastructure areas according to the assessments is given below (Figure 23).

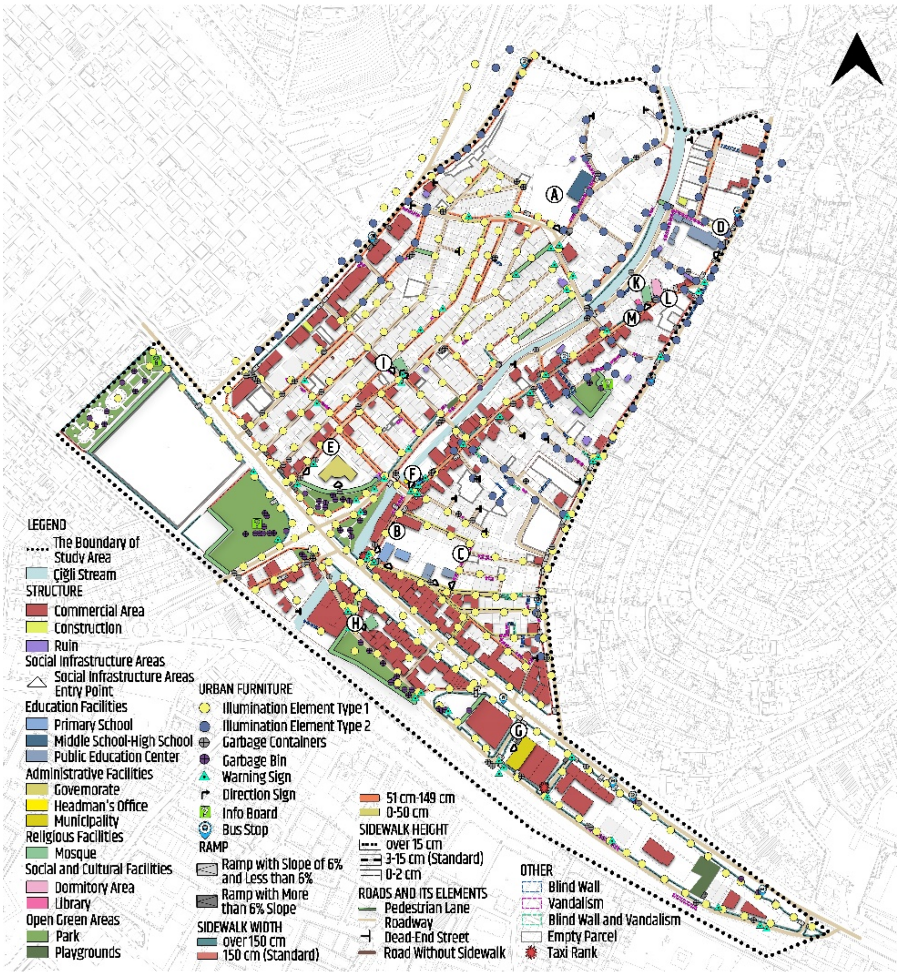


Figure 23. Social Infrastructure Areas Analysis

One of the most important criteria in evaluating the accessibility of social infrastructure areas is transportation relations. There are 11 bus stops in the study area. 21 of 32 bus lines passing through Çiğli district borders serve in the study area and buses pass through Anadolu Avenue, Köyiçi Avenue, Dere Avenue, 8050 street and 8055 street. Among the 12 social infrastructure areas in the study area, the public transport relation of the A coded middle school-high school I coded mosque, K coded mosque, L coded dormitory and M coded library is weak compared to other social infrastructure areas (See Figure 24).

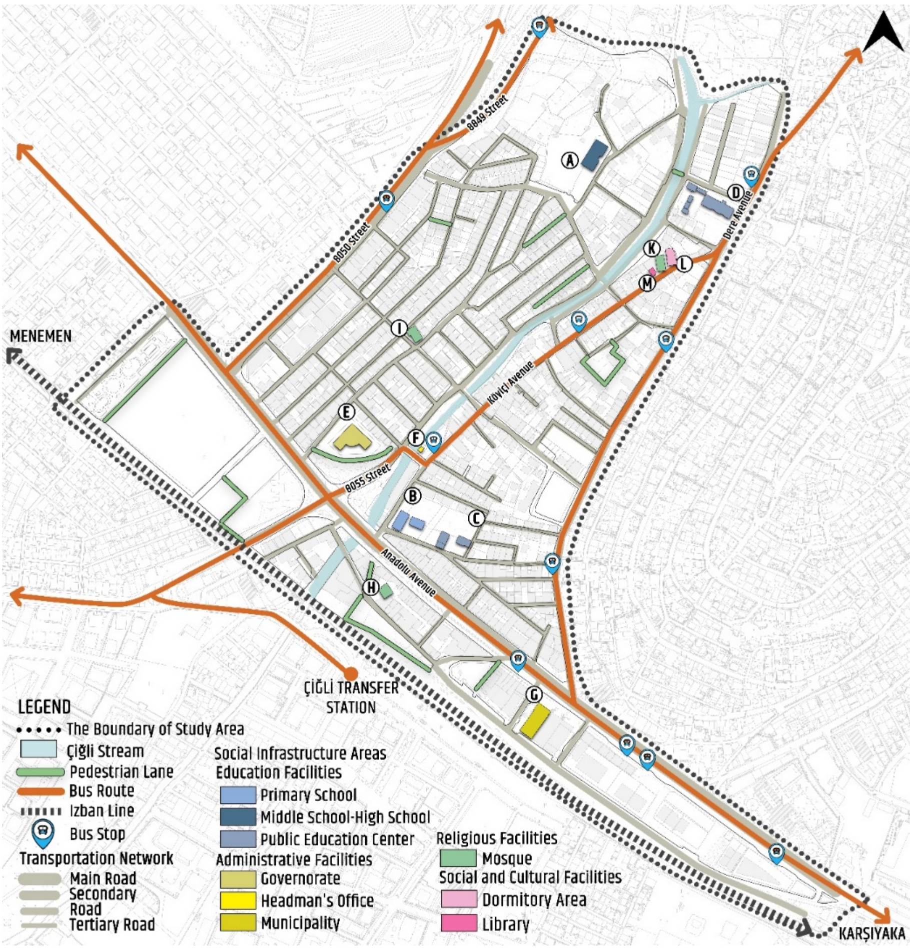


Figure 24. Transportation Relations of Social Infrastructure Areas in the Study Area

Illumination elements are an important element within the scope of the security of social infrastructure areas. There are 408 illumination elements in two different types (Type1, Type2) in the area (Figure 25). While 296 of them are Type1, 112 of them are Type2. According to the types of these illumination elements, their length and Lux values also change (LUX: Average illuminance level). The data on the illumination elements were taken by Gediz Elektrik, which provides service in the field, in the form of brand, model, feature and spatial distribution, and the maximum lux and radius values that can be provided by the brand and model obtained as a result of the sector research were used to determine the light and dark areas.

Illumination element Type1 has 4 different lux radius (5-10-15-20 meters). Illumination element Type2 has 13 different lux diameters (1.5-2-2.5-3-4-5-6-8-10-14-30 meters). In addition, 22 illumination elements do not have a lux effect diameter and therefore cannot illuminate its surroundings.

As a result of the examination, there are problems in terms of lighting in 7 of the social infrastructure areas in the area (A, D, H, G, K, L, M).

DOI: 10.15320/ICONARP.2022.225

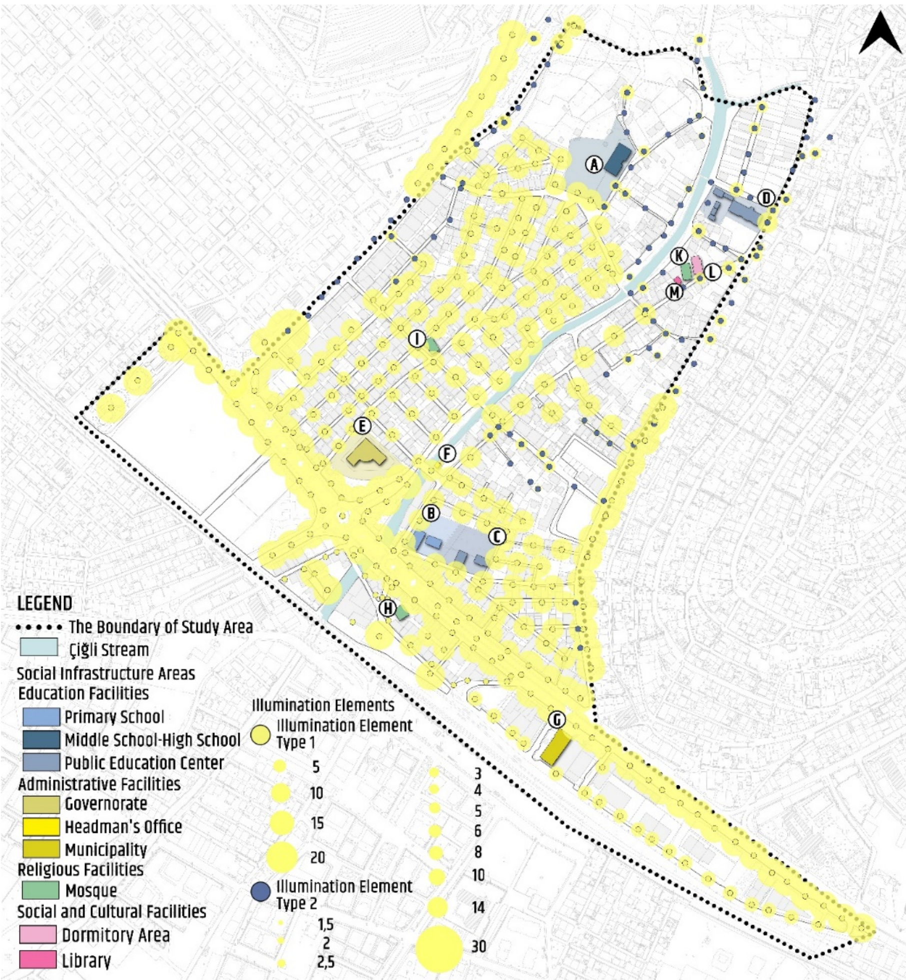


Figure 25. Existing Social Infrastructure Areas and Illumination Elements

In line with the analysis of social infrastructure areas and the assessment criteria of social infrastructure areas, the problems were identified under 3 headings: accessibility, security and usability. There are 5 problems under the title of accessibility, 6 problems under the title of security, and 4 problems under the title of usability (Figure 26).

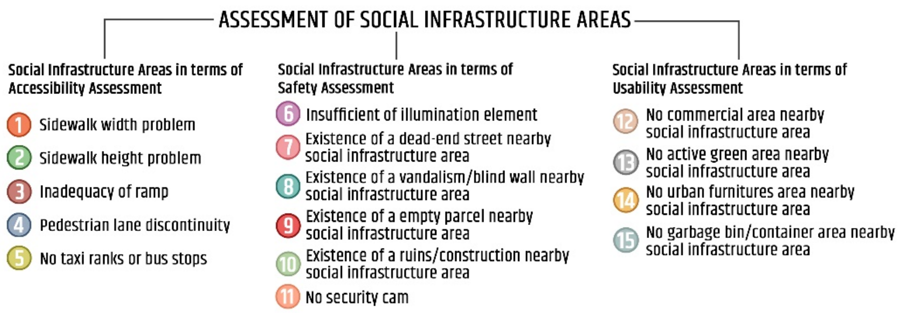


Figure 26. Classification of Problems of Social Infrastructure Areas

These identified problems were evaluated in detail for 12 social infrastructure areas in the study area and presented in a table (Figure 26). Although 15 problems were identified, as a result of the assessment, it was observed that there were at most 12 problems from the social infrastructure areas in the study area. As can be seen in the table, the problem of not having urban furniture nearby (problem 14) is seen most

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

in social infrastructure areas, while the problem of having a dead-end street nearby (problem 7) is seen at least. The problems of social infrastructure areas were determined by looking at their ratios in the category (accessibility, security and usability) and which problem title was prioritized (Figure 26). There is no emergency button in any of the social infrastructure areas. Since this problem is valid for all social infrastructure areas, it was not presented as a separate problem, but was presented as a suggestion to all social infrastructure areas (Figure 27).

SOCIAL INFRASTRUCTURE AREAS	PROBLEMS	PRIMARY PROBLEMS
A Education Facility-Middle School/High School	1 2 4 5 6 7 8 9 10 11 13 14	Safety
B Education Facility-Primary School	1 2 3 4 11 14	Accessibility
C Education Facility-Public Education Center	1 2 4 8 9 11 14 15	Accessibility
D Education Facility-Public Education Center	1 2 4 5 6 8 9 10 11 12 13 14	Safety
E Administrative Facility-Governorate	1 2 8 10 14	Accessibility
F Administrative Facility-Headman's Office	1 2 4 8 11 14	Accessibility
G Administrative Facility-Municipality	6 13 14	Usability
H Religious Facility-Mosque	6 11 14 15	Usability
I Religious Facility-Mosque	1 2 3 4 5 8 9 10 11 13 14 15	Accessibility
K Religious Facility-Mosque	1 3 4 5 6 8 11 12 13 14	Accessibility
L Social and Cultural Facility-Dormitory Area	1 4 5 6 12 13 14	Accessibility
M Social and Cultural Facility-Library	1 3 4 5 6 8 11 12 13 14	Accessibility

Figure 27. Problems of Social Infrastructure Areas in the Study Area

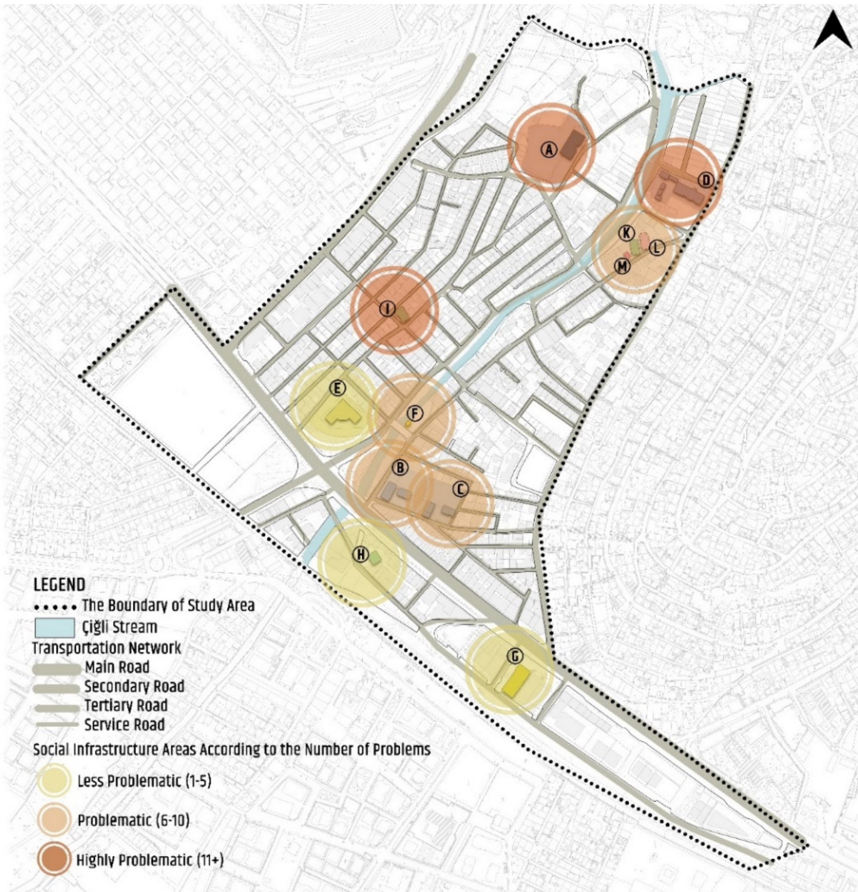


Figure 28. Social Infrastructure Areas by Number of Problems

DOI: 10.15320/ICONARP.2022.225

When the priority problems were examined, 8 (B, C, E, F, I, K, L, M) accessibility problems, 2 (A, D) security, 2 (G, H) usability problems were detected.

Assessment of Social Infrastructure Areas According to the Number of Problems: The social infrastructure areas in the study area were examined in 3 categories as very problematic (11 or more), problematic (6-10) and less problematic (1-5) in terms of 15 problems. In this context, out of 12 social infrastructure areas, 3 are very problematic (A, D, I), 6 are problematic (B, C, F, K, L, M) and 3 are less problematic (M, G, H).

The social infrastructure area in each category has been examined in detail one by one by associating it with the land use status.

Assessment of the Highly Problematic Social Infrastructure Area:

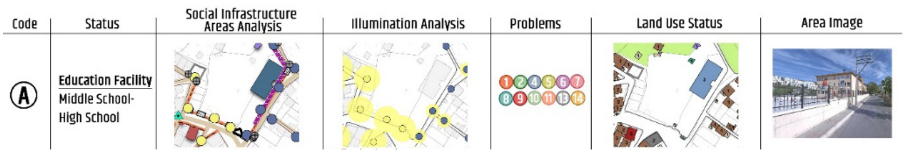


Figure 29. Assessment of "Code A" Social Infrastructure Area

When the A-coded social infrastructure area, which has the characteristics of middle school and high school, is examined, the lack of continuity of the sidewalk surrounding this area (problem 4), the fact that its width and height do not comply with the standards (problem 1 and problem 2) limit the accessibility of this education area. The absence of taxi and bus stops in the immediate vicinity (problem 5) makes it difficult to access this middle school-high school area. Since the illumination elements in the streets surrounding the middle school-high school are insufficient (problem 6) the feeling of insecurity increases. The presence of a dead end (problem 7), vandalism/blind wall (problem 8), empty parcel (problem 9) and ruins/construction (problem 10) nearby creates a feeling of insecurity. There are no security cameras (problem 11). The absence of active green space (problem 13) and urban furniture (problem 14) nearby affects the usability of this area.

There are housing areas, commercial areas (C1), orchards, ruins, annex, buffet-market-grocer, empty shops and transformers around this middle school-high school, which has many problems.

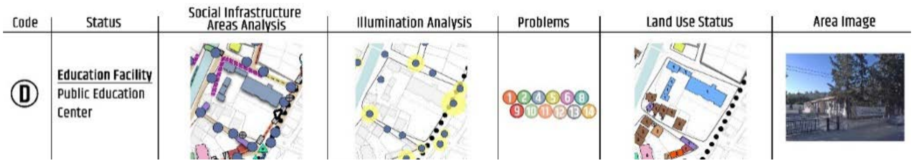


Figure 30. Assessment of "Code D" Social Infrastructure Area

When the D-coded social infrastructure area, which is a public education center, is examined, the lack of continuity of the sidewalk surrounding this area (problem 4), the fact that its width and height do not meet the standards (problem 1 and problem 2) limit the accessibility of this education area. The absence of taxi rank and bus stops in the vicinity (problem 5) makes it difficult to access this public education centre. Since the illumination elements in the streets surrounding the public education center are insufficient (problem 6) the feeling of insecurity increases. The presence of vandalism/blind wall (problem 8), empty parcel (problem 9) and ruins/construction (problem 10) nearby creates a feeling of insecurity. There are no security cameras (problem11). The absence of a commercial area (problem 12), active green space (problem 13) and urban furniture (problem 14) nearby affects the usability of this area.

There is housing area, ruins, construction and annex uses around this public education center, which has many problems.

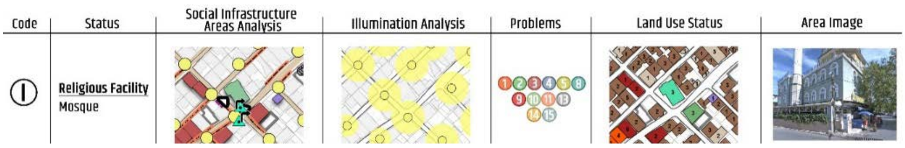


Figure 31. Assessment of "Code I" Social Infrastructure Area

When the social infrastructure area I code, which is a mosque, is examined, the lack of continuity of the sidewalk surrounding this area (problem 4), the fact that its width and height do not meet the standards (problem 1 and problem 2) limit the accessibility to this religious facility. The inadequacy of ramps at the entrance points of this religious facility (problem 3) is a deterrent, especially for individuals using disabled vehicles and strollers. The absence of taxi rank and bus stops in the immediate vicinity (problem 5) makes it difficult to access this mosque. The presence of vandalism/blind wall (problem 8), empty parcel (problem 9) and ruins/construction (problem 10) nearby creates a feeling of insecurity. There are no security cameras (problem 11). The absence of active green space (problem 13), urban furniture (problem 14) and garbage bin/container (problem 15) nearby affects the usability of this area.

There is housing area, commercial area (C1), barber, ruins and annex around this mosque, which has many problems.

Assessment of Problematic Social Infrastructure Area:

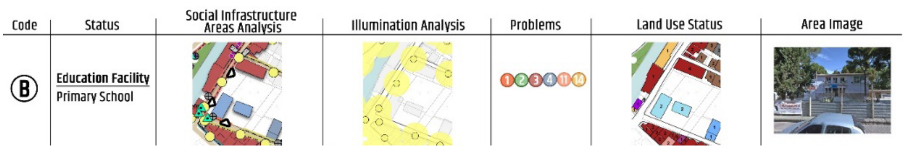


Figure 32. Assessment of "Code B" Social Infrastructure Area

When the B-coded social infrastructure area, which is a primary school, is examined, the lack of continuity of the sidewalk surrounding this area (problem 4), the fact that its width and height do not meet the standards (problem 1 and problem 2) limit the accessibility of this education area. The inadequacy of ramps at the entry points of this training facility (problem 3) is a deterrent especially for individuals using disabled vehicles and strollers. There are no security cameras (problem 11). The absence of urban furniture (problem 14) nearby affects the usability of this area.

DOI: 10.15320/ICONARP.2022.225

There are commercial area (C1), transformer, tailor, restaurant-cafe, public education center, buffet-market-grocer uses around this problematic primary school. Since this primary school is located on Köyiçi Avenue, which is connected to Anadolu Avenue and at an important intersection, it is used extensively.

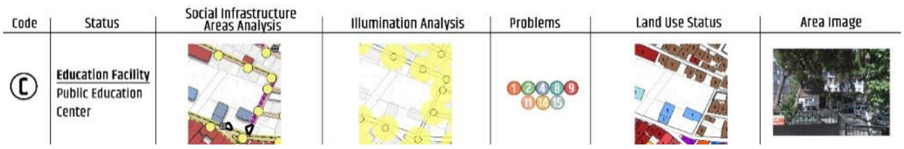


Figure 33. Assessment of "Code C" Social Infrastructure Area

When the C-coded social infrastructure area, which is a public education center, is examined, the lack of continuity of the sidewalk surrounding this area (problem 4), the fact that its width and height do not meet the standards (problem 1 and problem 2) limit the accessibility of this education area. The presence of vandalism/blind wall (problem 8) and empty lot (problem 9) nearby creates a feeling of insecurity. There are no security cameras (problem 11). The absence of street furniture (problem 14) and trash/container (problem 15) nearby affects the usability of this area.

There is housing area, primary school, commercial area (C1 and C2), passage-office building, restaurant-cafe, hairdresser and tailor uses around this problematic public education center.

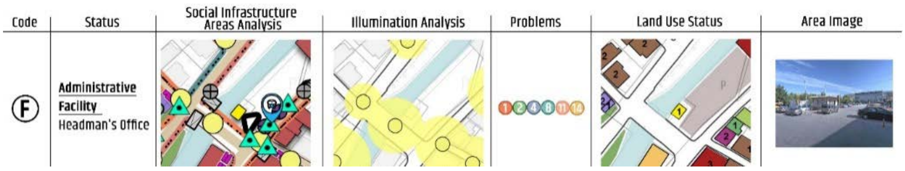


Figure 34. Assessment of "Code F" Social Infrastructure Area

When the F-coded social infrastructure area, which is a headman, is examined, the lack of continuity of the sidewalk surrounding this area (problem 4), the fact that its width and height do not comply with the standards (problem 1 and problem 2) limit the accessibility of this administrative facility. The presence of vandalism/blind wall (problem 8) nearby creates a feeling of insecurity. There are no security cameras (problem 11). The absence of urban furniture (problem 14) nearby affects the usability of this area.

There are parking lots, buffet-market-grocer, commercial area (C1), barber, tailor and plumbing shop in this problematic headman's office.

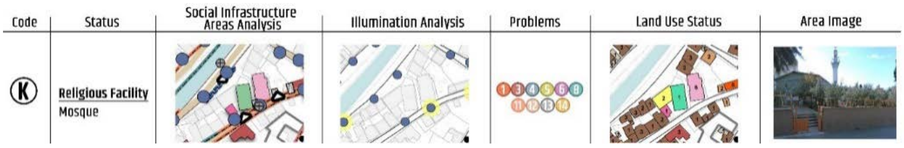


Figure 35. Assessment of "Code K" Social Infrastructure Area

When the K-coded social infrastructure area, which is a mosque, is examined, the lack of continuity of the sidewalk surrounding this area (problem 4) and its width not meeting the standards (problem 1) limit the accessibility to this religious facility. The inadequacy of ramps at the entrance points of this religious facility (problem 3) is a deterrent, especially for individuals using disabled vehicles and strollers. The absence of taxi and bus stops in the immediate vicinity (problem 5) makes it difficult to access this mosque. Since the illumination elements in the streets surrounding the mosque are insufficient (problem 6) the feeling of insecurity increases. The presence of vandalism/deaf front (problem 8) nearby creates a feeling of insecurity. There are no security cameras (problem 11). The absence of a commercial area (problem 12), active green space (problem 13) and urban furniture (problem 14) nearby affects the usability of this area.

There is housing area, dormitory area, association, library and commercial area (C2) uses around this problematic mosque.

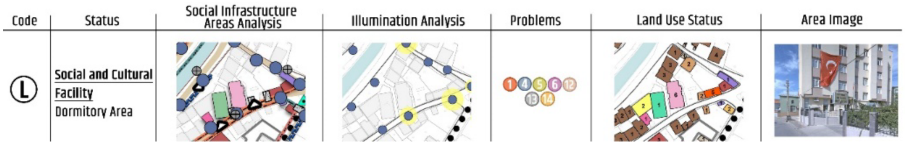


Figure 36. Assessment of "Code L" Social Infrastructure Area

When the L-coded social infrastructure area, which is a dormitory, is examined, the lack of continuity of the sidewalk surrounding this area (problem 4) and its width not meeting the standards (problem 1) limits the accessibility to this social and cultural facility. The absence of taxi rank and bus stops in the immediate vicinity (problem 5) makes it difficult to access this dormitory area. Since the illumination elements in the streets surrounding the dormitory area are insufficient (problem 6) the feeling of insecurity increases. The absence of a commercial area (problem 12), active green space (problem 13) and urban furniture (problem 14) nearby affects the usability of this area.

There are housing area, mosques, associations, library, warehouse, hairdressers and commercial area (C2) uses around this problematic dormitory area.

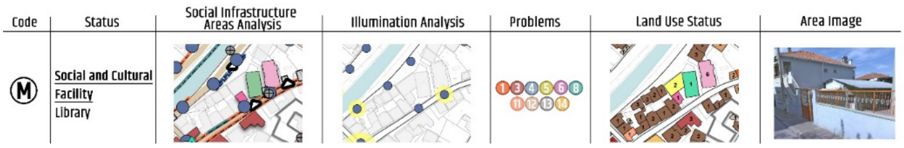


Figure 37. Assessment of "Code M" Social Infrastructure Area

When the M-coded social infrastructure area, which is a library, is examined, the lack of continuity of the sidewalk surrounding this area (problem 4) and its width not meeting the standards (problem 1) limits the accessibility to this social and cultural facility. The inadequacy of the ramps at the entrance points of this social and cultural facility (problem 3) is a deterrent especially for the access of individuals using disabled vehicles and baby carriages. The lack of taxi rank and bus stops nearby (problem 5) makes it difficult to access this library. Since the illumination elements in the streets surrounding the library are insufficient (problem 6) the feeling of insecurity increases. The presence of vandalism/blind wall (problem 8) nearby creates a feeling of insecurity. There are no security cameras (problem 11). The absence of a commercial area

DOI: 10.15320/ICONARP.2022.225

(problem 12), active green space (problem 13) and urban furniture (problem 14) nearby affects the usability of this area.

There is housing area, dormitory area, associations, mosques and commercial area (C2) uses around this problematic library.

Assessment of the Social Infrastructure Area with Less Problematic:

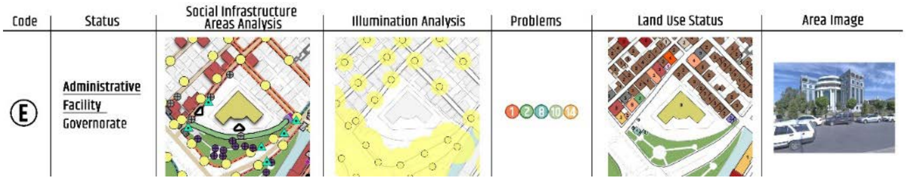


Figure 38. Assessment of "Code E" Social Infrastructure Area

When the E-coded social infrastructure area, which is the district governor's office, is examined, the fact that the width and height of the sidewalk surrounding this area do not comply with the standards (problem 1 and problem 2) limits the accessibility of this administrative facility. The presence of vandalism/blind wall (problem 8) and ruins/construction (problem 10) nearby creates a feeling of insecurity. The absence of urban furniture (problem 14) nearby affects the usability of this area.

There is housing area, commercial area (C2), ruins, parks, transformers, coffee shops, barbers, buffet-markets-grocer, repair shop and annex in this area, which has few problems. Since this governorate is located on Anadolu Avenue and at the crossroads, it is used extensively.

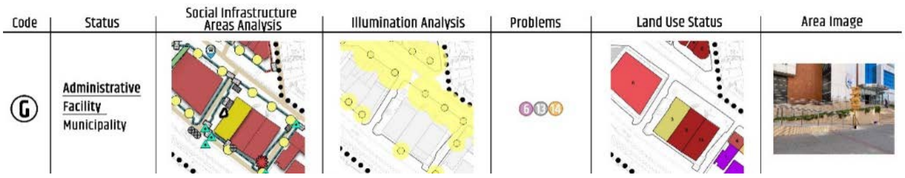


Figure 39. Assessment of "Code G" Social Infrastructure Area

When the G-coded social infrastructure area, which is a municipality, is examined, the feeling of insecurity increases as the lighting elements in the streets surrounding this area are insufficient (problem 6). The absence of active green space (problem 13) and urban furniture (problem 14) nearby affects the usability of this area.

There is commercial area (C1 and C2), restaurant-cafe, square and passage-office building uses around this municipality, which has little problems. The fact that Çiğli İzban Station is close to the municipality, that it is located on Anadolu Avenue, and that it has land uses such as commercial areas with many and various user profiles increases the importance of this administrative facility.

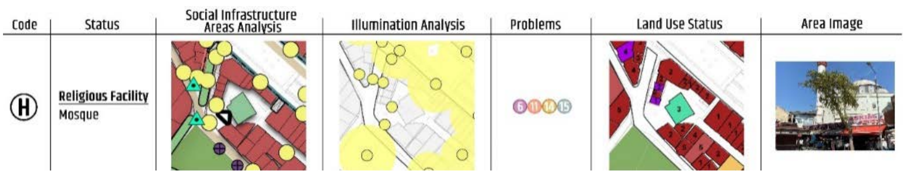


Figure 40. Assessment of "Code H" Social Infrastructure Area

When the H-coded social infrastructure area, which is a mosque, is examined, the feeling of insecurity increases as the lighting elements in the streets surrounding this area are insufficient (problem 6). There are no security cameras (problem 11). The absence of urban furniture (problem 14) and garbage bin/container (problem 15) nearby affects the usability of this area.

There is commercial area (C1 and C2), park and restaurant-cafe uses around this mosque, which has few problems. The fact that it contains many and various user profiles such as commercial areas near the mosque and Çiğli İzban Station makes this area important.

CONCLUSION AND ASSESMENT

Assessment of 12 social infrastructure areas in the study area has been discussed under 3 headings as accessibility, safety and usability (Figure 26). Priority problems of social infrastructure areas were determined according to the 3 titles determined within the scope of the assessment. At the same time, the land use status is zoned on an island basis depending on which use is intense. In this direction, the social infrastructure areas, whose priority problems were determined, were evaluated together with the land use areas (Figure 41).

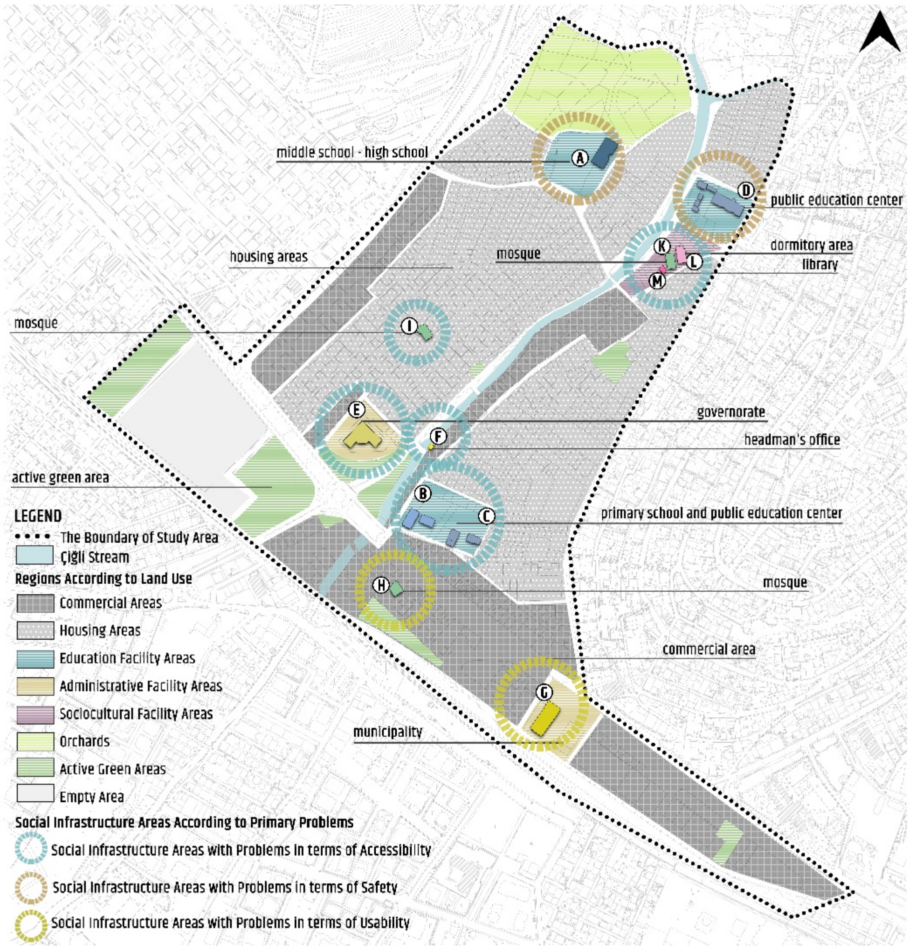


Figure 41. Priority Problems of Social Infrastructure Areas and Their Relationship with Land Use

DOI: 10.15320/ICONARP.2022.225

According to the review;

• A-code middle school-high school: It is close to the fruit and vegetable garden and the residential area, and it is an educational facility area that has problems in terms of security.

• B coded primary school: Being connected to Anadolu Avenue causes intensive use of this area. This primary school, which has educational facilities, residential and commercial areas around it, is problematic in terms of accessibility.

• C-coded public education center: It is close to the education and housing area and is a problematic education facility area in terms of accessibility.

• D-coded public education center: It is close to the socio-cultural facility and housing area, and it is an educational facility area that has problems in terms of security.

• E-coded governorate: It is an administrative facility on Anadolu Avenue, close to residential, commercial and green areas, and has problems in terms of accessibility.

• F-coded headman's office: It is an administrative facility area that is close to residential and commercial areas and has problems in terms of accessibility.

• Municipality with G code: It is heavily used by various user profiles since it is located near Çiğli İzban Station and Anadolu Avenue. This administrative facility, surrounded by a commercial area, is problematic in terms of usability.

• Mosque with code H: Çiğli İzban Station is close to commercial and active green areas and is a problematic religious facility in terms of usability.

• Mosque with code I: It is near the residential area and is a problematic religious facility in terms of accessibility.

• K-coded mosque: It is close to the socio-cultural facility and residential area, and it is a religious facility area with problems in terms of accessibility.

• L-coded dormitory area: It is close to the socio-cultural facility and housing area and is a problematic social and cultural facility area in terms of accessibility.

• L-coded library: It is close to the socio-cultural facility and housing area and is a problematic social and cultural facility area in terms of accessibility.

After the examinations and assessments, suggestions were made within the scope of the problems identified under the headings of accessibility, security and usability for 12 social infrastructure areas in the study area. 5 suggestions were made under the heading of accessibility, 5 under the heading of security, and 6 under the heading of usability (Figure 42).

Figure 42. Suggestions for Social Infrastructure Areas

Suggestions covered under 3 headings:

In terms of accessibility;

• Regulation of sidewalk widths according to standards (150 cm and above) (SW)
• Regulation of sidewalk heights (3-15 cm) according to standards (SH)
• Useful ramp (6% or less slope) recommendation at park entrance points (R)
• Ensuring the continuity of pedestrian lanes and sidewalks (PS)
• Taxi call button and/or bus stop suggestion (S)

In terms of safety;

• Illumination element recommendation (IE)
• Placing warning signs on the streets that have the character of a dead end, in order to inform the passengers who do not know this street in advance (WS)
• Maintenance/repair on blind wall such as vandalism (F)
• Maintenance/repair of ruined structures (RS)
• Security camera recommendation (SC)

In terms of usability;

• Suggestion for a commercial area to meet the needs of his/her relatives (C)
• Green area proposal (GA) in order to increase the usability near it
• Emergency button suggestion (EB)
• Info board recommendation (IB)
• Direction sign recommendation (DS)
• Garbage bin/container recommendation (GB)

Suggestions developed for each social infrastructure are given in Figure 43.

Although 16 suggestions have been determined, since the suggestions developed for each social infrastructure area are different, it is seen that there are 13 social infrastructure areas at most. As can be seen in the table, the most emergency button (EB) and info board (IB) suggestions were made to the social infrastructure areas, and the least warning sign (WS) was recommended.

