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PREFACE

In a world that is rapidly evolving, the realms of architecture, urban and regional planning, landscape architecture, and environmental studies have never been more interconnected and consequential. As the editors of this compilation, it is our distinct privilege to present to you **"Architectural Sciences and Urban/Environmental Studies -I,"** a tapestry of knowledge that delves into the intricacies of these intertwined disciplines.

This book emerges from a collective effort to explore the myriad ways in which architecture shapes our living spaces, urban landscapes, and the broader environment. It stands as a testament to the collaborative spirit of scholars, researchers, and practitioners who share a common commitment to advancing our understanding of the built environment's profound impact on society, culture, and the natural world.

Within these pages, you will find a diverse array of perspectives, each offering a unique lens through which to view the complex tapestry of architectural sciences, urban dynamics, and environmental considerations. Our contributors bring together a rich mosaic of insights that range from theoretical explorations to pragmatic case studies. This book is not only a reflection of their intellectual pursuits but also a testament to their dedication to charting a path towards more sustainable, resilient, and harmonious built environments.

The chapters presented herein encompass a wide spectrum of topics, from innovative design methodologies that blend technology and aesthetics to urban planning strategies that foster inclusive and vibrant communities. We also delve into the intricate dance between architecture and the environment, acknowledging both the challenges and opportunities that lie ahead as we strive to coexist harmoniously with the planet.

As you embark on this intellectual journey, we encourage you to approach these pages with an open mind and a hunger for knowledge. Whether you are an academic, a professional in the field, a student aspiring to shape the future, or simply a curious individual with a passion for understanding the spaces we inhabit, this book holds insights that are bound to inspire, provoke, and enlighten.

We extend our heartfelt gratitude to the contributors who have poured their expertise and enthusiasm into this project. Their dedication underscores the collaborative spirit that fuels progress in these dynamic disciplines. We would also like to express our appreciation to the readers, whose curiosity and engagement will carry the ideas presented here into meaningful conversations and transformative actions.

"Architectural Sciences and Urban/Environmental Studies -I" is more than just a compilation of chapters; it is an invitation to explore, question, and contribute to the ongoing dialogue that shapes the future of our built world. It is our hope that this book serves as a stepping stone towards a more enlightened and conscious approach to the design, planning, and stewardship of our shared environments.

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CONTENTS

Evaluation of the Main Factors Affecting Planting Design in Residential Gardens

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1. Introduction

Residential gardens are an important part of urban components. People spend a significant part of their daily lives in the immediate vicinity of their homes. There are many expectations from these fields. Residential gardens are expected to meet the basic needs of the users as well as to have functions that will enable the users to have a pleasant time (Güneroğlu & Bekar, 2019). When the residential gardens are examined closely, although they can consist of small areas in square meters, they contain many qualities together. These attributes vary according to the user's needs and wishes. Therefore, residential gardens form the basis for designs that will be created by combining user requests with environmental inventories in the basic education of landscape architecture (Güneroğlu & Bekar, 2020).

The design process of residential gardens is completed with the creation of the master plan. In order to create this plan, environmental conditions are evaluated in line with user requests and a master plan is created according to design principles. The purpose of the master plan is to transform the spaces and functions in which the user will be comfortable and enjoy the landscape into a residential landscape aesthetically, functionally and ecologically. It is necessary to use natural and artificial elements to create spaces and functions in the residential garden. These elements are considered as components of the landscape. While these elements can be an individual in the design, they should form a whole with a holistic point of view. For this, the design process of the master plan should be handled meticulously. The design process must be worked out step by step and the final result supports all phases. In order for the stages to turn into a whole in a healthy way, each stage should be used as a base for the other stage. Although the design process and duration vary, there are some basic stages of design (Acar & Bekar, 2017). These stages are survey work, landscape analysis, determination of the needs program, function chart, determination of the conceptual design elements, and the creation of the final design. These stages are essential to the sustainability of the final design. Especially residential gardens are considered as areas where the user wants to have close contact with nature. Therefore, residential gardens are areas where natural materials are used frequently and mostly. Users generally want to experience nature while meeting their basic needs (resting, eating, having fun, etc.) (Figure 1). This experience is expected to appeal to one sensory system (touch, hearing, watching, smelling, tasting, etc.) and sometimes to many different sensory systems. Many natural landscape elements are included in the residential garden design process in order to create this experience, which changes according to both the user's wishes and the designer's foresight. Plants are at the forefront of these natural landscape elements. Looking at the definition of the word garden, it is seen that it is a piece of land on which groundcovers, shrubs and trees can grow, generally associated with the residence. As can be understood from this definition, the plant is the most important component of the residential garden. Plants provide the user with many experiences and enable users to come into contact with nature (Gülpınar Sekban & Bekar, 2018; Kahveci & Onur, 2021; Onur & Altuntaş, 2021).

