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A Theoretical Approach to the Spaces of the New Future: Planning under the Uncertainty Principle

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Abstract

Over the past few decades, the world has become an increasingly dangerous and complex place, and thus, expectations from spatial planning have changed. The study defines the concept of uncertainty as an important problem area of spatial planning. Based on lack of native studies on this subject, it is aimed to reveal how the uncertainties in spatial planning process are handled in international literature. It consists of two basic steps. In the first step, a three-stage model, "Uncertainty Components of Spatial Planning" is proposed. These stages involve (i) the conceptualization, (ii) the classification and (iii) the evaluation of uncertainty. In the second step, a triangular framework was formed for the conceptualization stage of this model having components of (1) identification and modelling, (2) theories and processes, (3) legal regulations. The theoretical handling suggested that the concept of uncertainty is synonymously used with the concepts of vagueness and ambiguity in everyday life despite their differences. It is also found that uncertainty is the subject of many international studies having a common point of presenting either a model or a method to evaluate uncertainty. These studies were categorized in three groups in handling uncertainty; (1) in multidisciplinary context within a general framework, (2) in the field of planning under two subcategories (2a and 2b), and (3) in the field of environment. The studies carried out in the second category allowed for regular conceptual patterns in themselves, and they were shallower and more inward-oriented than those studies in the 1st and 3rd groups, and there is an apparent interaction between the 1st and the 3rd groups. In the model proposed, the focus was only on (i) the conceptualization. However, as the origin, definition and basis of the concept of uncertainty were revealed, it might provide an important initiation for future studies. The study is original in introducing the concept of uncertainty to native literature by elaborating on how it is handled in international studies. Proposals were offered on how to place this concept on a theoretical basis before establishing an evaluation framework for uncertainties within the spatial planning process in Türkiye.

Keywords:
New future, New order, Spatial planning, Turkish planning system, Uncertainty

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INTRODUCTION

Spatial planning is a process of organizing and implementing a plan by establishing an order between decisions given in the past, at the present, and in the future. However, the order in this process may not always proceed smoothly and be stable due to its multi-actor and multi-component nature. This may be said to be mainly the result of the increasing "unhealthy piles" of population in cities, as well as how wrong political engineering and planning–as a means of spatial intervention– decisions are addressed by precision approach. Since the late 20th century, the increase in negative impacts of climate change on social (drought, famine, poverty, climate migration, and wars) and natural life (extinction of species and destruction of nature) a new period came into the scene. Moreover, the level of capitalism, which is the ultimate point of modernism today and the Covid-19 pandemics since the end of 2019, has called for the need to the question of "new era order". At this point, there is need to remind that “the chief purpose of spatial planning at the level of regional, and even more so national planning is to give guidance in situations that are characterised by uncertainty and conflict around spatial development where there needs to be mutual learning.” (Faludi, 2000, p. 304).

It is a fact that the daily environment is significantly affected by the dynamic environment experienced, yet spatial planning has long considered this environment as “static”. However, as De Roo et al. (2020, p. 2) stated “[d]ynamic processes of change … that lead to … unexpected and unpredictable change demand a different planning perspective”. In particular, uncertainties, which display a breaking point or milestone characteristic, dominate gradually in everything today, are increasing, and “[a]t this stage, the issues of uncertainty and uncontrollability in social life, confront mankind with difficult and complex problems to solve.” (Karakaş, 2020, p. 551). In sum, recognizing and handling uncertainty in planning, an effective means of intervention in shaping the future, has become a key task (Silva, 2002; Maier et al., 2006).

The complement of the information, the lack of information, the gap between what is known and what needs to be known are typical characteristics highlighted in the definition of uncertainty. Uncertainty definitions have been made in various fields; however, an overall handling has not been possible due to its broad scope. Van Asselt and Rotmans (2002, p. 78) emphasize that it is difficult to define uncertainty, which is usually carried out by classification and that a means for this requires investigation of different sources of uncertainty. In planning discipline, deepening the concept of uncertainty by in a more comprehensive manner is important for the ideal management of urban uncertainty, which has a multi-dimensional structure as the city, but in today's complex systems, even this remain incapable. Being among the issues that decision-makers are focusing on, it is a priority for cities to find out what uncertainty measures can be in the urban planning process. In this context, unlike the principle of certainty that dominates the Turkish planning system, which is mainly shaped by the principles of traditional planning, it is necessary to develop methods that enable the evaluation of uncertainties in the setting of the new future. Although this discussion increasingly draws attention of international scholars, it remains as an issue that is not addressed in Turkish planning literature. In the literature reviewed, the focus on the classification of uncertainty

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has caused a shortfall in the theoretical look that is important in setting a base for the conceptualization of this phenomenon.

This study, remaining in the field of planning theory, focuses on the overlook of the uncertainty problem in Turkish the planning process. From here, the main goal is to make an in-depth literature review on uncertainty, and to discuss characteristics and the basis of handling the definition and conceptualization of uncertainty, models created for it, the related changes in planning approaches in a historical perspective. In this context, two key steps have been identified in the study. In the first step, a three-stage model called "Uncertainty Components of Spatial Planning" was proposed to address a theoretical framework based on uncertainty in defining the concept. The stages of the model with feedbacks in between are (i) the conceptualization, (ii) the synthesis, and (iii) evaluation of uncertainty. In the second step, a triangular framework was formed by focusing on the first stage, the conceptualization. This framework comprises components of (1) identification and modelling, (2) theories and processes, (3) legal regulations. The scope of the study was based on the conceptualization of uncertainty, the first stage of the model, and the first two components of this stage, "identification and modelling" (Section 2) and "theories and processes" (Section 3), were investigated in literature.