A city's being friendly to women depends on women being able to use that city as much as men. Social infrastructure areas, which are one of the most important areas of urbanity, should also be women-friendly and should be used by women. This text presented a model that is open to development on how social infrastructure areas should be examined and

DOI: 10.15320/ICONARP.2022.225

how their problems should be evaluated in the creation of a woman-friendly city.

	SOCIAL INFRASTRUCTURE AREAS	PRIMARY PROBLEMS	PROPOSALS
A	Education Facility-Middle School/High School	Safety	SW SH PS S IE WS F RS SC GA EB IB DS
B	Education Facility-Primary School	Accessibility	SW SH R PS SC EB IB DS
C	Education Facility-Public Education Center	Accessibility	SW SH PS F SC EB IB DS GB
D	Education Facility-Public Education Center	Safety	SW SH PS S IE F RS SC C GA EB IB DS
E	Administrative Facility-Governorate	Accessibility	KG SH F RS EB IB DS
F	Administrative Facility-Headman's Office	Accessibility	SW SH PS F SC EB IB DS
G	Administrative Facility-Municipality	Usability	IE YA EB IB DS
H	Religious Facility-Mosque	Usability	IE SC EB IB DS GB
I	Religious Facility-Mosque	Accessibility	SW SH R PS S F RS SC GA EB IB GB
K	Religious Facility-Mosque	Accessibility	SW R PS S IE F SC C GA EB IB DS
L	Social and Cultural Facility-Dormitory Area	Accessibility	SW PS S IE C GA EB IB DS
M	Social and Cultural Facility-Library	Accessibility	SW R PS S IE F SC C GA EB IB DS

Figure 43. Suggestions for Social Infrastructure Areas in the Study Area

ACKNOWLEDGEMENTS/NOTES

The authors thank to the rectorate of Dokuz Eylül University, the dean of the faculty of architecture, the head of the Department of City and Regional Planning, the Izmir Chamber of Commerce and the Çigli Municipality. and thanks to editor and rewivers.

This paper was written from the studies of both a the social responsibility Project and a scientific project "Women Friendly City Approach in Combating Violence Against Women: The Case of Çiğli". Izmir Chamber of Commerce and Çiğli Municipality signed a protocol for this project. The project aimed to plan Çiğli district with women-friendly city criteria. The project became one of the projects that won the Raci Bademli Good Practices Award (Raci Bademli İyi Uygulamalar Ödülü kapsamında Özendirme Ödülü) one of the important awards of the urban planning profession in Turkey, in 2021. In addi-tion to the success of the award, the project provided the employment of five female city planners as per the protocol. The Project report is in the process of being published as a scientific book with the same name as the Project. The book includes the main titles of accessibility, security, green areas, social infrastructures and urban deprivation. In this paper, the title of the book's social infrastructures has been developed. All studies aim to create a guide for women friendly cities.

CONFLICT OF INTEREST

No conflict of interest was declared by the authors.

FINANCIAL DISCLOSURE

The authors declared that this study has received no financial support.

ETHICS COMMITTEE APPROVAL

Ethics committee approval was not required for this article.

LEGAL PUBLIC/PRIVATE PERMISSIONS

In this research, the necessary permissions were obtained from the relevant participants (individuals, institutions, and organizations) during the survey and in-depth interviews.

REFERENCES

Adler, S. & Brenner, J. (1992). Gender and space: Lesbians and gay men in the city. International Journal of Urban and Regional Research, 16(1), 24-34.

Akkar, Z. M. (2006). Kentsel dönüşüm üzerine Batı'daki kavramlar, tanımlar, süreçler ve Türkiye. Planlama, 2, 29-38.

Alkan, A. (2012). Şehircilik Çalışmalarının Zayıf Halkası: Cinsiyet. Nermin Abadan Unat'a Armağan - Birkaç Arpa Boyu: 21.Yy.'A Girerken Türkiye'de Feminist Çalışmalar. (Der. S. Sancar). İstanbul: Koç Üniversitesi Yayınları.

Andanwerti, Noeratri. (2005). Universal Desain, Sebuah Pendekatan Desain untuk Menjawab Keberagaman, Jakarta: Jurnal Visual. Vol. 8 No. (ISSN 1410-4903).

Appleton, J. (1975). The experience of place. London, England: John Wiley.

Arendt, Hannah, İnsanlık Durumu, (Çev. Bahadır Sina Şener), İletişim Yayınları, İstanbul 1994.

Avrupa Belediyeler ve Bölgeler Konseyi (CEMR), Yerel Yaşamda adın ve Erkek Eşitliği Şartı, 2014. Erişim Adresi: https://www.ccre.org/img/uploads/piecesjointe/filename/charte_ egalite_tr.pdf

Baxi, P. (2003). Rape and Delhi's urban environment [Article]. Retrieved from http://www.indiatogether.org/2003/nov/wom-delhienv. htm.

Baykan, D. (2015). Yerel Yönetimler İçin Kadın Dostu Kent Planlaması ve Tasarım İlkeleri Kitabı. Ankara, Uzerler Matbaacılık.

Benn, S. & Gaus, G. F. (1983). Public and Private in Social Life. London: Croom Helm.

Bernard, J. (1981). The female world. New York: Free Press.

Bialeschki, M. D., & Michener, S. (1994). Re-entering leisure: Transition from the role of motherhood. Journal of Leisure Research, 26(1), 57-74.

Booth, M.L., Owen, N., Bauman, A., Clavisi, O., & Leslie, E. (2000). Social–cognitive and perceived environment influences associated with physical activity in older Australians. Preventive Mediciene, 31(1), 15-22.

Bourdieu, P. (2014). Eril Tahakküm [Masculine Domination]. (B. Yılmaz, Trans.). İstanbul: Bağlam Kitabevi.

Bourdieu, P. (2014). Eril Tahakküm [Masculine Domination]. (B. Yılmaz, Trans.). İstanbul: Bağlam Kitabevi.

Bowman, C. G. (1993). Street harassment and the informal ghettoization of women. Harvard Law Review, 106(3), 517–580.

Buckingham, S. (2010). Examining The Right to The City from Gender Perspective. Cities for All. (Ed. A. Sugranyes, Ve C. Mathivet). Chile: Habitat International Coalition.

Burton, E. & Mitchell, L. (2006). Inclusive Urban Design: Streets for Life. Oxford: Architectural Press.

Byrne, J. & Wolch, J. (2009). Nature, race, and parks: past research and future directions for geographic research. Progress in Human Geography, 743-765.

Cantek, F. Ş., Ulutaş, Ç. Ü., & Çakmak, Ş. (2014). Evin İçindeki Sokak, Sokağın İçindeki Ev: Kamusal İle Özel 'Ara'sında Kalanlar. Funda Şenol Cantek (Der.), Kenarın Kitabı: 'Ara'da Kalmak, Çeperde Yaşamak İçinde, 121-159.

DOI: 10.15320/ICONARP.2022.225

Carmona, M. (2010). Contemporary public space: Critique and classification, Part One: Critique. Journal of Urban Design, 15(1), 123-148.

Clarke P, Ailshire JA, & Lantz P. (2009). Urban built environments and trajectories of mobility disability: findings from a national sample of community-dwelling American adults (1986–2001). Social Science and Medicine, 69(6), 964–970.

Connell, B. R., Jones, M., Mace, R., Mueller, J., Mullick, A., Ostroff, E., Sanford, J., Steinfeld, E., Story, M., & Vanderheiden, G. (1997). Principles of universal design. Raleigh: North Carolina State University, Center for Universal Design.

Çubuk, M. (1991). Kentsel Tasarım Ve Kamu Alanları. Kamu Mekanları Tasarımı Ve Kent Mobilyaları Sempozyumu, 15-16.

Day, K. (2001). `Constructing masculinity and women's fear in public space in Irvine, California'. Gender, Place and Culture, 8(2), 109-128.

Deem, R. (1986). All work and no play? Milton Keynes: Open University Press.

Demirbaş, G. (2012). Kadınların mekan algısı ve mekanı kullanma biçimleri (Master's thesis, Trakya Üniversitesi Sosyal Bilimler Enstitüsü).

Efe Güney, M., Tezcan, S., & Ağın, C. (2020). Being Able to Exist In The City In Defiance Of Planning: An Examination On A Woman-Friendly City İn İzmir–Konak. Journal of Planning, 30(2), 273-293.

Eveline, J., Bacchi, C. (2010). What Are We Mainstreaming When We Mainstream Gender?. International Feminist Journal of Politics, 7(4):496-512.

Fenster, T. (1999). Space for Gender: Cultural Roles of the Forbidden and The Permitted. Environment and Planning D: Society and Space, 17(2), 227-246.

Firestone, J., and Shelton, B. A. (1988). An estimation of the effects of women's work on available leisure time. Journal of Family Issues, 9(4), 478–495.

Fisher, B. S. & Nasar, J. L., (1992). Design for vulnerability: Cues and reactions to fear of crime. Sociology and Social Research, 76(2), 48-58.

Fobker, S., & Grotz, R. (2006). Everyday mobility of elderly people in different urban settings: The example of the city of Bonn, Germany. Urban studies, 43(1), 99-118.

Fox, R. L., and Schuhmann, R. A. (2001). Mentoring experiences of women city managers: Are women disadvantaged? The American Review of Public Administration, 31(4), 381–392.

Gardner, C. B. (1995). Passing by: Gender and Public Harassment in Public Space. Berkeley: University of California Press.

Glass T. A. & Balfour J. (2003). Neighborhoods, aging, and functional limitations. In I. K. Berkman, Neighborhoods and Health (pp. 303–334). New York: Oxford University Press.

Glendinning, A., M. Nuttall, L. Hendry, M. Kloep, and S. Wood. (2003). Rural communities and well-being: A good place to grow up? Sociological Review, 51(1), 129–156.

Gökgür, P. (2008). Kentsel mekânda kamusal alanın yeri. Bağlam Yayıncılık.

Gordon, M. T. & Riger, S. (1991). The Female Fear. Gender and Society, 625-629.

Güldal, A. D., Limnili, G., & Çelik, M. (2019). Birinci basamak sağlık hizmetlerinin değerlendirilmesi. The Journal of Turkish Family Physician, 10(4), 163-172.

Gülen, M. (2006). Stratejik planlama yaklaşımı çerçevesinde kentsel projeler-kamusal alan ilişkisi: Büyükdere aksı Levent plazalar alanı örneği (Master's thesis, [yy]).

Habermas, J. (1991). The structural transformation of the public sphere: An inquiry into a category of bourgeois society. MIT press.

Hahn, H. (1986). Disability and the Urban Environment: A Perspective on Los Angeles. Environment and Planning D: Society and Space, 273-288.

Hale, S. (1996). The New Muslim Woman:'Sudan's national Islamic front and... The Muslim World, 86(2), 176-199.

Hénaff, M., & Strong, T. B. (Eds.). (2001). Public space and democracy. U of Minnesota Press.

Henderson, K.A., Hodges, S., & Kivel, B. D. (2002). Context and dialogue in research on women and leisure. Journal of Leisure Research, 34(3), 253-271.

Hutchinson, R. (1994). Women and the elderly in Chicago's public parks. Leisure Sciences, 229-247.

Hutchison, R. (2009). Constructions of urban space. Bingley: Emerald Group Publishers.

Jackson, P. (1987). Race and Racism: Essays in Social Geography. London: Allen and Unwin.

Jacobs, J. (1961). The Death and Life of Great American Cities. New York: Vintage Books.

Kaczynski, A. T., & Henderson, K. A. (2008). Parks and recreation settings and active living: A review of associations with physical activity function and intensity. Journal of Physical Activity and Health, 5(4), 619-632.

Kadıoğlu, B., and Toy, S. (2021). Kentsel Mekânlarda Kadın Davranışlarının Güvenlik Kapsamında Değerlendirilmesi: Erzurum Kenti Muratpaşa Mahallesi Örneği. Kent Akademisi, 14(3), 789-810.

Kaypak, Ş (2016). İnsanlar İçin Kente Bakış; Dost Kentler. 2. Uluslararası Çin'den Adriyatik'e Sosyal Bilimler Kongresi (5-7 Mayıs 2016) Kongre Kitabı. Uluslararası İlişkiler - Kamu Yönetimi– Hukuk Özel Sayısı. Ed. Ragıp Pehlivanlı, Selçuk Demirkılınç. s.134-146. İKSAD Yayını, Adıyaman.

Kaypak, Ş. (2014). Toplumsal Cinsiyet Bakış Açısından Kente Bakmak, Niğde Üniversitesi İibf Dergisi, 7(1), 344-357.

Keleş, R. (1990). Kentleşme politikası (Vol. 13). İmge Kitabevi.

Kelly, J. R. & Ross, J. (1989). Later-life leisure: Beginning a new agenda. Leisure Sciences, 47–57.

Kennedyl, W. & Silverman, R. A. (1985). Significant others and fear of crime among the elderly. International Journal of Aging and Human Development, 20(4), 241-256

Kohn, M. (2004). Brave New Neighborhoods: The Privatization of Public Space. New York: Routledge.

Krenichyn, K. (2003). Women and physical activity in an urban park: Enrichment and support through an ethic of care. Journal of Environmental Psychology, 24(1), 117-130.

KSGM (2008). T.C. Başbakanlık Kadın Statüsü Genel Müdürlüğü, Toplumsal cinsiyet eşitliği ulusal eylem planı 2008-2013, Ankara: Fersa Baskı..

Larson, R., & Verma, S. (1999). How children and adolescents spend time across cultural settings of the world: Work, play and develop mental opportunities. Psychological Bulletin, 125(6), 701-736.

Letherby, G. (2003). Feminist Research in Theory and in Practice. Buckingham: Open University Press.

Low, S., Taplin, D. & Scheld, S. (2005). Rethinking Urban Parks: Public Space and Cultural Diversity. Austin: University of Texas Press

Mace, R. (1997). The Principles of Universal Design formulated by The Centre of Universal Design, North Carolina State University.

Mackinnon, Catharina A. Feminismus, Marxismus, Methode und der Staat: Ein Theorieprogramm, in: Elisabeth List / Herlinde Studer (Hg.) , Denkverhältnisse: Feminismus und Kritik, Frankfurt 1989, s. 86-132.

DOI: 10.15320/ICONARP.2022.225

Markson, E., & Hess, B. (1980). Older women in the city. In C. R. al., Women and the American city (pp. 124-140). Chicago: University of Chicago Press.

McDowell, L. (1999). Gender, Identity and Place: Understanding Feminist Geographies. Minneapolis: Minnesota Press.

Mekansal Planlar Yapım Yönetmeliği (Spatial Plans Design Regulation), 14.06.2014 tarih ve 29030 sayılı Resmi Gazete.

Moser, C. (2012). Mainstreaming Women's Safety in Cities into Gender-Based Policy and Programmes. Gender & Development, 20(3), 435–452. doi: 10.1080/13552074.2012.731742.

Newman, O. (1996). Creating Defensible Space. Washington: Rutgers University.

Özdemir, A. (2009). KATILIMCI KENTLİ KİMLİĞİNİN OLUŞUMUNDA KAMUSAL YEŞİL ALANLARIN ROLÜ: ANKARA KENT PARKLARI ÖRNEĞİ. Turkish Journal of Forestry, 10(1), 144-153.

Painter, K. (1996). The influence of street lighting improvements on crime, fear and pedestrian street use, after dark. Landscape and urban planning, 35(2-3), 193-201.

Park, Y., & Garcia, M. (2020). Pedestrian safety perception and urban street settings. International journal of sustainable transportation, 14(11), 860-871.

Patterson, P. K. & Chapman, N. J. (2004). Urban form and older residents' service use, walking, driving, quality of life, and neighborhood satisfaction. Americam Journal of Health Promotion, 19(1), 45-82.

Schmidt, S. & Nemeth, J. (2012). Space, place and the city: Emerging research on public space design and planning. Journal of Urban Design, 15 (4), 453-457.

Sewell, J. E. (2011). Women and the everyday city: Public space in San Francisco, 1890-1915. U of Minnesota Press.

Silver, C. (2000). Being there: The time dual-earner couples spend with their children. Canadian Social Trends, 57, 26-29.

Sister, C., Wolch, J. & Wilson, J. (2010). Got green? addressing environmental justice in park. GeoJournal, 75, 229-248.

Spain, D. (2014). Gender and urban space. Annual Review of Sociology, 40, 581–598.

Steinfeld, E. (2001). Universal design in mass transportation. Universal Design Handbook. New York: McGraw Hill.

Story, M. F. (2001). Principles of universal design. Universal design handbook.

Tekinbaş, E. (2015). Kadın Dostu Kent Uygulama Rehberi. 20 Mart 2019, http://kader.org.tr/wp-content/uploads/2018/11/kdk-uygulama-rehberi.pdf.

Thomas, S. (1991). The impact of women on state legislative policies. The Journal of Politics, 53(4), 958-976.

Tinsley, H., Tinsley, D. and Croskeys, C. (2002). Park usage, social milieu, and psychological benefits of park use reported by older urban park users from four ethnic roups. Leisure Sciences, 24(2), 199-218.

UN Habitat. (2005). World Charter for The Right To The City. Erişim Adresi: Http://Www.Urbanreinventors.Net/3/Wsf.Pdf

United Nations. (2012). Gender Issue Guide- Urban Planning and Design. Nairobi: Un Habitat.

United Nations-Habitat. (2013). State of Women in Cities 2012-2013: Gender and The Prosperity of Cities. Nairobi, Kenya: UN.

Valdemarsson, M., Jernryd, E., & Iwarsson, S. (2005). Preferences and frequencies of visits to public facilities in old age—a pilot study in a Swedish town center. Archives of gerontology and geriatrics, 40(1), 15-28.

Valentine, G. (1990). Women's fear and the design of public space. Built Environment, 16(4), 288–303.
Varna, G., & Tiesdell, S. (2010). Assessing the publicness of public space: The star model of publicness. Journal of Urban Design, 15(4), 575-598.
Wearing, B., and Wearing, S. (1988). "All in a day's leisure": Gender and the concept of leisure. Leisure Studies, 7(2), 111–123
Woodward, D., Green, E., & Hebron, S. (1988). The Sheffield study of gender and leisure: Its methodological approach. Leisure Studies, 7(1), 95-101.
Young, I. M. (1990). Justice and the Politics of Difference. Princeton University Press.
Young, I. M. (2000). Inclusion and Democracy. Oxford: Oxford University Press.

Resume

Mercan EFE GÜNEY is a faculty member at Dokuz Eylul University, Faculty of Architecture, Department of City and Regional Planning. She completed her PhD in Ecological Planning. She is working on "women" and "other" subjects. In addition to her undergraduate program at the university, she gives lectures on ecological planning and others at the Graduate School of Natural and Applied Sciences and Social Sciences. She is the coordinator of a project related to a Women Friendly City.

Beste Tuncay is an urban planner who completed her undergraduate education at Dokuz Eylül University Faculty of Architecture. At the same time, she is studying geographic information systems at Anadolu University. She is interested in transportation plannig, strategy planning and geographic information systems issues. And now, she is a member of a team that works on women-friendly cities.

Sıdal Tanrıverdi is an urban planner who completed her undergraduate education at Dokuz Eylül University Faculty of Architecture. She is interested in disaster risk management and protection planning issues and is also improving herself in the field of visual design. And now, she is a member of a team that works on women-friendly cities.

Nurseli Şanlı is an urban planner who completed her undergraduate education at Dokuz Eylül University. She is now doing her Master's in Urban and Regional Planning at Dokuz Eylul University. She participated in Erasmus + Learning Mobility during her master education. She is interested in sustainable spatial planning with her graduate education. She is an expert in sustainability, so she is involved in different projects for the Sustainable Development Goals.

Hacer Akbudak completed her undergraduate education at Dokuz Eylül University and her graduate education at İzmir Institute of Technology, Department of City and Regional Planning. She is interested in agricultural land conservation policies, rural planning and plan implementation tools with her graduate education. She is currently a member of a team working on women-friendly cities and is doing her internship in Rome, Italy with Erasmus + Internship Mobility..

Filiz Ay completed her undergraduate education at Dokuz Eylül University as an urban planner. And now, she is doing her master's degree in City Planning Program at Izmir Institute of Technology. She is interested in geographic information systems (GIS), urban morphology and climate change with her master education. She is currently a member of a team that works on women-friendly cities.

DOI: 10.15320/ICONARP.2022.225

Research Article

ICONARP
International Journal of Architecture and Planning
Received: 04.03.2022 Accepted: 20.08.2022
Volume 10, Issue 2/ Published: 20.12.2022
DOI: 10.15320/ICONARP.2022.226 E- ISSN:2147-9380

ICONARP

Sustainable Schoolyards as Learning Landscapes

Beste Sabır Onat*

Funda Yirmibeşoğlu**

Abstract

Learning for sustainability encourages informal learning, embeds daily usages and observations into the learning process, and has the potential to cultivate ecological-based habits for a sustainable future. We cannot separate the learning process and everyday life from each other. Therefore, the present research focuses on sustainable learning programs and designs in schoolyards within the framework of "learning landscapes," which is an emerging topic that requires interdisciplinary approaches. This article aims to combine curriculum design, spatial design, informal learning, and ecological design themes and explain the practice-based processes in "Design Your Schoolyard" workshops. This participatory and hands-on project involves multiple stakeholders and unfolds this multilayered structure within its process. Nature-child connections are insufficient in most cities, and the cultivation of sustainable practices only happens with nature and the practicing of sustainable behaviors in daily life. Therefore, school gardens are emerging with a new approach that interprets these areas as learning landscapes, not just as spatial designs but as an approach that creates connections with the curriculum and ecology to help children learn about sustainability and builds bonds between nature and children in daily life.
This study aims to launch a new discussion about schoolyard designs that support children in learning about sustainability and to highlight the principles of these learning landscapes. Secondly, the research offers various suggestions about handling these sites, the importance of the design of multi-stakeholder processes, and the inclusion of various disciplines into the process from a participatory and experiential project experience.

Keywords:
Green schoolyards, informal learning environments, learning landscapes.

*Faculty of Architecture, Department of Urban and Regional Planning, İstanbul Technical University, İstanbul, Turkey. (*Corresponding author*)
Email: sabirb@itu.edu.tr

** Faculty of Architecture, Department of Urban and Regional Planning, İstanbul Technical University, İstanbul, Turkey.
Email: funday@itu.edu.tr

To cite this article: Sabır Onat, B., & Yirmibeşoğlu, F. (2022). Sustainable Schoolyards as Learning Landscapes. *ICONARP International Journal of Architecture and Planning,* 10 (2), 844-867. DOI: 10.15320/ICONARP.2022.226

INTRODUCTION

The question of what kind of city we want cannot be divorced from the question of what kind of people we want to be, what kinds of social relations we seek, what relations to nature we cherish, what style of life we desire, or what aesthetic values we hold. (Harvey, 2012)

Spatial constructs have the potential to transform the habits of inhabitants' social consciousness and strengthen their connections with the environment. For sustainable and livable cities, ecological awareness is of significant importance starting from the individual scale. In parallel with this, the main aim of the present study is the transformation and cultivation of the habits of individuals who are moving away from nature and sustainable practices, particular in urban areas, by strengthening their connections with the environment and raising their ecological awareness.

The industrial revolution and the urbanization that accompanied it, and the related ways of life and thought, are all crucial in terms of disrupting nature-human relationships. Anthropocentric living practices dominate nature and the environment in today's cities. This view also reflects eco-dominant urbanization processes. There is an urgent need for a paradigm change in design processes to establish a connection with nature. The connection created during childhood by everyday life experiences and encounters with nature is of critical value, as are the bonds established with nature in childhood.

Based on the human-nature-space relationship, in line with the view that the transformation of human ecological consciousness and its relationship with the environment will bring about positive behavioral changes on many scales with systemic acceleration, this study was undertaken to pursue informal learning processes and methods in schoolyards as learning landscapes regarding sustainability.

Issues such as energy, climate change, scarcity, and environmental problems have become increasingly important and new solutions need to be found. The systems approach can have significant potential in creating solutions to these problems, which are not singular or stand-alone problems. Rather, they are all interrelated and should be addressed with a relational, holistic, systemic approach rather than singular solutions. In parallel with this view, children need to be introduced to sustainable practices and learn about the systemic relations through which we are connected on various scales to nature and our environments. Latour (1991) uses the term *bricolage* to emphasize the holistic and systemic link between the human and non-human (such as nature or technology) in the system and the necessity of considering it all together. De Certeau (1984) reinterprets the concept of bricolage, which was first used by the French anthropologist Claude Lévi-Strauss, and refers to it to describe how people perform everyday mundane activities such as speaking, reading, and cooking. In this way, people can make countless tiny transformations and adapt themselves

DOI: 10.15320/ICONARP.2022.226

to the dominant cultural economy (p. 18). In other words, *creative tactics* are defined as bricolage.

Therefore, everyday life is crucial in terms of transforming the habits and behaviors of people. Throughout this study, schoolyards are interpreted as learning landscapes where the everyday lives of children and many different interactions happen. This study aims to cultivate sustainable practices in students' daily lives. With such learning landscapes, students can be exposed to sustainable practices and learn how to use knowledge such as composting, recycling, or planting by experiencing these things in their gardens and seeing how they can apply the knowledge they gain in their daily lives as habits.

Design practices must integrate these concepts and ideas into the spatial design of such areas in cooperation with other disciplines. Therefore, this study focuses on education for sustainability in schoolyards as learning landscapes and interprets learning landscapes as pedagogical sites. New lenses are applied to blend pedagogy, outdoor learning, learning for sustainability, and curriculum designs in schoolyards.

Learning landscape is a concept that is becoming important. This concept is related to informal and Place-Based learning styles, where the learning is experienced with the help of the place, spatial design, and hidden curriculum that is embedded in the site. In these spaces, outdoor learning happens by experiencing the qualities of the place. Nowadays, edible gardens, green schools, and sustainable schoolyards have become crucial, and learning about sustainability started to be placed in schoolyards. Examples are shared in this paper. This study handles and interprets learning landscapes with schoolyard design, informal and Place-Based learning approaches, curriculum, and sustainability. First, therefore, it has an important on combining various disciplines. Secondly, studies in literature usually consider these spaces theoretically. But this research traces the literature and unfolds a practical-based process. Thus, it has importance in its theoretical and practical-based context and approach.

METHODOLOGY

This study highlights the importance of learning landscapes and the approach to developing and designing these sites with interdisciplinary approaches. Furthermore, it unfolds a participatory and practice-based workshop process that highlights learning about sustainability in schoolyards as learning landscapes.

Learning landscapes should be considered as bricolage with all parts of the system, such as nature, ecosystems, buildings, the internet, and technology as non-human factors. Throughout this study, informal learning, learning about sustainability, and learning about landscape design are examined and discussed relationally.

While learning landscapes are examined, as the first limitation, the research area is limited to school gardens. Another limitation was

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

determined for learning about sustainability, with the study focusing on how learning about sustainability occurs in schoolyards.

During a practice-based pilot project that spanned approximately six months, online meetings were held with sixth- and seventh-grade students from Antalya Muratpaşa Dumlupınar Middle School. The researcher developed a curriculum blending sustainable design and environmental design and supported the students in creating projects after each session. All weekly meetings were supported by design projects and the students learned about recycling, composting, permaculture design, and various sustainability issues by creating projects and designs related to those topics. This curriculum was developed for the ages and developmental stages of the students and the online workshops were held during lockdowns for the COVID-19 pandemic. Table 3 in the following section explains the content and process of the pilot project. The online workshops prepared students to think about and discuss sustainable ideas and environmental problems, to define the main problems of their schoolyard, and to create sustainable solutions for school gardens.

The students designed their school garden in parallel with the workshops on sustainability and implemented the ideas that they produced in a participatory and experiential process with the support of the Istanbul Technical University Housing UYGAR Research Center and students from Antalya Bilim University's Department of Architecture.

Human change is not a sudden process, but by experimenting, interacting, learning, and sharing in different creative ways human behaviors may change and be cultivated. Learning landscapes and learning about sustainability require interdisciplinary and inter-relational system connections and perspectives. Therefore, curriculum design, informal learning, space, and ecology should be interpreted holistically and interactively. An urgent transformation is needed in schoolyards to interpret these learning spaces as a blend of curriculum, space, and ecological design laboratories. With that approach, this study undertakes a review of the literature by first considering informal learning and its relationship with place and curriculum, then reviewing works on learning about sustainability, and finally discussing learning landscapes and connecting all of this with the pilot study.

INFORMAL LEARNING: THE LINK BETWEEN SPATIAL DESIGN AND CURRICULUM

Informal learning is the experience and knowledge that can be gained at home, from friends, while traveling, and from newspapers and books or media platforms, which spreads throughout life and consists of knowledge, abilities, and perspectives gained in daily life. This type of knowledge is generally not organized or systematically disseminated; it is knowledge that a person gains in life (Coombs and Ahmed, 1974:8).

Learning processes take place in out-of-school environments informally together with the formal processes that take place in school. Formal learning is a planned and systematic process that occurs within a specific institutional

DOI: 10.15320/ICONARP.2022.226

educational structure. Informal learning, on the other hand, involves random and spontaneous processes that permeate life.

Cities are becoming increasingly urbanized; therefore, the built environment is losing its green areas. Experiences of encountering, connecting with, and exploring nature in cities are disappearing. In this sense, school gardens as laboratories can become bases for learning in daily life and can facilitate experiential learning about sustainability. The potential of such places for teaching through experience is excellent. Therefore, schoolyards should be treated as three-dimensional and experiential maps or books and hidden curricula should be embedded in them by design practices.

The spatial design dimension of pedagogically based program studies is lacking. The present study discusses pedagogy, design, and ecology inter-relationally within the framework of "learning landscapes" with an interdisciplinary and holistic approach following the systems approach.

"An effective environmental education requires students to leave the classrooms" (Sobel, 2014:11). As cities become denser and more urbanized, children's mobility and access to informal play may decrease because of increased traffic, dangerous intersections, and parental fears (Freeman and Tranter, 2011). "Studies show that when urban children on different continents are told about the Amazon jungle or similar global ecological issues, children become desensitized" (Sobel, 2014:15). Children who cannot connect with environmental problems and phenomena may grow up as individuals who reject and ignore such problems. At this point, place-based education, the explaining of these phenomena and problems with examples from the immediate environment, and the development of practices that allow children to establish bonds by experimenting are all essential. Children can experience and learn about sustainability in learning landscapes in their daily lives in schoolyards and can learn to adopt sustainable practices and apply that knowledge in their lives. Harvesting rainwater from the roof against the danger of drought, learning about carbon footprints by recycling, and practicing planting in schools provide opportunities for children to connect with nature and environmental phenomena. The importance of learning in life by experimenting, observing, and discovering is an issue that needs to be underlined, and learning spaces should be designed considering these processes.

"As the subject of learning ecosystems is researched, we notice that place-based education stands right in the middle of formal, informal, and non-formal education as the philosophical binder of all possible learning experiences… Place-based education can take many forms, from informal to formal learning, from individual/family out-of-school experiences to teacher-led or school-sponsored activities, and from a course/project/unit/coursework to a fully designed school. Place-based education is a learning strategy that educators can apply in urban, rural, and suburban areas, and the possibilities are truly endless" (Ark and Schneider, 2016:7). In place-based and practice-based learning processes, the place and the relationship that the place will have with the curriculum are vital. This study and the related workshops were undertaken with the aim of creating bonds among place, spatial design, sustainability, and curriculum. When the principles of place-based learning are summarized, many stand out, such as communication, observation, research, relations with the environment, learner orientation, interdisciplinary approaches, and flexible environments with play, experience, and exploration (Getting Smart).

In Figure 1, a learning pyramid highlights the importance of environment, interaction, and experience. Learning and how it happens should be interpreted by engaging in this process with informal learning practices. The learning pyramid below shows the ways of learning.

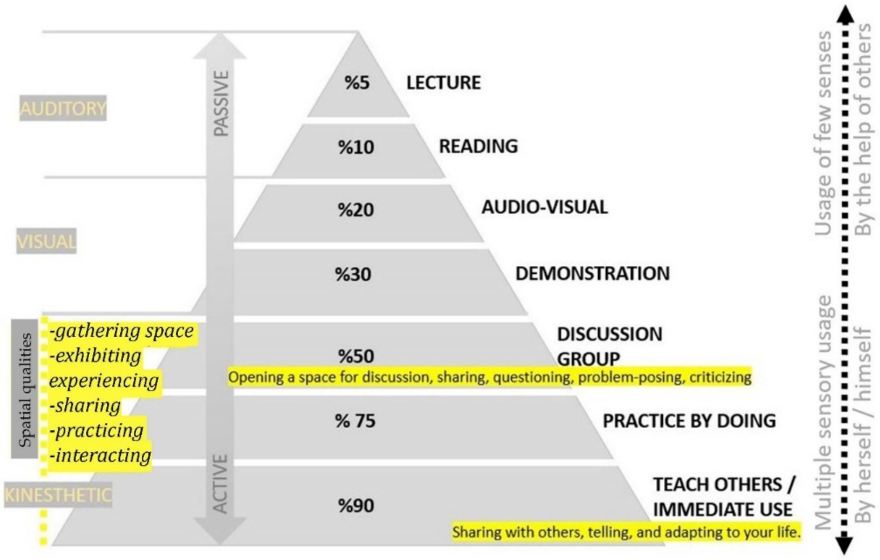


Figure 1. Learning pyramid by Edgar Dale (1969). Source: Edited and developed by the author.

The learning process has a strong relationship with participation levels. Figure 1 explains that spatial gatherings, dialogue, practice-based projects, communication, adapting knowledge to life, and sharing/explaining knowledge with others significantly affect the learning process. In this sense, processes of learning about environmental education and sustainability gain importance in terms of re-establishing the child-nature relationship with participatory and practice-based learning processes.

In parallel with its definition by many other authors and researchers, environmental education includes processes such as fostering active participation in environmental issues, environmental protection, sustainable development, bonding with nature, taking environmental responsibility, and raising environmental awareness by establishing cause-and-effect relationships. It is the whole of various processes that aim to strengthen human-environment and child-nature relations and to ensure participation in design solutions for learning spaces (Ağyar, 2014; Nagel, 2005; Demirkaya, 2006). While children participate in design ideas for learning spaces, they interact with the place and each other, which may lead them to active learning processes, as well. The student's level of participation is at the highest level while establishing relationships with the place and nature and during learning processes. Hart (1997:41) describes children's degree of participation according to various levels. At the lower levels, we notice that there is no participation and children are not included in the decisions or planning processes. At the upper levels, participation increases. Children are informed and consulted, and they have space to express their ideas, necessities, and priorities. They also take responsibility in decision processes.

Play is another crucial act that supports creative and informal learning. Louv (2010) states that in Europe after the Second World War, a playground designer examined children playing on asphalt and concrete playgrounds and discovered that children preferred to play with soil and timber from war debris. Children have instincts of playing and learning naturally; they play and learn in daily life, discover, observe, make, break, and re-make, and through

DOI: 10.15320/ICONARP.2022.226

these playful and observatory processes, they bond with natural materials or with natural landscapes. In short, they play and learn.

Hewitt (2016) states that children do not only need classrooms to learn. They can also learn in the field in their daily lives; for example, while planting seeds they can learn geometry and mathematics. This concept is becoming more and more widespread in Europe and the United States; children can play in the mud, build castles, play on swings made of car tires, light campfires, or cook outdoors, learning about astronomy, gardening, and nature in the process. Louv (2010) states that such programs and spaces allow children to experience natural elements directly.

"Learning…is the process of creating knowledge by transforming experience" (Kolb, 1984:38). Experiential learning, as put forward by Kolb, is parallel to informal learning in this sense and it establishes a strong connection with place-based learning methods. Jacobs (1999:51) defines *experiential learning* as a process in which the learner produces knowledge, skills, and values from direct experience. Learning by doing is also included in this process. In the process of approaching schoolyards as learning landscapes and designing them for learning about sustainability, informal learning methods have an essential place and establish links between the place and curricula.

As Sobel (2014) underlines, children should learn by playing games and teaching each other through informal processes. The practice-based part of this study used these informal learning methods and applied them to the structure of the workshops. Participation, playful learning, experiencing, and interactions were the focus during the design and development of the workshop studies.

LEARNING ABOUT SUSTAINABILITY AND CHILDREN-NATURE CONNECTION

Children need nature for the healthy development of their senses, as well as for learning and developing their creativity (Louv, 2010:67). However, when children grow up in cities, gradually disconnecting from nature, they forget their knowledge of nature as they become adults. Providing space for children to communicate with their environments naturally and experientially through bonding should be one of the primary goals of urban design.

"Education for sustainability develops the knowledge, skills, values, and world-views necessary for people to act, in ways that contribute to more sustainable patterns of living. Sustainability education is futures-oriented, focusing on protecting environments and creating a more ecologically and socially just world through informed action. Actions that support more sustainable patterns of living require consideration of environmental, social, cultural, and economic systems and their interdependence" (Australian Curriculum).

"For the new generation, nature is more of an abstraction than a reality. Day by day, nature becomes something to be watched, consumed, dressed, and even ignored" (Louv, 2010:3). We have recently become acquainted with the concept of ecophobia. "City residents with small children in their immediate vicinity will notice immediately that these children do not have any connection with nature if they look carefully. This rupture loses its rationality from time to time…like children who are afraid of black flies or children who refuse to pluck fruit from their branches and refuse to eat them" (Sobel, 2014:14). Ecology should not be a phobia for the child; it should be perceived as a source of enjoyment and even a playground.

Environmental-based education, which is known by various names, is an idea that is at least a century old (Louv, 2010:243). As mentioned, environmental education covers many different practices and methods. Activities such as observation in ecological areas, trips to botanical gardens, garbage collection activities with active participation, bird watching in parallel with nature education, and underwater ecosystem observations in wetlands are included in environmental education. Figure 2 explains the spaces where learning can happen outside the classrooms. Also figure explains the spatial necessities and criteria of those spaces.