Figure 1. Some places where basic needs are met in private residence gardens (Houzz, 2023)

In addition, plants have the ability to transform aesthetic and ecological requirements into gains (Güneroğlu & Bekar, 2018). A plant or plant community is appealing to the eye with the color of its flowers or leaves, it can appeal to many senses with its smell, fruit, and the sound of its leaves in the wind. In addition, plants provide many benefits to both the residential garden and its immediate surroundings in terms of ecosystem services (Sarı & Karaşah, 2020). At the beginning of these gains are contributions such as carbon sequestration, water permeability, contribution to biodiversity, microclimate regulation through shadow creation (Bekar, Yalçınalp & Meral, 2020; Gülpınar Sekban & Bekar, 2019). Each of these gains is very important both for the user and for the sustainability of the city (Pearlmutter et al. 2021).

In order to use the herbal element correctly and to meet the needs, all the existing and added plant elements should be carefully examined at each stage of the main design process and integrated into the design stages.

1.1. Factors Affecting Planting Design

Plants are one of the five main classes defined in the classification of living things. This main class should be divided into two as veined and non-vascular. While creating planting projects of landscape designs, vascular plants are generally used. Planting classes consist of many families, species and genera. This diversity highlights the originality of planting designs. Many species can provide unique natural experiences when certain conditions are met. In order for the planting design to be successful, the design processes must be plant-oriented (Güneroğlu, Bekar & Kaya Şahin, 2019). It is necessary to determine the factors affecting the planting design. The determined factors should be examined meticulously within the study area. For this study, survey and analysis studies, which are the first stage of design, are very important. It is important to know that each landscape area has its own characteristics. Planting decisions should be carefully evaluated in the residential garden, both individually and holistically.

1.1.1. Ecological factors affecting planting design

For the success and sustainability of planting design in residential gardens, it is necessary to accept the fact that the study area is unique. Because the residential garden is affected by many different environmental factors, no matter how small square meters it has. In addition to the fact that residential gardens are different from each other, there can be many different environmental situation variability within the same garden. Each garden has different light, wind, temperature, water and soil values compared to other areas. In addition to the dominant data of the landscape, it is necessary to analyze small-scale changes for the sustainability of the design. Before the planting design is made, the ecological characteristics of the area should be examined. The characteristics to be examined are temperature, light, wind, water and soil values, which are very important for the life of plants.

Analyzing temperature values is a very important ecological factor for plant species selection. In order for the plants to develop healthily, it is necessary to pay attention to the temperature zone in which the area is located. Within these temperature values, the maximum, minimum temperatures and the number of frosty days is very important. The temperature zone allows general decisions to be made in plant species selection. However, the most important factor to be considered at this stage is to analyze whether the temperature zone and the current temperature data of the area match. As it is known, height can specially change the temperature data of a special natural or artificial conditions that can include existing wind corridors or area. Therefore, it would be correct to obtain the ecological data of the area and to do it on the same area. The area and its immediate surroundings should be examined with this eye, and environmental data should be analyzed with precision. Along with temperature data, another important data affecting plant species selection is the presence of light. The amount of light that plants consider necessary for a healthy development and survival changes. It is necessary to analyze the amount of light in the existing area and choose plants accordingly. However, there is another point to be noted here. At the stage of designing plant compositions in planting design, the features that the plants will bring to the environment should be carefully considered. For example, when the necessary conditions are considered, it is necessary to know that Pinus nigra plants planted in an environment with plenty of light will now create shade in that area at all times of summer and winter. The amount of shading to be provided by the plants, which are considered as the basic plant and forming the top cover, should be considered at this stage and if a decision is to be made for the lower layer, it is necessary to make decisions accordingly. The presence of water is very important for plants like all living things. The amount of water in the soil and in the air is one of the critical ecological factors for the selection of plants. So much so that the presence of water affects the ability of some plants, which are not suitable for temperature values, to tolerate the environment. While some plants need a lot of water to survive, some plants may experience root rot in the amount of water that is considered normal for other plants. However, the amount of water in shaded areas and in areas with full sun varies from each other. If the irrigation systems to be arranged in the residential gardens are built on a single type system, the amount of water in the sun-exposed areas may be low for the plant, and the same amount may cause ponding in the shaded areas. Therefore, the amount of water and the demands of the plants should be specially evaluated. In addition, within the scope of ecosystem services, plants have the benefits of draining excess water and reducing the runoff of water. It is suggested that plants will offer natural solutions in such problematic areas and that special plants should be used accordingly.