IDENTIFICATION AND MODELLING

In literature review, mainly the definition of uncertainty, its models, and grouping of these models were focused, and the link between the study and literature was set.

Identification

Uncertainty is a very broad term that can be interpreted differently and its forms can be defined in different ways. The "uncertain" that is addressed in this respect is defined as; "1a: not known beyond doubt, 1b: not having certain knowledge, 1c: not clearly identified or defined" in Merriam-Webster dictionary; "feeling doubt about something; not sure" in Oxford English Dictionary; "1) The degree to which a value or relationship is unknown. Uncertainty can be a result of a lack of knowledge, disagreement about what is known, data errors, ambiguous concept or terminology, or similar reasons. 2) Increasing likelihood of unpredictable development of future expectations, the failure to know the possibilities and changes in a specific subject or field" in the Glossary of Terms against Desertification/Land Degradation and Drought (2015). Öztürk et al. (2019, p. 36) who studied the impact of the phenomenon on institutions/organizations defined uncertainty as "inability to predict accurately what will happen in general". Since the "probability world of thermodynamics" and its first laying out by Heisenberg in the field of quantum physics in 1927 (Tekeli, 2009, p. 305) and from the 1920s to the 1960s, in the works of Heidegger, who saw the purpose of philosophy as basic ontology and who was one of the important philosophers of existentialism, uncertainty has found place in theory and practice of many fields.

Led by these studies, "[i]t has become important to address the future through indeterminacy perspective, and moving away from Newtonian understanding of causality and thus approaches that the future will be closed to surprises and predictable." (Tekeli, 2009, p.

305). According to Balamir (2018, p. 63) "uncertainty is a situation, where there is a lack of knowledge in risk management environments or where change predictions are impossible due to the numerous factors and where there are decision-making difficulties." This phenomenon has been widely discussed in economics, especially in the 20th century, and has been the subject of many studies in methodological and theoretical context (Aksoy and Şahin, 2009).

"In reality, uncertainty is complex and, in many cases, the full concept is difficult to communicate or condense into one or two sentences." (Skinner et al., 2013, p. 196) and "it can be seen as a result of error, ambiguity, vagueness or lack of information and forms an umbrella term for these concepts" (Fisher; 1999 and Atkinson and Foody, 2002 cited in Vullings et al., 2007, p. 3). At this point, it is also necessary to clarify the concepts of ambiguity and vagueness, which are often used synonymously with the concept of uncertainty (Table 1).

Table 1. Definitions of the terms ambiguity and vagueness

Dictionary	Concept	Definition
Turkish Language Institution	ambiguous	the state of being ambiguous
	vague	uncertainty
Oxford English	ambiguous	that can be understood in more than one way; having different meanings
	vague	not clear in a person's mind
Merriam-Webster	ambiguous	doubtful or uncertain especially from obscurity or indistinctness; inexplicable; capable of being understood in two or more possible senses or ways
	vague	not clearly expressed: stated in indefinite terms; not having a precise meaning; not clearly defined, grasped, or understood: indistinct, slight; not clearly felt or sensed: somewhat subconscious
Cambridge	ambiguous	having or expressing more than one possible meaning, sometimes intentionally
	vague	not clearly expressed, known, described, or decided

A simple example of definitions in Table 1 can be given as;

- Ambiguity: I saw Melissa with my binoculars. -There are two possible meanings.

First, I saw Melissa while wandering around with my binoculars, and Second, I saw Melissa while she was looking at something with my binoculars.

- Vagueness: I saw Melissa there. -There's no detail about where she was seen.

"[U]ncertainity … that involves the shock, surprise that an individual experience … is an ex-post concept. However, uncertainty also means lack of knowledge about the future [as seen from the dictionary definitions discussed above]; that gives [to it] ... an ex-ante dimension (Yalçınkaya and Özsoy, 2003, p. 4). Decisions taken by planning, which is a broad-framework discipline, can create uncertainties to an acceptable extent (Türk and Erkan, 2018). Based on his claim that "[t]he future is the great unknown" Abbott (2005, p. 237) emphasizes that "[p]lanning is about changing the future, or at least the expected future."

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As Myers stated (2001, p. 366), "the future is the only issue that other professions have transferred to planners as a relatively undisputed field". According to Abbott (2005, p. 237), "[u]ncertainty is a term that is used widely but rarely defined" According to Christensen (1985, p. 63) "[a] crucial planning task is to discover, assess, and address uncertainty." As Moroni and Chiffi (2021, p. 10) also stated "[r]ecognition of the existence of uncertainty does not imply in itself that we can know nothing or do nothing. It simply asks for adequate strategies to cope with it." Based on these explanations and in its broad scope, it can be stated that "to address uncertainties is one of the reasons for existence of planning". However, the basis of the definition offered to planners under the unknowns is not sound and is not expected to be so under the current circumstances.