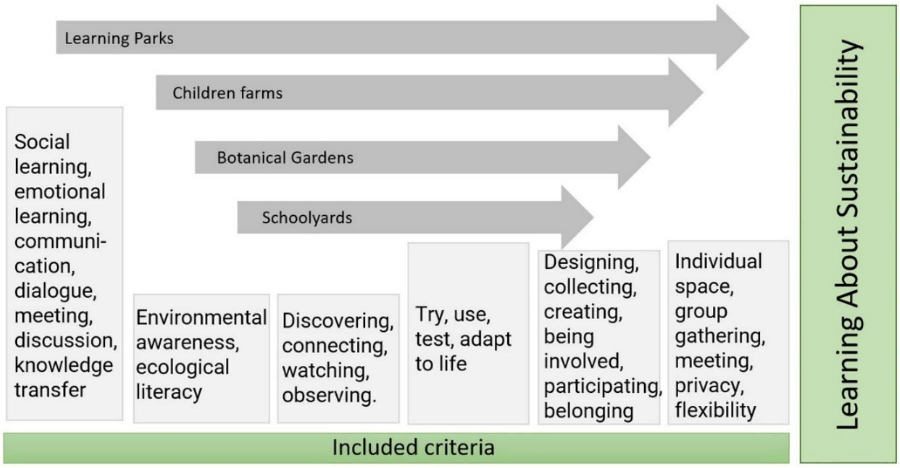


Figure 2. Informal learning about Sustainability in various spaces and their spatial necessities. Source: Developed by the author.

Learning about sustainability can happen outside the classrooms with an informal learning process. Figure 2 unfolds how learning can happen in these informal learning spaces.

In the Educating for a Sustainable Future program, UNESCO underlines the vital link between environmental education and sustainable development and explains how to develop skills, attitudes, values, and understanding by avoiding a focus on passive information within the framework of "Education for Sustainable Development." There are strong links between sustainable development and environmental education. In general, it can be said that education programs in Turkey do not include sufficient subjects or facilitate appropriate student acquisition of "education for sustainability." Therefore, considering the current and future trends, it is necessary to change or organize programs in line with these principles so that future teachers and students can receive environmental education considering these transformations. Another issue is providing the appropriate time, place, and activities to achieve these objectives because environmental-based experiences are not passive gains that can be realized without practice-based applications, and their results cannot be observed quickly. Schools should apply holistic environmental education and organize themselves according to environmental education. Environmentally based studies should be increased in terms of quality and quantity with different environmental organizations or voluntary organizations" (Tanriverdi, 2009:102)

In this sense, it is essential to consider school gardens holistically. Therefore, environmental education programs need to be planned together with school administrators, students, and teachers with the spatial dimension, developing interdisciplinary approaches for this multi-stakeholder process and disseminating ideas at the intersection of education, sustainability, and spatial design. Throughout the practice-based process of this research, multiple

DOI: 10.15320/ICONARP.2022.226

stakeholders were included in participatory processes. The stakeholder and pilot project process relations will be explained in the following section.

LEARNING LANDSCAPES

The environment is a "silent curriculum" that can provide positive or negative learning experiences. Solutions for the interpretation and design of learning landscapes lie in seeing the physical environment and the quality of the environment as active and indispensable parts of the learning process (Taylor, 2008:25).

After the participatory workshop pilot studies, the main problems could be highlighted as a lack of understanding about learning landscapes. Spatial design and curriculum design are not separate topics. Learning processes, educational theories, and participatory processes should be included in the design process of learning landscapes. This is not only a design issue; design disciplines should also be interacting with educational studies, as well.

Learning landscapes are defined by Taylor (2008) as thoughtfully designed, attractive learning spaces that offer open spaces for mathematics, science, history, art, literature, and ecology. Griffith (2021:24) underlines the importance of space that allows for experience and discovery in the learning process. According to Griffith, children want to spend most of their time in places where learning and discovery are possible and welcome. In this sense, in the design and organization of learning spaces, it is necessary to consider the instinctive needs of children to explore and experience during their learning processes.

Fielding (2006) examines the best examples of learning environments and lists six crucial characteristics of the fields that provide education. These characteristics are:

- Supporting teaching and learning.
- Maximizing physical comfort and well-being.
- Demonstrating environmental responsibility.
- Serving the community.
- Establishing design principles that make buildings work better, last longer, cost less to renovate and maintain, and inspire and adapt to changing needs.
- Applying open, transparent, and collaborative processes that allows the school and community assume ownership of planning and design.

In the pilot study, while designing and developing ideas for the schoolyard, these characteristics were blended and highlighted. To support learning in an outdoor space, an open classroom was designed in the garden. A transparent and participatory process was shared in the school environment. To demonstrate environmental responsibility, students were taught about sustainability, and they discussed and developed sustainable solutions for their gardens. These steps will be explained in the following section.

Lackney (2000), on the other hand, offers 33 principles related to learning areas in much more detail. Some of these principles that were used or provided inspiration during the pilot project of the present study are listed and explained in Table 1.

Table 1. Chosen and applied principles from Lackney's (2000) explanation of learning areas. Source: Developed by the author.

Principle used or inspirational during pilot studies	**Explanation**
Consider Home as a Template for School	During the sustainability workshops families were included and some projects were done with families. What students learned and practiced at school was shared at home and new behaviors were practiced at home.
Maximize Collaboration in School Planning and Design	The garden was developed for communal usage and usage details of the areas were explained, such as how to use the composting area or how to take care of planting areas shared via an open classroom wall.
Provide Space for Sharing Instructional Resources	An open classroom and community boards in the garden were used to share instructional resources such as how to water the garden or how to use the composting zone. This allowed students to learn, take responsibility, and take care of the garden together.
Provide Studios to Support Project-based Learning	Design applications provided open spaces for learning areas; for example, art lessons can be held there, and nature art installations or yarn bombing can be applied with a place-based learning style. Students can also learn mathematics and geometry by planting in the permaculture garden.
Establish a Community Forum	With the open class area, a communal area was established in the garden.
Establish a Variety of Outdoor Learning Environments	Various learning spaces related to sustainability were applied in the garden, such as a composting area, nature art stations, a permaculture garden, recycling stations, bug hotels, an herb garden, and a sensory path.
Separate Children and Pedestrians from Vehicles and Service	In the beginning the school garden was used as a parking zone and there was no boundary for the parking spots. Vehicles were separated from the garden and a sensory garden area was established just for students' usage.

Taylor (2008:326) mentions that learning landscapes should make room for various elements and defines these elements as follows:

- Natural elements: Climate, plants, animals, habitats, soils and rocks, sun and shade, water, hills/topography, wetlands, etc.
- Multi-sensory elements: Variety in textures, colors, patterns, sounds, tastes, and smells.
- Agricultural elements: crop garden, farms, orchards, irrigation systems, land management areas, animal shelters.
- Built elements: Play structures and equipment, exercise equipment, trails, beamed earth, steps, shade structures, sports fields, pavilions,

DOI: 10.15320/ICONARP.2022.226

gazebos, seating, storage, fencing, walls, flooring and graphics, signage, roof playgrounds.

- Outdoor classroom items: Weather stations, power stations (windmills, solar panels), sundials, amphitheaters, musical playgrounds of outdoor instruments, nature trails, sports tracks, solar greenhouses, water harvesting systems, science laboratories
- Cultural elements: Indigenous design, entryways, student art, public art, courtyards, plazas, gathering spaces for groups of different sizes, architectural styles, local materials, separate access for public use.
- Transition elements: Plants ways to bring the outside in and expand the learning environment, including patios, patios adjacent to classrooms, patios, sunrooms, patios, openable walls and windows, views, skylights, open courtyards, roof gardens/green roofs, vertical wall/ green walls, indoor landscaping, smart facades and new photovoltaic functions, transparency in design, the juxtaposition of formal and natural landscapes -terraced slopes, cascading drains, lily ponds in courtyard settings.

During the pilot study, these elements were included in the design process. A multisensory garden was developed and applied in the school garden with natural elements, and agricultural learning spaces and an outdoor classroom were also applied, creating relations between themselves. The aromatic garden was placed next to the bug hotel and the permaculture garden was placed next to the composting area, allowing these sustainable practices to support each other. In the following section, the details of the process will be explained.

Another approach to this topic has been made by the Children & Nature Network as part of the "Green Schools" movement. This organization defines learning spaces as "multi-functional spaces for play, learning, discovery, and development" (Children and Nature Network). Accordingly, learning landscapes establish a relationship between the interior and exterior environments of the school building, not only with spatial relationships but also with community engagement and by providing space for relations and interactions, encounters, and sharing. The organization also suggests ways to transform school gardens and make them healthier. Outside of school hours, learning landscapes can be used as public spaces, opening them to the use of neighborhoods and communities. Green school gardens should include outdoor classrooms, local and pollinated gardens, rainwater harvesting, traditional playground equipment, nature playgrounds, edible gardens, paths and walkways, trees, shrubs, and other planting elements as for the Children and Nature Network.

Takahashi (1999) states that if we adopt learning environments beyond a building, our vision of school and learning will expand. Thus, the garden, terraces, softscape and landscaping arrangements, terrace areas, pavilions, and gazebos will become parts of the school as spaces where the learning process takes place. One of the main issues to be considered in the design process of a learning environment is the need to move away from the idea that education takes place only inside buildings. In the building design, gaps and doors opening to the outside should be blurred and the relationship between indoor and outdoor space should be strengthened. Classrooms need instant action with arrangements that will establish relations with the outside (Takahashi, 1999). Therefore, the blurring of indoor-outdoor boundaries and the permeability of the building in learning landscapes should be ensured to

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

establish outdoor learning programs in schoolyards. Figure 3 illustrates the spatial qualities of green schools that support outdoor learning with examples.

Figure 3. Examples of schoolyard designs as learning landscapes. Source: **(a).** Michael Reynolds Sustainable School in Uruguay. Apart from planting activities, softscapes are integrated into different usages. Indoor and outdoor borders are blurry and in relation. (Jewell, 2018). **(b).** Kirkkojärvi School in Helsinki, Finland. (Landezine, n.d.). **(c).** The lessons are held in a natural environment; the time spent is in nature in such a way as to establish a relationship with natural elements and materials. (Green School, n.d.). **(d).** A learning landscape example in the schoolyard that aims to connect different ecosystems and sustainable solutions and use them in daily life. Green school, Bali. (Nowbali, n.d.). **(e)** Lewis Elementary School, USA (Learning Landscapes, n.d.) **(f).** Volcan Ojos del Salado Kindergarten, Santiago. (Dejtiar, 2020).

For learning to take place outside the building and to transform gardens into learning landscapes, various experiential design applications can be applied in schoolyards. These include open-space classrooms; islets where different sizes of groups can work; applied areas such as laboratories where students can observe applications on agriculture, biodiversity, or renewable energy; areas such as poultry houses, crop areas, and other gardens; and areas for rainwater harvesting, all of which can be used as learning landscapes.

Principles and Elements of Learning Landscapes

In parallel with the literature review and the case studies mentioned above, the qualities and elements of learning landscapes may be listed as follows:

- Areas should be designed with natural materials such as water, sand, wood, stone, and bark so that children can touch, feel, explore, observe, and connect with nature.
- Learning landscapes should include space and materials for play and movement as determined by the child. They should also include elements that develop creativity, like open-ended, perishable, natural materials such as sand, stones, rocks, and logs.
- Spaces consisting of flexible and loose materials that contain bushes, twigs, and other materials from nature will give students opportunities to re-make and disrupt. Spaces should be open to development and events that allow for making, spoiling, and re-making rather than finished products. These spaces also provide opportunities for children to develop their imaginations.

DOI: 10.15320/ICONARP.2022.226

- Habitat gardens, plant spirals, "hotels" to watch insects and reptiles, areas for observing biodiversity such as bird houses, and areas for natural habitats should be included.
- Planting areas and vegetable beds will help develop the responsibility, self-discipline, healthy eating habits, and ecological awareness of the students.
- Playful, rugged topographies and multisensory environments that develop kinesthetic and sensory abilities should be created.
- Various outdoor gathering, working, and observation places should be established. Such spaces allow interactions and create cascades of them. Individual, hidden niches and other alternatives will allow students to gather as groups or spend time individually connecting with nature.
- Eco-art and nature art spaces that emphasize recycling, nature watching, discovery, and observations can be designed for learning about nature and sustainability. Art classes can be applied in these processes.
- Students should be able to observe and utilize applications such as recycling, rainwater harvesting, and solar energy systems, applying them in daily life.
- An integrated spatial approach should be offered with fixed and moving landscape components in parallel with the physical, social, emotional, and cognitive development and needs of the children.
- Boundaries between the school building and the schoolyard should be dissolved with cooperation among the architectural design, landscape, pedagogy, and ecology. Boundaries between indoors and outdoors should be blurred, spreading the curriculum across the entire schoolyard.

Table 2. Learning spaces and their qualities. Source: Prepared by the author.

Description of learning spaces	**Source**
Opening a space for discovery and experience.	(Griffith, 2021)
Carrying environmental responsibility and design criteria.	(Fielding, 2006)
Active, ready for the formation/birth of new events.	(Kwon, 2004)
Wild, exploratory.	(Louv, 2010)
People, practices, and places should be evaluated in their integrity, and the human-practice relationship as a social learning environment should be associated with experience and Place-Based learning.	(Malinin, 2017)
Extension of the interior.	(Şener, 2001)
On a neighborhood-scale, a community learning center, that allows sharing within the community.	(Lackney, 2000)
Establish a relationship between indoor and outdoor.	(Takahashi, 1999)

In parallel with this, learning landscapes can be evaluated according to the descriptions of learning space design. Instead of ending with finished products and materials, they should be approached as active and interactive spaces that are open to development, formation, decomposition, and reconstruction at any time.

Schools carry, reflect, and produce the culture, habits, shared values, and social behaviors of the places where they are located. They also produce new values and principles with their implicit and explicit curricula. In this sense, many countries consider the relationship between education and design as an essential issue and adopt holistic, interdisciplinary approaches in these institutions' designs and programs for raising future individuals. As designers, we need to re-think this current and critical issue of how school campuses can become learning tools.

"It is known that individuals spend time with artificial materials in closed areas since their early childhood, due to reasons such as technology, urbanization, or lack of time. With the increase in the time spent indoors, the contact of people with nature has begun to decrease gradually" (Ataş, 2021:426). On the other hand, nature's contribution to children's social and emotional learning and development is a vital subject that is often discussed (Chawla, 2007; Louv, 2010; Sobel, 2014; Göl-Güven, 2021). Children's needs for exploring, moving, and playing are present in natural environments, and, in parallel with this, it is worrying to see children moving away from nature (Louv, 2010). As Ataş (2021) reports, children's experiences in nature have decreased significantly, the culture of children accustomed to playing outside is gradually disappearing, and most of their daily lives are spent indoors. As mentioned above, school gardens are of great importance in sustainability, establishing children's relationships, and creating informal learning processes.

A PRACTICE-BASED PILOT STUDY: "DESIGN YOUR SCHOOLYARD" WORKSHOPS

This study emphasizes the potential of school gardens in the learning process within the framework of "learning landscapes" and considers these environments as active learning spaces.

The "Design Your Schoolyard" workshops offered an experiential, hands-on, participatory process that united multiple stakeholders. Throughout this practice-based research and pilot study, the researcher collaborated with sixth- and seventh-grade students from Antalya Muratpaşa Dumlupınar Middle School. Online workshops focusing on sustainability education were carried out for six months. With the help of these workshops, the students developed sustainable design solutions for their schoolyard. Online programs, drawings, and models were used in this creative process. At the end of the online workshops, within a democratic atmosphere, suitable projects and ideas were selected for application. Later, with the support of the Istanbul Technical University Housing UYGAR Research Center, these ideas were applied. In the final step, students from Antalya Bilim University's Department of Architecture joined the process and applied the sustainable ideas together with the middle school students within the themes of social architecture, children's participation, and sustainable design.

This practice-based study underlines that learning by experience, discovery, participation, and taking responsibility has an important place in the process of learning about sustainability.

DOI: 10.15320/ICONARP.2022.226

Ataş (2021) describes the relationships among school, home, and society as "areas of support" for closeness to nature and states that children's close relationships with nature are supported by this trio. Additionally, learning landscapes, as ecological learning-based designed spaces, have important value in terms of closeness to nature and sustainable practices. New stakeholders can be added to the trio, such as partnerships with NGOs, permaculture designers, universities, architectural planning and landscape design students, social architecture clubs, researchers, and other multi-stakeholder collaborations. Strong collaborations can be created by school and public administrators. In addition, environmental education and space design should be brought together with school administrators, students, and teachers from a holistic perspective.

These connections and collaborations also strengthen participation. This practice-based study was designed to include multiple-stakeholder collaborations in its processes. The diagram in Figure 4 integrates and expresses the roles of stakeholders in the processes of the pilot study.

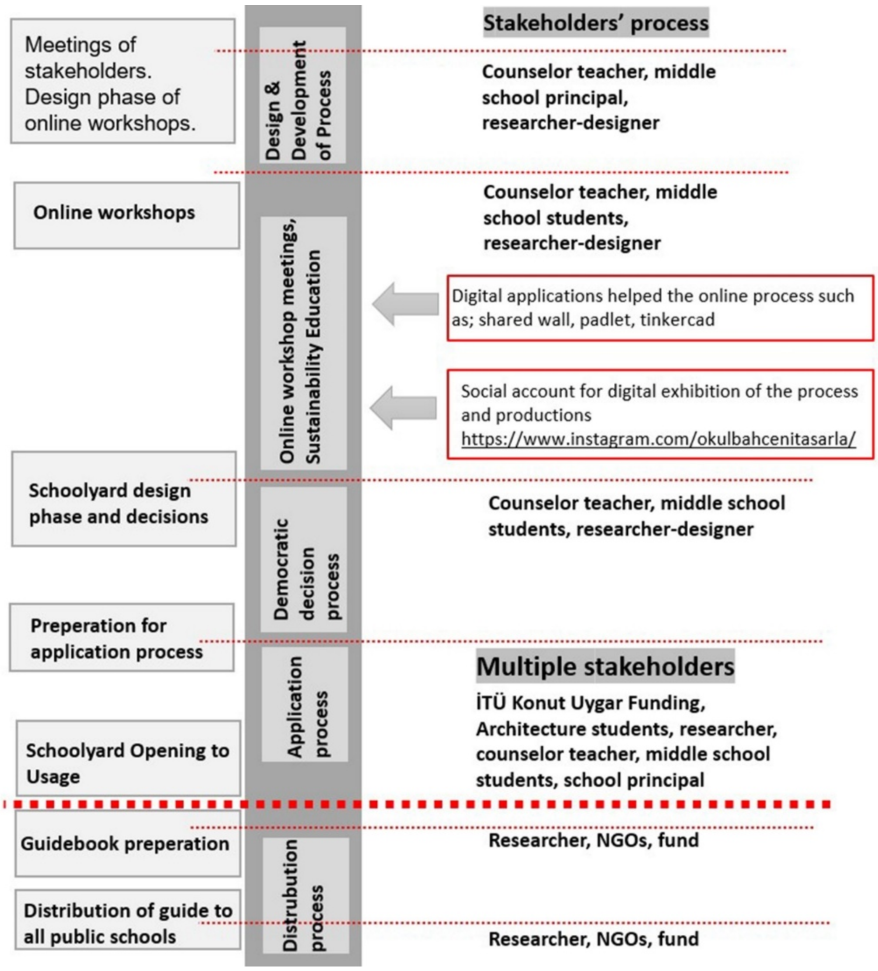


Figure 4. "Design Your Schoolyard" process and the stakeholders. Source: Prepared by the author.

Issues such as education for sustainability, landscape design, schoolyard design, and curriculum design cannot be interpreted separately; they involve interrelated stakeholders and operational processes. Therefore, they should be analyzed and applied with multidisciplinary approaches.

The "Design Your Schoolyard" online workshops started in January 2021 and ended with a participatory and experiential application project in June 2021. Over the course of six months, weekly online meetings focused on education about sustainability. Table 3 presents the main topics of the workshop.

Table 3. Curriculum: Online and face-to face workshop topics and the process. Source: Prepared by the author.

January-March 2021	ONLINE WORKSHOPS	The problems of our cities, neighborhoods, and our solutions.	Model making, sketches, digital works
		What is sustainability? Environment and Ecology. Sustainable cities. Sustainable Transportation.	
		Recycle, Reuse. Our carbon footprint.	
		Compost application examples. Making our own compost at home.	
		Healthy Eating, Agriculture in the City, Food. Community Gardens, Crop gardens. DESIGN YOUR SUSTAINABLE NEIGHBORHOOD.	
		Permaculture principles, sister plants.	
		Energy, Water, Waste, renewable systems.	
		Design your sustainable home.	
		Plant and Animal Diversity, biodiversity. Insect, bee hotels. ecosystems.	
		Basic Design, Eco-art and re-use.	
		Mind maps. Garden maps. Schoolyard discussions.	
April 2021		Design your schoolyard with sustainable principles.	
May 2021 **Decision and Discussion**		Self-criticism, discussion, taking decision as a group. Deciding on the projects to apply to garden. -Design of application process. Decision of materials. Meeting with architecture students.	
June-July 2021	Schoolyard	APPLICATION PROCESS (Sharing the process with online social media page.) -Material selection and procurement. - Organization and orientation of students, distribution of tasks. -Application and design on site as well.	

During the process of designing the schoolyard, the students chose a dead space, namely the backyard of the school that was being used as a parking lot and developed ideas for that area.

DOI: 10.15320/ICONARP.2022.226

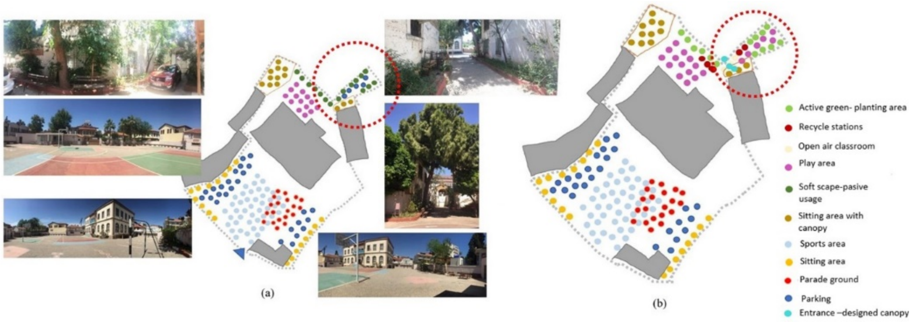


Figure 5. Activity and usage analysis of the pilot project. (a). Before the design application. (b). After the design application. Source: Prepared by the author.

Figure 5a shows the original usages of the front and back parts of the garden with photos of the site. As is seen, usages were limited by the parking lot. Figure 5b illustrates the additional usages with a new usage diagram of the garden. The following conceptual diagrams explain the functional relations of the yard before and after the implementation.

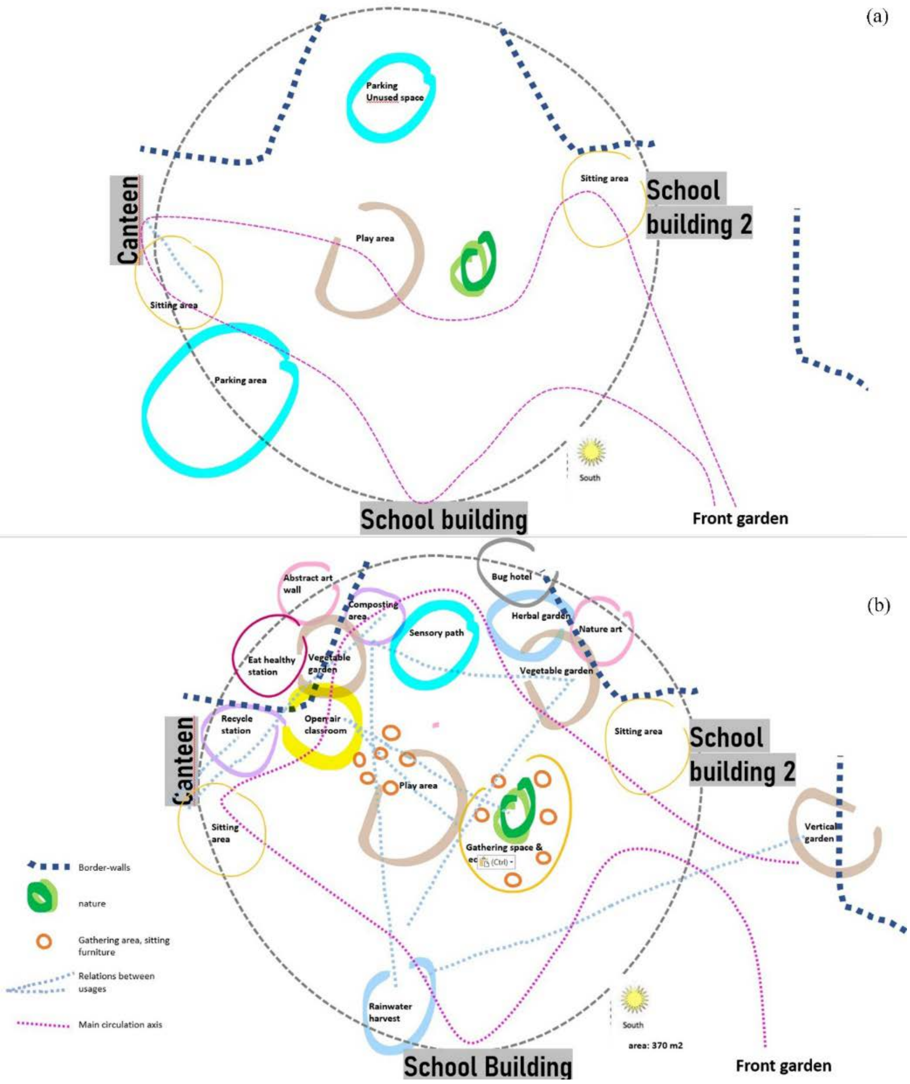


Figure 6. Conceptual diagram of functional relations in the pilot project area. (a). Before the implementation. (b). After the implementation. Source: Prepared by the author.

As seen in Figure 6a**,** there was previously no daily usage or activity in the backyard. The area was used as a parking lot, but the students noticed some potential there and wanted to apply design ideas to this space. Figure 6b explains the usage of the site after the application. It also shows the relations between the design ideas and usages and the main circulation axis spread into all parts of the yard.

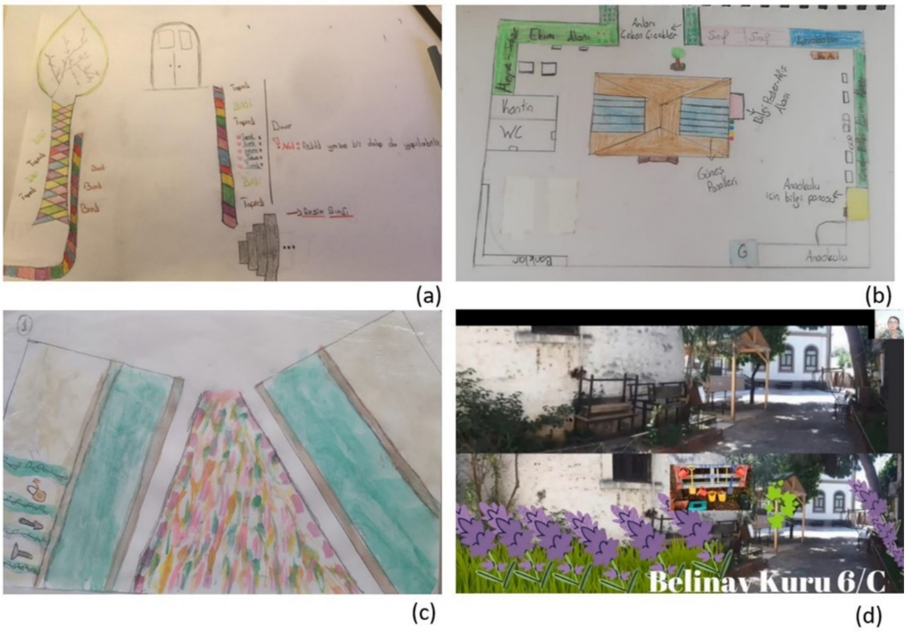


Figure 7. Student sketches and representations during online workshops for the design of the schoolyard. (a). Student sketch on eco-art and permaculture design of vegetable garden. (Student: Belinay Dikmen). (b). Student work for the schoolyard as a plan. (Student: Melisa Çağala). (c). Student sketch expresses the planting area, eco-art, sensory path ideas. (Student: Naz Belinay Kahraman). (d). Student digital work expressing aromatic garden and organization of the backyard during the online workshops. (Student: Belinay Kuru) Source: Prepared by the author.

The middle school students developed ideas for their schoolyard following the sustainability principles to which they were introduced during the online workshops.

During the application process, architecture department students worked with them, as well.

Figure 8. Design applications to the site. Source: Prepared by the author from the process, photos taken by Beste Sabır Onat.

DOI: 10.15320/ICONARP.2022.226

Their ideas came to life in the schoolyard. A bug hotel, aromatic herb garden, vegetable garden with permaculture principles, healthy eating station, information boards, canopy over the garden's entrance, vertical garden, sensory path, open-air classroom, recycling stations, composting area, rainwater harvesting station, and eco-art and yarn bombing projects were applied to the site.

Figure 8. Participatory process of "Design Your Schoolyard" pilot project. Source: Prepared by the author from the process, photos taken by Beste Sabır Onat.

In Figure 9, photos expose the application process of workshop. Students applied their designs to the schoolyard. In the first line (from left to right): First photo shows the application of composting bin, second photo shows the application process of yarn bombing to the tree, the students wanted to gather under this tree, third photo shows the supplication of permaculture garden. Students learnt the permaculture criterions and planted the vegetables through permaculture rules.

In the second line: first photo shows the application of sensory path. Second photo shows the application of vertical garden, and third photo shows the discussion process before the application of planting areas.

In the third line, first photo shows the application of aromatic garden next to the bug hotel, second photo shows the canopy area in the entrance of sensory garden, third photo shows the preparation of the art wall.

In the fourth line, first photo shows the preparation of open classrooms black board, second photo shows the materials of sensory path, and the third photo shows the sensory garden after the workshops.

DISCUSSION, EVALUATION AND RESULT

Learning is a double-sided process; while the environment shapes the child, the child can also participate and shape the environment to strengthen the learning process.

This study has focused on learning landscapes and learning about sustainability in schoolyards. Informal learning processes were presented to incorporate learning about sustainability in the everyday lives of students as an outdoor learning and practice-based process.

This study has addressed how to transform schoolyards into learning landscapes. During the practice-based part of the research, the study first aimed to strengthen students' knowledge of sustainability with online workshops, to secondly support students and involve them in developing ideas for their schoolyard, and to thirdly support them in applying their ideas in the schoolyard via a participatory process.

This experience-based study has sought to launch a new discussion about learning landscapes while blending this issue with sustainability and hopefully opening a new debate on this emerging area where spatial design can meet educational theories, ecology, sustainability, and curriculum design.

There is an urgent need to organize and design school gardens with new lenses, focusing on ecological solutions and interdisciplinary approaches that blend sustainability, design, and learning theories with curriculum design. Research asserts that schoolyards are vital spaces for children to come into contact with nature, cultivate sustainable practices, and grow to become active citizens. The design methodology of learning landscapes is an emerging area and should be interpreted with multifaceted approaches that include curriculum, pedagogy, ecology, and environmental education.

During the participatory and practice-based processes of the workshops, the themes and key lessons listed in Table 4 emerged.

Table 4. Lessons Learned from "Design Your Schoolyard" Online Workshop Process

Themes of Online Workshop & Application Process:	**Key Lessons:**
Education for sustainability online workshops	Workshops helped students learn about sustainability principles and practices and supported them while designing the schoolyard and learning about sustainability; it was also a supportive and empowering process during the COVID-19 pandemic
Making shared decisions about the garden with online discussions	Democratic processes allowed students to listen and learn from each other and make decisions together as a step of the participatory process

DOI: 10.15320/ICONARP.2022.226

Application of ideas/designs together with university students as a participatory process	Students supported and helped each other while applying design ideas such as bug hotel, sensory path, canopy, etc.; they formed and developed new ideas together at the site and shared knowledge while planning, planting, and cleaning the garden
Shared goals	Planning a green schoolyard with sustainable ideas and applying these designs strengthened feelings of belonging to the school, the community feeling in school, participatory processes, and learning from each other
Starting a "sustainability club"	The idea of the club strengthened students' sense of belonging to the school, owning the ideas that they produced and chose together, respecting each other's ideas, spreading knowledge, teaching each other, and learning from the place and each other, and distributing the work and taking responsibility in the garden
Shared learning	All participants and stakeholders of the process learned from each other; for example, schoolteachers and the principal learned from the practice-based project while university students and middle school students learned from each other, and the online process helped build knowledge, collaboration, and inclusivity for students to get involved and develop more ideas together
Integration of families	Families were involved in sustainable practices and the learning process; students passed knowledge and practices on to their families and started to apply sustainable practices such as composting, recycling, and reusing waste products at home

Planning and design disciplines should address crucial processes such as the design of collaborations and partnerships and creating stakeholder relations for dialogue, such as planner-educator-student collaborations, student-student collaborations, and application-curriculum-student relationships.

On the other hand, as the environment and space design meet their users, they can also transform, change, and direct their behaviors towards ecologically based practices. In this sense, some processes need to be designed and re-developed with interdisciplinary approaches, from the materials to be selected to the learning processes integrated into the site design and curriculum. These processes cannot happen without the cooperation of multiple actors.

Schoolyards need to be interpreted as ecological and social transformers of schools. As the ecological transformation begins at home, on an individual level, the school has a crucial role in cultivating sustainable practices. Therefore, schoolyards as learning landscapes need urgent and innovative approaches and design processes that include multiple stakeholders and dialogues.

This pilot study unfolded the participatory, Place-Based structure of these sites. Schoolyards as learning landscapes need to be interpreted and discussed with different disciplines together with a holistic approach. On the national scale, urgent regulation is needed to blend curricula and learning with outdoor environments. Students should be included in the design and organization of these learning landscapes. Architects and spatial designers should start developing not only physical designs but also context and curricula for these sites.

ACKNOWLEDGEMENTS/NOTES

Special thanks to the participants, stakeholders, and supporters of this practice-based process: Muratpaşa Dumlupınar Middle School 6th and 7th grade students, Counselor teacher Hülya Ayan, School Principal Ahmet Kartöz, Antalya Bilim University Architecture Department Students, İTÜ Konut Uygar Research Center.

Students: Ecrin Doğan, Elif Kundakçı, Eylül Ürenç, Asaf Ata, Deniz Ayan, Defne Ayan, Aymira Şimşek, Umut Eymen Arıkan, Belinay Kuru, Selen Işık, Atakan Kurşun, Aslıhan Acar, Doruk Şahin, Tuana Şimşek, Zehra Boztepe, Ceylin Ünal, Özge Metin, Songül Sancak.

Through this link more images and videos can be found:
https://www.instagram.com/okulbahcenitasarla/

This article is an excerpt from Beste Sabır Onat's Dissertation Thesis, supervised by Prof. Dr. Funda Yirmibeşoğlu at Istanbul Technical University.

REFERENCES

Ağyar, E. (2014). Çocuk ve Çevre. [Child and Environment]. G. Ogelman (Ed.), *Küçük Çocuklara Çevre Eğitimi Verilirken Nelere Dikkat Edilmelidir?* Ankara: Eğiten kitap.

Ark, T. V., Schneider, C. (2016). Genius Loci: Place-Based Education & Why It Matters, E-book, in Getting Smart. (Retrieved on 21.08.2022 from: https://www.gettingsmart.com/2016/07/genius-loci-place-based-education-why-it-matters/, pp.7.)

Australian Curriculum, Assessment and Reporting Authority (ACARA) (Retrieved 21.08.2022 from https://www.australiancurriculum.edu.au/f-10-curriculum/cross-curriculum-priorities/sustainability/)

Ataş, B. (2021). Doğa ve SDÖ. [The Nature and Social Emotional Learning, SEL]. M. Göl-Güven (Ed.), in *Çocuklukta Sosyal ve Duygusal Öğrenme* (pp. 425-459). Yeni insan Yayınevi, Eğitim Serisi, Tohum yayıncılık, İstanbul.

Chawla, L. (2007). Childhood Experiences Associated with Care for the Natural World: A Theoretical Framework for Empirical Results. *Children, Youth and Environments,* 17(4), 144-170. (Retrieved on 21.08.2022 from: http://www.jstor.org/stable/10.7721/chilyoutenvi.17.4.0144)

Children and Nature Network, Green Schoolyards for Healthy Communities. (Retrieved 21.08.2022 from https://www.childrenandnature.org/wp-content/uploads/Green-Schoolyards-Benefits.pdf)

Coombs, P. H., Ahmed, M. (1974). *Attacking Rural Poverty: How Non-formal Education Can Help*, Baltimore: John Hopkins University Press.

Dale, E. (1969). *Audio-Visual Methods in Teaching*, Holt, Rinehart & Winston, New York, pp. 108.

DOI: 10.15320/ICONARP.2022.226

De Certeau, M. (1984). *The Practice of Everyday Life*, University of California Press, Berkeley.

Demirkaya, H. (2006). Çevre Eğitiminin Türkiye'deki Coğrafya Programları İçerisindeki Yeri ve Çevre Eğitimine Yönelik Yeni Yaklaşımlar. [The Place of Environmental Education in Geography Programs in Turkey and New Approaches to Environmental Education]. *Fırat Üniversitesi Sosyal Bilimler Dergisi*, 16 (1): 207-222. (Retrieved on 21.08.2022 from: https://app.trdizin.gov.tr/makale/TlRreE1EazU/cevre-egitiminin-turkiye-deki-cografya-programlari-icerisindeki-yeri-ve-cevre-egitimine-yonelik-yeni-yaklasimlar)

Dejtiar, F. (2020, January 28). Patio Vivo: Transforming Schoolyards into Learning Landscapes. https://www.archdaily.com/932655/patio-vivo-transforming-schoolyards-into-learning-landscapes/5e1cd4303312fd6845000288-patio-vivo-transforming-schoolyards-into-learning-landscapes-photo?next_project=no

Fielding, R. (2006). Best practice in action: six essential elements that define educational facility design. CEFPI Planner. (Retrieved on 21.08.2022 from: https://silo.tips/download/1-supporting-teaching-and-learning-changing-the-paradigm-from-turf-centric-class)

Freeman, C., Tranter, P. (2011). *Children and their urban environment: Changing worlds*. London: Earthscan Publications.