1.1.2. Plant characteristics affecting planting design

Planting design is directly related to many structural features of the plant. Because many features of the plant are used as a design element in planting design, and the usage patterns vary according to the desired and design purposes. Before examining the design components of plants, it is necessary to have knowledge about the life cycle of plants. For example, a plant that grows fast in an area with a small garden area or has a high closure rate when grown should not be used. In addition, when a flowering plant is selected for an area used only in summer, plants that bloom in March-April should be removed from this selection. In order to make such decisions and adjust the planting compositions, the life cycles and growth developments of the plants should be carefully examined. In addition, the life cycle of plants should be known in order to produce plants and ensure the sustainability of plants. This means: When the user wants an edible garden in planting design, it is necessary to use pollinators and plants together, which will facilitate the fruiting of the plants. Using this type of information together ensures that the yield to be obtained from the edible garden is high. In addition to these, plants can be answers to many questions that affect the function and aesthetic value of the garden. These questions can be answered according to the user's wishes.

In order to determine the many benefits that plants provide to the garden, designers and users need to jointly answer some questions. For example, “what kind of view is desired to be encountered from the kitchen window”? Or “Which color should be active in autumn colouring?” or “should there be focus or privacy at the entrance to the garden?” Planting options are produced in line with the user's requests for questions.

After the planting design decisions are determined in the basic and upper plan, the selection phase of the plants comes into play. In the selection of plants, factors such as growth structure, leaf structure-color, flower structure-color, leafing time, flowering time, stem structure-color, rooting system, crown development are considered (Bekar et al., 2018; Bekar & Güneroğlu, 2018; Gülpınar Sekban & Bekar, 2018). For these, the characteristics of the plants are meticulously studied.

The classification of plants consists of many families, genera, species, subspecies varieties and forms. This shows that there are many options to be used in planting design. While the basic components of each plant are the same (stem, leaf, flower, root), these components show numerous variations within themselves. The correct assessment of this diversity affects the quality of the design and the experience to be gained from the garden. Namely, plants are used in many parts of the city. However, the stress of daily life and the excess of urban stimuli prevent us to experience all the features of plants and the perception of these properties of plants by our brain. However, while sipping our coffee after eating our meal in our house garden, we can feel the leaf size, stem bark and flower smell of the tree on our terrace and add it to our memories. That is why each component of the plants is directly effective in the selection of plants in order to design the residential gardens correctly, to minimize mistakes and to avoid bad experiences.

In plant species selection, leaves are at the forefront of the structural features of plants. The leaves have very effective aesthetic values in terms of structure, texture, size, color, defoliation, leaf odor and foliation color. In residential gardens, the most basic selection criterion is the selection of the plants for their defoliation characteristics in order to associate the plants with the correct functions. Because in a residential garden that will be used at all times of the year, the feature that will most affect the view and function is whether the plant is a deciduous or an evergreen species. The leaves of the plants add density to the garden. Although this density is vertical, it is horizontal with the characteristics of the plant. This is the formation of space, constraint. According to seasonal use, the top layer formed by a deciduous tree provides horizontal density. This density resting area, together with the building façade, will provide shade on hot days in summer according to the angle of insolation, and will enable users to benefit from the warmth of the sun as it sheds leaves in winter (Figure 2). The foliation structure is very important for making such decisions.

When the leaf types are examined, there are many types of leaves (Figure 3) (Chaki et al., 2020). While classifying the leaf structure, the leaves are classified according to the structures of "shape, lobing and division, tips and bases main margins" (Brickell & Zuk, 1996). All of these make up the leaf structure of the plant. At the beginning of these types are "linear, strap-shaped, oblong, oval, elliptic, ovate, rounded, heart-shaped, diamond-shaped, arrow-shaped, fan-shaped, peltate" (Brickell & Zuk, 1996).