As of the first quarter of the 21st century, all natural events/hazards such as floods, earthquakes and landslides that are now more severe as a result of human pressures accumulated on nature pose increasing threats to settlements and cause disasters that result in damage and loss. This is supported by the latest reports from the Intergovernmental Panel on Climate Change (IPCC). The 5th report predicts that the increase of greenhouse gases will continue, especially with applications for the development of the energy sector, and thus global warming and climate changes will continue in the future (IPCC, 2014). The 6th report mentions that even if carbon dioxide emissions are reduced to net zero and global warming stops, glacier melting and sea level rise will take thousands of years (IPCC, 2021). In addition, with the Covid-19 global pandemic started at the end of 2019, predictions for the future are fundamentally upset. In order to ensure the support for this new order of planning paradigm and practice within the scope of this changing social order, the focus should not only be on future uncertainties but also on the uncertainties and its dimensions for the past, present and future. This is one of the important issues on the agenda of the international article studies (Bulutay, 2011).

Environmental issues and uncertainty in planning are defined in two ways.

- "Ordinary uncertainty derived from probabilistic nature of the phenomena, and
- Incertitude, defined by the uncertain knowledge or even ignorance, not knowing the environment and the processes in it." (Chechile, 1991 cited in Mlakar, 2009, p. 93).

According to Mlakar (2009, p. 92) "[t]he uncertainty in spatial planning is reflected as a series of diverse doubts in virtually all aspects and phases of planning, as the causes for uncertainty are numerous." As for Sissoko (2020, p. 33), "[u]ncertainty can be defined as the difficulty to predict with accuracy the outcome of planning during the planning process or the actors' behavior toward plans implementation." However Denoo (2020, p. 13) states that "the perspective of uncertainty in theory and practice of urban planning is nearly uncharted." A similar thought is

asserted by Marris (1987, p. 159) as "[p]lanning means, essentially, controlling uncertainty – either by taking action now to secure the future, or by preparing actions to be taken in case an event occurs".

The current situation of planning, characterized by the traditional planning paradigm, as Yaman Galantini (2018, p. 57) states "plans … are not dealing with unexpected change, they are not updated and they no longer respond to the current requirements" has called for a need to establish the acceptable criteria of the uncertainties–such as illegal/ irregular construction, construction densities, continuous interventions to natural areas, gaps between decisions and their implementations–and evaluate their state. In line with this, from the late 1970s to the present, "a significant emphasis is made on the concepts such as "ambiguity, uncertainty, contingency, [...], indeterminacy" (Çelik, 2003, p. 194).

Modelling

The fact that uncertainty exists in all areas and the need to be dealt with in a transparent and effective manner is inevitable. Different categories are used to understand and conceptualize uncertainty in the studies that deal with this subject (see Van der Sluijs, 1997; Walker, 2003; Maier and Ascough, 2006). Early research focused on assessing uncertainty due to possible systematic errors in a physical measurement (Henrion and Fischoff, 1986; Beck, 1987), yet, over time, a need has emerged to address this concept in various dimensions. In particular, for the last two decades, there has been a rapid evolution in the conceptualization of uncertainty. These studies for modelling uncertainty in decision-making process were summarized in three groups with respect to their addressing of the uncertainty either (1) in interdisciplinary scope in a general framework; (2) in planning–examined in two subcategories (2a and 2b), and (3) in the field of environment (Table 2).

The pioneering study in the creation of a general assessment framework for uncertainty in the first group is the uncertainty matrix developed by Walker et al. in 2003. In this context, three dimensions and their subcomponents are proposed concerning the location, level, and nature of uncertainty (Table 3). Although the basic framework of the matrix remained similar in the subsequent studies referring to this study, it was used by making changes especially to its subcomponents. According to this matrix, uncertainty should be addressed by it locational subcomponents of context, model, inputs, parameters, model outcomes at the levels of statistical uncertainty, scenario uncertainty, or recognized ignorance, and as epistemic or variability uncertainty in terms of its nature (Table 3).

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Table 2. Studies on uncertainty literature reviewed and their grouping within the scope of the study (*)

Group	Author/s-year	Study
1	Walker et al., 2003	Defining uncertainty: A conceptual basis for uncertainty management in model-based decision support
	Petersen, 2006	Uncertainty and economic analysis of climate change: A survey of approaches and findings
	Van der Sluijs et al., 2008	Exploring the quality of evidence for complex and contested policy decisions
	Knol et al., 2009	Dealing with uncertainties in environmental burden of disease assessment
	Kwakkel et al., 2010	Classifying and communicating uncertainties in model-based policy analysis
2a	Christensen, 1985	Coping with uncertainty in planning
	Friend, 1993	Planning in the presence of uncertainty: principles and practice
	Stacey, 2007	Strategic management and organisational dynamics: The challenge of complexity to ways of thinking about organisations
	Bertolini, 2010	Coping with the irreducible uncertainties of planning: An evolutionary approach
2b	Abbott, 2005	Understanding and managing the unknown: The nature of uncertainty in planning
	Vullings et al., 2007	Dealing with uncertainty in spatial planning
	Mlakar, 2009	Uncertainty in spatial planning proceedings
	Abbott, 2012	Planning as managing uncertainty: Making the 1996 Livable Region Strategic Plan for Greater Vancouver
	Lau, 2015	Tackling uncertainties in plan implementation: Lessons from a growth area in England
	Wei et al., 2016	The general land-use planning in China: An uncertainty perspective
3	Maier and Ascough, 2006	Uncertainty in environmental decision-making: Issues, challenges and future directions
	Refsgaard et al., 2007	Uncertainty in the environmental modelling process – A framework and guidance
	Ascough II et al., 2008	Future research challenges for incorporation of uncertainty in environmental and ecological decision-making
	Mosadeghi et al., 2013	Uncertainty analysis in the application of multi-criteria decision-making methods in Australian strategic environmental decisions