Getting Smart. E-book: What Is Place-Based Education and Why Does It Matter? Getting Smart in Partnership with Edu innovation & Teton Science Schools. (Retrieved on 21.08.2022 from: https://www.gettingsmart.com/wp-content/uploads/2017/02/What-is-Place-Based-Education-and-Why-Does-it-Matter-3.pdf)

Griffith, M. (2021). *Okulsuzluğun El Kitabı – Tüm Dünyayı Çocuğunuzun Dersliği Olarak Nasıl Kullanabilirsiniz?* [The Handbook of Unschooling – How to Use the Whole World as Your Child's Classroom]. Yeni insan Yayınevi, Eğitim Serisi, Tohum yayıncılık, İstanbul.

Göl-Güven, M. (2021). SDÖ Tanımı, Kavramsal Çerçevesi, Modeller ve Yöntemler. [The Definition of Social Emotional Learning, Conceptual Frameworks, Models and Methods]. M. Göl-Güven (Ed.), in *Çocuklukta Sosyal ve Duygusal Öğrenme* (pp. 27-71). Yeni insan Yayınevi, Eğitim Serisi, Tohum yayıncılık, İstanbul.

Green School. (n.d.). https://www.greenschool.org/bali/green-school-english/

Harvey, D. (2012). Rebel Cities: From the Right to the City to the Urban Revolution, New York: Verso, Part 4.

Hart, R. A. (1997). Children's Participation: The Theory and Practice of Involving Young Citizens in Community Development and Environmental Care. London: Earthscan Publishing.

Hewitt, B. (2016). Okulsuz Büyümek: Okulsuz Eğitim, Kırsalda Yaşamak, Doğayla Bağ Kurmak ve Yaşayarak Öğrenmek Hakkında Sıra dışı Bir Ebeveynlik Macerası. [Home Grown: Adventures in Parenting off the Beaten Path, Unschooling, and Reconnecting with the Natural World]. Sinek Sekiz Yayınevi.

Jacobs, J. (1999). Experiential education: The main dish, not just the side course. Boulder, CO: Association for Experiential Education.

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development* (Vol. 1). Englewood Cliffs, NJ: Prentice-Hall.

Kwon, M., 2004, One Place After Another: Site-Specific Art and Locational Identity. Cambridge, MA: MIT Press.

Lackney, J.A. (2000). 33 Principles of Educational Design. School Design Research Studio, National Clearinghouse for Educational Facilities (NCEF).

Landezine. (n.d.). Kirkkojarvi School Yard. www.landezine.com/index.php/2020/09/kirkkojarvi-school-yard/

Latour, B. (1991). *We Have Never Been Modern*. Cambridge: Harvard University Press.

Learning Landscapes. (n.d.). Lewis Elementary School Forest Climber. https://learninglandscapesdesign.com/projects/lewis-elementary-school-forest-climber/

Louv, R. (2010). Doğadaki Son Çocuk; Çocuklarımızdaki Doğa Yoksunluğu ve Doğanın Sağaltıcı Gücü. [Last Child in the Woods: Saving Our Children From Nature-Deficit Disorder]. TÜBİTAK Popüler Bilim Kitapları, Ankara.

Nagel, M. (2005). Constructing apathy: How environmentalism and environmental education may be fostering "learned hopelessness" in children. Australian Journal of Environmental Education, 21: 71-80.

Nowbali. (n.d.). https://www.nowbali.co.id/inspiring-a-brighter-future-at-green-school-balis-sustainable-solutions-festival/

Sobel, D. (2014). Ekofobiyi Aşmak, Doğa Eğitiminde Kalbin Yeri. [Beyond Ecophobia: Reclaiming the Heart in Nature Education]. Yeni insan yayınevi, İstanbul.

Şener, E., A. (2001). *Okul Öncesi Çocuk Eğitim Merkezleri İçin Değişebilir/Dönüşebilir/Esnek Bir "Fiziksel Çevre Mode*li. [A Changeable/Transformable/Flexible "Physical Environment Model for Preschool Child Education Centers]. (Yayınlanmış Doktora Tezi, İTÜ Fen Bilimleri Enstitüsü, Mimari Tasarım Programı Mimarlık Anabilim Dalı İstanbul). (Retrieved on 21.08.2022 from: https://tezarsivi.com/okul-oncesi-cocuk-egitim-merkezleri-icin-degisebilir-donusebilir-esnek-bir-fiziksel-cevre-modeli)

Taylor, A. (2008). *Linking Architecture and Education: Sustainable Design of Learning Environments*, University of New Mexico Press.

Takahashi, N. (1999). Educational Landscapes: Developing School Grounds as Learning Places. Volume 3. Building Blocks to Better Learning Series. Virginia Univ., Charlottesville. Thomas Jefferson Center for Educational Design.

Tanrıverdi, B. (2009). Sürdürülebilir Çevre Eğitimi Açısından İlköğretim Programlarının Değerlendirilmesi. [Evaluation of Primary Education Programs in terms of Sustainable Environmental Education]. *Eğitim ve Bilim*, 34-151: 89-102.

Resume

Beste Sabır Onat: After City and Regional Planning (YTU) and Architectural Design (ITU) education, her doctoral thesis continues at ITU. Her research topics are interdisciplinary design, urban pedagogy, design pedagogy. She currently works as a part-time lecturer at Antalya Bilim University since 2017.

Funda Yirmibeşoğlu: She has a diploma in architecture, master's degree in urban planning and Ph.D. in urban planning program from ITU. She is a chairman of the Department of Urban and Regional Planning since 2022. She teaches graduate and undergraduate courses.

DOI: 10.15320/ICONARP.2022.226

ICONARP
International Journal of Architecture and Planning
Received: 27.08.2022 Accepted: 08.12.2022
Volume 10, Issue 2/ Published: 20.12.2022
Research Article
DOI: 10.15320/ICONARP.2022.227 E- ISSN:2147-9380
ICONARP

Evaluation of Antalya Bus Station Information Element Designs in terms of Visual Aesthetic Quality

Mikail Açıkel*
Yavuz Bahadır Certel**
İbrahim Bakır***
Hacer Mutlu Danacı ****
Kemal Reha Kavas*****

Abstract

A The concept of information, known as information expansion, has been at the forefront in terms of the needs of societies from the past to the present. Recently, especially with the development of technological facilities, the importance of information design systems has increased considerably. Information and guidance elements exist in every field of social use, enabling the transfer of information; It is an important element in providing interaction for information and orientation within the spaces and gaining the functional and visual aesthetic appreciation of people with effective visual communication tools. As a social use, bus station structures also stand out as an important public space in the design of information and guidance elements. Within the scope of the study, focusing on the informatics language of bus station structures; It is aimed to determine the signage systems in the building through the example of Antalya Bus Station and to evaluate these designs in the context of graphic design space. In the evaluation of the identified signage systems, semi-structured interview techniques and descriptive analysis methods were used. In the first stage of the study, passenger, and employee opinions about the information-guidance qualities of the existing signage systems were taken. Within the scope of the interview data obtained, signage systems were evaluated by making descriptive analyses in the context of design elements and design principles as information-guidance design components determined in the existing literature. As a result of the evaluations, it was seen that most of the signage systems in the bus station structure were insufficient in terms of functional and visual aesthetic quality and that identity was not given to the bus station space and the city. As a method criterion, the study is expected to be a source for researchers from many disciplines that are active in the information and guidance design of bus station structures with approaches and elements appropriate to the identity of the city.

Keywords:
Information, information and guidance design, visual aesthetic quality, bus station structures, antalya bus terminal

*Faculty of Architecture and Design, Akdeniz University, Antalya, Turkey.
Email: mikailacikel@akdeniz.edu.tr

**Faculty of Architecture and Design, Akdeniz University, Antalya, Turkey.
Email: bahadircertel@akdeniz.edu.tr

***Faculty of Architecture and Design, Akdeniz University, Antalya, Turkey. (Corresponding author)
Email: ibakir@akdeniz.edu.tr

****Faculty of Architecture and Design, Akdeniz University, Antalya, Turkey.
Email: hacermutlu@akdeniz.edu.tr

*****Faculty of Architecture and Design, Akdeniz University, Antalya, Turkey.
Email: kemalkavas@akdeniz.edu.tr

To cite this article: Açıkel, M., Certel, Y.B., Bakır, İ., Mutlu Danacı, H. & Kavas, K.H. (2022). Evaluation of Antalya Bus Station Information Element Designs in Terms of Visual Aesthetic Quality. ICONARP International Journal of Architecture and Planning, 10 (2), 868-890. DOI: 10.15320/ICONARP.2022.227

INTRODUCTION

Interest in the concept of information, which is known as one of the ways of transferring information from past to present, is increasing day by day, and the need for people's need for information is growing.

People who experience a space need information before they can make decisions or act. The process of receiving information is achieved by looking, touching, or feeling. For this reason, appropriate design elements should be used in the spaces where users should be informed (Akaydın and Türkyılmaz, 2018). In the spatial sense, knowledge means that it is appropriate to design and place various elements in space to obtain information (Ertaş, 2012). Ergonomically, the organization of information in space describes the process by which a person easily accesses and distinguishes information before deciding or acting. In this process, when information data is incomplete or insufficient, problems such as confusion and incomprehension arise.

Although information and guidance design are mentioned as a very new concept in various sources, it is a current field of design with an important and historical background that is discussed in many respects. The observance of information and guidance design, which cooperates with different disciplines and works with different disciplines, has become more effective thanks to the developing communication and transportation channels (Güler, 2008). Design elements that provide information and guidance within spaces help users move easily by providing their understanding between spaces and accelerating workflow. Especially in structures with complex organizations such as hospitals, schools, libraries, and bus stations, the quality of the information network; allows users to understand the spaces and move easily between the spaces.

Erik Spiekermann (2009), an active designer in information design, while discussing the process that he calls information crisis, also stated that we are in an environmental order that forces us to constantly look, listen and react in the transmission of information and that the information we need is often not well designed, citing instruction manuals, highway signs, and bookmarks as examples. Terry Irwin (2002) stated that he encountered many definitions for information design, especially the concepts of useful, informative, helpful, pure, powerful, accessible, collective, general, inclusive, meaningful, and functional concepts that shaped information design.

From informatics to communication, information, and guidance design, which has a wide range of places from engineering to architecture, is examined by many different disciplines (Durukan et al., 2020). Information design involves engineers, graphic designers, architects, industrial designers, and experts from different disciplines. In this context, it is possible to say that information design has turned into an interdisciplinary field and the importance of the discipline of architecture in this field has increased in planning design processes and visual aesthetic values.

DOI: 10.15320/ICONARP.2022.227

In this context, it can be stated that functional and aesthetic qualities are effective in the design of information design systems. One of the goals of these systems is to transform complex information data into visual expressions and make use of symbols with universal meaning (Crnokrak, 2008). Information and guidance elements should appeal to all kinds of audiences in both aesthetic and functional terms, making it easier for people to need information and receive information.

Information and guidance design is influenced by many areas such as typography, colors, materials, urban texture, ergonomics, readability, interaction, icons, and identity. Successful information and guidance design has meaning and creates identity in terms of visual aesthetics as well as the information it contains. When these systems are examined, the space it is designed for should be considered and all visual design decisions, from their form, color, and typography to dimensions, should include information about this spatial identity (Irmak, 2009).

Information and guidance design elements that are designed without considering their relationship with the space can cause many problems in terms of functionality and visuality. In orientation and information design, many principles, and elements such as typeface, material, color, the symbol used, visual formatting, and location selection affect the visual aesthetic quality of design elements. In summary, information design is a way of multiplying information daily with a common language formation that can appeal to everyone. In the spaces we use, collective, unusual, creative, and interesting designs made for people should be revealed (Gibson, 2009). Since information and guidance designs appeal to a wide audience, they should be impressive and memorable in terms of visual aesthetic quality.

Orientation design, which is one of the information components, was first developed for transportation spaces such as highways, train stations, airports, and bus stations (Ay, 2021). Bus stations are used to provide road transportation within and between cities, to achieve their roles, bus stations are equipped with information and direction signs, door nameplates, ticket offices, platform numbers/locations, etc., and become public spaces that contain areas that require design.

The review of current literature indicates that there is very little research on the design of information and guidance in different cities of Turkey and the world in terms of bus station structures as the use of public space in a large part of this research, was seen that the functional nature of the existing information and guidance elements and design suggestions were included. In the current literature, it has been determined that the information and guidance elements are not evaluated in terms of visual aesthetic quality, and design solution suggestions are not made in this respect. Within the scope of the literature and sample field investigation, it was seen that the designs for the signage systems in the bus station structures were insufficient in terms of visual aesthetic quality.

In this direction, bus station structures, which are among the examples of buildings with complex organization, are discussed within the scope of the study. This study aims to determine the visual aesthetic adequacy of the information and guidance design elements at the bus stations and the problems for design solutions. The study discussed Antalya's existing intercity bus station as an exemplary space. In the selection of this spacious area, the fact that it is in a central location that can easily reach every point of the city by public transportation and that it is obtained through the architectural project competition as a qualified bus station structure has been a factor.

Within the scope of the study, focusing on the informatics language of bus station structures; It is aimed to determine the signage systems in the building through the sample of Antalya Bus Station and to evaluate these designs in the context of graphic design and space relations. Evaluation of the identified signage systems was carried out in two stages; At the first stage of the evaluation, the opinions of passengers and bus station employees about the information-direction qualities of the signs used in and around the Antalya bus station were taken. Signage systems were evaluated by making a descriptive analysis in the context of design elements and design principles as information-guidance design components determined in the current literature within the scope of the data obtained through the verbal interview.

EVALUATION of INFORMATION COMPONENTS FROM the POİNT of VISUAL QUALITY

With the influence of technology, language and perception have developed rapidly in recent years in information design. One of the reasons for this is the prevalence of computer graphics that allow the presentation and sharing of information. Today, the need for information design has increased with the transformation of visual language and perception into an aesthetic value as the design circles have been named. As Vignelli (2009) points out, "Changing the world is not the job of designers but protecting and beautifying the environment visually is something we can do."

Information and orientation design uses an interdisciplinary approach and focuses on shaping functional design consisting of multiple complex strings. For designs to be inspiring, enlightening, entertaining, and functional at the same time, they must carry some visual aesthetic elements. In the design of information and direction, visual aesthetic values should be at the forefront as well as the content. Developing methodologies in order not to look subjectively at the design processes, getting help from other disciplines, and being analytical give visual meaning to the information given in terms of design (Makal, 2009).

Information and guidance designers use design principles and elements to organize and use information, considering the user and the circumstances; thus, explanatory, and instructive writings are improved

DOI: 10.15320/ICONARP.2022.227

to understand complex materials, to easily access this information, and at the same time to maintain visual appeal (Segalini, 2009). While informative and orientation designs visually present information through typography and graphic elements, they carry out the identity communication of the structure by helping us to understand the architecture and infrastructure (Galindo, 2012). According to Sayın (2021), the principles in design are how to make a design; elements are concepts related to what will be used in a design. Each informational design element is designed to convey designated messages to a specific audience. In this context, when the existing literature on design elements is examined:

In the aesthetic perception of information and orientation design elements, grid system, font and typography, color, image, movement and sound, use of form, use of materials, suitability for space, location selection and application size are the basic design elements used in design (Topaklı and Nas, 2019; Ay, 2021; Durukan et al., 2020; Keskin, 2017; Becer, 2019; Lupton, 2006; Dinek et al., 2017; Baer, 2008; Öztuna, 2007; Sayın, 2021; Codur, 2010).

Table 1. Design component parameters those are active in the design of information and guidance elements

Information and Guidance Design Components			
Elements in Information and Guidance Design		Principles in Information and Guidance Design	
Font-Typography	Uyan Dur, 2011; Keskin, 2017; Becer, 2019; Lupton, 2006; Gibson, 2009; Fişenk, 2012; Sayın et al., 2009; Calori et al., 2015; Felici, 2003; Bringhurst, 2001; Ambrose and Harris, 2019; Ay, 2021; Durukan et al., 2020; Topaklı and Nas, 2019;	Order-Hierarchy	Becer, 2019; Sayın, 2021; Ambrose and Harris, 2014; Ay, 2021
		Balance	Becer, 2019; Sayın, 2021; Ay, 2021
Color	Dinek et al., 2017; Keskin, 2017; Öztuna, 2007; Bulut and Uslu, 2017; Baer, 2008; Sağocak, 2005; Lidwell et al., 2010; Topaklı and Nas, 2019; Uebele, 2007	Contrast	Ermiş, 2012; Uyan Dur, 2011; Sayın, 2021; Ay, 2021
		Ratio-Proportion	Ay, 2021; Becer, 2019
Forming Usage	Codur, 2010; Ay, 2021; Durukan et al., 2020	Weighing (Rhythm)	Becer, 2019; Aslan, 2002; Sayın, 2021; Ay, 2021
Material Usage	Topaklı and Nas, 2019; Gibson, 2009; Fişenk, 2012; Calori et al., 2015; Ay, 2021	Integrity / Unity	Keskin, 2017; Sayın, 2021; Ay, 2021
Relevance to space	Topaklı and Nas, 2019; Durukan et al., 2020; Ay, 2021	Emphasis-Focus	Uçar, 2019; Keskin, 2017; Karaalioğlu, 2015; Ay, 2021
Positioning	Topaklı and Nas, 2019; Okcu, 2007; Ay, 2021	Continuity	Becer, 2013; Keskin, 2017; Sayın, 2018; Ay, 2021

In the aesthetic perception of information and guidance design elements, the concepts of order-hierarchy, balance, contrast, ratio-proportion, weighing (rhythm), integrity-unity, emphasis-focus point, and continuity stand out as the basic design principles used in design (Sayın, 2021; Ambrose and Harris, 2014; Ay, 2021; Becer, 2019; Ermiş, 2012; Keskin, 2017; Uçar, 2019).

Information and guidance design elements in bus station structures in terms of transportation spaces that are multi-use and complex; draft elements such as font-typography, color, forming usage, material use, material usage, relevance to space, location selection (positioning), and design principles such as order-hierarchy, balance, contrast, ratio-proportion, weighing (rhythm), integrity-unity, emphasis-focal point, continuity was evaluated (Table 1).

Evaluation of Information and Guidance in Bus Station Structures from the Point of Visual Quality

The concept of a bus station is defined by the Turkish Language Association (TDK) as "the place where intercity and intra-city motor vehicles pick up and drop off their passengers". The need for travel is compelling because people travel less frequently to meet the necessities of daily life. Mobility is an indispensable feature of social life, defining the ability to participate in modern society (Schofer, 2020).

Bus stations are dynamic and effective places that can be the scene of all kinds of functions that appeal to the residents of the city as important social and public spaces of the city. Often at large bus stations or transfer points, the sense of anxiety and anxiety created by the complex and chaotic environment destroys the positive emotions and thoughts in the minds of people traveling. At the beginning of the problems that cause this negative effect, architectural space and design solutions are included. The passengers' comprehension of the space, reading, finding their direction, and effortlessly going to the places they want to access depend on the performance of the space organization and information element designs. In terms of these aspects, a qualified design arrangement creates a positive psychological and spiritual effect on people. Visual aesthetic quality is a very important criterion in the design of informing and directing people to give a sense of alarm anxiety or peace-confidence in such spaces.

One of the important factors in the performance of the systems in bus station structures is the concept of time covering the times before and after the journey. In bus station structures, efficient use, and minimization of the time until the arrival of the bus to the platform, passenger reception, baggage loading, and departure are possible with the successful design of the movement areas and information systems (Ay, 2021). While designing information and guidance elements in bus station structures; solutions should be developed for the following questions: which way people or vehicles are going, which road they use, which places they are directed, where information needs are needed and how guidance elements can help them.

Information and direction signs such as bus waiting areas within bus stations, offices where we buy tickets, entry and exit points, wet

DOI: 10.15320/ICONARP.2022.227

volumes, infographics, administrative units, food and beverage places, and direction graphics showing incoming and departing passenger platforms are used. Within the scope of these structures, in cases where it is difficult to communicate and agree verbally, there is a need for information and guidance designs that enable people to reach their goals well and quickly. The main objectives to be followed when designing information elements are; to create appropriate and legible images that can appeal to different audiences, to create an original design with a simple aesthetic that works well by using the third dimension, resistant to temporal processes when necessary (Wyman, 2009).

In the design of the information elements in Taşcıoğlu and Aydın (2015), the authors emphasized that the designed system should be developed by anticipating where and what the user will need and that it should be able to convey the right information to people at the right point. At this point, in the design of information and guidance elements; It is important to produce quality designs that consider current needs and produce solutions that appeal to all users, and that conform to visual aesthetics.

EVALUATION of ANTALYA BUS STATION INFORMATION ELEMENTS in Terms of VISUAL AESTHETIC QUALITY

The project, which was awarded the first prize within the scope of the architectural project competition opened by Antalya Municipality in 1987, wain terms designed by Hazan Architecture, it was made with the joint work of experts Yakup Hazan and İlhami Özkese. The project building was produced in 1987 and Construction started in 1996 and was completed in 1997. Within the scope of the competition, the desire to solve the intercity and city bus terminals together formed the basic points in the design of the structure. The design is based on a horizontal structure positioned between intercity bus traffic and urban traffic and the movement of passengers at ground level between the two traffic flows of the building area (Itez, 1996). In the building space organization, the functional flow was ensured by separating the incoming and departing passengers in the planned plane (Figure 1).

Figure 1. Antalya bus station layout plan and bus station entrance section (Hazan, 2021)

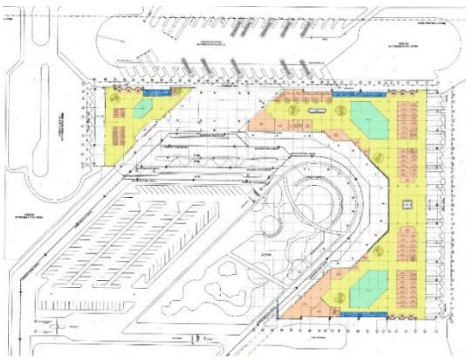
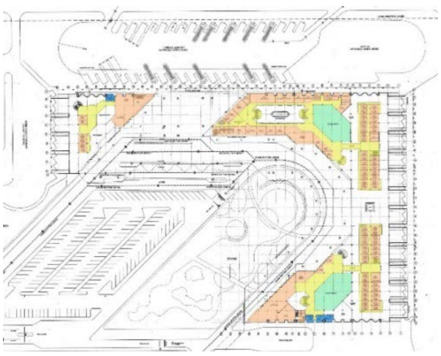
In the planning scheme of the bus station, the city and intercity terminal buildings relate to a design of wide eaves. This was used in the design of the shade as an accentuating element in the fringe plan. However, passengers arriving at the terminal meet the city without entering the structure under the eaves. One of the main points of the design is that the broken plate console is planned to take passengers under the shadow of the buses waiting afternoon as a remarkable detail. (Figure 2).

Figure 2. Antalya bus station eaves and broken plaque design (URL 1)

In the interior of the building, all the carrier and mechanical systems are designed visibly. Under the eaves, the façade of the building is covered with nine meters-high glass surfaces, and the eaves shade a part of the interior from the glass surfaces. An atmosphere that provides a microclimate is created with the internal gardens designed in the structure. The water element designed in the interior garden was also used as an effective element in balancing the air quality and temperature indoors (Figure 3).

Figure 3. Antalya bus station interior visuals (Y. Hazan, personal interview 21 December 2021; Original, 2022)

Table 2. Bus station structure places on the ground and first floors

Ground Floor	First Floor
	
Counter & Commercial Spaces Circulation Areas Indoor Gardens Wet Volumes	Counter & Commercial Spaces Circulation Areas Indoor Gardens Wet Volumes

DOI: 10.15320/ICONARP.2022.227

The building consists of 2 floors. On the ground floor: Inside the building, there are ticket offices, wet areas, bus waiting areas, food, and beverage areas, and outside the building, under the eaves design, there are bus platforms and passenger circulation areas. On the first floor, are office spaces that are not in use, administrative units, technical room uses, few eating and drinking places, and wet volumes (Table 2).

Methodology

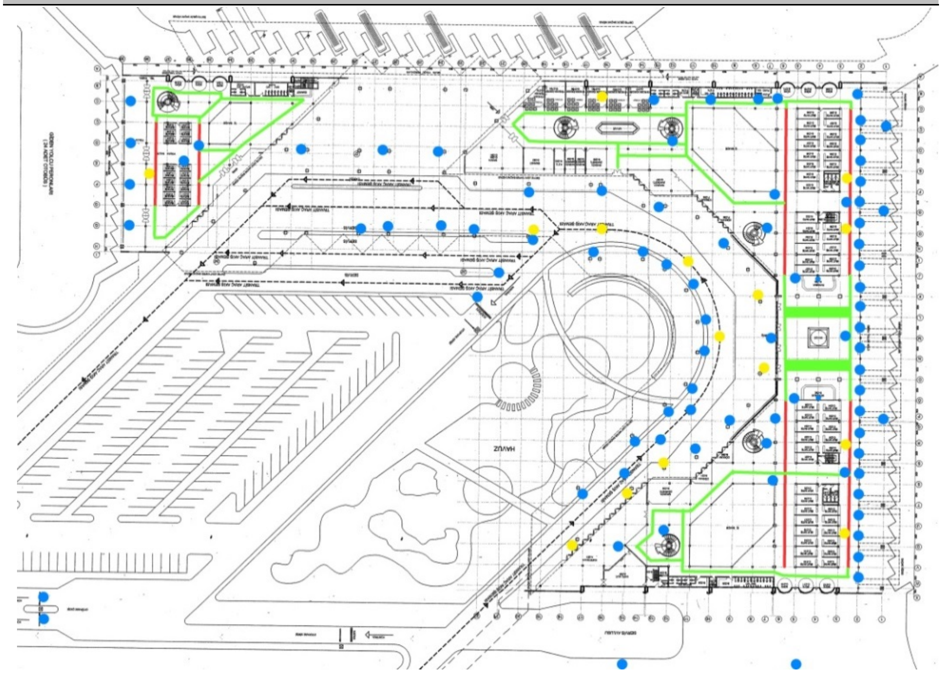
Information and guidance designs can be classified as stationary, moving, and interactive signage systems. Stationary signage systems are the most used forms of information. As printed graphics, user interaction is limited to seeing and reading only. Motion graphics are systems that present information on a screen in a certain amount of time. Examples of these systems include digital clocks or passenger information monitors that provide routing. Interactive infographics are systems that can present information, visuals, and control over visual thinking to the reader digitally and with the interaction of the user.

In this context, when the information and guidance elements of the Antalya bus station were examined, it was determined that stationary/static signage systems were mostly used. In the bus station building, there was no information element other than the digital signs hanging on the ceiling plane and the bus departure times as a moving information element. There is no interactive information or guidance staff in the bus station building (Figure 4). In the bus station building, it was found that information elements were mostly used within the scope of the ground floor where circulation is the most intense. Within the scope of the first floor, it was found that some of the technical spaces and management venues were not used, and these places were informed and guided over the ground floor. In this context, the information and routing elements of the bus station building were examined within the scope of the ground floor.

Figure 4. Antalya bus station moving signage systems (Original, 2022)

There is an information and guidance system that serves 3 different purposes in the bus station building. The first of these are the signs that provide the direction of the space inside and outside the building, the second is the company signs that define the ticket sales/office spaces, and the third is the information and warning signage systems that provide information in case of a mandatory or emergency inside and outside the existing building (Table 3).

Table 3. Location of Antalya Bus Station Information and Guidance Staff

Location of Signs in Ground Floor Layout	
	
Signs for Location/Location Orientation	Circulation Areas
Ticket Sales/Office Signs	Information and Warning Signs

In this part of the study, the information and guidance staff at Antalya Bus Station are discussed through three headings. Since the information and guidance elements examined in this direction provide in-building and out-of-structure orientation, the visual aesthetic quality of these elements in spatial organization and information design was analyzed within the scope of design components and user opinions determined in the context of the existing literature.

The information and guidance elements in Antalya bus station were examined within the scope of compliance with the design components; The positive and negative aspects of signage systems in terms of structural compatibility, perceptibility-readability, functionality, and aesthetic quality have been determined. In this context, in the first stage of the study, 20 departing passengers, 6 company employees, and 3 business managers were interviewed using a semi-structured interview technique. In the selection of the interviewed users in line with the semi-structured interview technique; Company employees and managers, who are the people who could experience the existing structure the most, as well as departing passengers waiting along the 1st and 20th Platforms were preferred.

In the oral interview conducted within the scope of the research, users were asked questions directly about the signs that could be seen

DOI: 10.15320/ICONARP.2022.227

from their location, and about the signs that could not be seen, about the design elements given in Table 4 through the marked places in the plan of the building and the printed photographs. In line with the oral interviews, user opinions for design elements and basic design principles affecting the visual aesthetic quality of these elements were used in the description-based analysis of signage systems.

Table 4. Interview questions for the evaluation of signage designs within the scope of design elements

Font Element
• Do you find the writing on the signs readable and perceptible?
• Do you find the fonts on the signs appropriate?
Color Element
• Do you find the color of the signs generally appropriate and compatible with the space?
• Do you find the color of the signs perceptible?
Form and Material Element
• Do you find the shapes, sizes, and materials used for the signs appropriate? If there are elements you find inappropriate, what are they?
Location Selection and Positioning
• Do you find the positions and positions of the signs correct?
• Are the signs placed frequently enough where necessary?
Relevance to space
• Do you find the signs placed suitably for the place in general?

Within the scope of the interview data obtained in the second phase of the study, signage systems were evaluated by descriptive analysis in the context of design elements and design principles as information-guidance design components determined in the existing literature.

Evaluation of Signage for Space/Place Orientation

The signs for spatial orientation in the bus station structure are generally the signs showing the entrance and transportation directions of the space, emergency exit and meeting places, platform-box office locations, and numbers in the interior space. On the exterior of the building, there are sign systems showing vehicle traffic regulations, entry-exit, and parking-tram transportation.

When the signs for in-building and out-of-building space/place orientation were examined, 11 different types of use were identified (Table 5). Signage systems are classified within the scope of their intended use and formal qualities. When these signage systems are evaluated within the scope of design elements-principles determined in the context of the literature and user opinions for the existing signs.

Table 5. Examination of signs for space/place orientation in the context of design components

Signs for Location/Location Orientation					
TYPE 1	**TYPE 2**	**TYPE 3**	**TYPE 4**	**TYPE 5**	**TYPE 6**
					
TYPE 7	**TYPE 8**	**TYPE 9**	**TYPE 10**	**TYPE 11**	
					

Design Elements	**Explanation**
Font-Typography	The signs used in the orientation of the venue generally do not have a specific writing form and size. However, the many repeating plates 1,2,4 5,8,9, and 10 both in the interior of the building and outside the structure have a certain font and size consistent in themselves.
Color	The signs used in the space orientation do not have a general color wity. However, a large number of repeating platform numbers, routing signs, and types of signs indicating box office queues have a certain standard color consistent in themselves.
Forming Usage	Certain standard forms were used in the repetitive signs; forms in the form of arrows were selected on the exterior direction signs, rectangular forms were selected in the direction and place name signs in the interior, circular forms were selected in the platform numbers and a three-dimensional rectangular prism-shaped form was selected in the box office sequence numbers.
Material Usage	The signs used in the space orientation are mostly made of metal materials painted in matte colors, and some of them are made of plastic materials.
Relevance to space	Blue type 1 signs, which contrast with the cream color used mainly in the interior and are used with firmness, and circular labels showing platform numbers are suitable for the space with their font, color, form, and material components. However, portable and yellow signs (type 3 and type 7) are not suitable for space because they do not provide linguistic unity and integrity with blue-colored signs used mainly in spatial orientation and weaken perception.
Positioning	The places where the signs are positioned are generally the right places that can be easily detected by the user.
Design Principles	**Explanation**
Order-Hierarchy	The signs pointing to the neighborhoods, platforms, emergency exits, assembly areas, and toll booths within the building and regulating the traffic outside the building, and directing it to the tram line are in a sequential and repeating order.
Balance	Although each sign group has a balance within itself, there is generally no linguistic unity.
Contrast	The signs in type 1 and type 4 groups provide the principle of contrast with the color contrast they create in the space, and the signs in the type 5 group provide the principle of contrast with their circular forms located in a gridal façade layout. However, it cannot be said that the principle of opposition is provided in other signs.
Ratio-Proportion	All types of signage have proportions that can be perceived and noticed within the space.
Weighing (Rhythm)	The platform, the signs indicating the toll booth numbers, and the traffic regulatory signs are repeated on a certain line and the venue

DOI: 10.15320/ICONARP.2022.227

	direction signs are repeated in a regular rhythm at the intersection points of the structure.
Integrity / Unity	Different types of signage groups show integrity in color, font, and size, but they do not show integrity with each other.
Emphasis-Focus	The focal point of the signs in the Type 1 group is the color contrasts of the signs both within themselves and with the space in general. The focus of Type 5, 10, and 11 signs is the rhythmic repetition of the signs. The focus of type 2 and type 9 signs is their location. It is not possible to speak of a focal point for other types.
Continuity	Signs that are located in various positions in groups or that repeat in certain rows are continuous in themselves. However, it cannot be said that the different types of signs used in the building form a linguistic unity or are continuous.

Although the signs for the space/place orientation used in the Antalya Bus Station structure do not provide a complete language unity, it is seen that the principles to strengthen the user perception are followed in terms of font, color, texture, form, size, material selection and positioning of the signs in general. The fonts and sizes used in the signs, the contrast created by the space where the sign is located and the background colors of the font colors and the symmetrical and repetitive placement of the signs at the necessary points, and the material choices are the design elements and principles that strengthen the user perception.

In the interviews with the users, the main problems identified within the scope of the design components in the signage systems are the orientation of the bus waiting areas as the main transportation places, the bus platform numbers, and especially the inadequacy of the signs that guide the ticket sales venues in terms of readability and perceptibility (Figure 5).

Figure 5. Antalya bus station entrance hall, placement of toll booths, and box office direction sign (Original, 2022)

In the interviews with the users, it was generally taken that the writings used in the space direction signs were in the appropriate style and readable sizes and that the sign's colors and sizes were easily noticeable. However, 18 outgoing passengers, 6 company employees, and 2 business managers stated that the materials and colors used in the signs should be updated by today's technology. In the interviews, 15 departing passengers, 4 company employees, and 3 business managers found the places where the signs were placed generally appropriate. However, it has been reported that the placement angle of the signboards at some points makes it difficult to perceive the writings texts and becomes perceptible and readable only when they get close (Figure 6).

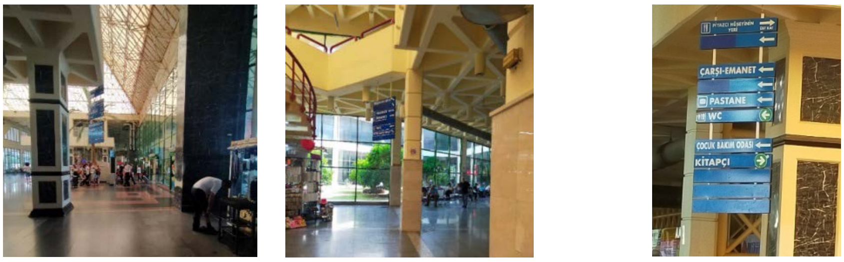


Figure 6. Angled orientation signs (Original, 2022)

Evaluation of Signs in Ticket Sales / Office Spaces

There are 2 different types of ticket sales and office signs in the bus station building, as signs indicating the toll booths and numbers of different travel companies. The signage systems of the bus companies are located on the upper part of the office spaces planned in the building, and the toll booth numbers that define these offices are located on the ceiling plane of the ground floor circulation areas. When these signage systems are evaluated within the scope of design elements-principles determined in the context of the existing literature and user opinions on the existing signboards (Table 6).

Table 6. Examination of Ticket Sales / Office signboards in the context of design components

Ticket Sales / Office Signs	
TYPE 1	**TYPE 2**
	
Design Elements	**Explanation**
Font-Typography	Type 1 signs are a group of signs that repeat regularly and indicate toll booth numbers and have a specific font. Type 2 signage, on the other hand, is the signboard of each travel company that is unique to itself, so a specific font cannot be mentioned in them either.
Color	There is no color integrity in ticket sales and office signs.
Forming Usage	Ticket sales and office signs are designed in standard sizes. Signs are generally rectangular in shape, in harmony with the area they are in. The signs showing the box office numbers are in the form of cubes, with writing on all four sides.
Material Usage	There is no standard material usage. Type 1 group signs are made of a semi-transparent material to allow the use of light. Type 2 group signs, on the other hand, are made of white, matte-colored plastic material.
Relevance to space	These signs are suitable for the place physically and functionally in terms of their location, size, and color.

DOI: 10.15320/ICONARP.2022.227

Positioning	Type 1 and type 2 group signs are located behind the box office in a position that can be easily detected and read.

Design Principles	**Explanation**
Order-Hierarchy	Type 1 and type 2 signs have a regular and repeating pattern.
Balance	Although each sign type has a balance in terms of form, color, and size, a general unity has not been achieved.
Contrast	The principle of color contrast is seen in Type 2 signs, whereas in other signs, a general contrast principle in terms of color and form is not seen.
Ratio-Proportion	Signs of each type have easily detectable proportions in the space.
Weighing (Rythm)	Type1 and type 2 group signs are placed in a certain rhytm following the box office rows.
Integrity-Unity	Although type 1 and type 2 group signboards show integrity in terms of form and size, there is no integrity and unity in terms of color and texture in general, and there is no integrity between different signage types.
Emphasis-Focus	The location of ticket sales and office signs constitute the focal points.
Continuity	Type 1 and Type 2 signs are continuous along the rows of toll booths.

Although the use of different signboards by travel companies prevents the establishment of language unity, the standard sizes, positioning styles, proportions in the space, and rhythmic repetitions on the signs are design elements that strengthen the perception of the user. Within the scope of design components, it is seen that the use of blue color within the framework of company signboards in terms of visual aesthetics provides integrity and emphasis in terms of suitability for the space. It has been determined that the use of characters and their position in terms of typography in the signage system, which defines the box office numbers classified as Type 2, are difficult to understand for the passengers and their perceptibility is low. Although the signage positions are in the right places in terms of location selection, which is an important element, it has been determined that their design qualities are low within the scope of design principles.

In the verbal interviews with business employees, managers, and passengers, users stated that; the box office signs which have different colors and graphics, which are unique for each company, increases the distinguishability of the signboards and they find this signage group appropriate in this respect. Among the users, 8 departing passengers, 6 company employees, and 3 business managers found the illuminated systems, materials, dimensions, and sign positions used in the signs appropriate (Figure 7).