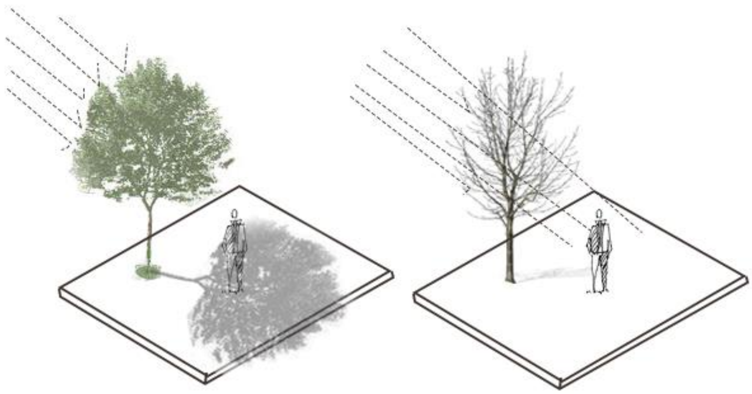

Figure 2. The seasonal blocking of the sun's rays by the foliation structure

Leaf structure and leaf characteristics are very effective on the texture of the plant. Texture is the way in which the general surface of the plant and its individual leaves are defined. Plants are generally described as coarse, medium and fine textured. The size of the leaves, the density of the leaves, the surface of the leaves is highly effective on the texture. Making texture differences in design decisions can break the monotony of the design and add vitality to that design. In addition, the texture creates different results on the user's perception. That is, fine-textured plants are perceived farther away, while coarse-textured plants are felt closer. This difference in perception can be used to make small areas appear larger and large areas smaller. Although the designs vary according to the wishes of the designer and the user, the use of rough textured plants in small areas is not preferred. Because rough textured plants will be perceived closer, small gardens will be perceived as smaller areas. These should be taken into account when making spatial perception decisions.

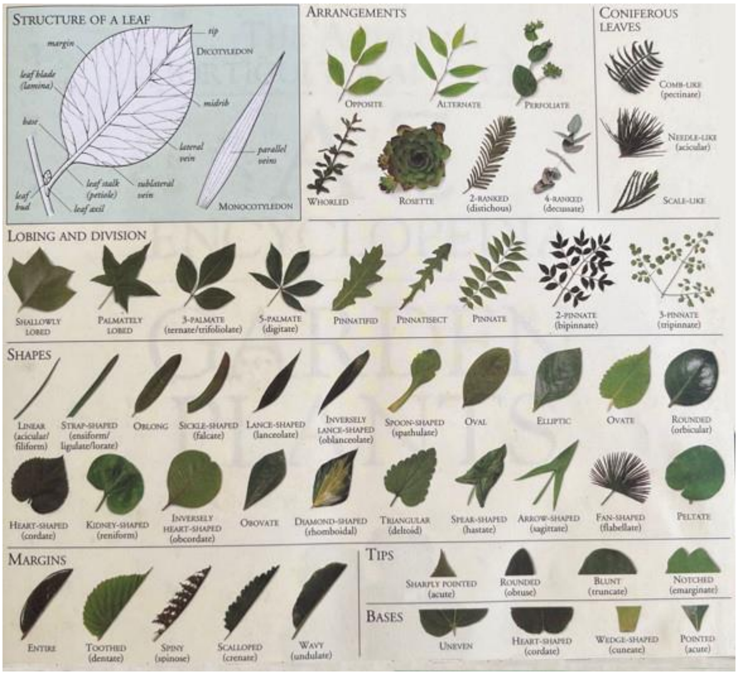

Figure 3. Some types of leaves and their examples (Brickell & Zuk, 1996)

However, it should not be forgotten that tissue diversity is related to the environment and other plants. Namely, a medium textured plant can be defined as coarse textured among fine textured plants. If the same plant is among coarse-textured plants, it will be perceived as fine-textured. Therefore, in planting design, besides the individual evaluation of plants, plants should be evaluated in compositions. Design decisions should include compositional decisions along with individual decisions. In addition to leaf structure, leaf color is one of the most important factors affecting planting design. The leaf color of the plants reflects the base color of the planting. Namely, leaf color can be considered as the main factor in the color design of compositions. However, this varies according to the duration of flowering and autumn coloration. The change in the color of the leaves of the plants in autumn provides a great advantage for the user to experience nature. The color change of plants before they shed their leaves is the aesthetic value of nature's cork. This change can turn into unique landscapes. In order to experience this change, plants whose leaf color changes in autumn are generally used in residential gardens. One of the most important features to be considered in the use of deciduous plants is the good adjustment of the ratio of deciduous and evergreen plants. If this ratio is not observed, the vegetation structure of the residential gardens will weaken in the winter months. If too many deciduous plants are used, the garden will look rather empty and inadequate during the winter months.

Flowers are unique and unique structures that contain the reproductive organs of angiosperm plants (Figure 4) (Brickell & Zuk, 1996). Flowers add variety to nature with their variety of colors (Zhao & Tao, 2015). It is known that the flowers of plants attract living things in nature with certain features and increase biological diversity (Campbell, Bischoff, Lord & Robertson 2010; Lan, Tam, Xing, Rina & Chan, 2022; Lusebrink, Girling, Dobrindt, Jackson, Newman & Poppy, 2023).