(*) The studies from which the arrows originate, pioneer the methodology of the ones where the arrows reach, either in the same or different group.
(The groupings belong to the authors)

Table 3. Uncertainty matrix (Walker et al., 2003, p. 15)

LOCATION		LEVEL			NATURE	
		Statistical uncertainty	Scenario uncertainty	Recognised ignorance	Epistemic uncertainty	Variability uncertainty
Context	Natural, technological, economic, social and political, representation					
Model	Model structure					
	Technical model					
Inputs	Driving forces					
	System data					
Parameters						
Model Outcomes						

Using this framework Kwakkel et al. (2010), have made changes to its level and nature subcomponents. Ambiguity is introduced into the

nature dimension of uncertainty and the importance of considering multiple frameworks is emphasized. In the level subcomponent, it was criticized that in the previous matrix it was classified with groups for technical examination and was open to multiple interpretations, and four levels were proposed in expressing the level of uncertainty with a sound setup of the "measurement scales theory" including shallow, medium, deep uncertainty and recognized ignorance (Kwakkel et al., 2010, p. 312). Despite these changes, the common characteristics of the studies are the use of location, level, and nature dimensions to understand uncertainty (see Refsgaard et al., 2007; Van der Sluijs et al., 2008). The content of these three dimensions is briefly summarized below.

- Nature: It is related to the question of why a phenomenon is uncertain. It is whether the uncertainty is caused by external factors or entirely from the process itself (such as lack of information). For example, ontic uncertainty, epistemic uncertainty.
- Level: It is related to the question of to what extent uncertainty can be reduced. Here, an indicator chart is used, from the generally certain situation to the full state of ignorance.
- Location: It is related to the question of what is uncertain. It aims to understand what kinds of uncertainties (data uncertainty, model uncertainty) exist in which step in the stages of the development of the phenomenon.

Another model that broadly addresses uncertainty in the first group is the framework proposed by Petersen (2006) and developed by Knol et al. (2009, p. 3) defines six characteristics of uncertainty as "location, nature, range, recognized ignorance, methodological unreliability and value diversity among analysts". Analysing uncertainty as a "technical" problem or simply addressing it through consensus interpretations of inconclusive evidence has been inadequate over time. With a different approach, Van der Sluijs et al. (2008) suggested various focuses such as the creation of the problem framing, involvement of stakeholders, selection of indicators, appraisal knowledge base, mapping and assessing of relevant uncertainties and reporting uncertainty information. In the focus of mapping and evaluating the relevant uncertainties, the development of the uncertainty matrix proposed by Walker et al. (2003) and integrating it with the sample uncertainty issues examined is aimed. As a result, a typology of uncertainty for the assessment and communication of uncertainty was developed and implemented in terms of an environmental problem (Van der Sluijs et al., 2008).

In the second group, the handling of uncertainty within the scope of planning discipline was examined in two subcategories (2a and 2b) (Table 2). The first category (2a) comprises the framework proposed by Christensen (1985) and similar ones following his pioneering work. All the works in this category try to understand the impacts of complex and

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indeterminable situations. The second category (2b) involves the framework proposed by Abbott (2005) and the studies pioneered by his work. All the works in this category focus on the continuous interaction of the planning process and the social environment though emphasizing the need for their separate handling in the context of uncertainty.

In Christensen's (1985) matrix, which is widely used and forms the basis of the uncertainty studies in the first category (2a) (Table 2), to achieve a total of four planning situations of uncertainty 'the state of knowledge' is related to the tool (technology) variable and 'the state of compromise' is related to the goal variable on the axes of binary dimensions (Figure 1). Here, the focus is on agreement on the goal and on knowingness of the tool (technology) for transitioning from certainty to chaos in planning. In other words, "[t]he matrix produces four prototype variations of conditions that can characterize planning" (Christensen, 1985, p. 64). In the first region (A) there is certainty in planning. In the second region (B), planning turns into a learning process, in the third region (C), it turns into a negotiation process. In the last region (D), there is chaos environment in planning (Figure 1).