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

Figure 7. Placement and layout of travel companies' signs in the space (Original, 2022)

However, 12 users stated that they wanted to see the information board and office signs together so that it would be easier for them to decide where to buy tickets and head there. This view of the passengers from among the users shows the importance of the information conveyed to the user and the importance of the visual integration between the spaces to guide the user. In the verbal interviews, it was stated that 18 outgoing passengers had difficulty in finding the travel company they were looking for, but it was concluded that, rather than the inadequacy of the signboards, this situation was because the box office is in a fragmented structure and its location in the building does not provide visual contact with the main entrance of the building, rather than the inadequacy of the signboards. In this context, passenger usage experience shows that architectural design decisions in signage systems constitute an important factor in the user's perception and orientation of the space.

Evaluation of Information and Warning Signs

9 types of signage systems have been identified that are placed inside and outside the Antalya bus station structure to inform the user of the rules and prohibitions, to convey information such as price tariffs and bus departure times to the user, and to convey the necessary warnings for the safety of the passengers. When these signage systems are evaluated within the scope of user experiences and design elements-principles determined in the context of the existing literature and user views on the existing signage (Table 7).

The information and warning signs used in the Antalya Bus Terminal building are basically placed to regulate vehicle traffic and to inform the users about the rules valid in and around the building, as well as the timetables and service tariffs. The forms and fonts of the signs do not constitute linguistic integrity. However, the chosen red text color and the predominantly used white background create contrast and strengthen the visibility of the signs and strengthen the perception that the red texts in and around the building are important warning and information signs for the user (Figure 8).

DOI: 10.15320/ICONARP.2022.227

Table 7. Examination of Information and Warning signs in the context of design components

Information and Warning Signs

TYPE 1

TYPE 2

TYPE 3

TYPE 4

TYPE 5

TYPE 6

TYPE 7

TYPE 8

TYPE 9

Design Elements	Explanation
Font-Typography	Due to the variety of information and warning signs used, it is not possible to talk about a general font typology. Although a standard font style and size have not been determined on the signs placed by the bus station management, the red text on a white background partially provides unity.
Color	It is seen that the color red is predominantly used in the warning and information signs used. While a white background is used in static signs to increase the visibility of the text, a black background is used in the illuminated information sign (Type 7) to highlight the text. The colors are used to strengthen the user perception by creating contrast both with the space and within the sign itself.
Forming Usage	The signs are designed in rectangular forms by the area in which they are generally used.
Material Usage	Information and warning signs are generally made of metal or plastic and painted with matte paint. Type 7 signage, on the other hand, is produced from the glass, plastic, and metal materials required by digital signage.
Relevance to space	Information and warning signs are suitable for the space with the generally used color, font, and form components.
Positioning	Information and warning signs are positioned where necessary and can be easily seen by the user.
Design Principles	**Explanation**
Order-Hierarchy	Generally, the signs at one or two points in certain parts of the structure are positioned in the best way to be seen, but there is no specific order.
Balance	When the warning signs and information signs are considered as groups separately, it can be said that they have a balance in terms of form, color, and size, but no language unity was provided in the warning and information signs.
Contrast	The red text and white background colors of the information signs provide the principle of contradiction both in the place where they are used and in their designs. The same contrast principle is also for the blue-weighted colors of warning signs.
Ratio-Proportion	Each type of sign has easily perceived rates in the space.
Weighing (Rythm)	There is no specific rhythm in the signs in this group.
Integrity-Unity	Warning and information signs are designed using certain colors

	and in rectangular forms. However, in general, there is no unity and integrity in terms of color, size, and texture.
Emphasis-Focus	Warning and information signs are positioned in the main entrance and gathering places, which are used most frequently by users, and are designed using colors that will strengthen their perception. In this sense, it can be said that the focal point of the signs in this group is visibility.
Continuity	These signs, which are mostly single at certain points, are not continuous.

Figure 8. Examples of Warning and Information Signage Elements (Original, 2022)

However, during the interview with 6 company employees, it was learned that the board (Type 6) that provided information about the departure times was quite inadequate and that the passengers generally learned the departure times by asking the company workers. The general opinion of the users is that the information and warning signs are sufficient to fulfill their functions, but the signs do not create a united language and they are not suitable for the bus station of a metropolis like Antalya, do not have aesthetic value and are far behind the contemporary technologies.

RESULTS

In today's conditions, with the increase in the need for information and being informed, the concept of information and guidance design has emerged, and the importance of information systems has increased. Especially with the needs of modern life, the design of information elements in the discipline of architecture emerges as an important design component. In this respect, in cases where information and guidance elements are missing and insufficient, the public spaces planned by the designers as intensive-use areas may become visually negative and functionally inadequate because they do not involve information reflecting urban identity. The fact that information and orientation designs of the public buildings built in the past were also designed within the technological possibilities of the past period, results in the inability of the existing information and guidance systems for responding to contemporary requirements therefore, examining the design of the past from today's perspectives becomes important during the identification of the above-mentioned inadequacy.

When studies on information and guidance design in our country and different cities of the world are examined, it is seen that there are insufficient studies for bus station structures in public space use, although there are studies on the design of these elements. In this

DOI: 10.15320/ICONARP.2022.227

context, it is seen that there should be design systems in bus station structures that are suitable for the urban identity and design elements and principles as design components, for being able to inform and direct users easily. Information and guidance element designs in bus station structures; It is concluded that besides their role as informational elements that indicate where users are located and where they want to reach, informing and directing elements in the bus stations become important design elements that contribute to the space in terms of functional, formal, and aesthetic value.

While designing information and guidance signs, it has been determined that elements such as color, material, font typography, and suitability for the space, including all design principles, are important in terms of visual aesthetics and these elements should be considered in the design, considering the characteristics of the spaces used in the bus station and the users. In this direction, it has been determined that the information and guidance element designs in Antalya Bus Station are not sufficient in terms of both visual and functional aspects within the scope of design components. It is thought that most of the signboards in the bus station structure are designed without considering different types and design components, and they do not give an identity to the bus station space and to the city.

When the user opinions on the design components of the information and guidance elements in the Antalya bus station building are examined, the opinion that the signage systems are insufficient in terms of perceptibility and readability comes to the fore. It is possible to state that the use of different colors and forms in terms of visual aesthetics in existing signage systems; does not allow the user to access information easily, causing a shift in perception levels and not being memorable.

It has been determined that the user evaluations made in terms of visual aesthetic quality are only about the use of color and material, and most evaluations are made for functional solutions. In this context, it is seen that in the design of signage systems, functional solution proposals are kept in the foreground in terms of the designer's view and user profile, while aesthetic elements as design components are secondary.

It is seen that the result of the descriptive analysis made within the scope of the determined design elements and principles of the existing signage systems are parallel with the user impressions. The signs used are suitable for their functions with their positioning, sizes, font sizes, and forms. However, it can be said that design elements such as font and size, color, size, and the material do not show integrity, and design principles are completely ignored. In this sense, it is possible to say that these signboards were made without aesthetic concerns, only to respond to the function.

Information and guidance elements, which the users come across in places such as bus terminals, airports, and stations where there is a lively usage environment, inform and guide people who encounter them while making a significant contribution to their aesthetic appreciation

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

levels. For this reason, researchers and designers must conduct examinations and evaluations in these areas; It is thought that it will both provide functional conveniences to the transportation spaces in public use and contribute to the development of the aesthetic appreciation levels of the users.

REFERENCES

Akaydın E. Ö. ve Canbay, T. Ç. (2018), İşlevsel Dönüşüme Uğramış Yapılarda Ergonomi Kavramı; Üsküdar Nevmekan Örnek İncelemesi. Mühendislik Bilimleri ve Tasarım Dergisi, Cilt 6, s. 279 – 292.

Ambrose, G. and Harris, P. (2014). Grafik Tasarım Temelleri: Grafik Tasarımda Izgaralar. İstanbul: Literatür Yayınları.

Ambrose, G. and Harris, P. (2019). Görsel Grafik Tasarım Sözlüğü. İstanbul: Literatür Yayınları.

Ay, Ş. (2021). Bilgilendirme ve Yönlendirme Tasarımı Bağlamında Otogar Grafikleri ve Bir Uygulama. Yüksek Lisans Tezi. Hacettepe Üniversitesi, Güzel Sanatlar Fakültesi, Grafik Anasanat Dalı. Ankara.

Baer, K. (2008). Information Design Workbook: Graphic Approaches, Solutions, and Inspiration + 30 Case Studies. US: Rockport Publishers.

Becer, E. (2019). İletişim ve Grafik Tasarım. Ankara: Dost Kitabevi Yayınları.

Bringhurst, R. (2001). The Elements of Typographic Style. Canada: Hartley & Marks Publishers.

Bulut, D. M. ve Uslu, Ö. (2017). Mekân Tasarımında Bilgilendirme ve Yönlendirme Elemanlarının İncelenmesi. Forum Mersin Örneği. İdil Dergisi, 6(37). 2557-2579.

Calori, C. and Vanden-Eynden, D. (2015). Signage and Wayfinding Design: A Complete Guide to Creating Environmental Graphic Design Systems. New Jersey: John Wiley & Sons Inc.

Codur, M. B. (2010). Tematik Mekân Düzenlemelerinde Grafik Tasarım Uygulamaları. Sanatta Yeterlilik Tezi. Hacettepe Üniversitesi, Sosyal Bilimler Enstitüsü, Grafik Anasanat Dalı. Ankara.

Crnokrak, P. (2008). Feature: Signs of the Times: Infographics. IDN – International Designers Networks Magazine, 15, 23-25.

Dinek, Ö., Arı, T., Şahin, C., ve Bilirdönmez, K. (2017). Tasarımda Renk ve Subliminal Mesajların Etkileri. 2. Uluslararası Basım Teknolojileri Sempozyumu. ss. 257-271.

Dur, U. İ. B. (2011), Bilgilendirme Tasarımında İlkeler, Öğeler ve Uygulama Sorunları "Bilgilendirme Tasarımı Uygulaması". (Yayınlanmış Sanatta Yeterlilik Tezi). Hacettepe Üniversitesi, Sosyal Bilimler Enstitüsü, Grafik Ana sanat Dalı. Ankara.

Durukan, A., Bekar, İ. ve Ertaş, Ş. (2020) KTÜ Faik Ahmet Barutçu Kütüphanesi'nin İşaret ve Yönlendirme Tasarımı Bileşenlerinin Tespiti. Akademik Sosyal Araştırmalar Dergisi. 8(108):404-417

Ermiş, S. (2012). Grafik Tasarım İlkelerinin Öğretiminde Etkileşimli CD'ye Dayalı Tasarım Programının Öğrencilerin Başarısına Etkisi. Yüksek Lisans Tezi. Gazi Üniversitesi, Eğitim Bilimleri Enstitüsü, Resim-İş Eğitimi Anabilim Dalı. Ankara.

Ertaş, Ş. (2012), Çocuk ve Spor İlişkisi Üzerine Fiziksel Biçimlenmeyi Etkileyen Ergonomik Faktörlere Dayalı Bir Model. Karadeniz Teknik Üniversitesi, Fen Bilimleri Enstitüsü, Doktora Tezi, Trabzon.

DOI: 10.15320/ICONARP.2022.227

Felici, J. (2003). The Complete Manual of Typography A Guide to Setting Perfect Type. Berkeley: Peachpit Press.

Fişenk, H. (2012). Yönlendirme Dizgelerinde Yerleşke Kimliğine Uygunluk ve Grafik Tasarım Sorunları: Ankara İli Çankaya İlçesi Kızılay Mahallesi İçin Yönlendirme Dizgesi Tasarımı. Sanatta Yeterlilik Tezi. Hacettepe Üniversitesi, Sosyal Bilimler Enstitüsü, Grafik Ana sanat Dalı. Ankara.

Galindo, M. (2012). Signage Design. Berlin: Braun Publishing.

Gibson, D. (2009). The Wayfinding Handbook / Information Design For Public Places. New York: Princeton Architectural Press.

Güler, T. (2008). Grafik Tasarımda Yeni Bir Alan: Bilgilendirme Tasarımı ve Bir Uygulama. Sanatta Yeterlilik Tezi. Dokuz Eylül Üniversitesi, Güzel Sanatlar Fakültesi, Grafik Anasanat Dalı. İzmir.

Hazan, Y. (2021). 2021 December. The architecture of the bus station is taken from a personal interview with Yakup Hazan.

Irmak, O. (2009) Bilgilendirme Tasarımı: Profesyonellerden Görüşler. Grafik Tasarım Dergisi, 28, 80.

Irwin, T. (2002) Information Design: What is it and Who does it? https://www.yumpu.com/en/document/view/42242225/information-design-what-is-it-andwho-does-it-by-terry-irwin. (Erişim Tarihi 2 Haziran 2022)

İtez, Ö. (1996). https://www.arkitera.com/proje/antalya-sehirlerarasi-otobus-terminali/. (Erişim Tarihi 2 Haziran 2022).

Karaalioğlu, S. (2015). Görsel Kültürde Bilgilendirme Tasarımı Ürünleri: Üniversite Kampüsleri. The Turkish Online Journal of Design, Art and Communication. 4(5), 87-97.

Keskin, S. (2017). Sağlık Sektöründe Kullanılan Bilgilendirme Grafiklerinin Görsel Göstergebilim Açısından İncelenmesi ve Bir Uygulama. (Yüksek Lisans Tezi). Hacettepe Üniversitesi. Ankara.

Lidwell, W., Holden, K., and Butler, J. (2010). Universal Principles of Design. United States of America: Rockport.

Lupton, E. (2006). The Birth of the User. Looking Closer 5. s. 23-25. NY: Allworth Press.

Makal, E. (2009). Bilgilendirme Tasarımı: Profesyonellerden Görüşler. Grafik Tasarım Dergisi, 28, 84.

Odabaşı, A. H. (2002). Grafik'te Temel Tasarım. İstanbul: Yorum Sanat Yayınları.

Okcu, B. (2007). Dış Mekânda Grafik Tasarım Uygulamaları ve Hacettepe Üniversitesi Şenlikleri için Bir Öneri. Hacettepe Üniversitesi, Sosyal Bilimler Enstitüsü, Grafik Ana sanat Dalı. Ankara.

Original (2022). It was obtained within the scope of fieldwork.

Öztuna, Y. H. (2007). Görsel İletişimde Temel Tasarım. İstanbul: Tibyan Yayıncılık.

Sağocak, M. (2005). Ergonomik Tasarımda Renk. Trakya Üniversitesi Fen Bilimleri Dergisi, 6(1). 77-83.

Sayın, S. (2018). Hareketli Bilgilendirme Tasarımı ve Bir Uygulama. (Sanatta Yeterlilik Tezi). Hacettepe Üniversitesi, Güzel Sanatlar Enstitüsü, Grafik Ana sanat Dalı. Ankara.

Sayın, Z. (2021). Grafik Tasarımda Etki: Görsel İletişimde Etki Uygulamaları. Ankara: Pegem Akademi. 2. Baskı.

Sayın, Z., Bulduk B. Ve Songür Dağ E. (2009). Kentlerin Bilgilendirici ve Yönlendirici Göstergeleri: Tabelalar. H. Ü. Güzel Sanatlar Fakültesi IX. Ulusal Sanat Sempozyumu "Kamusal Alanda Sanat" Bildiriler Kitabı, Ankara. ss. 213-223.

Schofer, J. L. (2020). Mass Transit. http://global.britannica.com/EBchecked/topic/368374/mass-transit. (Erişim Tarihi 2 Haziran 2022)

Segalini, A. (2009). Bilgilendirme Tasarımı: Profesyonellerden Görüşler. Ö. Durmaz (Ed.) (E. Say, Ö. Durmaz, Çev.) Grafik Tasarım Dergisi, 28, 85.

Spiekermann, E. (2009). Bilgilendirme Tasarımı. Ö. Durmaz (Ed.) (E. Say Çev.). Grafik Tasarım Dergisi, 28, s. 44-45.

Taşçıoğlu, M. ve Erdoğan A. D. (2015). Grafik Tasarımın Bilgilendirme ve Yönlendirme Tasarımındaki Rolü ve Londra-Eskişehir Örneklemi Üzerinden Bir İnceleme. Anadolu Üniversitesi Sanat ve Tasarım Dergisi, 5(2), 227-245.

TDK. https://sozluk.gov.tr/. (Erişim Tarihi 2 Haziran 2022).

Topaklı, A. ve Nas, E. (2019), Sinop İli Yönlendirme ve İşaretleme Tasarımları Üzerine Bir Değerlendirme, Ulakbilge Sosyal Bilimler Dergisi, 37, 429-448.

Uçar, T. F. (2019). Görsel İletişim ve Grafik Tasarım. Ankara: İnkılap Kitapevi.

Uebele, A. (2007). Signage Systems + Information Graphics. Londra: Thames & Hudson.

URL 1. Antalya Şehirler Arası Otobüs Terminali. https://www.arkitera.com/proje/antalya-sehirlerarasi-otobus-terminali/. (Erişim Tarihi 2 Haziran 2022).

Vignelli, M. (2009). Bilgilendirme Tasarımı Dosyası. Ö. Durmaz (Ed.) (E. Say Çev.). Grafik Tasarım Dergisi, 28, 56-60.

Wyman, L. (2009). Yönlendirme Sistemleri. Grafik Tasarım Dergisi, 28, 68-77.

Resume

Mikail Açıkel, graduated from Karadeniz Technical University, Faculty of Architecture, Department of Interior Architecture in 2014. He completed his master's degree at Akdeniz University Faculty of Architecture in 2019. He still works as a research assistant at the same university and continues his doctoral studies.

Yavuz Bahadır Certel, Yavuz Bahadır CERTEL graduated from Ankara Gazi University, Faculty of Architecture, Department of Architecture in 2012. He worked in various project offices and international construction projects for seven years. In 2019, he completed his master's degree at Süleyman Demirel University. Since 2022, he has been working as research assistant at Akdeniz University Faculty of Architecture and continues his doctoral studies.

İbrahim Bakir, graduated from Konya State Engineering and Architectural Academy in 1980. Between 1980-1983, he worked as the director of development in Bucak Municipality. He started his academic career as a research assistant at Selçuk University in 1983. He completed his master's degree in 1986. He earned his doctorate degree with dissertation that was titled "An Essay for Solving the Problems of Settlement and Space of the Western Taurus Nomads" in 1996. He continues his academic career at Akdeniz University, Faculty of Architecture, department of Architecture.

Hacer Mutlu Danaci, graduated from Yıldız Technical University (YTU) Architectural Department in Istanbul in 1993. She gained a wide range of expensive while working on architectural projects for several offices specializing in general architecture and interior design. She benefited from the experience, acquired when she opened her own architectural office in 1999. She started her Master's education in 2004, studying Landscape Planning at Yıldız Technical University and, transferred to Akdeniz University in 2004, and was awarded her MA in 2007 in visual analysis and environmental aesthetics and, awarded her PhD in 2012 in the cultural landscape and vernacular architecture. In 2005, she was

DOI: 10.15320/ICONARP.2022.227

educated in Belgium at the "Erasmushogeschool, Environment and Garden Landscape Architecture. She is still studying in the architectural department at Akdeniz University. She has a lot of articles about architectural education, visual analysis, environmental aesthetic, ecology and nanotechnology, cultural landscape and vernacular architecture.

Kemal Reha Kavas, Received his B.Arch (2002) and M.Arch (2005) degrees from the Department of Architecture at METU (Middle East Technical University), his Ph.D. in History of Architecture from METU in 2009. Received the 2009 "Thesis of the Year Award" by Prof. Dr. Mustafa N. Parlar Association for Education and Research. Currently works as professor at Akdeniz University Faculty of Architecture in Antalya. Major research interests include theory and historiography of architecture, environmental aesthetics and vernacular architecture.

Research Article

ICONARP
International Journal of Architecture and Planning
Received: 29.04.2022 Accepted: 09.12.2022
Volume 10, Issue 2/ Published: 20.12.2022
DOI: 10.15320/ICONARP.2022.228 E- ISSN:2147-9380

ICONARP

Completely Accessibility Solutions for Historical Building and Areas in the Multi-Layered City Center of Sivas

Mehmet Akif Çelimli*
Murat Oral**

Abstract

The study's major objective is to demonstrate that historical structures and locations are completely accessible to all people. While the required architectural modifications are performed in historic buildings and locations, they are intended to provide suitable solutions for everyone, not just a particular impaired group. The goal is to identify architectural alternatives that can be quickly implemented while preserving the original values. Individual and in-depth interviews with people with disabilities were done using questionnaire, interview and observational procedures. Successful examples from across the globe were scanned using scanning and descriptive techniques and project data were then examined and compared. The connected, comfortable, convenient, convivial, and prominent (5C) characteristics from the LPAC London Strategy were taken into account in Sivas city's monitoring and spatial analytic methodologies. Projects for architectural applications were created and technical data and solution suggestions were given using the original methodology while maintaining the integrity of the architectural language. It was shown that enhancing the accessibility of historical structures and locations has an impact on how many handicapped people participate in cultural events. Making historical structures and locations completely accessible would enhance the city's identity. The historical structure and setting are more accessible thanks to thoughtful and appropriate design arrangements. The architectural modifications necessary to enable complete accessibility may also be done to old structures and locations. Without compromising the texture, it is feasible to make historical and protected buildings accessible. The discussion environment, physical interference sensitivities in registered monuments, consideration of the needs of numerous different disability groups in the design of architectural arrangements, difficulties in correctly and effectively communicating with disabled people, and ethical sensitivities all contribute to the study's limitations. The research influenced designers to raise awareness of the need to make our surroundings more accessible. Additionally, field research was done in five particular Sivas buildings with people who are orthopedically, visually, or both. And as a result, the ability to build user-oriented solutions has been established. The unique significance of the research lies in its richness in addressing the concerns of appropriate intervention to registered structures while simultaneously taking into account the balance of preservation and usage in historical buildings and places with the topic of universal design. The research is also a thorough paper on the subject of duties resulting from legal requirements. It may be the first study in the literature to thoroughly examine architectural choices made to promote future research by increasing awareness of the accessibility of historic sites and structures.

Keywords: *Accessibility, Universal design, Historical building and areas, Disability rights.*

* Konya Technical University, Faculty of Architecture, Department of Architecture, Konya, Türkiye. (*Corresponding author*)
Email: macelimlil@gmail.com

**Konya Technical University, Faculty of Architecture, Department of İnterior Architecture, Konya, Türkiye
Email: moral@ktun.edu.tr

To cite this article: Çelimli, M. A., Oral M. (2022). Completely Accessibility Solutions for Historical Building and Areas in The Multi-Layered City Center of Sivas. *ICONARP International Journal of Architecture and Planning,* 10 (2), 891-915. DOI: 10.15320/ICONARP.2022.228

INTRODUCTION

The average life expectancy of individuals has improved recently, along with technical advancements, as a consequence of successful medical research. Due to this circumstance, there are now older individuals overall, which has led to a rise in the prevalence of the age-related disabilities. According to study conducted by the UN Department of Economic and Social Relations in 2019, 12% of the world's population is already old, with that number expected to rise to 35% by 2050. (United Nations Department of Economic and Social Affairs, 2019). According to research done in our nation in 2020 by the Turkish Statistical Institute (TSI), the number of persons 65 and older—those who are deemed to be part of the senior population—rose by 22.5% over the previous five years, from 6,495,239 in 2015 to 7,953,555 in 2020. From 8.2% in 2015 to 9.5% in 2020, the old population's share of the overall population grew (TÜİK, 2020). In accordance with universal design principles, architectural arrangements for everyone have the potential to improve the quality of life for various handicap groups, who make up a significant portion of society according to the study. The arrangements for everyone will fulfill the demands of a sizable portion of society when taking into account the handicapped people and their families who are battling with them against the challenges present in the environment we live in.

According to the European Urban Charter, everyone has the right to freely and independently visit any area of the city in social life, regardless of their age, race, or physical or mental health. Persons with physical limitations have different demands from those of people without them when it comes to participating in urban life. It has been noted that people whose movement is limited as a result of a congenital condition or later handicap scenario tend to separate themselves from social life owing to the constraints of their living environment and inappropriate and insufficient behaviours. All people should be able to leave their houses alone and enjoy time outside equally and freely in order to participate fully in all aspects of public life. This will help us attain equality. Making the notion of "accessibility," which is one of the basic rights of every person in urban life, appropriate for the setting in which we live, is the first step in this context. It is seen a social ethical need as well as a legal requirement to apply architectural principles that allow all people, regardless of disability, to freely access any building or area of the city they want without help (Lee, 2005; Pothier, 2006).

Architectural practices that will enable people with disabilities to live with equal rights and standards in the context of participation in social life and daily life like everyone else have been made legal requirements with the "Number of 5378 Law on the Disabled" which entered into force in Turkey as of July 1, 2005. Even while the current rules are binding, it is nonetheless evident that our nation has not yet implemented punishments at the necessary degree.

The research focuses on Turkey's historical structures and locations that have accessibility issues. In our nation, public institutions are required by law to provide accessibility to public buildings within the parameters of the "Number of 5378 Law on the Disabled". This commitment also includes the need to conserve fields and cultural treasures. For those with impairments, accessibility to historic structures and locations is crucial. The topic of cultural and athletic events should be taken into account by those in charge of making decisions on how to improve the lives of those with disabilities.

DOI: 10.15320/ICONARP.2022.228

LITERATURE REVIEW

The study (Foster, 2004) emphasizes a special accessibility process for historical buildings, also contributes to the literature in terms of drawing attention to cost and legal processes. It argues that standard solutions are not possible when making historic buildings more accessible. Successful access plans differ in scope and approach. Also each structure needs special solutions resulting from its own special situation. It was examined through The M Certificate and the British 8300 Standard, which was guided by the standards but could not offer solutions. Other study (Braganca et. al., 2006) try to be expanded through different problems. Comparison and cost analysis ideas are noteworthy. Researchers examine the Guimaraes region of Portugal, which stands out for its long history. The historic site, which was awarded a Unesco World Heritage Site in 2001, is aimed at improving accessibility. In the study, user needs were determined and comparisons were made on two alternatives.

Plimmer and his friends attempted to determine a mental framework on the balance of conservation use of historical buildings (Plimmer et. al., 2006). Since 2004, cultural heritage sensitivities have emerged in ensuring the accessibility of legally guaranteed historic buildings in the United Kingdom. Although the accessibility of historical buildings is legally mandatory, the practical dimension of its possibility is questioned and it is significant that a framework of discussion is drawn up in order to deepen the issue.

Other research (Eric and Gardner, 2008), discusses the accessibility of cultural heritage buildings under the American Equal Opportunity Act and the Federal Disability Discrimination Act (DDA). Within the scope of the universal design, it is noted that strollers, couriers and furniture carriers, parents with children and people with disabilities will benefit from the regulations. In a similar study for a different region, the plan can be made more comprehensive by examining the section, perspective images and material details.

It is based on a guide prepared by the University of Teselya within the scope of the Cultural and Heritage Added Value to Regional Policies project for Tourism Sustainability in (Deffner et. al., 2015). Accessibility to cultural heritage is examined in three major headings; Physical accessibility, perceptual accessibility, and appropriate accessibility resulting from blending.

The research (Ask, 2015), examines that universal design in six major headings. Issues such as knowledge and expertise, building and construction, open spaces, outdoor recreation and cultural heritage areas, information and communication technology, transportation, business, industry and innovation in tourism are questioned together with the idea of universal design.

Other study (Srinurak et. al., 2016) conducts in the historic Chiang Mai region in northern Thailand. The aim of the study is to identify problems by conducting investigations in the context of accessibility and evacuation of the historical site in case of any disaster. With the Space Syntax method, the labyrinthine structure of the historical region was revealed and ideas on accessibility were developed.

Strategies for bringing disabled tourists to the country are examined within the scope of tourism, which has been identified as the sixth highest economic input of Malaysia’s economy researches in (Zahari et. al., 2016). It is on the importance of evaluating Malaysia's cultural heritage structures in the context of accessible tourism. The study mentions that restorations to make historic cities accessible in Northern Italy have not been carried out (Pretto, 2019). It is also revealed that it is possible to make the necessary architectural arrangements in a very short time and at cheap costs. Lynch and Proverbs discusses alternative accessibility solutions for situations where physical access is considered unreasonable. It develops a conceptual framework by showing that making historical structures accessible is complex and challenging (Lynch, 2019). It proposes to challenge arguments for preserving the historical texture and concludes that historic buildings exclude people with disabilities in (Diehl, 2022). Following the revised relationship between historical structure and accessibility, it aims to conceptualize historical structures as places of interesting experience for all. The paper is based on qualitative research conducted in Trento, a former Italian city. This study contains findings that norms and regulations related to conservation always prevail over regulations related to accessibility (Pretto, 2022).

THEORETIC FRAMEWORK: UNIVERSAL DESIGN WITHIN THE SETTING OF ARCHITECTURAL PROTECTION

Arguments for preserving historic sites and issues with preservation

Kevin Lynch attributes the significance of the historical environment that serves as the record of past life in public life in general to the fact that the adjunct circles in question enable people to look to the future in a secure manner and provide justifications for the continuation of life in his work on the place of historical process in the life of societies (Lynch, 1960). Historical structures provide environmental benefits, but they also directly shape how cities remember themselves. The idea of protection is a multifaceted phenomenon with a complicated structure made up of several diverse elements. With elements like purpose, technique, legislation, regulation, and application present everywhere in the globe, this phenomenon is becoming a more self-contained structure that is expanding. Preservation of cultural heritage does not include leaving the environment or building alone. It necessitates incorporating old sites and structures into modern life. He makes the case that it is feasible to exploit the potential of historical circles and to contribute to the urban life in which they are situated while outlining an active conservation of Akçura while assuring the long-term durability of cultural assets (Akçura, 1978). In this perspective, accessibility is one of the fundamental requirements for an active conservation philosophy.

The degree to which historical structures and places of civilizations are protected is a significant indicator of the level of progress. The founding of many cities was also heavily influenced by the historical structures and locations that play a key part in defining the original and genuine qualities of the city. Kuban clarified the requirements for claiming history; he describes the preservation of universal values—which bind individuals to the past and help them build their cultural identities—as a duty incumbent on civilized society (Kuban, 1998). A culture is seen as more civilized and advanced the more it works to

DOI: 10.15320/ICONARP.2022.228

preserve and pass on the architectural artefacts and goods created by earlier civilizations (Tapan, 1995). Conservation serves as a planning principle as well as a way of thinking that reflects humanity's progress and degree of development. In this subject, the topic of how to safeguard what is debated together with the need for intellectual accumulation, learning, and research (Günay, 2007). A building or place must meet certain criteria in order to be deemed a cultural asset. At various eras, different words are used to characterize these values. The issue of why a cultural institution should be conserved is addressed by these values, which are sometimes characterized as justification, other times as values, and yet other times as criteria.

The following causes are listed:

- Protection for the development of societies' cultural identities,
- Protection on account of aesthetic, architectural, artistic, and archival values,
- Protection in order to maintain the sociological, cultural, and historical values of civilizations at all times,
- Protection to maintain the built environment's changing processes and speeds under control (Yaldız, 2013).

Cultural assets must be conserved in order to understand the past, gain from experiences, draw conclusions about the future, and transmit it as a record to subsequent generations.

The modernization of civilizations' cultures occurs concurrently with the act of protection, which is seen as a contemporary and cultural action. Therefore, regardless of the time it was created, it should be kept to the best of technical ability if it has formal cultural value or improves aesthetically and functionally (Madran and Özgönül, 2005).

After high-speed trains begin operating in Sivas in 2022, a working region, new earning potential is created in the economic setting. The economic potential of the city will be considerably increased by the creation of accessible historical structures and locations in accordance with the universal design philosophy and holistic conservation strategy. The economic worth of cities rises along with the value of records, identities, and uses when cultural heritage is protected. The case for protecting historic sites and structures may be made in this context.

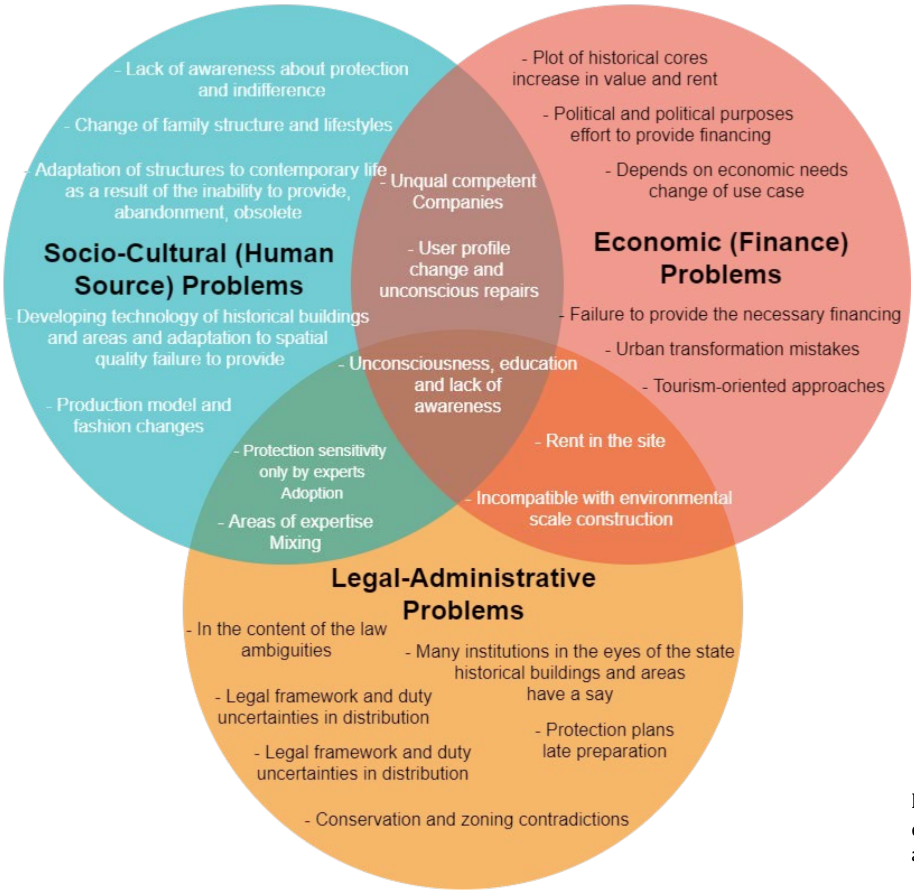


Figure 1. Problematic aspects in the conservation of historical buildings and places (Çelimli, 2022).

Concepts of Accessibility and Universal Design

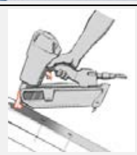
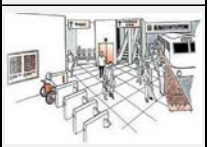
Kevin Lynch also asserts that residents of a well-designed city should be able to access other people, activities, services, and information at any time and in any location (Lynch, 1985; Ünver, 2015). In addition, the Universal Declaration of Human Rights and all other international agreements indicate unequivocally that all people are equal and should be able to enjoy social rights equally. From this point, every member of society has the right to equitable education, employment, health care, and participation in sports and cultural activities (Ünver, 2015).

The notion of accessibility may be defined as the ability to reach any location with a simple explanation. In reality, accessibility (reachability) is a technological factor (Iwarson and Stahl, 2003), which is an umbrella word affecting human activities in the built environment for all parameters. A well-designed urban environment is regarded to be liveable and readily accessible to everybody. Numerous urban planners strive to construct liveable cities today. Accessibility and human mobility were deemed to be the most important criteria in developing liveable cities (Evcil, 2009). Social theorists see accessibility as a prerequisite for membership in society (Kitchen and Law, 2001). In the United Nations Conventions, accessibility is also included as a guiding for urban design. Every public rule promotes equitable chances for everyone. The accessibility chain refers to the continuous accessibility of all structures and areas. Everyone may need to use open areas, such as health facilities,

DOI: 10.15320/ICONARP.2022.228

schools, public administrative structures, business structures, residences, sidewalk, parks, pedestrian crossings, which serve different purposes in the cities in which we reside, and the means of transportation that connect these areas at random times of the day. Therefore, it is insufficient if just a subset of the alternatives given be available. When considering the accessible chain for a visually impaired person, there should be sidewalk to be used until leaving the home and entering a public building, barrier-free crossing distances, audible warning signals at pedestrian crossings, arrival time information at public transportation stops and in-car location information announcements, curb tracking, and tactile surface applications. Each of these modifications is a link in the accessible chain, which is defined by these edits. In the event that one of these rings breaks, the whole chain disintegrates, i.e. (Erişilebilirlik Kılavuzu, 2020).

Table 1. Sampling and visual representation of Universal Design Principles (Assembled from Dostoğlu et. al., 2009 and Çepehan, 2020.)

UNIVERSAL DESIGN PRINCIPLES		
Policies	**Remarks**	**Examples**
1- Equitable Use	The design should be available to individuals with different levels of competence. Equal conditions should be provided in the design for different users. There should be no distinction between users, no user stigma. The rules regarding security and privacy should cover all users. The design should be of a nature that all users will like.	
2- Flexibility in Use	The design should cover different individual preferences and competencies. Different forms of use should be provided. The product should be equally useful and usable for right and left-handed users. It should allow the user to make mistakes or not have precise motor skills. The product must allow the user to detect at different speeds.	
3- Simple and Intuitive Use	Design should be easy to understand regardless of the user's level of experience, knowledge, language skills and instant focus. Unnecessary complexity should be avoided. It should not contradict the user's expectations and intuitive use. The design should cover a wide range of reading levels and language skills. The information must be sorted by importance. Usage information and feedback should be provided at the right time during and after use.	
4- Perceptible Information	The design must effectively provide the necessary information for the user, regardless of the ambient conditions or the user's sensory sensing ability. The "readability" of basic information should be at the highest level. Product-specific elements should be easily explained to the user. The product must include techniques or interfaces to ensure compatibility, including users with sensory limitations.	
5- Tolerance for Error	The design should minimize the dangerous and bad consequences that may occur as a result of accidents or undesirable behaviors. The most used design elements should be most accessible, and those that may cause danger should be destroyed, isolated or sheltered. Behaviors and design elements that may cause accidents and errors should be clearly stated. Features that do not allow errors must be provided.	
6- Low Physical Effort	It should be design, effective and easy to use, allowing the least degree of fatigue. The user should not have to keep his body in unnatural positions. The product must be able to operate with an acceptable degree of force. The product should not require repeated behaviors. The need for long-term use of force should be minimized.	
7- Size and Space for Approach and Use	Regardless of the user's body size, posture position and mobility, the appropriate size and space should be provided for approach, reach, manual use and general use. For sitting and standing users, an unobstructed view of important usage items should be provided. All items should be equally easily accessible while sitting or standing. Different hand size and grip characteristics should be considered. Adequate space should be provided for auxiliary equipment (wheelchairs, walking equipment, etc.) or for people to help.	