Figure 4. Some types of flowers and their examples (Brickell & Zuk, 1996)

Flowers are very aesthetic with their color, odor and shape as well as having unique features for the reproduction of plants (Brickell & Zuk, 1996). They contribute greatly to the aesthetic value of plants

(Kamalova & Azimova, 2023). Users' experiences of spring are defined by the blossoming of trees. The expression "spring has come" is used when a tree blooming in spring is observed among users. Flowers are very important in planting design during the selection of the plant type. There are some conditions that should be considered during this selection. These are bloom color, bloom time and bloom time. These three characteristics are very important in evaluating the flowering ability of plants in planting design. So much so that if you want a garden to be a garden where you can live and feel the seasons, the use of plants whose flowering period follows each other in the same composition will provide different experiences to the user. In addition, it is the harmony of flowering colors that should be considered during the side-by-side use of plants whose flowering period is at the same time. Namely, the flowering characteristics of the selected plants should not have mutually suppressive or destructive features. The fact that the characteristics of the plants support each other, be compatible or create contrasts when necessary varies according to the main design decisions of the designer.

2. Conclusion and Suggestions

Plants are natural landscape elements that provide opportunities for users to experience nature. The use of plants in the residential garden should be the result of a study that requires meticulousness and is based on different factors. Because plants are living elements that live, grow and have certain needs. There are many features that should be considered for the sustainability of the residential garden landscapes. In this type of landscape areas, evaluation of plants based on species and making choices based on species can create many problems or failures that may jeopardize the success of the design. It would be a more correct approach to make decisions based on the combination of species as well as individual compositions in the selection of planting design.

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Interaction of Urban and University Campuses; KTU Kanuni Campus Example

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1. Introduction

Universities, which have an intense use and an important place in the city, are areas that highlight the social-economic structure, cultural and political characteristics of the society they are in and have significant potential to create alternative green spaces in cities (Korkut et al., 2017; Yıldız, 2020; Çorbacı et al., 2020; Çorbacı et al., 2022). Universities are institutions that train high-level staff needed by the society, while at the same time present their scientific studies for the benefit of individuals and societies and contribute to the development of the society in the regions where they are established (Ertekin & Çorbacı, 2010; Jackson, 2011). The location selection of the university campuses, the region where it is established, its economic, social and cultural characteristics are important in terms of the development of the campus and its surroundings, and also constitute their spatial setup. Therefore, the establishment of a university in a region that is desired to be developed is a tool to achieve the determined goals (Bodur et al., 2005). University campuses offer a different life to the city, citizens, and students such as reducing unemployment, increasing productivity in the society, providing economic development, personal development, socio-cultural developments, improving the quality of life, etc. In addition to meeting social and cultural needs, the fact that it is an urban image also increases the relationship of the university with the city (Korkut et al., 2017; Çorbacı et al., 2020).

Universities in every country are elements that highlight the social and economic structure, cultural and political characteristics of the societies they are in, and are also one of the important urban structures of the province they are located in. University campuses create different strategies within the scope of their location in the cities and the cause-effect relationships that they establish under the influence of social, physical, cultural, and political factors. In this way, they present their spatial constructs by presenting life to the student, the city, and the citizens. By including the city university campus within its structure, it enables to be formed within the boundaries of the campus, without or with a world cut off from itself. While the relations in this direction take place between the campus and the city, it is the physical conditions provided by the city and the users of the city that shape it by keeping it active. Considering these reasons, it is possible to reveal the changes experienced from the past to the present and the differences between the places caused by the changes by evaluating the economic, social, cultural, and educational perspectives and strategic positions of the campuses according to their periods. In addition to the social and cultural benefits that the settlements provide (reducing unemployment, increasing productivity, personal development, socio-cultural developments, economic development, social and physical infrastructure needs, increasing cultural activities, gradually improving the quality of life, etc.), how the settlements are related to the city as an urban image and the necessity of its establishment is a subject that is constantly discussed (Korkut & Kiper 2016; Sipahi & Yılmaz, 2020).

Another point to be considered in the spatial relationship between the city and the campus is the level of economic, social, and physical development of the city. This level generally plays an important role in the positioning of university campuses that are newly established in cities. Therefore, it becomes necessary to evaluate the needs and general structure of the city in the spatial organization of campus and city relations. In short, standard approaches should not be used in determining the location of the campus (Bodur et al., 2005; Sipahi et al., 2021). The campus, which has a rich relationship with the city, is also rich in terms of feeding the city in terms of the social and cultural values and needs it offers to the city as a production and academic environment. Similar to this, it provides parallel approaches to settlements in urban values. The mutual interactions of the settlements whose relations with the city are weak also remain weak, and as a result, problems occur (Ekinci, 2003). Physical development is very important in newly established university campuses. Determining the core point of a historical identity created in the city and starting the design is one of the most important steps in terms of becoming the university of that region and that city (Irgatoğlu, 2011).