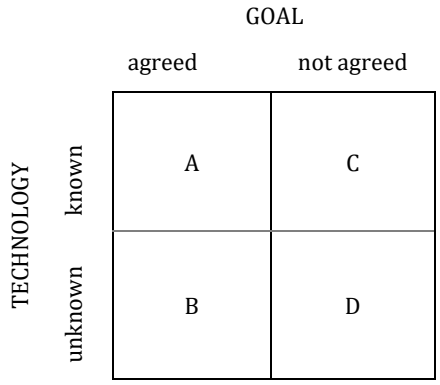
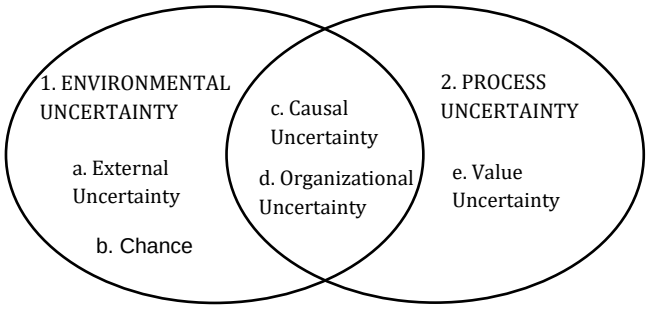


Figure 1. Prototype conditions of planning problems (Christensen, 1985, p. 64)

Again in this category (2a); another effective framework for assessing uncertainty in the strategic choice approach was proposed by Friend (1993). Unlike Christensen's framework (1985), this framework is based on the handling of uncertainty within the planning process, not on tools (i.e., technology) and goals. Uncertainty is defined in three areas. The first field is "in the work environment", which requires different examinations, and the second is "for the guiding values" that show the transparency of the objectives, and the third is the uncertainties "about the relevant choices" outside the problem area (Friend, 1993, p. 3). Based on these areas, the need for planning to learn in managing uncertainty in a strategic manner is emphasized. The state of chaos (region D in the matrix), which was characterized by unknown technology and no agreement among the four variations of Christensen (1985) is detailed by Bertolini (2010) with a similar framework composed of quadruple regions. In another study examined, Stacey (2007) proposed a quite similar framework to Christensen's (1985) yet different from it in terms of the nature of the variables. So as to make graduality/rationing possible, a shift is made from the binary categorical

scale to the ratio scale in variable measurement and the goal-technology duality turned into a disagreement-uncertainty duality. Adapting the matrix in this way allows the complexity of the planning problem to be defined with respect to the amount of uncertainty and disagreement (Stacey, 2007).

The second category (Table 2) was pioneered by more recently by the model developed by Abbott (2005) who synthesized the proposals of Christensen (1985) and Friend (1993). With this model, it is aimed to discover the five dimensions of uncertainty that affect planning, and these five dimensions are addressed under two main areas of uncertainty arising from the social environment that everyone can perceive at a different level and the planning process that only those responsible/concerned can perceive (Abbott, 2005, p. 239) (Figure 2). One of the main uncertainties arising from Christensen's goal and technology (tool) form the basis for process uncertainty while its subcategories (c, d, e shown in Figure 2) are composed of some types of uncertainties proposed by Friend (1993).



1. ENVIRONMENTAL UNCERTAINTY; Uncertainty caused by the social environment or uncertainty of planning;
   a. External uncertainty; uncertainty about the wider social environment and how it relates to and influences the situation
   b. Chance; truly unknowable for once chance events
   c. Causal uncertainty; uncertainty about the basic causal relationships (physical, economic, and social) in the situation
   d. Organizational uncertainty; uncertainty about predicting the actions and future intentions of other people and organizations in the situation
2. PROCESS UNCERTAINTY; Uncertainty arising from the planning process;
   c. Causal uncertainty; uncertainty about the basic causal relationships (physical, economic, and social) in the situation
   d. Organizational uncertainty; uncertainty about predicting the actions and future intentions of other people and organizations in the situation

Figure 2. Dimensions of environmental and process uncertainties
(The explanations and the figure combined from Abbott, 2005, p. 239, 242, and 245)

In the study of Vullings et al. (2007), which was examined in the second category (2b) of planning, a framework dealing with uncertainty in spatial planning and aiming at increasing transparency of planning processes is described, and similar to Abbott (2005), the need to address uncertainties throughout the planning process, is highlighted. An uncertainty classification guideline consisting of plans, processes and procedures has been developed for spatial planning. Mlakar (2009), who designed his work according to these two frameworks, was interested in uncertainties in the field of spatial planning based on

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certainty and absolute knowledge. The author (2009) proposed procedures based on two main principles of standardization (norms and rules depending on predefined solutions) and optimization (best solution), focusing on the reduction of uncertainties in planning similar to Vullings et al. (2007). According to Mlakar (2009, p. 102) "[t]he co-existence of both principles is possible and necessary, but the reasonableness of using one or the other depends primarily on individual steps within the planning process and the context of solving everyday spatial planning problems." In relatively new studies, it is seen that the implementation dimension for uncertainties in planning has been a prevailing issue. One example is Abbott's study in 2012, in which he applied the model he developed in 2005 to a plan, examining the impact of planning on uncertainties (Abbott, 2012). As a result, it is stated that the uncertainties in the implementation process have not disappeared even for a finalized plan that has been agreed upon. Another is Lau's 2015 study, defining the two broad types of uncertainty based on Abbott's (2005) model covering the plan making process. In complementing the shortcoming of Abbott's model that lacks the plan implementation stage, Lau (2015) contributed to literature by revealing how different types of uncertainty can be discerned and handled through both plan making and plan implementation by means of sample plans.

In another study, Wei et al. (2016), in order to reduce uncertainties in land-use planning has defined the social environment uncertainties in Abbott's (2005) model as external; process uncertainties as internal factors and applied them to a planning case. In addition, the authors (2016, p. 375), similar to the two main principles defined by Mlakar (2009) state that as for the forms of intervention into internal uncertainties; "[i]n future planning practices, we should improve land-use planning theory, optimize land-use planning schemes and strengthen land-use planning legislation to incorporate the uncertainties fully and ensure the legislations authority, effective implementation, and value as a guideline in the planning process."