Additionally, a person operating a battery-powered car, the visually impaired, the hearing impaired, or the elderly are not considered "disabled" in accessible environments. Similarly, in a situation where accessibility norms and accessible chain cannot be given, a non-restricted person becomes "disabled" (Sherrer, 2001). Goldsmith said, "Handicapped people are disabled because the architect who created the building did not think and care about their requirements" (Goldsmith, 1997).

The notion of universal design refers to a comprehensive approach to design that enables everyone, regardless of age, ability, or physical condition, to utilize the whole product and surroundings. This strategy encompasses a broad variety of scales, including industrial product design, architecture, urban planning, basic environmental control systems, and complicated urban information technology. Design and universal design principles for everyone (Code on Accessibility, 2013).

SIVAS URBAN METHODOLOGY EXAMPLE FOR COMPLETELY ACCESSIBLE HISTORICAL BUILDINGS AND AREAS

Completely accessibility approach of all historical buildings and places

The viewpoint that envisions the necessity to make historical structures and surroundings completely accessible forms the core of the research. It is not difficult to make the cultural treasures that must be safeguarded so that everyone may participate in social life, despite certain restrictions. People with disabilities have the same right as everyone else to participate in cultural events, use public services, and enter any location without exception, which may be constructed and updated independently.

Man is the primary unit of measure in the architectural field. When designing, the architect must address the notion of measuring (Arcan and Evci, 1999). Due to their historical significance, some groups cannot be separated or disregarded. Nothing is more precious than a person, including cultural treasures, historical structures, and agricultural land. A dependable architect must constantly defend the ethical in relation to human values.

The significance and value of cultural assets exist because humans assign them such significance and worth. This worth and significance gained from humans cannot be more precious than humans. The legal notions of location, historical structure, monumental monument, and cultural asset are human inventions. Accessibility is a fundamental human right, according Mamatoğlu. Although the notion of human rights is fictitious, in terms of historical values, it predates fiction. As long as individuals can live freely and equitably, they may create cultural value-based fictions. It is not possible for organisms to live in nature if they succumb to their own falsehoods on crucial topics (Mamatoğlu, 2015).

The core of the notion of complete accessibility is "everyone," as opposed to a particular set of individuals with barriers as the intended audience. From a person who can only operate his battery-powered car with eye motions to a young person with no impairments or health issues, the model where everything is accessible without assistance symbolizes complete accessibility. The city of Sivas has undeniably a thirteenth-

DOI: 10.15320/ICONARP.2022.228

century design in a context where the common design idea for regular consumers is evolving. The process of discussing the accessibility of a major monument from the 19th century to the current day is quite challenging. However, in the congested academic repetitive environment, which has not progressed enough in our nation since 2005, a strategy that challenges complete accessibility via historical structures and areas and offers real alternatives presents a more creative and modern perspective.

Within the scope of the investigation, five hypotheses were formulated.

1- Different disability groups have varying rates of engagement in cultural events and visits to historical structures
2- The accessibility of listed and protected buildings in Sivas is impacted by protection rules and practices
3- Conscientious and precise architectural arrangements increase the accessibility of historical structures and the surrounding environment
4- Architectural modifications essential for complete accessibility may also be implemented in historic structures and locations.
5- Historical and protected structures may be made accessible without causing tissue damage.

The assumptions formulated with the use of scientific data acquired from surveys done in the city of Sivas and in-depth field investigations conducted on five chosen buildings were examined. Four of the five hypotheses are concretely supported by the data described and discussed in the appropriate sections.

FIELD RESEARCH

Survey Methods

Within the scope of the survey research, six distinct survey applications were conducted. Face-to-face and online multiple choice and semi-structured (open-ended) questionnaires and in-depth interviews were done as an empirical component of the thesis research to expose accessibility concerns of historical buildings and locations, identify demands, and guide architectural solutions. The survey's findings will be assessed alongside the scientific findings of the systematic examination received from other components of the study. Within the framework of the survey studies designed to represent the user profile of the city of Sivas, different statistical data are intended to be compiled.

Within the purpose of the research, 159 impaired and non-disabled residents of the city of Sivas were asked to complete a questionnaire including forty items. The "Personal Information and Urban Activity Survey" is the initial step in the collection of socio-demographic information and descriptive statistics.

In the second stage, five structures were chosen; surveys numbered 2, 3, 4, 5, and 6 were conducted for each of the 55 questions for each of them: Buruciye Madrasa, Sivas Grand Mosque, Sifaiye Madrasa (Keykavus Madrasa), Congress Building Ataturk and Ethnography Museum, Historical Sivas Train Station. The surveys in the second part, titled "Building Use Purpose-Frequency Experience Surveys," were conducted with 20 orthopedically, hearing, and visually-impaired individuals who worked as technical and administrative personnel in various Sivas-based public institutions and who were specially selected for their participation. In the surveys of the second section, where architectural terms are used more intensively, the selected structures were conducted with participants who were familiar with the problems of disabled individuals and mastered the subject in order to obtain more accurate data from individuals who dominated the subject.

Examination of Survey Results

The surveys were conducted face-to-face in the building of "Sivas Association for The Relief and Solidarity with Families with Physically Intellectual Disabilities and Disabilities" and in the historical buildings in the city center of Sivas, as well as online with the aid of 'Google Forms' for the convenience of visually and hearing-impaired individuals.

Table 2. Socio-Demographic Investigation.

Variable		n	%
Gender	Male	114	71,7
	Female	45	28,3
	Total	159	100,0
Variable		n	%
Age	19-30	37	23,3
	31-40	56	35,2
	41-50	35	22,0
	51-60	25	15,7
	61-70	4	2,4
	Total	157	98,7
	Unanswered	2	1,3
	Total	159	100,0
Variable		n	%
Education	Primary	16	10,1
	Secondary school	11	6,9
	High school	61	38,4
	University	59	37,1
	Graduate	5	3,1
	None	7	4,4
	Total	159	100,0
Variable		n	%
Employment	Working full-time	78	49,1
	Retired	25	15,7
	Busy with housework	16	10,1
	Unemployed	35	22,0
	Other	4	2,5
	Total	158	99,4
	Unanswered	1	0,6
	Total	159	100,0

Table 3. Analyses of the Status of Obstacles.

DOI: 10.15320/ICONARP.2022.228

Variable		n	%
Fhysical Disabilities	Deaf	27	17,0
	Blind	23	14,5
	Orthopedic disability	85	53,5
	Temporary disability	10	6,3
	Not disabled	11	6,9
	Total	156	98,1
	Unanswered	3	1,9
	Total	159	100,0
Variable		**n**	**%**
If Temporary Disability Reason	Broken	2	1,3
	The Stroller	2	1,3
	Pregnancy	2	1,3
	Accident	1	0,6
	Operation	3	1,9
	Total	10	6,3
	Unanswered	149	93,7
	Total	159	100,0
Variable		**n**	**%**
How Disability Occurs	Congenital	98	61,6
	Aftermath	47	29,6
	Total	145	91,2
	Unanswered	14	8,8
	Total	159	100,0
Variable		**n**	**%**
Auxiliary Apparatus Usage Status	Crutches	8	5,0
	Prosthesis	41	25,8
	Wheelchair	1	0,6
	Battery vehicle	28	17,6
	None	58	36,5
	Other	16	10,1
	Total	152	95,6
	Unanswered	7	4,4
	Total	159	100,0

Using the SPSS tool, the survey's findings were transformed into scientific statistics may be categorized as; In all surveys, the objective of closed-ended questions is to get statistics and numbers for analysis, whereas the objective of open-ended questions is to obtain specifics. The primary goals of the survey investigations;

• Examination of the historical structure and accessibility of individuals with disabilities in the city of Sivas, as well as identification of the challenges encountered, exposing the participants' urban activity levels,

• Determination of accessibility levels to the ancient city square from the residential areas of different groups of persons with disabilities and all city residents, as well as from other sites in the city,

• Determination of accessibility issues and requirements in five chosen registered buildings, determination of the structures' frequency of usage,

• The testing of hypotheses generated within the scope of the proposed Full Accessibility Model.

Table 4. Evaluation of urban activities and awareness.

Variable		n	%
11. Can You Move Within the City Independently / Without The Need of Anyone's Help?	Yes	116	73,0
	No	42	26,4
	Total	158	99,4
	Unanswered	1	0,6
	Total	159	100,0
Variable		n	%
12. How Do You Provide Transportation within the City?	Public transport	70	44,0
	Own car	64	40,3
	Pedestrian	22	13,8
	Other	3	1,9
	Total	159	100,0
Variable		n	%
13. Do you think public transportation is suitable for the use of people with disabilities?	Yes	39	24,5
	No	120	75,5
	Total	159	100,0
Variable		n	%
14.If You Are Driving An Individual Vehicle, Do You Have Parking Problems Within the City?	Yes	114	71,7
	No	19	11,9
	Total	133	83,6
	Unanswered	26	16,4
	Toplam	159	100,0
Variable		n	%
15. Do you think architectural regulations prevent your urban life?	Yes	131	82,4
	No	28	17,6
	Total	159	100,0
Variable		n	%
16. Do You Have Any Non-Governmental Organization Membership-Activity?	Yes	56	35,2
	No	103	64,8
	Total	159	100,0
Variable		n	%
17. Do you know about the Law no. 5378 on the Disabled?	Yes	60	37,7
	No	98	61,6
	Total	158	99,4
	Unanswered	1	0,6
	Total	159	100,0
Variable		n	%
18. Can you participate in cultural activities in Sivas City?	Yes	87	54,7
	No	72	45,3
	Total	159	100,0
Variable		n	%
19. How Often Do You Participate in Cultural Activities in General?	Once a week	16	10,1
	Once a mount	66	41,5
	Once a year	19	11,9
	Never	56	35,2
	Total	157	98,7
	Unanswered	2	1,3
	Total	159	100,0

902

Table 5. Measurements of structure and surrounding user experience and performance

User Experience Performance Measurement on Structure and Environment (21.-33. Questions) Statistics													
Question Number	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33
Participant (n)	157	157	159	157	158	157	159	159	159	159	159	159	159
Unanswered	2	2	0	2	1	2	0	0	0	0	0	0	0
Average	3,1401	2,9936	1,8931	3,7834	3,8544	1,7452	1,8302	2,0440	2,1384	2,0943	1,9119	3,6730	4,1384
Standard deviation	1,22714	1,06516	1,11145	1,16750	1,12202	0,83899	0,99497	1,09859	1,11081	1,10690	1,02737	1,02189	1,16096
Varyans	1,506	1,135	1,235	1,363	1,259	0,704	0,990	1,207	1,234	1,225	1,055	1,044	1,348
Minimum	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Maximum	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00

DOI: 10.15320/ICONARP.2022.228

Table 6. Cross tabular information by barrier status and independent transaction status

(Physical Disability * Unhelpful Movement) Crosstab					
			Unhelpful movement		Total
			YES	NO	
Disability	Deaf	Number of attendent	26	1	27
		% in (Disability)	96,3%	3,7%	100,0%
		% in (Unhelpful Movement)	22,8%	2,4%	17,4%
		% Total	16,8%	0,6%	17,4%
	Blind	Number of attendent	8	15	23
		% in (Disability)	34,8%	65,2%	100,0%
		% in (Unhelpful Movement)	7,0%	36,6%	14,8%
		% Total	5,2%	9,7%	14,8%
	Orthopedic	Number of attendent	63	22	85
		% in (Disability)	74,1%	25,9%	100,0%
		% in (Unhelpful Movement)	55,3%	53,7%	54,8%
		% Total	40,6%	14,2%	54,8%
	Temporary dis.	Number of attendent	7	3	10
		% in (Disability)	70,0%	30,0%	100,0%
		% in (Unhelpful Movement)	6,1%	7,3%	6,5%
		% Total	4,5%	1,9%	6,5%
	None disability	Number of attendent	10	0	10
		% in (Disability)	100,0%	0,0%	100,0%
		% in (Unhelpful Movement)	8,8%	0,0%	6,5%
		% Total	6,5%	0,0%	6,5%
Total		Number of attendent	114	41	155
		% in (Disability)	73,5%	26,5%	100,0%
		% in (Unhelpful Movement)	100,0%	100,0%	100,0%
		% Total	73,5%	26,5%	100,0%

Table 7. Evaluations of public transit accessibility by gender

(Gender * Public Transport Accessibility) Cross-table					
			Public Transport Accessibility		Total
			YES	NO	
Gender	Male	Number of attendent	26	88	114
		% in (Gender)	22,8%	77,2%	100,0%
		% in (Public trans. access)	66,7%	73,3%	71,7%
		% Total	16,4%	55,3%	71,7%
	Female	Number of attendent	13	32	45
		% in (Gender)	28,9%	71,1%	100,0%
		% in (Public trans. access)	33,3%	26,7%	28,3%
		% Total	8,2%	20,1%	28,3%
Total		Number of attendent	39	120	159
		% in (Gender)	24,5%	75,5%	100,0%
		% in (Public trans. access)	100,0%	100,0%	100,0%
		% Total	24,5%	75,5%	100,0%

The comments of participants are organized into categories with these settings;

- In mosques, ablution and prayer space for the elderly and crippled,
- Warning and educational signage,
- The prominence of the pedestrian walkways,
- Social events should be hosted in the city plaza, with accessible seating and restrooms in the area where book fairs are held,
- Audio headphones in Sivas museums,
- Information screens in museums,
- Anti-slip floor adhesions in winter months, as it snows a lot in Sivas province,
- Audio devices presenting the historical building for the hearing-impaired and visitors,
- Placing warnings around the trees in the medieval plaza of Sivas and clearing the square of obstructions,
- Electric scooter rental,
- Audio commentary at museums, Braille alphabet information,
- Elevators, ramps, and restrooms in buildings,
- Dedicated prayer sections for battery-operated automobiles,
- Resting areas for women with infants and baby-care rooms,
- Seating units for pregnant ladies and handicapped individuals with prostheses,
- There is no distinct entry for the handicapped to museums, and the restrooms are used as storage,
- A specialized ablution area for the elderly,
- Rest and sitting areas accessible to the handicapped,
- Appropriate quantity and breadth of parking spots,
- Sign language staff,
- Removal of fractures and deformations in the flooring,
- Requests for any item that will facilitate the use of wheelchairs in comfort.

According to the findings of the questions about the accessibility of historical buildings, the five chosen structures in Sivas have fairly low

DOI: 10.15320/ICONARP.2022.228

levels of accessibility. The buildings picked from a variety of roles represent the city's most significant tourism potential and visitor-friendly structures. The purpose of the project is to develop a comprehensive accessibility model based on the experiments conducted in these buildings. It is quite difficult to produce a single guide for historical structures or a set of universal norms. Rather, the philosophy of developing reasonable and practical projects for hurdles in a tangible manner and the logic of total accessibility were attempted to be internalized through the chosen cases.

FINDINGS AND RESULTS

Field Research on Five Selected Registered Historical Structures

In this section of the research, the workspace and workgroup were identified to be the foundation of the entire accessibility model. In the continuation of the surveys in the city of Sivas, numerous field investigations were carried out on the buildings. Field investigations consist of a total of six separate survey studies, one of which is in general and five in buildings, followed by accessibility studies carried out in five registered structures chosen in the city of Sivas. In order to steer the model, accessibility difficulties and architectural editing requirements highlighted in surveys were questioned on site in five buildings with diverse roles and solution suggestions were produced.

Within the scope of the research, five registered buildings in Sivas with distinct roles were chosen. These structures, respectively.

1- Sivas Buruciye Madrasa,
2- Sivas Grand Mosque,
3- Sivas Sifaiye Madrasa (Keykavus Hospital),
4- Sivas Convention Center of Ataturk and Ethnography Museum,
5- Sivas Historical Railway Station.

Figure 2. A panoramic picture of the medieval town square of Sivas (Sivas Atlas, 2020)

Redevelopment, repair, and exhibition-planning initiatives for the structures; T.C. Official communication with the Ministry of Culture and Tourism, the Provincial Directorate of Relief and Monuments in Sivas, and the General Directorate of Foundations gave the information. After the assessments of issues and needs, the recommended solutions have been redesigned.

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

The multi-layered city of Sivas and the ancient architecture and environment in the city center were chosen as a field study for the following reasons in relation to the values and challenges it contains;

- Sivas is a city in Central Anatolian of natural and cultural significance that has been home to several civilizations throughout history.
- The wealth of the worldwide design memory of the city, which is home to a civilization that sought to treat with the sound of water in the Great Mosque of Divriği in the Middle Ages, where persons with mental disorders were burnt to death,
- To have a tangible and abstract historical and cultural framework, together with variety and the city's original historical texture,
- Possessing the potential for accessible tourism as a significant crossroads of civilizations for a very long period,
- Increasing the city's tourist potential and tourism accessibility via high-speed rail,
- Extensive historical building and environment stock with a variety of purposes,
- The historical city square is a laboratory in which the accessibility of historical buildings and locations may be questioned via the use of various colossal monuments that have survived to the current day,
- The accessibility to historical structures and locations in Sivas is quite poor,
- Disabled residents of Sivas are anxious to explore historical structures, but cannot owing to insufficient and improper architectural arrangements,
- The abundance of accessibility issues that are readily observable throughout the city,
- Historical structures are not accorded the respect they deserve, and historical fabric is deteriorating daily,
- Inadequate conservation efforts, the inability of local governments and allied organizations to implement appropriate preservation policies in the city.

DOI: 10.15320/ICONARP.2022.228

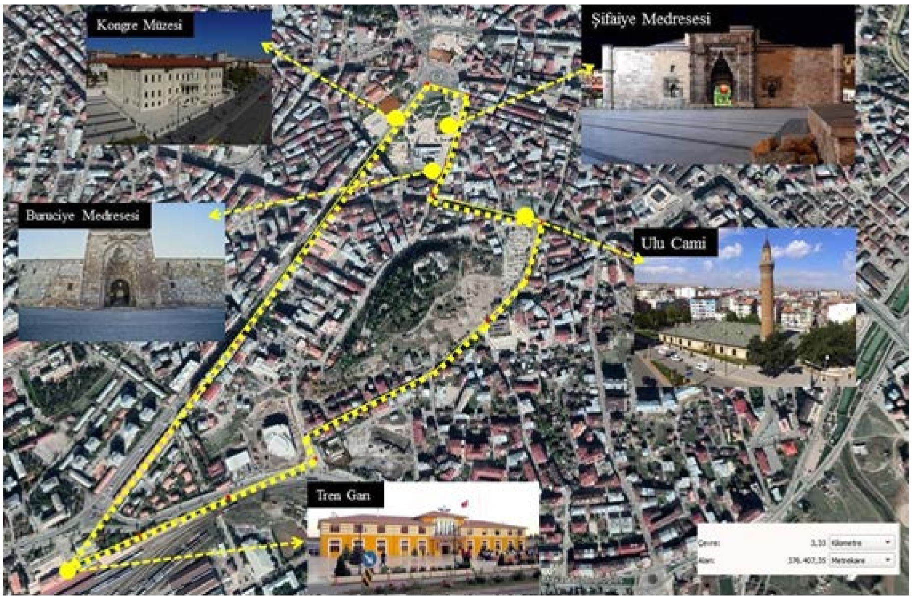


Figure 3. Accessible route and selected structures in Sivas city center.

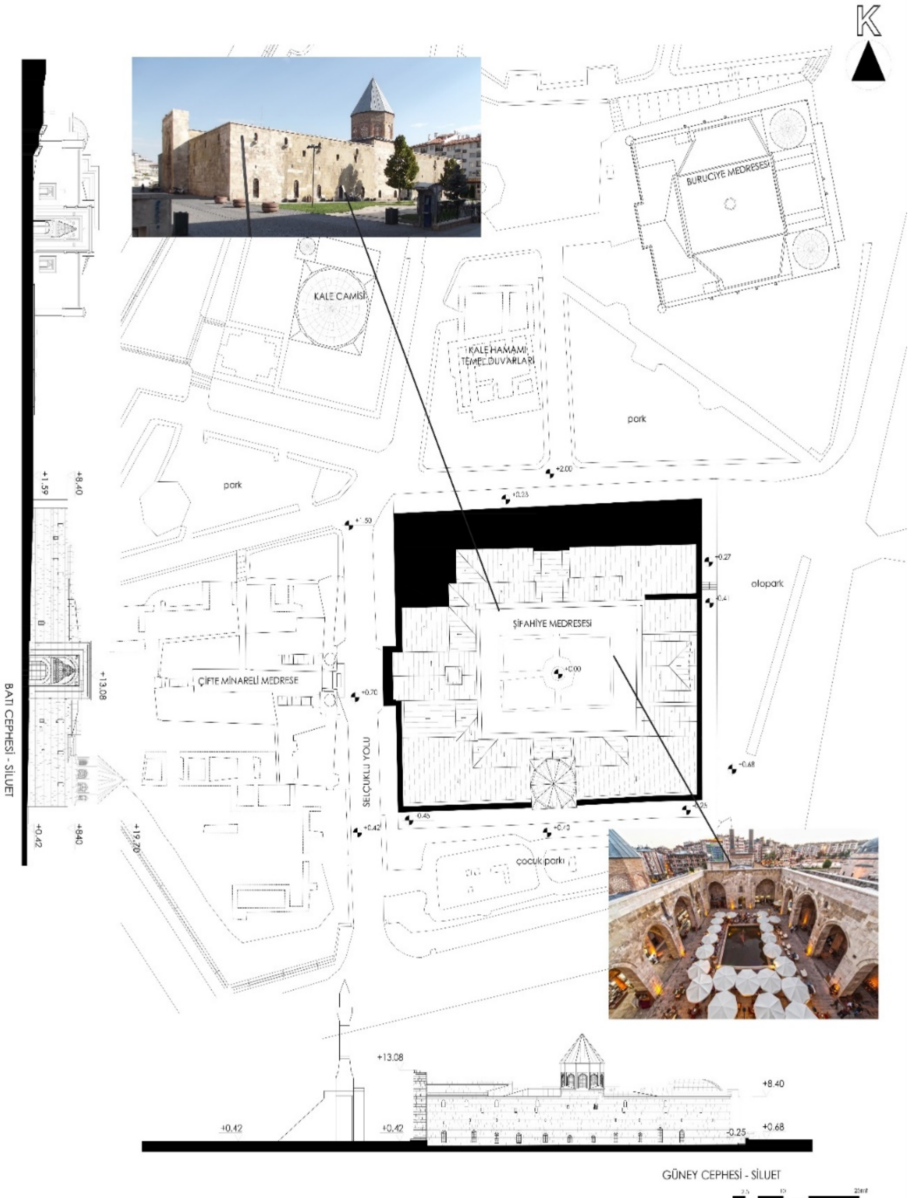


Figure 4. Sifaiye Madrasa Situation Plan and silhouettes (T. R. Directorate General of Foundations (VGM) archive was used)

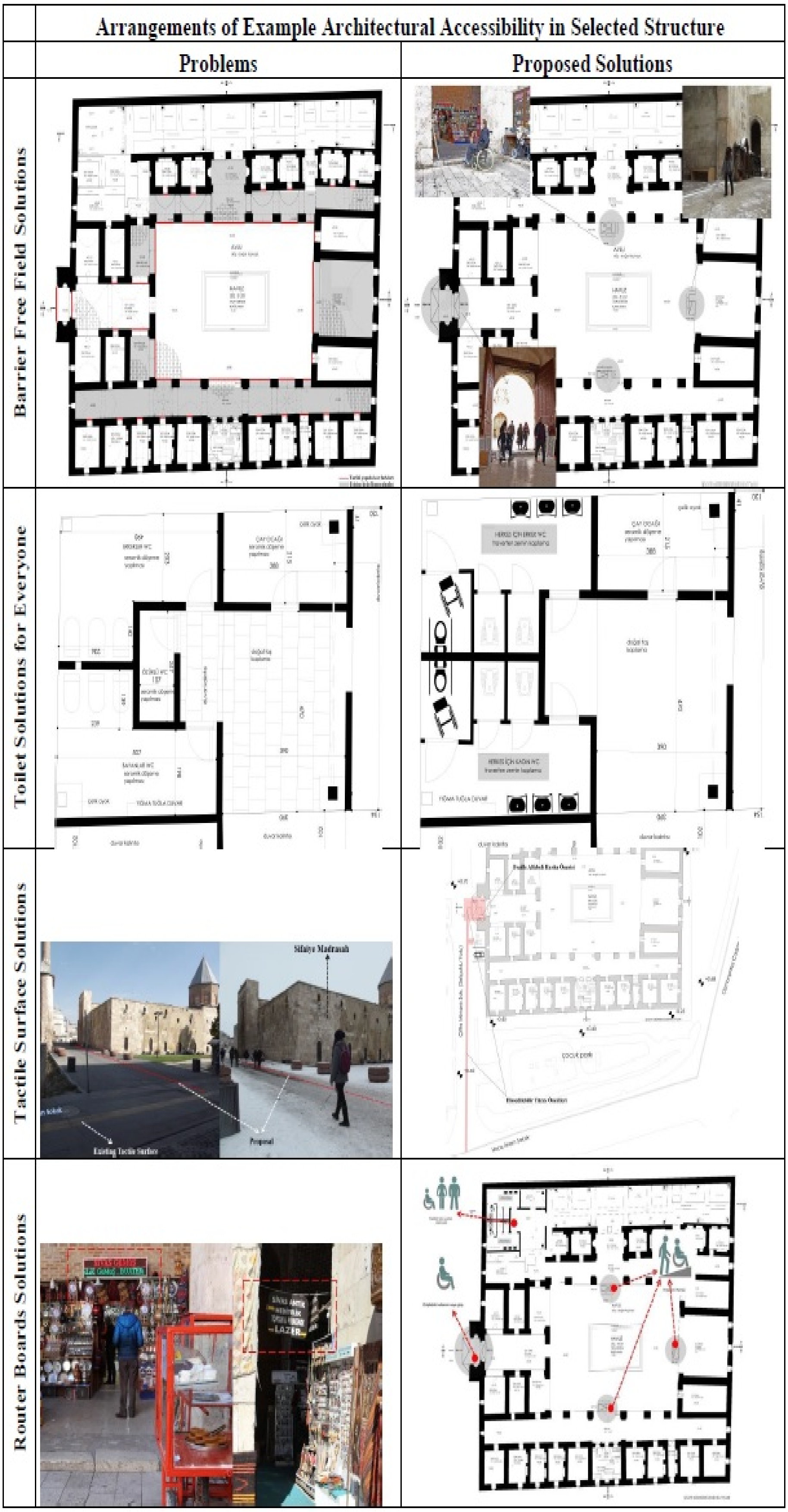


Figure 5. Sifaiye Madrasah sample problem-solution applications (DGF archive used)

DOI: 10.15320/ICONARP.2022.228

DETECTION AND SOLUTION RECOMMENDATIONS OF ACCESSIBILITY PROBLEMS IN THE STRUCTURE OF "SIVAS SIFAIYE MADRASA"				
NU.	TOPIC ACCORDING TO FULL ACCESSIBILITY METHOD	PROBLEM	SOLUTION	EXPLANATION
1	BARRIER FREE SITE, RAMP, RAILING AND URBAN EQUIPMENT REGULATIONS	18 cm denim difference consisting of 2 steps at the entrance of the structure	Two standard ramps were proposed at the entrance	Projected
		Access to the northern front portico at +0.20 from the courtyard at +0.00	Ramp recommended	Projected
		Access to the eastern front portico at +0.15 from the courtyard at +0.00	Ramp recommended	Projected
		Access to the southern front portico at +0.20 from the courtyard at +0.00	Ramp recommended	Projected
		Threshold application that makes up the difference of 5 cm jeans in the tomb section	It was proposed to remove the threshold and level it	Projected
		Ground deformations around the structure	Repair recommended	Written in plan notes
		Ground deformations throughout the courtyard	Replacement of broken and collapsed stones	Written in plan notes
		Rain gutt in the courtyard and gaps in metal caps	Exchange with composite or stone covers recommended	Visual detections presented
		Intensive furnishing in the courtyard prevents crossings	Seating units proposed to be removed by 50%	Visual detections presented
		Lack of handles and handrails on the ramp that provides access to the structure from Osmanpasa Street	Recommended in double-sided railing and non-slip handrail	Sample project added
		The need for usable urban furniture for everyone	Ergonomic benches proposed around the structure	Written in plan notes
2	ACCESSIBLE PARKING REGULATIONS	Lack of accessible parking space for everyone	Parking offered on Double Minaret Street	Projected
		Remote location of the indoor car park area to the building entrance	Double Minaret Street car park proposed instead of municipal car park	Projected
		Lack of parking space close to the historic town square	The axle used before street sanitation has been re-proposed.	Written in plan notes
3	ELEVATOR AND PLATFORM SOLUTIONS	Problem accessing upper floors used as repository	No elevators or platforms were proposed	No solution proposed
		Steep and long ramps providing access to the structure in the town square	Fielding proposed on ramps, platform not proposed	No solution proposed
4	TOILET SOLUTIONS FOR EVERYONE	Use of the so-called disabled wc as a warehouse	Instead, the toilet for everyone new was designed	Projected
		3 men's and 3 ladies inaccessible toilets	2 toilets recommended for everyone in the Bay and Mrs. Toilet	Projected
		90 cm toilet door that opens inward	Toilet door with 100 cm panic bar opened outward	Projected
		Non-ergonomic toilet furnishings and equipment	Mirrors, toilet bowls, handles for everyone's use	Projected
5	TACTILE SURFACE-BRALILE ALPHABET MAP APPLICATIONS	Tactile surface application located only on Hoxha Imam Street	Tactile surface was proposed at the historic town square and building entrance	Projected
		Historic Double Minaret Street needs a tactile surface	Standard-compliant sensable surface recommended	Projected
		Problem of accessing the structure from the parking area for the visually impaired	New arrangement proposed for building entrances from the parking area	Projected
		The need for a guiding palpable surface in the courtyard	Audible warnings and map proposed instead of palpable surface in courtyard	Projected
		Lack of ramp heads and all denim differences	Guide track proposed at building entrance and up to embossed map	Projected
		Problem of detecting structure and places for visually impaired individuals	Braille alphabet map and metal guide tracks recommended	Positioned at the entrance of structure
6	DIRECTIONAL, INFORMATIVE, STIMULI AND INNOVATIVE SOLUTIONS WITH DIGITAL SOFTWARE	Router shortcomings that provide access to the structure	Router proposed from car park to structure, structure to rooms	Schematic representation made
		Lack of routers around the structure and in the courtyard	Router recommended for building entrance, ramps, toilets and rooms	Schematic representation made
		Lack of stimulating informative within the structure	Stimulants were recommended in appropriate places within the structure	Schematic representation made
		The need for stimulants for the visually impaired	Voice alert screen recommended next to Braille alphabet map	Written in plan notes
		Ease of visit for the hearing impaired	Projection system recommended	Written in plan notes
		Perception of the location of the structure in the city for the visually impaired	General accessibility map and mobile app recommended for the city	Examples shown
		Lack of solutions to allow virtually touring the structure	Virtual accessibility recommended with native mobile apps	Written in plan notes
		Charging station requirement for battery-powered vehicles	One charging station proposed in historic city liance	Shown in the plan

Figure 6. Determinations and remedies to Sifaiye Madrasa accessibility issues

CONCLUSION AND DISCUSSION

Within the scope of the research, the accessibility of historically significant buildings and locations that need to be preserved is questioned, and a model for complete accessibility is proposed. Within the framework of the Protection of Cultural and Natural Assets Law No. 2863, the essential architectural provisions were considered in registered structures and locations within the scope of the legally guaranteed accessible right under the "Number of 5378 Law on Disabled". Using survey research, problems and demands in the city of Sivas, which is classified as a working area, were discovered. On the basis of scientific data derived from surveys, architectural layouts are meticulously planned within the framework of a comprehensive accessibility model for the ancient city core of Sivas. It was proposed that historical buildings and surroundings may be made accessible to everyone via universal design and the use of unique solutions.

According to the findings of the research, it is both important and feasible to make historical buildings and surroundings accessible. Within the context of comprehensive preservation, historically significant structures that are accessible to everybody are becoming more functional and habitable. It has been determined that increasing the accessibility of historical buildings and regions within the scope of the research promotes the engagement of individuals with disabilities in cultural activities and favorably impacts their social participation. In historic urban areas, it has been recognized that persons with impairments need accessible maps. It is believed that accessibility maps make it simpler for visitors to see a city, while simultaneously improving the living conditions of persons with impairments. It has been found that public transportation in the city of Sivas is inaccessible. In addition, investigations with survey participants have shown that, despite handicapped people's great desire to be present in historical buildings and locations, these structures and public spaces remain inaccessible. It has been discovered that inadequacies in architectural rules and improper procedures are the primary obstacles to accessibility. As a result of significant literature study, assessments of successful samples from across the globe, socio-demographic data of survey respondents, and description statistics, the essential rules have been categorized under six topics;

1. Regulations for Barrier-Free Field, Ramp, Railing, and Urban Equipment
2. Parking Accessibility Regulations
3. Solutions for Elevators and Platforms
4. Toilet Solutions for Everyone
5. Applications of Tactile Surface-Braille Alphabet Map
6. Innovative Options with Router, Informative, Stimulants, and Digital Applications

Instead, the architectural arrangements to be developed in the defined themes are demonstrated, and projects and visuals should be used to

DOI: 10.15320/ICONARP.2022.228

build solutions appropriate to each structure. The suggested architectural arrangements were developed with realism in mind, taking into consideration existing national and international norms. Realistic solutions that include worldwide best practices without ignoring local factors have been devised. The research also determined that the present accessibility criteria for historical buildings and sites are insufficient, and it is suggested that they be changed as quickly as possible to reflect modern advances. In addition, there is a void in the law addressing the legal infrastructure that governs the accessibility of the protected assets. In this subject, scientific research should be increased, and successful research should be supported as a model for eliminating touch protection prejudices.

In an environment where only possible user groups are addressed in architectural arrangements and the balance between preservation and usage is often weighed in favor of conservation, questioning the accessibility of historical buildings and landscapes is a very challenging endeavor. Planning physical alterations in a listed monument with architectural preservation concerns requires extensive technical knowledge and expertise. In this way, the chosen workplace has aided comprehension of the topic via its many construction options and architectural arrangement examples for these buildings. In addition, in the process of building accessible places for everyone within the scope of the research, difficulties and requirements faced by persons from a variety of disability groups in a structured setting were found. It has become tough to communicate accurately and effectively with persons with impairments who have specific requirements. This disadvantage has been addressed via dialogues with non-governmental groups organizing handicapped persons and their families in Sivas.

In recent years, it has been observed that scientific research on accessibility culture in Turkey have gained popularity, although there is a lack of application-based studies, which often provide theoretical material. With scientific evidence, the suggested paradigm cascades tangible steps towards quick implementation. In the framework of being a fruitful model, certain buildings and locations may implement actual applications that involve architectural arrangements. It is possible to do comparative scientific research on the business programs, management strategies, and cost conditions of the proposed architectural arrangements. New technologically accessible items that are incorporated into the urban information system, such as smart ramps, that are proposed within the scope of the research may be copyrighted, and a business concept can be developed as prototype manufacturing continues. Future scientific research will be able to analyze the notion proposed for visually challenged folks to have architects interpret historical locations using audio descriptions.

Numerous institutions, organizations, legal and natural individuals may benefit directly or indirectly from this research. Ministry of Family and Social Services, Ministry of Environmental Urbanization and Climate

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

Change, Ministry of Culture and Tourism, Protection boards of cultural assets, Protection and control offices (KUDEB), associations and non-governmental organizations providing services for people with disabilities, Local governments (municipalities, provincial private administrations, village legal entities), Universities, Related professional chambers, Employers employing people with disabilities. It is also organized professionally as a resource for all technical staff working on architectural preservation and accessibility challenges. It is the first research in the literature to comprehensively analyze architectural arrangements in historical buildings and fields and expose them to the scientific debate environment within the integrity of architectural language, in contrast to accessibility instructions issued by ministries.

Following is a list of some of the suggestions provided on the topic based on the difficulties noticed during the research and the thoughts generated:

The problem should be brought to the attention of project manufacturers and technical staff who perform the most significant duty in making our living environment accessible, and their technical skills should be enhanced. In this context, trainings should be provided, all authorities should have access to scientific papers, and practitioner employees should be encouraged to internalize academic accumulation.

The actions of non-governmental groups that best understand the challenges and requirements of individuals with disabilities should be encouraged, together with social awareness and architectural accommodations.

All rules that will make the public transportation system accessible should be enacted expeditiously, and public transportation should offer unassisted access to historic structures and sites.

There should be legislative incentives for studying sign language and the Braille alphabet.

Comprehensive investigations covering the number of handicapped persons residing on a provincial level and the sorts of disabilities should be updated in order to give data for scientific research.

The significance of accessibility to urban identities and the positive contribution to tourist potential should be brought to the attention of all city residents by emphasizing their importance.

In historical structures and sites, the architectural modifications requested within the framework of the full accessibility model should be completed expeditiously.

To maintain accessibility, it is necessary to give further evidence that the physical modifications made, when conducted carefully, provide long-term protection without harming the historical fabric. In this context, scientific efforts should be fostered in order to provide decision-makers with beneficial examples from throughout the globe. Increase the number of scientific research exemplifying accessible arrangements, rather than standardize them, while considering the unique dynamics of each structure in historical buildings and locations.

DOI: 10.15320/ICONARP.2022.228

Standards TS 9111, TS 12460, TS 12576, and TS ISO 23599, which are needed to be revised within the scope of the research, should be updated in accordance with international standards and new technical advancements.

Legal consequences should be modernized, and architectural rules should be pushed for those accountable, particularly municipal governments. In addition, arrangements such as special service discounts and tax exemptions should be implemented for accessible buildings.