Higher education institutions, which; reduce unemployment, increase productivity and individual income in the society, and thus ensuring the economic development of the country, are important for the individual and society when they are evaluated together with their socio-cultural developments. Although the main mission of universities seems to contribute to the personal and intellectual lives of people, the economic dimensions of universities are also very important. Since the 1960s, higher education institutions have been seen as a tool in regional development in many European countries. For this reason, they were established and expanded in undeveloped and collapsed regions, considering that they would have a multifaceted effect in the regions they are located (Görkemli, 2009). The university has individual, social and economic (contribution to the social-cultural life of the city, contribution to the economy of the city) contributions to the city and the region (Görkemli, 2009). Universities have traditionally been established in the center and inside of cities, in close proximity to many different advantages. In terms of students, these advantages are listed as the opportunity to mingle with the city and its citizens and to ensure their development. In terms of citizens, they can benefit from the university's library, sports fields, educational and intellectual environment, auditorium, etc. The campuses are the universities developed in the building blocks, which are part of the city (Sönmezler, 1995). Urban campuses have positive aspects such as social integration, economic contribution, non-formal education, benefiting from recreational activities and negative aspects such as growth and development, lack of infrastructure and social areas, unplanned construction in the city, parking and traffic problems, lack of recreation areas and pedestrian roads, lack of urban awareness, etc., which have caused many urbanization problems. According to Karakaş (1999), it is possible to collect the reasons for the growth of the campuses under two headings:

1. Users need more and new spaces within themselves (micro growth),
2. The need for new uses (macro growth),

While the campuses grow and develop in line with their needs, the integrity of the newly created structures and the existing structures and the structures to be built in the future should be ensured. In order to experience a healthy development, development plans should be prepared and these plans should be compatible with the existing campus (Dober, 1992; Karakaş, 1999). While the result of developments in the campuses is growth, there must be flexibility in developments. Flexibility at the spatial scale is a sought-after feature in university structures. At the same time, large-scale changes can take place by providing flexibility in the entire infrastructure and general layout of the settlement, as well as in flexibility. Flexibility should be emphasized in infrastructure decisions, otherwise the inadequacy of the existing infrastructure will cause greater economic problems (Çınar, 1998; Yıldızoğlu, 2006). These problems need to be solved in order for the city and its surroundings to be more livable, safe, healthy and sustainable (Sipahi & Tavşan, 2019). With this study, the urbanization process of Trabzon city center will be revealed, its spatial development over time, socio-economic and potential situations will be examined, and the problems that cause urbanization will be revealed in this direction. In the light of these data, suggestions will be made to make Trabzon a more livable city and to ensure its urban sustainability.

2. Material and Method

The main material of the study is Karadeniz Technical University (KTU) Kanuni Campus and its surroundings located in Ortahisar district of Trabzon (Figure 1). As supplementary material, relevant literature, bases obtained from public institutions (satellite photos, ortho photos), zoning plans, observations made in the study area, photographs taken in the field, notes taken during the field survey, reports and Google Earth Pro package program were used.

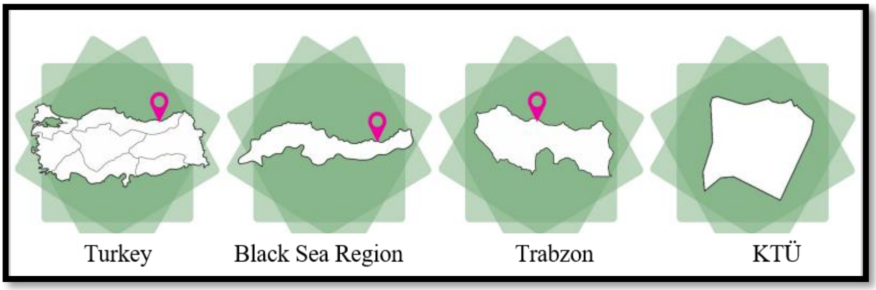

Figure 1. Study area

Quantitative and qualitative research methods were used in the research and in this context, domestic and foreign literature belonging to the research subject was scanned. All verbal and numerical data of the study area were obtained from the relevant institutions. In the study, orthophotos of 1955 and 1989 were obtained from the General Directorate of Maps, and the image of 2023 was obtained from the Google earth pro program. Suggestions were developed by revealing the past and present situation of the area and determining the contribution and effects to the city in the development process.

3. Findings

KTU Kanuni Campus is an important asset for the city of Trabzon. Orthophotos and high resolution satellite images were used in this study, which was carried out to reveal the contribution and effects of the campus to the city from the year it was founded (Figure 2).