Studies reviewed in the third group (Table 2) address uncertainty in resolving environmental problems, and some of them adapt models proposed in the first and second groups to environmental problems. Maier and Ascough (2006) took into account the data, model, and human factors in modelling uncertainty in environmental decision-making process and pioneered in the measurement of uncertainties related to human impact with the model they proposed. Afterwards, Ascough II et al. (2008), by combining the uncertainty criteria with their types, defined a wider framework, where they proposed criteria for information, variable, decision, and linguistic uncertainty. Mosadeghi et al., (2013) have used the uncertainty framework including uncertainty types of location, level, and nature, which also formed the bases for the works of Walker et al (2003) and Refsgaard et al. (2007).

As seen, various models of uncertainty have been developed in different fields. Skinner et al. (2013), who investigated such models in terms of the characteristics of uncertainty as part of environmental risk research, concluded that even in a single scientific field, the terminology that is established is inconsistent and sometimes contradictory. The studies reviewed above also support this conclusion. It can be said that the reason for this is to be a direct classification of a concept, such as uncertainty, which is rather abstract and not yet defined in a particular form in any field, without further investigation.

THEORIES AND PROCESSES

A brief look at the history of civilization would be an essential starting point to interpret the historical development of planning in terms of increasing uncertainty. Toffler (2008) defines this history as three waves: The first involves agricultural development, the second involves industrial development, and the last one involves technological progress. In other words, "[c]ivilization; evolved or has been evolving with sometimes slow and sometimes or rapid pace under various names such as agricultural society, industrial society, information society, modern or post-modern society." (Yalçınkaya and Özsoy, 2003, p. 2). The approaches of planning as a regulatory institution, which is necessary for solving the unique problems of different, diverse, and very long-term social characteristics,–for example, the industrial revolution is divided into four different periods as 1.0, 2.0, 3.0, 4.0 periods (Eğilmez, 2018)–also evolved/has been evolving.

Until the mid20th century, the spatial planner was regarded as an organizer who did not need to explain how he/she arrived at the solutions of the problems in planning and predicted the future perfectly. However, this ongoing state of affairs underwent a significant change in the 1960s, especially by environmental movements. While initially the focus was on the final product (plan) by focusing only on the content/essence of planning, later approaches that took into account the planning process and were based on communicative rationality began to gain importance (Figure 3). In other words, "[p]reconceived notions based on the view that assume plans as ideal policy decisions (such as technical, rational, non-political, neutral, long-term and comprehensive best solution, complete and precise knowledge, homogeneous society and unitary public interest) are now controversial." (Demirci, 2004:309). That way, previous approaches dominated by the deterministic decision-making environments in which the future is seen as predictable, and the uncertainty is ignored despite its factual existence in every period, have come into question, and it has become essential to deal with uncertainties in later approaches (Eraydın, 2017) (Figure 3).

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	1900-1950s	1950-1960s	1950-1960s	1980-1990s	2000s +	
	PLANNING APPROACHES					
Deterministic decision-making environments are dominating and uncertainty is not on the agenda yet.	- Classical Planning - Urban Utopias: Garden City Beautiful City Linear City Industrial City Radiant City Wide Land City	Rational tradition: - Comprehensive Rational Planning - Judicious Planning - Marxist Planning - Systems Planning	- Incremental Planning - Pluralistic and Advocacy Planning	Globalization and project-based planning approaches: - Process Planning - Strategic Planning - Participatory Planning - Communicative Planning - Interactive Planning	- Adaptive Planning - Sustainable Planning - Protection-oriented Planning - Various urban planning approaches (eco-cities/healthy cities, etc.)	Discussions on uncertainty and the risks associated with came ito scene. Planning may not be able to foresee the future.
	- 19th century modernist planner solutions for the poor living conditions of industrial cities - Analytical frameworks built on the stability of the social and political structure - Only the problems related to the physical structure of the city are handled - Controlling urban changes with deterministic and top-down plans.	- The era of instrumental rationality - Holistic planning Approaches related to content/essence - The aim of reaching the final product based on modernity after World War II - What is a good plan? The city is not only handled physically, but also as a whole with its social, economic and societal problems.	- The dominant idea is that a fragmented social structure with different interests makes a rational and comprehensive planning approach impossible in an environment of high uncertainty - It is not discussed how the plan will be made, but for whom it will be made.	- Habermas's Communicative Action Theory based on communicative and strategic rationality - Prosedürel approaches It is important to agree on the process while reaching it, not the final product. - How to get a good plan? A more scientific and analytically based flexible perspective for cities that become complicated as a result of lacking a final physical plan	- Action-oriented and visionary approaches - Planning to respond to complex problems and act flexibly for the uncertain future	
	THE CONTENT OF THE PLANNING					

Figure 3. Changes in planning approaches over time and their handling of uncertainty
(Created using the figure in Yiftachel, 1989, p. 27, the explanations from Ayrancı, 2013, p. 42 and Ersoy, 2007; Tekeli, 2009; Levent and Sarıkaya Levent, 2011; Eraydın, 2017; Prosperi and Morgado, 2011)