REFERENCES

Akcura, N. (1978). Practical Aspects of Historical Environmental Protection and Necessary Expertise, p.18. METU Faculty of Architecture Restoration Department Panel, 30s.

Arcan, E.F. & Evci, F. (1999). Mimari Tasarıma Yaklaşım: Bina Bilgisi Çalışmaları, İstanbul: Tasarım Yayın Grubu.

Ask, L. N. (2015). Access to Cultural Heritage Sites for All, EXARC Journal Issue 2015/4, Publication Date, 2015-11-30, Norway.

Braganca, L., Fernandes C. & Botelho H. (2006). Accessibility Adaptation of a Building in a Historical City Centre, 8th AMER International Conference on Quality of Life, Malacca, Malaysia, 18-19 Mar 2020, (206-211).

Code on Accessibility in the Built Environment, (2013). Electronical publish by the building and construction authority. pp: 2:240.

Çelimli, M. A. (2022). Tarihi Yapi ve Alanlari Herkes Için Erişilebilir Hale Getirmeye Yönelik Model Önerisi; Sivas Kent Örneği, [Doctoral Thesis, Selçuk University Graduate School of Natural and Applied Sciences]. Konya. pp: (36) 381.

Çepehan, İ. Z. & Güller, E. (2020). Evrensel Tasarım Kapsamında Herkes İçin Erişilebilir Tasarım, Sosyal Politika Çalışmaları Dergisi Erişilebilirlik Özel Sayısı, Cilt-2 Aralık 2020.

Deffner, A., Psatha E. & Bogiantzidis N. (2015). Accessibility to Culture and Heritage: Designing for All, Conference: AESOP 2015, definite space – fuzzy responsibility, Czech Technical University, Faculty of Architecture, Prague.

Diehl, M., (2022). Historic Preservation for All People: Reconceptualizing Accessibility in Historic Buildings.

Dostoğlu, N., Şahin, E. & Taneli, Y. (2009). Evrensel Tasarım: Tanımlar, Hedefler, İlkeler, Mimarlık, sayı: 347, ss. 23-27.

Eric, M. & Gardner J. (2008). Access for all to Heritage Places, Endorsed and published by the Heritage Council of Victoria, Australia, November 2008.

Erişilebilirlik Kılavuzu, (2020). Aile, Çalışma ve Sosyal Hizmetler Bakanlığı, Engelli ve Yaşlı Hizmetleri Genel Müdürlüğü, Ankara, ss: 162.

Evcil, A. N. (2009). Wheelchair Accessibility to Public Building in Istanbul, Disability and Rehabilitation: Assistive Technology, Vol: 4, 2, pp.76-85, Ergonomic Abstracts.

Foster, L. (2004). Progressive Access: Unique Solutions for Historic Buildings, Journal of Architectural Conservation, Volume 10, 2004 - Issue 3, (73-86).

Goldsmith, S. (1997). Desinging For the Disabled. The New Paradigm (1.press), Oxford: Architectural Press, 85-89.

Günay, R. (2007). Kültür Mirasını Korumada Çeşitli Yaklaşımlar, Colloquium Anatolicum VI:1-25.

ICONARP – Volume 10, Issue 2 / Published: 20.12.2022

Iwarsson, S. & Stahl A. (2003). Accessibility, Usability and Universal Design-Positioning and Definition of Concepts Describing Person- Environment Relationships, Disability and Rehabilitation, Vol.25, No.2, pp57-66.

Kitchen, R. & Law, R. (2001). The Socio-spatial Construction of (in) accessible Public Toilets, Urban Studies, Vol.38, No.2, pp.287-298.

Kuban, D. (1998). The Operational Conditions of Claiming History, Architecture, p. 281. Istanbul. 8-9p.

Lee, T. M. (2005). Multicultural citizenship: The case of the disabled.

Lynch, K. (1960). The Image of the City, MIT Press, Cambridge MA.194s.

Lynch, K. (1985). Reconsidering the Image of the City, in: T. Banerjee & M. Southworth (Eds) (1990) City Sense and City Design: Writings and Projects of Kevin Lynch, pp. 247–256 (Cambridge, MA: The MIT Press).

Lynch, S., & Proverbs, D. G. (2019). How adaption of historic listed buildings affords access. International Journal of Building Pathology and Adaptation.

Madran, E. & Özgönül, N. (2005). Kültürel ve Doğal Değerlerin Korunması, TMMOB Mimarlar Odası, Ankara, 189s.

Mamatoğlu, N. (2015). Türkiye'de Engelliler İçin Erişilebilirlik Uygulamaları Algısı, Dosya 36, 2015/3, TMMOB Mimarlar Odası Ankara Şubesi, s. 6-13.

Plimmer, F., Pottinger, G. & Goodall, B. (2006). Accessibility Issues for Heritage Properties: a Frame of Mind? Shaping the Change XXIII FIG Congress, Munich, Germany, October 8-13, 2006, (1-15).

Pretto, A. (2019). Accessibility and Conservation in Contemporary Cities: A(n) (Im)possible Coupling. Architecture_MPS.

Pretto, A. (2022). A study on accessibility in an Old Italian City: when the past is worth more than the present. Disability & Society, 37(3), 496-521.

Pothier, D. & Devlin, R. (2006). Critical Theory: Essays in Philosophy, Politics, Policy and Law (s. 87-106), Vancouver: UBC Press.

Scherrer, V. (2001). Herkes İçin Ulaşılabilirlik Seminer Notları, (Seminar of Design for all Notes) OFD Publications, İstanbul, Cem Ofset, pp.38-42.

Srinurak N., Mishima N., Fuchikami T. & Duangthima W. (2016). Analysis Of Urban Morphology And Accessibility Character To Provide Evacuation Route In Historic Area, Urban Planning and Architecture Design for Sustainable Development, UPADSD 14- 16 October 2015. Article in Procedia - Social and Behavioral Sciences, January 2016.

Tapan, M. (1995). Koruma Bilinci, Cemre Basın Yayın, İstanbul. 76s.

Turkish Statistical Institute (TSI), (2020). Seniors with Statistics, 2020, News bulletin release date: March 18, 2021, issue: 37227.

United Nations Department of Economic and Social Affairs, (2019). World Population Prospects 2019: Highlights, https://www.un.org/development/desa/publications/world-population-prospects-2019-highlights.html.

Ünver, H. (2015). Ulaşılabilirliğin Akreditasyon Sürecinde Değerlendirilmesi ve Taşınmaz Kültür Varlıkları, [Doctoral Thesis, Anadolu University Graduate School of Natural and Applied Sciences]. Eskişehir, pp: (2) 282.

Yaacob, N. M. & Ormerod, M. (2004). Accessibility to Historial Public Buildings: Planning and Building Control in England and Wales, The University of Salford, International Built and Human Environment Research Week, Salford (United Kingdom), (309-319).

Yaldız, E. (2013). Anıtsal Yapıların Kullanım Sürecinde Değerlendirilmesine Yönelik Bir Model Önerisi, [Doctoral Thesis, Selçuk University Graduate School of Natural and Applied Sciences]. Konya. pp: 420.

DOI: 10.15320/ICONARP.2022.228

Zahari N. F., Harun S. F., Ahmad N. A., Zawawi Z. A. & Salim N. A. (2016). Comparative Analysis of Disabled Accessibility Needs of Heritage Building in Perak, MATEC Web of Conferences (2016) 66, Malaysia.

Resume

Mehmet Akif Çelimli received his bachelor's degree in architecture from Anadolu University, Faculty of Architecture (2010), master degree from Erciyes University (2016) and Ph.D. from Selçuk University (2022). Currently, he works as a technical expert at ILBANK which government works for Republic of Türkiye. His work has focused on universal design and architectural preservation.

Murat Oral currently works at Konya Technical University, Department of Interior Architecture as an Associate Professor. He received his master degree and PhD. in architecture from Selçuk University, Konya. He has been studying on interior design, architectural project design, and form and space layout concepts in architecture, basic design and plastics arts.

ICONARP
International Journal of Architecture and Planning
Received: 23.04.2022 Accepted: 12.12.2022
Volume 10, Issue 2/ Published: 20.12.2022
Research Article *DOI: 10.15320/ICONARP.2022.229 E- ISSN:2147-9380*
ICONARP

A Framework Proposal for Plan Evaluation in the Context of Turkish Planning System

Çiğdem İbişoğlu*
Mehmet Doruk Özügül**

Abstract

This study aims to propose a framework for plan evaluation in the context of Turkish planning system's structural characteristics. Within the scope of the study, main planning evaluation approaches (conformance-based and performance-based) were examined, and prominent evaluation methods were analyzed in detail. Then, type of planning systems and the major breaking points in changing process of planning system in Turkey are summarized. With reference to these issues, a filtered framework that can be used for plan evaluation in Turkey has been suggested. In this research, it has been concluded that the plan evaluation can be realized in three main dimensions and some sub-criteria: conformity (plan and output accordance, plan effects, relevance), rationality (internal coherence, external coherence, participation, cooperation and coordination), utilisation (guidance or direction). Although it provides an applicable framework, the suggestion does not offer a method that can be applied one-to-one for each plan. Under the rapidly changing conditions in our country, the evaluation criterion should be reconfigured in line with the features of relevant plan. It is foreseen that a basic monitoring mechanism can be created for planning institution by using the framework in this study. Also, it will provide self-evaluation opportunities for planning authorities. In this way, we believe that the success level of plans and planning system will increase. Evaluation of plan is an important research area in the international literature in terms of both qualitative and quantitative elements to be analyzed together. However, it is not yet included in Turkish planning literature. Therefore, this study is valuable as it highlights a new research area by pointing to an important gap in the national planning literature. It is thought that this study has original contributions to both theory and practice and will establish a functional bridge between them.

Keywords:
Conformance-based approach, evaluation in planning, performance-based approach, plan evaluation framework, Turkish planning system

*Department of Urban and Regional Planning, Faculty of Architecture, Yildiz Technical University, Istanbul, Turkey (*Corresponding author*)
Email: buyrukcu@yildiz.edu.tr

**Department of Urban and Regional Planning, Faculty of Architecture, Yildiz Technical University, Istanbul, Turkey
Email: ozugul@yildiz.edu.tr

To cite this article: İbişoğlu Ç., & Özügül, M. D. (2022). A Framework Proposal for Plan Evaluation in the Context of Turkish Planning System. *ICONARP International Journal of Architecture and Planning,* 10 (2), 916-944. DOI: 10.15320/ICONARP.2022.229

INTRODUCTION

After 1980, the rise of globalism and neoliberalism around the world resulted in a series of fundamental changes in economic policies, which were also echoed in the field of planning. Starting in 1980s, there has been a paradigm shift from instrumental rationality to communicative rationality. In following years, strategic plans replaced comprehensive rational plans which had been the most widely adopted planning approach since the 1950s (Allmendinger & Tewdwr-Jones, 2002; Eraydın, 2017; Ersoy, 2016a; Gedikli, 2016a, 2016b).

During this transition period, multiplicity in planning approaches and methods created a new set of issues concerning the evaluation of plan's effectiveness and functionality. Though, there has been a rise in the body of works in planning literature that raises about parameters and methods used to evaluate the success of strategic plans. According to the critiques, using same techniques and criteria that were used to assess spatial plans will not be appropriate to evaluate strategic plans (Alexander, 2006; Barrett & Fudge, 1981; Faludi, 1989; Mastop & Faludi, 1997). These critiques eventually triggered the search for new methods to evaluate the plan preparation and implementation processes. This pursuit gave rise to a series of new performance-based approaches. These approaches advocated that, when evaluating the strategic plans, the preparation processes of plans should be assessed along with implementation outcomes (Alexander & Faludi, 1989; Faludi, 2000; Oliveira & Pinho, 2009, 2010). This new era, in which the performance-based approaches accompanied the existing conformance-based approaches, coincides with the shift from comprehensive to strategic planning.

However, the case of Turkey unfolded differently. While comprehensive planning was the primary approach in planning system, project-based plans started to become more widely accepted (Eraydın, 2017). To put it differently, in current period, while the regulatory planning system continues, the concept of flexibility envisaged by the discretionary system has gained importance (Kılınç & Türk, 2018; Ozkan & Turk, 2016; Tarakçı & Türk, 2020, 2021). Sectoral plans, special-aimed plans and projects started to increase in number and diversity. So, it is possible to say that Turkey is on the threshold in the context of planning paradigm. Under these circumstances, it is open to debate on what kind of plans and what kind of techniques should be used for plan evaluation. Due to the coexistence of these two systems, it is not sufficient to evaluate the plans just in terms of consistency and compatibility within the hierarchical order. Plans prepared in same period but with different approaches should be evaluated from a holistic perspective within these two structures.

Accordingly, this study aims to provide a general framework on how plan evaluation can be done under the existing conditions in Turkey. Based on the plan evaluation techniques accepted in international literature and considering the specific features of planning system in Turkey, this frame has been formed mainly from a qualitative point of

DOI: 10.15320/ICONARP.2022.229

view. But some quantitative tools are also used, especially for the conformance dimension of evaluation. It is essential to note that this study does not attempt to provide a set of questions for each plan and each settlement. Instead, it aims to create a general framework for plan evaluation in Turkey. The research question is as follows: What is the best possible method for plan evaluation in Turkey, and which materials and indicators should be used to achieve a successful evaluation?".

MAIN APPROACHES FOR EVALUATION IN PLANNING

Planning evaluation systems branch in two main approaches: conformance-based and performance-based. These two groups encompass diverse evaluation methods that vary in terms of parameters and evaluation processes. This section clarifies the basic principles of these two main approaches, and following sections investigate the parameters of empirically tested models for their applicability.

Most of the studies in planning evaluation literature argue that spatial plans should be evaluated with conformance-based methods, and strategic plans should be assessed with performance-based methods. However, the examined plan can have the characteristics of both strategic and spatial plans; therefore, the question of "what is the type of this plan?" is fundamental before starting the evaluation process (Alexander, 2009; Faludi, 2000). Faludi (1989) bases onto differences between spatial/physical and strategic plans on following characteristics: object of the plan, duration of the interaction, future prediction, time-element, form, and effect (Table 1). In his work, the author uses the term 'physical plan' in sense of spatial plan.

Table 1. Differences between physical plans and strategic plans (Faludi, 1989, p.139)

	Physical Plans	**Strategic Plans**
Object	Material	Decisions
Interaction	Until adoption	Continuous
Future	Closed	Open
Time-element	Limited to phasing	Central to problem
Form	Blueprint	Minutes of last meeting
Effect	Determinate	Frame of reference

According to Faludi (1989), the object of a physical plan is material, its future is closed, and its interaction duration ends at the plan's approval. These plans are the detailed outcomes of a limited time frame consisting of multiple stages with limited impact. On the other hand, the object of a strategic plan is the decision, its future is open, and its interaction is continuous. Strategic plans are usually prepared as a policy document or meeting minutes and present a reference framework for the future of a settlement with a problem-focused time management system. The fundamental differences between these two types of plans require an evaluation method that fits the characteristics of concerning plan.

The conformance-based approach evaluates the level of conformity between the plan and its spatial outcomes. In other words, its concern is whether actual outcomes comply with decisions made in planning process. Additionally, this approach also examines the external factors that impact conformity or non-conformity of the plan and its outcomes. The conformance-based approach assumes that plans' preparation and implementation process are entirely rational, and future development of cities is determined by the plans. Spatial plans act within a top-down hierarchy. Implementing these plans means that policies developed at the top are transformed into operational decisions at the bottom (He, 2015). Therefore, conformance-based approach is considered suitable for evaluating spatial plans that are predominantly focused on the realization of pre-determined and definitive goals. This approach concentrates on linkage between the plans and realized spatial development, and the core of this approach is 'compliance' and 'level of conformity' between these two parameters (Berke et al., 2006; Berke & Conroy, 2000; Laurian et al., 2004; Loh, 2011; Lyles et al., 2016).

On the other hand, performance-based approach focuses on role of the plans on urban development and the outcomes that accompany it. The main goal of this approach is to investigate whether the evaluated plan offers a frame of reference for decision-makers. Therefore, it tries to understand how differentiating goals of the sectoral plans and plans on different scales affect urban development. The performance-based approach is a well-fitting method for problem and action-focused strategic plans. Because the implementation process in strategic plans is an interactive procedure that requires the communication and an agreement of all involved actors on the goals and the actions. The main point of strategic planning method is searching for a consensus through negotiation rather than trying to fit urban development into the static design solutions (He, 2015). In performance-based approach, aim of the implementation process includes not only putting a policy into action but also multidimensional analysis of the real-world outcomes (Barrett & Fudge, 1981). That is, the process is as important as results.

When evaluating the performance of strategic plans, it is crucial to set the goals correctly. Because it is not possible to assess the success of a strategic plan as a whole. The evaluation would work better if the assessment were done with a limited cluster of goals. In performance-based approach, it is perfectly normal to observe an urban development, that does not in line with the plan. However, this does not imply the plan's failure. If the plan has a direct or indirect impact on decisions that resulted in the real-world outcome, the plan's performance can be deemed successful (Faludi, 2000). Table 2 summarizes the fundamental differences between conformance and performance-based approaches.

DOI: 10.15320/ICONARP.2022.229

Table 2. Two approaches of plan evaluation (He, 2015, p.55)
-enhanced with additions by the authors-

	Conformance-Based Approach	Performance-Based Approach
Type of plan it's eligible for	Project oriented plans	Strategic plans
Planning process	Rational planning process	Communicative/participative planning process
Planning element	Elements with certainty	Elements with flexibility
Aim	Determining the level of compatibility between the plan and the actual development	Examining how the plan guides urban development in the process from its preparation to its implementation
Success criterion	If development patterns adhere to its policies and meet its objectives	Implemented if used or consulted in decision making process, no need to be strictly adhering to the actual outcome
Focus	Level of conformity	Utilisation capacity
Evaluation element	Outputs	Outcomes and effects
Evaluation method	Qualitatively and quantitatively	Qualitatively

Evaluation Methods Using Conformance-Based Approach

Evaluation methods that adopt the conformance-based approach are largely used to evaluate land use plans. In the literature, two prominent models are utilized the most: Grid-Overlay and Plan Implementation Evaluation (PIE).

Grid-Overlay Model:

This model investigates the relationship between the plan and its spatial outcomes. It is the most widely used model in evaluation of land use plans (Brody et al., 2006; Loh, 2011). This model is entirely quantitative, and it aims to measure which decisions are in line with the plan and which are not (Talen, 1997). To do this, Grid-Overlay model uses Geographical Information Systems and various mapping techniques including morphologic analysis and SWOT analysis etc.

The Grid-Overlay is modeled as five steps (He, 2015):

1. Describing a classification for the level of conformity; the outcomes in line with the plan, the missing implementations, the products that entirely deviate from the plan, etc.

2. Determining indicators to use in evaluation process; indicators for urban functions (ratio of residential area, green spaces, etc.)

3. Comparing spatial outcomes with the indicators determined in previous step

4. Combining findings with the classification decided in first step (congruent outcomes, missing outcomes, non-congruent outcomes, etc.)

5. Assessing factors that affected the plan implementation processes in the light of findings of analysis

Grid-overlay model not only analyses the conformity level it also tries to identify the potential effects that impact it. Its critiques usually focus on the fact that the model is entirely quantitative and concentrates only on physical outcomes (Brody et al., 2006; Laurian et al., 2004). Another shortcoming of this model is that it fails to explain how much time is needed to realize the plan, in other words, how much time should pass after the plan's approval.

Plan Implementation Evaluation (PIE) Model:

Like Grid-Overlay, the PIE model is also used to assess land use plans. Developed by Laurian et al. (2004) as a critique of Grid-Overlay model, PIE argues that conformance-based models should not be limited to evaluating the physical outcomes. In addition to evaluating conformity between the plans and their outcomes, this model suggested new materials such as "permitting decisions" to evaluate the success level of plans.

PIE model has two dimensions: (1)breadth and (2)depth (Laurian et al., 2004). The breadth of implementation indicates the diversity of its policies. This evaluation compares decisions that are never implemented with those that are implemented at least once. The depth of implementation indicates the conformity of implemented decisions to the methods laid out by the plan. Depth is measured by the ratio of implemented plan decisions with at least one technique.

PIE model also has five main stages (Laurian et al., 2010):

1. Determining the parts of plan that will be evaluated and the evaluation is only done by focusing on one aspect of the plan
2. Taking the policies and techniques as the main object of evaluation
3. Choosing the material for evaluation (permit, etc., building licenses) and deciding which techniques and implemented policies will be used for each material
4. Assessing the relationship between plan, techniques, and materials
5. Measuring the breadth (the ratio of implemented policies and the depth (the ratio of implemented policies for each material) of the implementation

PIE model describes an analysis setup based on the plan, decisions, permits, and outcomes. The critiques of this system argue that PIE uses an equal weight method when evaluating policy diversity and ratios. It also evaluates the situations via permits and documents and does not suggest on-site monitoring, and by doing so, it pushes the spatial outcomes into the background. Even though PIE is a conformance-based model, it offers a qualitative evaluation approach and important that it has been empirically tested (Berke et al., 2006; Berke & Conroy, 2000; Lyles et al., 2016).

The conformance-based models' stages can be summarized as (1)classifying the level of conformity, (2)determining the material of analysis (spatial outcomes, permits, building licenses, etc.), (3)comparing the plan with analytical material, (4)explaining the reasons behind the non-conformity. These models have well-defined and applicable steps. However, they fall short in analyzing complex systems, interactions, and uncertain situations (Barrett, 2004).

DOI: 10.15320/ICONARP.2022.229

Evaluation Methods Using Performance-Based Approach

Performance-based models are mainly used to evaluate strategic plans. These models do not require the project to be implemented entirely before evaluation. Moreover, it is believed that trying to implement a plan fully might not produce the best possible result, and the aim should not be the mere physical implementation of plan (Mastop & Faludi, 1997). According to these models, the higher level of conformity between plan and outcome does not mean that plan is successful. The plan's performance is more about reaching realistic goals than fitting into a limited set of criteria.

The changing conditions in the world make it hard to define a linear planning process that starts with policies and ends with actions. It is essential to see the implementation as a process where the policies and the actions run together. It is a negotiation process that goes on between policymakers and actors who will be affected by those policies (Barrett & Fudge, 1981). The strategic plans, which welcome uncertain developments and don not strictly define the future urban development, are prepared with a flexible approach. Therefore, in evaluation of these plans, the level of conformity is seen as less important in terms of the plan's success.

In performance-based models, the primary concern is how the plan is used as a reference in urban development process. The interaction between policymakers and practitioners focuses on communication, negotiation, and consensus. In other words, the consensus is valued more than conformity. While conformance-based models concern with concrete outputs, performance-based models are interested in results. Complete conformance is not sought after in these models. There are two main models in this approach, which are empirically tested: "Policy-Plan-Program-Project (PPPP)" and "Plans, Processes, and Results (PPR)."

Policy-Plan-Program-Project (PPPP) Model:

This model was developed by Alexander and Faludi in 1989. It emerged from a need for a new model for plan evaluation after strategic plans became widely accepted in 1980s. The main concern of this model is how the evaluated plan guides the urban development processes.

The PPPP model has five main stages (Alexander & Faludi, 1989):

1. Conformity: The notion of conformity is still essential, and it is the starting point for the evaluation.

2. Utilisation: Examining the plan as a guidebook in operational decisions.

3. Rationality: Analyzing the rationality of planning process with consistency, information, and participation criteria.

4. Optimality ex-ante: Evaluation of strategies and actions recommended by the PPPP model to see whether they are optimal in terms of the plan preparation decision making.

5. Optimality ex-post: Evaluating the optimality of strategies and actions recommended or adopted by the PPPP model in terms of the

values, goals, options, limitations, observed outcomes, impacts, and unexpected results.

In PPPP model, policies, plans, operational decisions, and spatial outcomes are evaluated by a series of questions (Table 3).

Table 3. Evaluation criterion and questions of PPPP model (Alexander & Faludi, 1989, pp.136-137)

CRITERION AND QUESTION	CONDITIONAL RESPONSE AND/OR EVALUATION
1. CONFORMITY	
1.1. Do policy-plan-programme-project (PPPP) outcomes or impacts conform to PPPP instructions or projections?	If yes, go to 1.1.1 If no, go to 2
1.1.1. Is conformity complete or partial?	If complete, go to 1.2 If partial, go to 1.1.2
1.1.2. Is degree of partial conformity significant in terms of impact on the relevant (socioeconomic, physical, built) environment?	If yes, go to 1.2 If no, go to 1.1.3
1.1.3. Is partial conformity so limited as to be almost negligible?	If yes, PPPP rates negative; go to 2 If no, disaggregate policy or plan evaluation into more conforming and less conforming parts and go to start for each separately
1.2. Does PPPP have a significant directive function (that is, is it more than a projection of practices, procedures, or trends that would have occurred without the respective PPPP, and is it more than a collage of other PPPPs)?	If yes, PPPP rates positive; assume that PPPP has been used; but it can still be evaluated for rationality and optimality; go to 3 If no, PPPP rates negative, in spite of conformity due to absence of directive function
2. UTILISATION	Since response to 1 indicates nonconformance, explore reasons for nonconformance with utilisation or nonutilisation; go to 2.1
2.1. Was the PPPP used or consulted in making operational decisions involved in the development or implementation of this or other PPPPs?	If no, go to 2.2 If yes, PPPP rates positive, but may still be assessed for rationality and optimality; go to 3
2.2. What was (were) reason(s) for nonconformance or nonutilisation?	
2.2.1. Change in decisionmakers?	If yes, go to 2.2.2 If no, go to 2.3
2.2.2. Could this change have been anticipated, or could the PPPP have incorporated flexibility or adaptability to respond to such a change?	If yes, PPPP rates negative, but may still be assessed for rationality and optimality ex ante; go to 3 If no, go to 2.3
2.3. Change in decision situation?	
2.3.1. Caused by (a) objective changes in environment, phenomena, trends? (b) perceived changes in environment, phenomena, trends? (c) changes in societal or organisational values, goals, objective? (d) changes in available means, resources, strategies, technologies?	If yes, go to 2.3.2 If no, PPPP rates negative but may still be assessed for rationality and optimality ex ante (go to 3); reasons for nonutilisation in absence of change may be found in these assessments
2.3.2. Could the change(s) in the decision situation have been anticipated or allowed for in the PPPP (for example, through prediction, flexibility, adaptability, potential for revisions, etc.)?	If yes, PPPP rates negative, but may still be assessed for rationality and optimality; go to 3 If no, PPPP rates neutral; go to 3
3. RATIONALITY	PPPP can always be evaluated for rationality; go to 3.1
3.1. Consistency: are the provisions of the PPPP internally logical, compatible, and	If yes, go to 3.2

DOI: 10.15320/ICONARP.2022.229

consistent with its goals, objectives, premises, and analysis?	If no, PPPP rates negative, but may still be evaluated for information and participation; go to 3.2
3.2. Information: does the PPPP incorporate and use the best data, technology, information, methods, and procedures that were available in the context and at the time of the PPPP's preparation and development?	If yes, go to 3.3 If no, PPPP rates negative, but may still be evaluated for participation; go to 3.3
3.3. Participation: did all relevant groups, interests, organisations, institutions, social units, and individuals participate in the preparation of the PPPP and in making critical decisions? Do these decisions and the PPPP in general reflect the weighted aggregate of affected groups?	If yes, go to 4 If no, PPPP rates negative, but may still be evaluated for optimality; go to 4 (Note: negative responses to these questions, when questions 2.2 or 2.3 received negative responses too, may offer reasons for nonconformity to or nonutilisation of the PPPP)
4. OPTIMALITY EX ANTE	PPPP can always be evaluated for optimality ex ante; go to 4.1
4.1. Was the recommended or adopted strategy or course of action in the PPPP optimal (that is, the 'best') in the light of the decision situation prevailing at the time of the PPPP's preparation and development?	If yes, PPPP rates positive; go to 5 If no, go to 4.2
4.2. Did the PPPP rate positive on the rationality criterion?	If yes, go to 3 and reassess If no, PPPP rates negative; go to 5
5. OPTIMALITY EX POST	PPPP can always be evaluated for optimality ex post; go to 5.1
5.1. Was the recommended or adopted strategy or course of action in the PPPP optimal (that is, the 'best') in the light of present analysis: perceived values, goals, objectives, options, constraints and observed outcomes, impacts, and unanticipated consequences?	If yes, go to 5.2 If no, PPPP is rated neutral; failure is not due to PPPP but to different values, options, constraints, impacts, etc., recognised in hindsight
5.2. Did the PPPP rate positive on the test of optimality ex ante?	If yes, PPPP rates positive If no, then this is a freak result which may be caused by post-PPPP value changes or unintended or unanticipated positive effects; assess for possible implications for future
5.3. Did PPPP rate positive on the rationality criterion?	If yes, PPPP rates positive If no, go to 3 and reassess

PPPP model offers a flexible model with the evaluation criteria and its recommended questions enable the evaluation of a plan that does not have well-defined goals and is realized in uncertain conditions. It establishes a connection between plan and outcomes through the plan's role and its guidance through the urban development process. This model argues that making an evaluation is possible without a direct link between conformity and performance. The non-conformity does not mean low performance. This method chooses to evaluate the process rather than the outcome.

While the planning transitions from comprehensive paradigm to communicative paradigm, the PPPP model took an important place in planning evaluation literature due to its adaptability to the characteristics of different plans and the structural conditions of system. PPPP model with its performance-based approach adapts to different aspects of evaluation and becomes a solid reference model for empirical works.

Plans, Processes, and Results (PPR) Model:

PPR Model was developed by Oliveira and Pinho in 2009, as a method of performance-based evaluation. The main criteria of PPR are as follows: external coherence, plan utilisation, commitment of resources, participation, planning effectiveness, internal coherence, planning system, relevance, and direction (Oliveira & Pinho, 2009, 2010). Regarding each of these criteria in PPR model; methodology including the object of assessment, the evaluation technique, and the material are summarized in Table 4.

Table 4. Methodology of PPR model (Oliveira & Pinho, 2009, pp.40-41)

SPECIFIC CRITERIA	EVALUATION SUBJECTS	SUB-CRITERIA	EVALUATION TECHNIQUES/DATA SOURCES
Internal coherence	Plan	Relationships between the objectives and the land uses of the plan Relationships between the objectives and the urban systems of the plan Relationships between the objectives and the plan implementation mechanisms	Reading of plan Impact matrices (different plan proposals)
Interpretation of planning system	Plan Planning system	Interpretation in terms of form (checklist) Interpretation in terms of substance	Reading of the plan and of the framing law-decrees
Relevance	Plan City	Relationships between the needs of the city and the objectives of the plan Relationships between the needs of the city and the land uses and urban systems Relationships between the needs of the city and the plan implementation mechanisms	Reconstruction of the baseline situation SWOT analysis Impact matrices (plan proposals – city needs)
External coherence	Plan Other plans	Relationships in terms of objectives Relationships in terms of territorial model Relationships in terms of implementation	Reading of the plan and of other plans for that territory
Participation in plan making	Plan City users	Quantity of citizens' written comments Quality of citizens' written comments Promotion of public participation by the local authority	Reading of the plan (particularly its participation reports)
Plan utilisation	Plan Planning process Political power	Influence of the political power in the plan, as well as in other planning products, processess and structures Influence of the plan and of the planning practice in the political power (discourses, programmes)	Reading of the different versions of the plan (during the period of its preperation) Interviews Reading of newspapers
Commitment of resources	Planning process (Human, financial) resources	Evolution of the availability of resources Type of resources available	Reading of other official documents prepared by the local authority (municipal budgets, activity plans) Interviews

DOI: 10.15320/ICONARP.2022.229

		Relationships between planning performance and utilisation of resources	
Participation during plan implementation	Planning process City users	Quantity of citizens' written comments Quality of citizens' written comments Promotion of public participation by the local authority	Reading of lower level plans (particularly their participation reports)
Effectiveness	City Planning process Development control Plan	Development of the plan through urban development plans and detailed plans Development of the plan through urban design projects Plan guidance in the process of development control	Reading of the plan and of lower level plans Cartographic analysis Field work Analysis of planning permits
Direction	City Planning process Development control Plan	Plan impact on demography Plan impact on transports and mobility Plan impact on housing Plan impact on economy	Reading of the plan Statistical analysis Cartographic analysis Field work Interviews

Like PPPP model, the PPR model offers a unique model based on performance-based approach and can be used for evaluation of strategic plans. It is one of the important models in the literature in terms of clearly defining the principles for plan evaluation and proposing a comprehensive measurement and evaluation technique. With the methodology offered by this model, two plans in Lisbon and Oporto were evaluated. The fact that it was used by its developers to measure performance in an empirical study is important in terms of demonstrating the applicability of the model. Although the criteria presented in this model are numerous and diverse, and even enable a comprehensive assessment of success level of the plan, they show a repetitive characteristic in terms of content and suggested measurement technique.

In summary, performance-based methods are used to evaluate strategic plans. There is no search for certainty, the emphasis is on processes, decisions, actions, and consensus among actors. Therefore, it can be said that performance-based approaches are more compatible with the current paradigm of current period.

STRUCTURAL CHARACTERISTICS AND CHANGE OF TURKISH PLANNING SYSTEM

Planning systems are generally divided as regulatory and discretionary systems. In regulatory systems, the basic principles are hierarchy and certainty, while in discretionary systems the concepts of horizontal-vertical subsidiarity and flexibility are prominent (Rivolin, 2008; Steele & Ruming, 2012). The main differences between these systems are indicated in Table 5.

ICONARP – Volume 10, Issue 2/ Published: 20.12.2022

Table. 5 Two models of planning systems (Rivolin, 2008; Steele & Ruming, 2012)

	Regulatory planning systems (conforming systems, plan-based systems)	Discretionary planning systems (performing systems, project-based systems)
Principles	Hierarchy	Vertical and horizontal subsidiarity
Advantages	Certainty	Flexibility
Disadvantages	Rigidity	Discretion
Role of plan	Regulative	Strategic
Function	Implementation	Application
Scale	Local	Regional, national, supra-national
Examples	USA, almost all European countries	UK, Ireland, New Zealand, Australia etc.

The Turkish planning system is theoretically shaped according to regulatory planning system (Ozkan & Türk, 2016). However, especially after 2000s project-based approaches are gaining weight and there is a tendency towards flexibility in planning system (Ozkan & Türk, 2016; Tarakçı & Türk, 2020, 2021). This situation reveals a dichotomy in which there is a definite hierarchical order on the one hand, and on the other hand this structure is flexed with various arrangements. Ozkan & Turk (2016) expresses the factors that shape flexibility in Turkish planning system as follows: special-aimed laws, plan revisions, plan amendments, plan notes, preliminary project implementations, and special planning agreements. The hybrid system creates some problematic areas in planning practice (Kılınç & Türk, 2018). Because the use of these tools in planning system creates uncertain conditions, ignores the principle of accountability, and expands the discretion of decision makers (Tarakçı & Türk, 2020, 2021).

After mentioning the general features of planning systems above, it is necessary to examine the Turkish planning system from a historical perspective. There have been periods when significant changes were made in who owns the planning authority and in plan types through a series of legal and administrative regulations. After the transition to planned development period in 1960s, four most important breaking points that radically changed the planning system. These issues can be listed as: (1)Reconstruction Law no.3194 (came into force in 1985), (2)establishment of the Ministry of Environment and Urbanization (Decree-Law no.644 in 2011), (3)Regulation for the Preparation of Spatial Plans (came into force in 2014), (4)transition to the Presidential System of Government (Presidential Decree no.1 in 2018). Nevertheless, legal and administrative changes are not limited to these four regulations. Today, interventions made both through changes in regulations and decrees are still the most important problem areas of planning discipline. In this part of the article, the main regulations affecting planning system are discussed chronologically in the context of planning authority and hierarchy.

When the regulatory planning system was the dominant approach in planning, Reconstruction Law no.6785, which was in effect from 1956 to 1985, defined a planning process in which the plans were prepared by municipalities and approved by central government. During this period,

DOI: 10.15320/ICONARP.2022.229

the ministry has authority to control the process. It can approve the plans without changes, approve them by changing, or send them back to the municipality to make necessary changes (Özdemir Sönmez, 2017). However, though the municipalities had authority to prepare plans, they left plan preparation process to the Bank of Provinces, since they did not have required institutional capacity at that time. In other words, the plans were developed in Ankara by proxy and the influence of local governments on planning process was quite limited. The structure of this system was almost completely centralized, and municipalities had only the role of implementers of plans (Enlil et al., 2020; Özdemir Sönmez, 2017).

Until 1980s, a top-down, closed-ended, comprehensive, regulatory, and entirely centralized system dominated the planning system in Turkey (Enlil et al., 2020). Nevertheless, after the neoliberal policies gained influence worldwide, the transformation of planning system accelerated as well. As the economy was directed by free market and its social and spatial reflections required a fundamental change, planning as an institutional practice was not able to keep up and eventually the need for new regulation mechanisms arose (Eraydın, 2006). The Reconstruction Law no.3194, which came into force in 1985 and is still in effect, was an important turning point in spatial planning legislation in terms of delegating planning authority to the local.

This law enabled the process in which the authority to make and approve the development plans was given to local municipalities within the boundaries of municipality and municipal adjacent area. And the authority to make plans outside of these zones is transferred to the Special Provincial Administration (Reconstruction Law no.3194, 1985). This change in the law increased the emphasis on localization and local governments became legally important actors in planning process. On the other hand, many areas were given a special status, and the right to plan these areas was transferred to various institutions of central government. Excluding local governments from the planning process of the special status areas resulted in fragmented legislation and spatial development shaped by fragmented plan decisions. (Özdemir Sönmez, 2017).

One of the first regulations that limited the jurisdiction area of local governments was Encouragement of Tourism Law no.2634 in 1982. With this law, the authority to make spatial plans in tourism regions passed to the Ministry of Tourism. This regulation bypassed the planning process to accelerate the development of tourism sector and facilitate tourism investments (Enlil et al., 2020). This model started with tourism sector and spread to other sectors in following years. A series of laws and regulations exempted from the Reconstruction Law and thus institutions that were equipped with some privileged planning authority in industry, conservation, environment, privatization, agriculture, housing, and many other sectors mushroomed one by one (Duyguluer, 2014). The piecemeal authorization of multiple actors in central government gradually decreased the role of local authorities and the central government continued to keep majority of the power in planning process. Similarly, with the Mass Housing Law that came into force in 1984 and the establishment of Mass Housing Administration, the planning of the privileged areas passed to this institution, which was also an actor of central government. The situation resulted in exclusion of the local authorities from the planning decisions regarding the planning of residential areas (Enlil et al., 2020).