Figure 2. Satellite images of KTU Kanuni campus for the years a.1955, b.1989, c.2023

In Ortahisar, the central district of Trabzon, the province where the campus is located, it is important to reveal the population increase rate in order to determine the problems and needs arising in and around the campus with the increasing population over time. According to Figure 3, it is seen that the population was 117,768 people in 1955 and 335,628 people in 2022 (URL-1, 2023). In the light of these data, it has been calculated that the population of Ortahisar district has increased by 184.9% in the last 67 years.

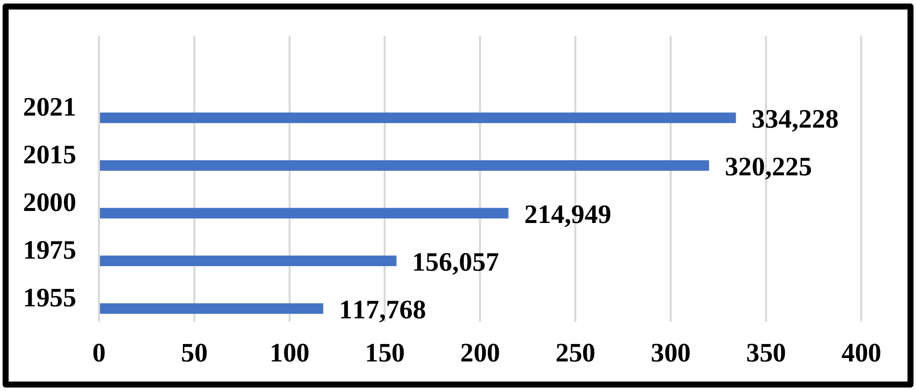

Figure 3. Trabzon Ortahisar population growth graph

When KTU Kanuni Campus and its surroundings are evaluated, it is seen that the University campus was located outside the city, there was no construction around it, it was surrounded by agricultural lands in the years it was founded, and the construction increased in line with the increasing population with the development of the university (Figure 4). It is determined that the agricultural lands in and around the campus have turned into structures over time, the transportation networks have increased, and the green areas have decreased in line with the increasing need for shelter and food.

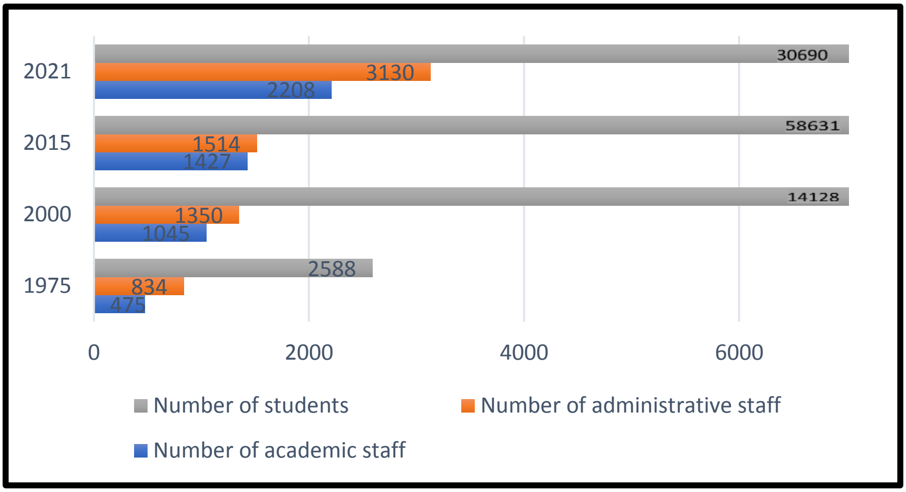

Figure 4. Change graph of the number of people in the campus (academic, administrative and student numbers)

Considering the number of people in the campus, it was seen that the number of students increased by 11.7%, the number of academic staff increased by 364.8%, and the number of administrative staff increased by 275.3%. The population growth in the campus (student, academic and administrative staff, etc.) is important to define the adequacy, needs and problems of the campus facilities. It is necessary to reveal and prevent the economic, ecological, social, and cultural problems such as the inadequacy of the transportation network with the increasing population, the increase in residential and administrative buildings, and the decrease in green areas.

4. Conclusion, Discussion and Suggestions

In order to develop a healthy society in universities, all educational, physical and spatial elements must be present in the campuses. Among these elements, open green areas constitute the most basic use of the campuses and serve many ecosystem services by connecting ecological systems, as well as providing physical and psychological benefits to users. These areas in the campuses add value to the quality of human life and protect natural resources, air, water and microclimate (Tzoulas et al., 2007).

The campuses provide a recreational environment to their users and their surroundings with the green areas they host and offer them the opportunity to relax psychologically. Due to the recent epidemic and psychological pressures, people's need and longing for green spaces has increased, and open green spaces in the settlements within the city have become the focal point. In order to meet the green space needs of the users, the need in this direction should be met in the campuses and in the cities in general, taking into account the amount of green space per person, which varies depending on the country, region, population (Aksoylu et al., 2005; Önder & Polat, 2012). In this study, which was carried out in and around the KTU Kanuni campus, it was observed that the green areas decreased with the increase in population and the construction in and around the campus increased.