It is seen that the concern in foreseeing the future has decreased, the main goal has become to arrive at a consensus on a solution" (Eraydın, 2020, p. 6) when looking at the theories and practices of the communicative planning approach that have its foundations established in the 1990s. However, since the early 2000s signals for an agenda of complex problems in the future started with large-scale changes made by neoliberal processes in cities (Keskinok, 2006; Levent and Sarıkaya Levent, 2011). As neoliberal pressures start causing irreversible destructions in cities (rapid population growth, floods, earthquakes,

etc.) and as conflicts between different interests on spatial decisions (e.g., economic development and ecological principles) emerge, an increase in focus on environmental planning issues is observed. So much so that the new world order

> spatial planners today need to balance many different interests contemporaneously, such as fighting against land scarcity while supporting economic growth, or striving to achieve a socially just distribution of land while emphasizing the importance of healthy urban living and flood resilient cities. (Gerber et al., 2018, p. 344).

This changing nature of space is expected to be addressed as the complex problems of the new world order, especially with sustainability and climate change issues, and uncover the need for renewed planning approaches to these issues (Rittel and Webber, 1973; Eraydın, 2017).

As seen in Figure 3, adaptable, participatory, interdisciplinary and mixed-focus planning approaches have been forming the bases of current planning practices, which entered into the agenda as a result of increasing uncertainty since the 2000s (Ersavaş Kavanoz, 2021). In this theoretical study, it can be stated that although the planning approaches are directed towards uncertainties, as far as the implementation is concerned, that is, in practice, the planning process still focuses on the final product and the uncertainties are ignored due to the continuation of traditional planning habits under the principle of certainty.

MODEL PROPOSAL ON "UNCERTAINTY COMPONENTS OF SPATIAL PLANNING"

Since the 1950s, the theoretical basis of planning, in which the future is predictable and identifiable with reference to "rational holistic planning" as a reflection of modernist thinking, continues to have an effect as a dominant understanding, and there is no room for uncertainty in planning decisions (Eraydın, 2020, p. 4). That is, uncertainty is not a concept taken into account in this understanding of planning as it has the infrastructure to know all kinds of circumstances for the future from today. Eraydın (2020, p. 14) expresses this situation by pointing the present day as: "Unfortunately, there is no concern on Türkiye's planning agenda to prepare cities and regions for the future and to develop capacity to cope with uncertainties." New theoretical studies are being carried out, including the issues that even the near future cannot be fully known and that planning should be dealt with approaches based on different foundations (Figure 3). However, it is also the case that these approaches do not have norms and standards and applications that can survive for years as the traditional planning approach (Ersoy, 2007). Moreover, as Abbott (2005, p. 239) emphasizes, "[u]ncertainty about the future is not the only relevant uncertainty for planning. Many aspects of the past and present may not be known or are uncertain". There may be ambiguities in information about past events, information about the current environment, and even the views of individuals or groups. From a different aspect, this situation can be grouped as the uncertainties related to the values of the guiding groups

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and political-technical decisions arising from the implementation framework. The process in which these approaches are joined in holistic manner is the "planning process". According to Mlakar (2009, p. 98), "[t]he framework for defining the other guidelines of uncertainty reduction is the planning process itself." Evaluating the rules or the steps of this process can enable the identification and management of uncertainties to a significant extent. However, for Turkish cities, the lack of "no concern … to prepare cities and regions … to develop capacity to cope with uncertainties", as Eraydın (2020, p. 14) states, and the ingrained, traditional planning approach adopted in practice as mentioned above are among the important shortcomings.

The planning process consists of the steps defined for the spatial plan to take its final form. In this study, a suggestion is made for the need for handling of spatial planning on the basis of uncertainty, and thus a need for developing a process-oriented approach. However, it should be a priority to present a scientific basis for the expression of uncertainty that we often use in everyday life. In this way, a shift can be made to the stages of embodying the concept of uncertainty, which is an important requirement for establishing a connection between spatial planning and uncertainties. Uncertainties cannot be managed if they are not identified, and potential types of uncertainty may not be identified if they are not understood. The direct focus on the classification of uncertainties in the reviewed literature should be approached critically. In addition, there is no clear method that directly relates this concept to urban planning in the discussions in the uncertainty literature. Based on this shortcoming, in this study, a three-stage model is proposed for how uncertainties should be defined in the Turkish planning system by considering a theoretical framework on the basis of uncertainty in the first step. This model consists of (i) the conceptualization, (ii) the synthesis, and (iii) the evaluation stages with feedback processes in turn, which are collectively referred to as the "Uncertainty Components of Spatial Planning" (Figure 4).