Examples of this fragmented planning approach can be multiplied. Institutions and organizations affiliated with the central government have authority to prepare and approve approximately 15 types of spatial plans (Özdemir Sönmez, 2017). Even though the localization rhetoric became the prominent discourse in the past decade, the planning system in Turkey continued to operate with a top-down approach (Enlil et al., 2020). Additionally, as stated in an OECD report, there are vertical and horizontal coordination problems among institutions that affect the healthy functioning of planning system in Turkey (Silva & Acheampong, 2015). All in all, in 1980s the concepts such as participation, negotiation, cooperation, and flexibility required by the communicative paradigm, could not find their way into planning agenda of the country.

Starting in 1980s, the regulatory function of planning system gradually dissolved and gave way to a more facilitating role and public-private partnerships, in which eventually private sector took the lead in planning (Öktem, 2006). This situation became more visible in 2000s. The special-aimed laws that emerged in this period paved the way for large-scale urban projects (Uzun, 2017). For example, with the Law no.5162 entered into force in 2004, Mass Housing Administration was given the authority to carry out transformation projects in urban slums. This regulation enabled the areas that are owned by the government converted into private property (Boratav, 2015). These changes resulted in a fundamental transformation of planning institution, as it gradually abandoned its holistic approach and regulatory function, and cities around the country were shaped by project-based interventions (Kahraman, 2021).

The most important institutional change in post-2000 period was the establishment of Ministry of Environment and Urbanization in 2011. In the founding decree, responsibility of the ministry is defined as "defining basic principles, strategies, and standards for all types and scales of spatial plans and overseeing their implementation" (Decree-Law no.644, 2011). The rights that are granted to Ministry of Environment and Urbanization were not limited to this. In addition to role of policymaking, strategy development, guiding and supervising local governments, they also have the authority to issue construction and occupancy permits for buildings for which construction permits are denied by the municipalities for a certain period (Özdemir Sönmez, 2017). Therefore, the planning authority that was gradually transferred to local governments in the past three decades has been re-centralized again with establishment of the ministry in 2011.

DOI: 10.15320/ICONARP.2022.229

The foundational element of spatial planning is the principle of "planning hierarchy" among plans on different scales that guide and supervise each other (Ersoy, 2000, 2016b; Ozkan & Turk, 2016). This hierarchical structure, which consists of successive plans, is defined in Reconstruction Law no.3194, with the statement "The plans are prepared as 'Regional Plans' and 'Reconstruction Plans', and reconstruction plans as 'Local Land Use Plans' and 'Detailed Local Plans in terms of the area they cover and their purpose." (Reconstruction Law no.3194, 1985). However, spatial strategy plans and upper-level land use plans, which sit at the top of planning hierarchy, are not mentioned in the 6th article of the law explaining planning stages (Ersoy, 2016b).

The plans that contain the most abstract and large-scale information on a national and regional level are called 'Spatial Strategy Plans' and sit at the top of the hierarchy, 1/1000 scale Detailed Local Plans are located at the bottom. In between, there are Upper-Level Land Use Plans and Local Land Use Plans (Ersoy, 2000, 2016b). In addition to these plan types, there are complementary plans mentioned in the law such as revision plan, additional development plan etc. Furthermore, additional tools such as plan amendments have also been defined and they became a staple in cases where inflexible spatial plans were not able to meet the needs of dynamic structure of cities in the long run (Ersoy, 2000). On the other hand, special areas and privileged institutions continued to be established through new laws and regulations top-down when conflicting issues emerged.

If they comply with the main principles and decisions made by the upper-scale plans, changes can be made in the lower-scale plans to respond to changing conditions and requirements of the urban space. The main parameter in the evaluation of congruence among plans is whether the land use type determined by the upper-scale continues to be the dominant land use type despite all diversification in the lower-scale plans (Ersoy, 2000, 2016b). However, while there are laws in place that allow various upper-scale plans to be made, there are also several legal regulations that disregard the plan hierarchy and create new plans above all other plans (Duyguluer, 2006). The places and types of plans created by various regulations are not clearly defined in the hierarchy of plans. Moreover, the authority to realize these plans is distributed among various institutions of central government. The influence of the upper-scale plans in terms of guiding the spatial development was gradually lost and a flexible structure formed by standalone projects has emerged (Özden, 2013). The number of institutions equipped with the planning authority and the diversity in plan types continued to increase, and confusion and complexity of the system deepen. Insomuch that, a study dated 2006 shows that there are 56 different plan types and 8 different scales that result in a fragmented planning system with 18 institutions authorized to make plans (Duyguluer, 2006).

In 2014, the "Regulation for the Preparation of Spatial Plans", which was prepared in accordance with Reconstruction Law no.3194 and

Decree-Law no.644, entered into force. This document encompasses detailed explanations about the definitions of plans, plan hierarchy, general planning principles, the scope and the elements of plans, stages, and the techniques used in planning (research, threshold analysis, standards, plan report, legend techniques, etc.), plan documents, plan revisions and amendments, distribution, monitoring and examination of the approval, suspension, and objection processes (Özdemir Sönmez, 2017). The by-law covers all the processes and procedures regarding preparation, examination, approval, and enactment of strategic plans, upper-level land use plans, local land use plans, detailed local plans, conservation plans, integrated coastal area plans, and urban design projects.

This regulation added a new level called 'spatial strategy plan' to the planning hierarchy and authorized the Ministry of Environment and Urbanization to prepare and approve this plan. The spatial strategy plan positioned at the top of hierarchy is a binding document for upper-level land use plans that are under the jurisdiction of metropolitan municipalities and special provincial administrations in non-metropolitan provinces (Enlil et al., 2020). This last move made it evident that in the past decade, the authority of local governments became even more restricted and the power of making spatial plans is gathered at the ministerial level (the name changed to the Ministry of Environment, Urbanization and Climate Change in 2021), and thus the planning system became highly centralized again. The planning system in Turkey becoming more and more top-down makes it almost entirely impossible to establish a bottom-up monitoring and feedback mechanism (Sezgin & Erkut, 2020).

Authorized institutions for preparation of regional scale plans in Reconstruction Law no.3194 have also changed over time. With Decree-Law no.641, which entered into force in 2011, the State Planning Organization was closed, and the Ministry of Development was established. Regional Development Agencies, under the Ministry of Development, are authorized to make regional plans. However, the Regulation for Preparation of Spatial Plans, which came into force in 2014, does not contain the 'regional plan' as a level in planning hierarchy (Özdemir Sönmez, 2017). Therefore, the new regulation does not define a direct relationship between spatial strategic plans and upper-level land use plans. This development renders the crucial regional scale, that links the country-level plans to local plans, undefined (Sezgin & Erkut, 2020), and creates disharmony in hierarchical system of planning.

The last main alteration in Turkey spatial planning system is the transition to Presidential of Government in 2018. With this administrative change, the planning authority was transferred to the units affiliated to central government, thus the planning power and influence of local governments has decreased (Büyükcivelek, 2022). Although a centralized structure has emerged within the Presidency, the authority to prepare and approve plans at various levels has been

DOI: 10.15320/ICONARP.2022.229

distributed to more than one ministry. It is not clear how the coordination between these institutions will be ensured (Dinçer, 2022).

Dinçer (2022) discusses the effects of new system on planning field over the following four topics. Firstly, planning policy has been replaced by policy planning through the established Policy Boards. Secondly, the number of privileged statuses has increased by the President's decisions about crucial facts such as urgent expropriation, identification of sensitive areas to be strictly protected, declaration of risky areas etc. Thirdly, local government became subordinate to the central government. As a result of hegemonic attitude of central government, values such as sharing of authority and responsibility in management, coordination, and joint decision making have been ignored. Also, it constitutes an obstacle to the services and investments of metropolitan municipalities. Lastly, with the reorganization of public sector on the axis of marketization, the government's disregard for public interest has become more apparent.

All these crucial changes show why it is difficult evaluating the level of success of a plan in Turkey's planning system. In other respects, it is evident that there is a need for a well-defined and feasible method that can partially compensate for the deficiency in monitoring and evaluation of urban planning in Turkey. Even in this complex planning environment, the hope for drawing a general framework for plan evaluation is not completely lost. To this end, the following section contains the methodological approach, criteria, main questions, and research materials of the evaluation process we propose.

PROPOSED FRAMEWORK FOR THE PLAN EVALUATION IN TURKEY

Methodological approach of the study is based on two issues: main evaluation methods coming from international literature and the major problems or distinctive vulnerabilities of national planning system. The evaluation criteria determined by filtering in line with the needs of current planning conditions are shown in Table 6. It was concluded that the plan evaluation in Turkey should have three pillars as (1)conformity, (2)rationality, and (3)utilization which will be explained in detail below.

Table 6. Reasoning of evaluation criteria *-produced by the authors-*

Dimension	Sub-criteria	Why is it important for plan evaluation in Turkey
CONFORMITY	Plan and output accordance	After the plans are approved, how and to what extent they are implemented in practice is not monitored, so there is such a need.
	Plan effects	There is a mechanism that evaluates the effects of plans before implementation with tools such as Environmental Impact Assessment. But there is no legal regulation that evaluates the post-implementation effects of plans.
	Relevance	Whether the plans are suitable for the needs and specific conditions of the planned area should be evaluated in line with the planning principles.
RATIONALITY	Internal coherence	The primary element that makes a plan successful is its consistency within itself.

	External coherence	A plan must be consistent with spatial plans within the hierarchical structure and must be integrated with other strategic plans prepared for the same area.
	Participation	Participation is defined as an obligation in Turkish planning legislation just in conservation plans. However, since the communicative paradigm is dominant today, the success level of a plan is directly related to the functioning of participation mechanism.
	Cooperation and coordination	There is a distribution of authority both between the central and local government and among the central government's own units. Also, there are more than one institution authorized for the same area. For these reasons, cooperation and coordination should be ensured appropriately and these processes should be controlled.
UTILISATION	Utilisation	Decisions of strategic plans regarding the planned area are expected to guide spatial plans. But the link between strategy documents and spatial plans is not strong enough in Turkey.
	Reasons of non-utilisation	If strategy documents or plans do not have a directive role on spatial decisions, they do not serve their purpose. The reasons for this should be questioned.

The evaluation should contain components related to (1)the plan itself, (2)the planning authority (planner), and (3)the object of plan that is “the planned” (environment, area, sector, etc.) (Figure 1). The relationship between these components also needs to be investigated. The sub-dimensions of conformity, rationality, and utilisation will become the tools to understand the relationality of components mentioned above.

While explaining the ‘plan’ element, it should first be stated that there are two stages of plan in Turkey’s planning system in the context of planning hierarchy. The first stage is named “upper-level plans” which are composed of Spatial Strategy Plan as thematic plans and followed by Upper-Level Land Use Plan which is prepared for the basin or only one or some provinces at least. The second stage is called “reconstruction plans” consist of Local Land Use Plan and Detailed Local Plan.

On the other hand, there are “special-aimed plans” focused on ‘specific themes’ and ‘planning authority’ such as conservation site, tourism master plans, integrated coastal areas plans etc. It carries great importance that these plans are evaluated in terms of their hierarchical order, types, purposes, and roles in the planning system. Even so, it can be said that the hierarchical relations between plans are the most remarkable indicators for evaluation in Turkish planning systematic within the context of national legislation, the law no.3194 on land development planning.

The ‘planner’ aspect (i.e., the planning authority), signifies the institutional context in which planning is practiced, that is the institution and the authority evaluated plan was prepared by, such as ministerial-level authorities, provincial and district organizations of central government, metropolitan municipalities, and other provincial and district municipalities. It is important to identify the overlapping and conflicting decisions that stemmed from different plans prepared for the same area that point out some institutional conflicts.

DOI: 10.15320/ICONARP.2022.229

The 'planned' environment/area/sector should be evaluated in terms of the hierarchy of plan and the role assigned to planning object within the planning system. If the evaluation object is a spatial plan, its impact on the plan area and the conformity of the plan to the needs and characteristics of the area should be considered. For example, if the plan is prepared from a sectoral point of view, the evaluation should touch upon the sector's future development rather than spatial outputs. The following sections explain how the evaluation can be carried out in line with these three components.

Figure 1. Evaluation framework proposed by the authors

Conformity

The conformity dimension of plan evaluation aims to determine the consistency between the subject of plan and its outcomes and impacts. The multifaceted and complex planning system that operates in the interface of strategic and spatial plans in Turkey, especially with developments in the past two decades, deems it necessary to start the evaluation with conformity.

Even though the global literature argues that a conformance-based approach should not be the primary method to evaluate strategic plans, the unique case of Turkey requires the investigation of whether the realized outcome is compatible with the plan decisions. For such an evaluation, in addition to comparison through the superimposition of plan and outcome, the process should be analyzed whether the goals were hit, even they were not realized exactly as they were described in the plan. What matters is that the results are in parallel with the principles and objectives envisioned at the beginning of planning process rather than the plan decisions. Therefore, during the evaluation of plan, not only the congruence between the plan and its spatial outcome but also the plan and the externalities it creates should be examined. In this respect, the following three questions should be answered.

a. Is the realized outcome compatible with the plan? To what extent did the projections of the plan come true? (Analyzing the relationship between the plan and its outcomes) - *coded C1 in Figure 1*

b. What are the positive and negative effects of the realization of the plan? (Analyzing the relationship between the plan and its effects) - *coded C2 in Figure 1*

c. Does the plan respond to the needs of the planned area? (Analysis of how well the plan responds to the requirements of planned area) - *coded C3 in Figure 1*

The main materials of conformity between the plan and its outcomes are the main objectives of the plan and the realized situation in target year of the plan. So, the goals of plan should be examined under certain categories (physical/spatial goals, economic goals, social goals, etc.), to the extent to which these goals were achieved quantitatively and spatially. Although the indicators such as employment, population, density, and reconstruction conditions are quantitatively compatible with the goals of plan, there could be some discrepancies in terms of the spatial distribution of these indicators. Therefore, the plan should be evaluated if it reached goals in terms of numbers with the help of statistical data and if the spatial distribution of functions is in line with the original plan.

In the analysis of the relationship between the plan and the externalities it creates, the objectives of plan must be classified to determine which category of objectives will be evaluated. The characteristics of the settlement and the type of the plan would define what should be evaluated and under what circumstances (i.e., the effect of plan decisions on tourism, the effect on natural environment, the effect on rural areas, etc.)

The evaluation of possible effects of the plans became a mandatory step with the Environmental Impact Assessment (EIA) regulation in 2017. However, EIA is not a sufficient tool on its own. This is partly because its connection to the zoning plans, which dictate spatial development, is weak. Moreover, as it is done ex-ante and based on estimation, the resulting evaluation carries the risk of not being accurate and healthy enough.

In evaluation of relationship between the plan and the features of planned area, the evaluation should consider to what extent the plan meets the needs of planning area. To be able to evaluate the plan performance, it is also important to correctly identify the problems and potentials of the area and related plan objectives. To summarize, the conformity element assesses the plan in terms of its congruity with the planned area. The physical outcomes of the plan, the plan's positive or negative impacts on planned area, and the ability of plan to respond to needs of area should be the center of evaluation process. Therefore, in addition to quantitative and spatial assessments, the opinions to be received from the relevant actors and institutions (local government

DOI: 10.15320/ICONARP.2022.229

representatives, planners, the public, etc.) would help to enrich the evaluation process.

Rationality

The rationality component of plan evaluation process encompasses internal coherence, external coherence, participation, cooperation and coordination.

The following questions should be answered to assess the internal coherence criterion. - *coded R1 in Figure 1*

a. Is the evaluated plan internally consistent?

b. Does the plan maintain its internal consistency throughout its duration?

The consistency of the plan is evaluated through these three elements: the purpose, the objectives, and the strategies/concrete decisions of plan. A simple conformity matrix easily shows the incompatibilities between these elements. However, this evaluation should be limited to the plan, and the external factors should not be included.

The issue of whether the plan maintains its internal coherence throughout its duration is evaluated through plan revisions and plan amendments. When an unforeseen change occurs, a plan revision becomes necessary, however, what kind of changes are predicted and whether there is really a need for a revision should be discussed.

A plan amendment is applied when there are only minor changes that do not require a plan revision. However, since it became a frequently used tool, it started to cause radical changes that exceed this simple tool's purpose. Therefore, plan amendments also pose an obstacle to maintaining the internal consistency of a plan. A large number of plan amendments disrupt the consistency of decisions made by the original plan and cause some problematic changes in population, employment, density, urban facilities, etc. This misuse of these essentially facilitating tools results in conflicts between their implementation and their definition in the law. Therefore, the internal coherence is closely associated with the relationality between the plan and the revision plan or spatial development that changes with these modifications. The questions to be answered in evaluation of the external coherence criterion are as follows. - *coded R2 in Figure 1*

a. Is the plan compatible with other plans?

b. Is the policy, plan, and project chain consistent with one another?

In pre-2000 period, the incompatibility of different plans was not very common. However, the 2000s created a rather complex structure in terms of diversity of plans in Turkey. Today, while the vertical hierarchy continues, the planning system is perforated by special-aimed plans, sectoral plans, etc., which are not clearly defined regarding their hierarchical positions. Therefore, when evaluating the external coherence, the plan should be examined along with the other plans produced for the same area. Furthermore, after 2000s, the abandonment of comprehensive planning approach and the emergence of a fragmented

ICONARP – Volume 10, Issue 2/ Published: 20.12.2022

structure made it difficult to evaluate the plans prepared in this period. Therefore, what sort of consistency these fragmented plans present becomes essential when evaluating these plans.

While evaluating the consistency of spatial plans, the consistency check can be done using essential functions like land use, density, and transportation. However, while assessing the coherence of the plan with the sectoral plans produced for the same area, the comparison should include objectives, strategies, and fundamental decisions to clearly see the harmonious and conflicting parts of these plans.

The other question related to the external coherence is whether there is congruity between the policy, plan, and project. Again, due to the discrepancies observed in Turkish planning system, for the period between 1985 and 2000, when Reconstruction Law no.3194 came into force, the consistency of development plans, regional plans, upper-level land use plans, local plans, investment decisions, and projects should be carefully evaluated. Additionally, today, sector-based plans should also be assessed if they are consistent with the goals of original plan. Therefore, external coherence emerges as a concept that should be evaluated simultaneously through the plan, policy documents, and sectoral plans.

Another component of rationality is participation. - *coded R3 in Figure 1.* The important question is what kind of participation mechanism is used in the preparation of plan. The methods used to ensure that participation functions properly and the deductions made during the process are also very crucial for evaluation process. The comprehensive paradigm that was dominant until 1980s did not have a participatory perspective. Thus, participation is not a valid criterion for evaluating plans made at that time. However, participation and negotiation in planning are the essential elements that legitimize the communicative paradigm and strategic plans. Today, participation is one of the most critical elements that stand at the intersection of the three-pillared structure (plan-planner-planned) which influences the success level of the plan.

Other sub-criteria of rationality are cooperation and coordination. - *coded R4 in Figure 1.* To evaluate that the following questions should be considered.

a. What kind of cooperation mechanism does the plan operate with?

b. Is there a coordination between institutions? If yes, how?

Cooperation and coordination are one of the most challenging criteria to evaluate plans in Turkey. Turkey’s planning system is highly centralized. The fact that many institutions are authorized for various plans, and the rapid changes in institutions render this assessment even more difficult. In pre-1980 period, when the planning system assumed a regulatory role, the discussion was focused on the central-local dilemma. However, today there is even a conflict of authority between the different institutions of central government. The confusion of authority in the areas with crossing borders results in conflicting plan decisions and due

DOI: 10.15320/ICONARP.2022.229

to the frequently canceled plans, some settlements remain without a valid plan for many years.

In the evaluation based on cooperation and coordination criteria, an examination should be made to include the elements of the plan and the planned area, starting with the 'planner.' The institution that prepared the plan, the other institutions whose opinions were sought in the process, and the institutions excluded from the process should be identified. The jurisdiction areas of the institutions should be clearly defined. It is also important to go beyond referring to another institution's opinion, a culture of cooperation should be created between institutions by establishing coordination units and participatory processes.

Lastly, while in the conformance dimension there is a linear relationship between the evaluated plan and the planned area, it is not possible to observe such linearity among plan-planning authority-planned object in the rationality dimension. The evaluation element in the internal and external coherence criteria is the 'plan.' While the collaboration and coordination criteria are located between the 'plan' and 'planner' components, the participation criterion is located at the intersection of all three parts. Therefore, in the context of rationality, the relationships between the components should be examined with an in-depth and multifaceted approach.

Utilisation

The utilization constituent in evaluation analyses whether the plan subject to evaluation guides subsequent plans and implementation processes. It is possible to describe the assessment in two stages. The following questions should be examined in the first stage. - *coded U1 in Figure 1.*

a. Has the original plan been consulted in making operational decisions in implementation or application processes?

b. Was the plan utilized in process? Does the effectiveness of the plan continue in following period?

In the context of these questions, at first, the plan which is the subject of evaluation should be evaluated by comparing it with other simultaneous plans and the plans in following period, based on targets and main decisions. The utilisation of the original plan should be evaluated toward the following aspects:

- Whether the decisions are consistent with the original plan.

- Even if decisions are not in line with the plan, the plan can explain the reason behind this situation.

- A deliberate deviation from the decision, that could still be explained with reference to the plan.

One of the most critical issues in the evaluating the utilisation is to examine whether the plan has a significant guidance effect on the process. To understand this, whether the multi-actor decision system defined in a strategic plan has been applicated and how effective the program is in guiding the actions of relevant actors can be assessed. In the case of Turkey, it is expected that if the plan is used decision-making processes in various investment projects, especially in private sector, will produce a positive result from the point of performance.

In the second stage of evaluation in the utilization dimension, an examination can be made on the following questions, and these questions can be diversified in relation to the planning history of area. - *coded U2 in Figure 1.*

a. What are the main factors that can affect (impair) the implementation of a plan?

b. What are the reasons if the plan was not utilized in process?

Key factors that may affect the realization of plan are the policies of central government, the vision, goals, and strategies adopted by the planning institutions, changes in relevant laws and regulations, changes in planning tools and resources, and changes in expectations of society. If the evaluated plan was not utilized in process, the reasons for this situation should be investigated within the framework of following questions:

- Has there been a radical change in the vision of central government?

- Have decision-makers or situations changed? Has the authority responsible for making plans changed?

- What changes have occurred in discretion and regulatory authority?

- Are there any changes in the legislation? How did the change in legislation affect the implementation process of plan? etc.

That is, in first stage of the utilisation, the relationship between the plan and the planned should be examined. However, in second stage, a multi-dimensional analysis including all three of the plan-planner-planned components should be made.

The criteria set in the suggested evaluation frame and related questions are summarized in Table 7.

Table 7. Criteria and questions of the proposed plan evaluation framework -produced by the authors-

Criteria	Sub-criteria	Questions
CONFORMITY	Plan and output accordance	Is the realized outcome compatible with the plan? To what extent did the projections of the plan come true?
	Plan effects	What are the positive and negative effects of the realization of the plan?
	Relevance	Does the plan respond to the needs of the planned area?
RATIONALITY	Internal coherence	a. Is the evaluated plan internally consistent?
		b. Does the plan maintain its internal consistency throughout its duration?
	External coherence	a. Is the plan compatible with other plans?
		b. Is the policy, plan, and project chain consistent with one another?
	Participation	What kind of participation mechanism is used in the preparation of plan?
	Cooperation and coordination	a. What kind of cooperation mechanism does the plan operate with?

DOI: 10.15320/ICONARP.2022.229

		b. Is there a coordination between institutions? If yes, how?
UTILISATION	Utilisation	a. Has the original plan been consulted in making operational decisions in implementation or application processes?
		b. Was the plan utilized in process? Does the effectiveness of the plan continue in following period?
	Reasons of non-utilisation	a. What are the main factors that can affect (impair) the implementation of a plan?
		b. What are the reasons if the plan was not utilized in process?

CONCLUSION

Today, the subject of plan evaluation is positioned as an essential research area in literature because it contains both qualitative and quantitative elements, and it requires new methods to be developed that are suitable with the needs of new paradigm. However, it did not gain enough acceptance in Turkey's planning system. Called as monitoring and feedback in planning process, plan evaluation is employed very superficially in practice.

Considering the structural conditions in Turkey, the main reason that impacts a plan's performance is the conflicting environment caused by diversity in planning authorities, mainly because since 2000s the high number of laws and regulations targeted the same issues. This is also a period when many different plans mushroomed, containing conflicting decisions and disrupting the plan hierarchy with special area plans. In addition to the local-central dichotomy, there are also compatibility issues among central government institutions. Planning powers transferred to local governments after 1985 have no effect in practice and with 2000s, a completely centralized planning system replaced the previous planning system.

This results from the blurred lines between the regulatory and discretionary planning systems in Turkey. In an environment where the market economy gained power and the planning institution gradually lost its regulatory role, it is tough to evaluate the performance of a plan only from a technical point of view. Since a comprehensive or strategic planning approach cannot be fully adopted and the transition in paradigm does not find its way into practice, there is a need for a qualitative and in-depth questioning of evaluation methods in planning. This study provides a systematic framework to fill this gap and offers a roadmap for evaluating the success of plans.

As a summary, plan evaluation in Turkey should follow three pillars: (1)conformity, (2)rationality, and (3)utilisation. The sub-criteria of conformity, rationality, and utilisation dimensions (plan-output coherence, plan-effect relationship, plan-needs relationship, internal coherence, external coherence, participation, cooperation and coordination, guidance or direction) can be the tools that will used to establish the context between three elements, which we can define as, 'plan', 'planning authority' and 'planned' briefly.

In conclusion, the proposed evaluation approach is thought to be a remarkable tool that can be applied to solve the uncertainty and coordination problems of the hybridizing planning system. Our study can contribute to the monitoring and evaluation mechanism to become an obligatory stage of the planning process via legal and administrative regulations in future.

ACKNOWLEDGEMENTS/NOTES
This article is derived from the doctoral thesis carried out by Çiğdem İbişoğlu and supervised by Assoc. Prof. Dr. Mehmet Doruk Özügül at Yildiz Technical University, Graduate School of Science and Engineering, Urban Planning Doctorate Programme.

REFERENCES

3194 Sayılı İmar Kanunu. (1985). T.C. Resmi Gazete, 18749, 9 Mayıs 1985.

644 Sayılı Çevre ve Şehircilik Bakanlığı'nın Teşkilat ve Görevleri Hakkında Kanun Hükmünde Kararname. (2011). T.C. Resmi Gazete, 27984, 4 Temmuz 2011.

Alexander, E. R. (2009). Dilemmas in evaluating planning, or back to basics: What is planning for? *Planning Theory & Practice, 10*(2), 233–244. https://doi.org/10.1080/14649350902884177

Alexander, E. R. (2006). Problems and prospects: dilemmas in evaluation and directions for the future. E. R. Alexander (Ed.), in *Evaluation in planning: Evolution and prospects* (1. Edition, pp. 267–276). Routledge.

Alexander, E. R., & Faludi, A. (1989). Planning and plan implementation: Notes on evaluation criteria. *Environment and Planning B: Planning and Design, 16*(2), 127–140. https://doi.org/10.1068/b160127

Allmendinger, P., & Tewdwr-Jones, M. (2002). The communicative turn in urban planning: Unrevalling paradigmatic, imperialistic and moralistic dimensions. *Space & Polity, 6*(1), 5–24. https://doi.org/10.1080/13562570220137871

Barrett, S. M. (2004). Implementation studies: time for a revival? Personal reflections on 20 years of implementation studies. *Public Administration*, *82*(2), 249–262. https://doi.org/10.1111/j.0033-3298.2004.00393.x

Barrett, S., & Fudge, C. (1981). *Policy and action: essays on the implementation of public policy.* Methuen.

Berke, P., Backhurst, M., Laurian, L., Crawford, J., Day, M., Ericksen, N., & Dixon, J. (2006). What makes plan implementation successfull? An evaluation of local plans and implementation practices in New Zealand, *Environment and Planning B: Planning and Design, 33*(4), 581–600. https://doi.org/10.1068/b31166

Berke, P.R., & Conroy, M. M. (2000). Are we planning for sustainable development? An evaluation of 30 comprehensive plans. *Journal of the American Planning Association, 66*(1), 21–33. https://doi.org/10.1080/01944360008976081

Boratav, K. (2015). *Türkiye iktisat tarihi: 1908-2009* (21. Baskı). İmge Kitabevi Yayınları.

Brody, S. D., Highfield, W. E., & Thornton, S. (2006). Planning at the urban fringe: An examination of the factors influencing nonconforming development patterns in southern Florida. *Environment and Planning B: Planning and Design*, *33*(1), 75–96. https://doi.org/10.1068/b31093

DOI: 10.15320/ICONARP.2022.229

Büyükcivelek, A. B. (2022). Olmak ya da olmamak: Türkiye'de mekânsal planlamanın toplumsal meşruiyetine ilişkin bir tartışma, in *9. Türkiye Şehircilik Kongresi: Planlamanın birikimi, zemini ve ufku* (pp. 118–137). TMMOB Şehir Plancıları Odası Yayınları.

Cumhurbaşkanlığı Teşkilatı Hakkında Cumhurbaşkanlığı Kararnamesi-1. (2018). T. C. Resmi Gazete, 30474, 10 Temmuz 2018.

Dinçer, İ. (2022). Planlamanın zemini için yeniden düşünmek, in *9. Türkiye Şehircilik Kongresi: Planlamanın birikimi, zemini ve ufku* (pp. 45–51). TMMOB Şehir Plancıları Odası Yayınları.

Duyguluer, F. (2006). İmar mevzuatının kayıpları. *Planlama Dergisi*, *4*, 27–37.

Duyguluer, F. (2014). İmar (sürecinin yeni) araçları. *Mimarlık Dergisi*, *375*.

Enlil, Z., Dinçer, İ., & Can Çetin, B. (2020). Planlamada müdahale, regülasyon ve yatırım ikilemleri: İstanbul üzerinden bir değerlendirme. İ. Dinçer, & Z. Enlil (Eds.), in *Hüseyin Kaptan'a armağan: Kent planlama* (pp. 69–84). YEM Yayın.

Eraydın, A. (2006). Mekansal süreçlere toplu bakış. A. Eraydın (Ed.), in *Değişen mekan-mekansal süreçlere ilişkin tartışma ve araştırmalara toplu bakış: 1923-2003* (pp. 25–67). Dost Kitabevi.

Eraydın, A. (2017). Planlamada yeni eğilimler. S. S. Özdemir, Ö. B. Özdemir Sarı, & N. Uzun (Eds.), in *Kent planlama* (pp. 561–581). İmge Kitabevi Yayınları.

Ersoy, M. (2000). İmar planlarının kademelenmesi ve farklı ölçeklerdeki planlar arasındaki ilişki. M. Ersoy, & Ç. Keskinok (Eds.), in *Mekan planlama ve yargı denetimi* (pp. 6–43). Yargı Yayınevi.

Ersoy, M. (Ed.). (2016a). *Kentsel planlama kuramları* (3. baskı). İmge Kitabevi Yayınları.

Ersoy, M. (2016b). Planlamada kademeli birliktelik ilkesi ve plan kademeleri. M. Ersoy (Ed.), in *Kentsel planlama ansiklopedik sözlük* (2. baskı, pp. 360–363). Ninova Yayınları.

Faludi, A. (1989). Conformance vs. performance: Implications for evaluation. *Impact Assessment,* *7*(2-3), 135–151. https://doi.org/10.1080/07349165.1989.9726017

Faludi, A. (2000). The performance of spatial planning. *Planning Practice and Research*, *15*(4), 299–318. https://doi.org/10.1080/713691907

Gedikli, B. (2016a). Stratejik mekânsal planlama: Planlamada yeni anlayışlar, yöntemler ve teknikler. M. Ersoy (Ed.), in *Kentsel planlama kuramları* (3. baskı, pp. 237–290). İmge Kitabevi Yayınları.

Gedikli, B. (2016b). İletişimsel akılcılık. M. Ersoy (Ed.), in *Kentsel planlama ansiklopedik sözlük* (2. baskı, pp. 159–160). Ninova Yayınları.

He, J. (2015). Evaluation of plan implementation: Peri-urban development and the Shangai Master Plan 1999-2020 [Doctoral Thesis, Delft University of Technology]. A+BE: Architecture and the Built Environment.

Kahraman, T. (2021). *İstisna mekan: Hukukun eşiğindeki kent.* Tekin Yayınevi.

Kılınç, N. & Turk, Ş. Ş. (2018). Hybridisation in planning systems and its effects on legal sources: Turkish case. *AESOP Congress 2018,* Gothenburg, Sweden.

Laurian, L., Crawford, J.B., Day, M., Kouwenhoven, P., Mason, G.C., Ericksen, N.J., & Beattie, L. (2010). Evaluating the outcomes of plans: Theory, practice, and methodology. *Environment and Planning B: Planning and Design, 37(4),* 740–757. https://doi.org/10.1068/b35051

Laurian, L., Day, M., Berke, P., Ericksen, N., Backhurst, M., Crawford, J., & Dixon, J. (2004). Evaluating plan implementation: A conformance-based methodology. *Journal of the American Planning Association*, *70*(4), 471–480. https://doi.org/10.1080/01944360408976395

Loh, C. G. (2011). Assessing and interpreting non-conformance in land-use planning implementation. *Planning Practice and Research*, *26*(3), 271–287. https://doi.org/10.1080/02697459.2011.580111

Lyles, W., Berke, P., & Smith, G. (2016). Local plan implementation: Assessing conformance and influence of local plans in the United States. *Environment and Planning B: Planning and Design*, *43*(2), 381–400. https://doi.org/10.1177/0265813515604071

Mastop, H., & Faludi, A. (1997). Evaluation of strategic plans: the performance principle. *Environment and Planning B: Planning and Design*, *24*(6), 815–832. https://doi.org/10.1068/b240815

Mekansal Planlar Yapım Yönetmeliği. (2014). T.C. Resmi Gazete, 29030, 14 Haziran 2014.

Oliveira, V., & Pinho, P. (2009). Evaluating plans, processes and results. *Planning Theory & Practices, 10*(1), 35–63. https://doi.org/10.1080/14649350802661741

Oliveira, V., & Pinho, P. (2010). Evaluation in urban planning: Advances and prospects. *Journal of Planning Literature, 24*(4), 343–361. https://doi.org/10.1177/0885412210364589

Ozkan, H. A., & Turk, S. S. (2016). Emergence, formation and outcomes of flexibility in Turkish planning practice. *International Development Planning Review*, *38*(1), 25–53. https://doi.org/10.3828/idpr.2016.2

Öktem, B. (2006). Neoliberal küreselleşmenin kentlerde inşası: AKP'nin küresel kent söylemi ve İstanbul'un kentsel dönüşüm projeleri. *Planlama Dergisi, 2*(36), 53–63.

Özdemir Sönmez, F. N. (2017). Planlamada yeni yasal düzenlemeler. S. S. Özdemir, Ö. B. Özdemir Sarı, & N. Uzun (Eds.), in *Kent planlama* (pp. 643–665). İmge Kitabevi Yayınları.

Özden, P. P. (2013). Üst ölçekli planlamadan projeci yaklaşıma planlamanın değişen yüzü. K. Eyüpgiller, & Z. Eres (Eds.), in *Mimari ve kentsel koruma / Prof. Dr. Nur Akın'a armağan* (pp. 435–455). YEM Yayın.

Rivolin, U. J. (2008). Conforming and performing planning systems in Europe: An unbearable cohabitation. *Planning Practice & Research, 23*(2), 167–186. https://doi.org/10.1080/02697450802327081

Sezgin, E. & Erkut, G. (2020). Kalkınma ajansları ve Türkiye mekansal planlama sisteminin dönüşümü. İ. Dinçer, & Z. Enlil (Eds.), in *Hüseyin Kaptan'a armağan: Kent planlama* (pp. 149–168). YEM Yayın.

Silva, E. A. & Acheampong, R. A. (2015). Developing and inventory and typology of land-use planning systems and policy instruments in OECD countries. *OECD Environment Working Paper,* No. 94.

Steele, W. & Ruming, K. J. (2012). Flexibility versus certainty: Unsettling the land use planning shibboleth in Australia. *Planning Practice & Research, 27*(2), 155–176. https://doi.org/10.1080/02697459.2012.662670

Talen, E. (1997). Success, failure, and conformance: An alternative approach to planning evaluation. *Environment and Planning B: Planning and Design*, *24*(4), 573–587. https://doi.org/10.1068/b240573

Tarakçı, S. & Türk, Ş. Ş. (2020). Shaping of flexibility in urban renewal legal sources in Turkey and its effect on practices. *International Journal of Architecture and Planning,* *8*(2), 652–671. https://doi.org/10.15320/ICONARP.2020.131

Tarakçı, S. & Türk, Ş. Ş. (2021). Kentsel yenileme ile ilgili yasal düzenlemelerde takdir yetkisinden gelen esneklikler. *Planlama Dergisi, 31*(3), 414–427.

DOI: 10.15320/ICONARP.2022.229

Uzun, N. (2017). Kentsel yenileme ve dönüşüm. S. S. Özdemir, Ö. B. Özdemir Sarı, & N. Uzun (Eds.), in *Kent planlama* (pp. 583–600). İmge Kitabevi Yayınları.

Resume

Çiğdem İBİŞOĞLU graduated from Istanbul Technical University as an urban planner in 2011. In 2014, she completed her master's thesis on the evaluation of governance and organization structure in industrial development districts in Turkey. She is a research assistant at Yildiz Technical University (Istanbul), Faculty of Architecture, Department of Urban and Regional Planning since 2013. She has been conducting research on the plan evaluation in the context of Turkish planning system for her Ph.D. thesis at Yildiz Technical University. Her research and interest areas are planning theories, evaluation methods in planning, urban and regional policies.

Mehmet Doruk ÖZÜGÜL is Associated Professor at Yildiz Technical University (Istanbul), Faculty of Architecture, Department of Urban and Regional Planning, where he has been since 2000. His research interests and publications span a variety of interconnected topics including planning theories, sustainable urban development, ecological planning, and strategic environmental impact assessment.

ICONARP – Volume 10, Issue 2/ Published: 20.12.2022