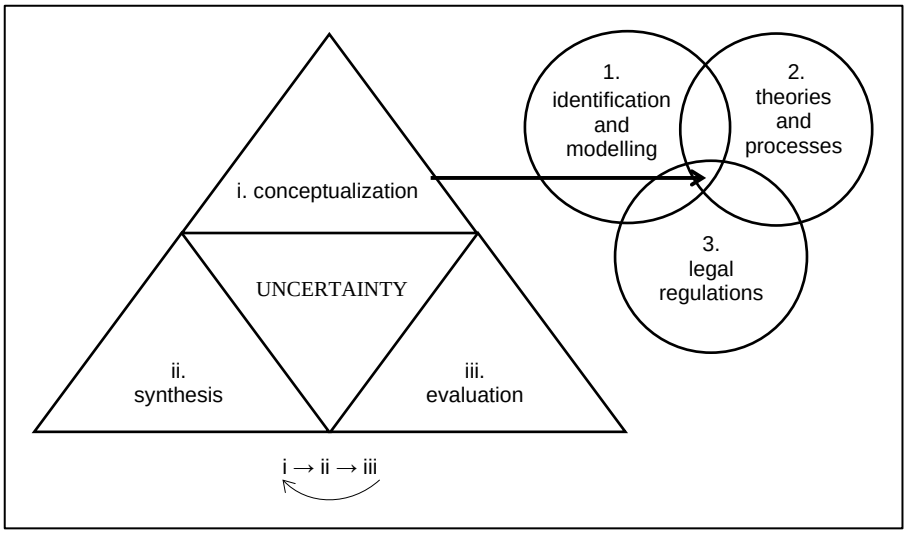

Figure 4. Uncertainty components of spatial planning and the subcomponents of its conceptualization
(Created by authors)

In the second step, a trivet was developed by focusing on the conceptualization stage (Figure 4). The features of this trivet and how it should be handled are described below:

(1) Identification and modelling: It is the examination of various definitions and suggested methods (models) for uncertainty within the scope of revealing the criteria for an uncertainty-based assessment that cannot be reduced to less. Here, the focus should be on international and native papers, research reports, books, and theses. In the present study, this review was carried out in terms of the international papers.

(2) Theories and processes: It comprises, from a historical perspective, the handling of contemporary planning theories for how their planning process steps and actions these for steps progress and change within the context of uncertainty. Here, it will be important to shift from the universal level to the site-specific investigation. In other words, in a study whose case area is in Türkiye, first, planning theories and uncertainty in the planning process should be evaluated, and then the prevailing planning approaches and uncertainty assessment in Türkiye should be taken into account. In this study, a literature review regarding the former step, i.e., the one before the site-specific investigation was conducted.

(3) Legal regulations: It is the introduction of how legal instruments such as laws, regulations, decrees, technical specifications that are binding for spatial planning provide the infrastructure in terms of uncertainties. Here, site-specific investigations will gain importance. That is, in a study whose case area is in Türkiye, the legal bindings of Turkish planning practices should be taken into account. This stage is not covered in the current study.

CONCLUSIONS AND RECOMMENDATIONS

Although planning approaches tend towards uncertainties with their changing context over time, it is observed in real planning practices, which should be based on such a basis, ignore uncertainties due to the continuing dependence of the traditional approach on the principle of certainty. Although it is criticized in many respect today, in the known state of “the involvement of the approaches and principles of holistic planning in implementation” (Eraydın, 2017, p. 564), which are effective in planning, at the very least, it will be required to reinterpret the basic stages of the traditional urban planning process in terms of the assessment of uncertainties. In the new world of the 21st century, along with the revision in the components of many disciplines, such a change/development in planning has become a necessity that cannot be postponed. It is important to define “uncertainties” for such an adaptation in the urban planning process. By doing this, it will be possible to assess whether urban planning processes are sufficiently effective or to what extent decisions are made under uncertainties. The starting point for such an assessment requires an in-depth conceptual analysis of uncertainty and an understanding of how the concept has gained a place in urban studies. The important aspect here is that the

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process of challenging with uncertainty should not only cover increasing the certainty of events but also providing room for manoeuvre in case of an unpredictable development of events. According to Abbott (2012, p. 571), "[t]he concepts of planning and uncertainty are closely linked …. [and in concluding his case study he explains that this particular] "plan-making process … is a dynamic interplay of expected and desired outcomes, actions and proposed actions, and uncertainties".

The international literature review in this study revealed that there has been a rapid evolution in the conceptualization of uncertainty, especially in the last two decades, and that different concepts have been used to classify uncertainty (see Walker et al., 2003; Abbott, 2005; Maier and Ascough, 2006). With the grouping of studies reviewed into three categories, a higher level of detail and interaction were observed between the dimensions and subcomponents of the uncertainty handled (1) in multidisciplinary studies in a general framework and (3) in environmental studies contrary to more shallower and inward-oriented (2) planning related studies.

As for a main limitation of the reviewed studies it can be stated that there have been no findings to address the conceptual foundations of uncertainty, models synthesising site-specific characteristics, and/or assessment of uncertainties in implementation. From here, the "Uncertainty Components of Spatial Planning" model is introduced, which will involve all these three stages as the main framework. With this model, it is thought that awareness will be raised for addressing uncertainties that are increasing daily, especially in the field of spatial planning, yet cannot go beyond discourse. After the completion of the three-stage model, one part of which is covered in the study, and the trivet in its first phase, an uncertainty-based evaluation framework should be established that will conform to the spatial planning system of Türkiye.

In this context, an effort is made to establish a conceptual basis for the places of the new future where uncertainty is decisive, and it was concluded that more comprehensive studies should be carried out in this regard, especially in the field of planning, on this subject ensuring a higher level of interaction with other disciplines.

Thus, with the development of the proposed model in future studies, it will be possible to embody an uncertainty-based evaluation framework that can be integrated with Turkish spatial planning system in the context of planning problems in example cases.

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