In the light of these data, similar to the result obtained by Çatalbaş (2016) in his study, infrastructure and social deficiencies, unplanned settlements, parking and traffic problems, lack of pedestrian and bicycle paths bring along urbanization problems.

As seen in previous similar studies (Mac et al., 1998; Alberti, 2005; Bennett & Saunders, 2010; Kesgin Atak, 2020), temporal changes increase human pressures on the campus and the city, resulting in incorrect use of land, reduction and destruction of green areas, causing such problems. This situation causes many ecological environmental problems by decreasing air quality in the campus area, decreasing biodiversity, comfort area, recreation areas and diversity, increasing energy use and impermeable surfaces. Runoff water, which is formed by the increase of impermeable surfaces, constitutes one of the most important ecological problems in the settlements. Made calculations and suggestions for the construction of an underground rainwater reservoir under the main artery where the rainwater accumulation is the highest in the KTU campus. Reservoirs and rain gardens to be planned in the campuses will also contribute to the protection of water resources in the city.

Literature studies and oral interviews, which contributed to the economic, social and cultural aspects of the surroundings of KTU Kanuni Campus and the city of Trabzon, were revealed. From past to present (1955-2023), it has been observed that the number of students, academic and administrative staff of the KTU Campus has increased, and accordingly, there has been a significant increase in the number of residential and commercial areas in and around the area where it was established. This contributes positively to the city's economy in terms of income, employment and expenditure items.

When the economic contributions of the campuses to the cities are investigated in the literature, it has been seen that there are academic studies examining the socio-economic effects of the universities on the city and the region where they are located in the 1990s (Erkekoğlu, 2000; Görkemli, 2009; Çayın & Özer, 2015).

- What should be done primarily for the campus and its surroundings evaluated within the scope of this study is not to allow new constructions, to protect the existing green areas, and to include the new green areas in the city and its vicinity, apart from the green areas suggested within the scope of the study. At the same time, open green space adequacy is not only met with quantity, but also the presence and quality of open green spaces is important. Passive and neglected green areas within the campus should be evaluated. Including the natural plant species of the region in the plant designs to be made in the open green areas will increase the quality of the open green areas. In addition, the fragmented green areas should be connected with green corridors between the campus and the city. Greenway planning is highly preferred in planning studies to combine such green space disconnections. It is possible to combine the structure of the campus, which is disconnected from nature, and create an alternative transportation network to the campus at the same time. This transportation network provides the campus with an opportunity to improve air quality, contribute to biodiversity, provide food and living environment for wildlife, increase the amount of green space, and alternative transportation for bicycle paths and pedestrians. It should be ensured that the existing green areas are protected and increased, the green tissue should be used to prevent noise, produce oxygen, dispose of dust and exhaust gases, etc. effects should be exploited.

- Since the hard floors in the area do not absorb sunlight, they increase the temperature of the environment due to the absorption of light. Therefore, it is necessary to increase the amount of vegetative tissue by reducing the number of hard floors in order to prevent the heat island effect.
- The transportation of heavily used areas within the campus should be well resolved and disabled individuals should not be forgotten. These points must be accessible in order for the campuses to be sustainable and to meet the basic needs of the people living there.

- It is necessary to give weight to public transportation among transportation options, to gradually reduce the areas reserved for car parks and/or to take them underground.
- The hard floors at some points in the area have been used intensively in a way that is completely dysfunctional and creates a heat island. In order to ensure that the area is used effectively, various activity and usage areas should be created, and an element of comfort should be developed for the users.
- In sustainable-ecological campuses, studies can be carried out for development and improvement in the campuses by conducting surveys for users.
- An alternative transportation system with pedestrian priority can be provided. Thus, the carbon and heat island effect of the campus and its surroundings can be reduced.
- In activities where the amount of waste is high, such as production, transportation, etc., the use of environmentally friendly energies should be supported.

With the planning studies to be carried out in line with these suggestions, ecological, economic, social and cultural contributions can be made to the campus and the environment by ensuring the integrity of the campus and its surroundings. In this way, it is possible to contribute to the biodiversity of the campus by protecting and increasing the green areas it has, to increase the air quality and life quality of the campus and its surroundings, and to provide ecological and economic contributions to the campus by recycling, solid waste, energy and water management.

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Rethinking Urban Spatial Standards in the Changing Perspective of Planning and Design

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1. Introduction

Amidst the challenges arising in today's cities, elevating the quality of life, and creating identity-driven spaces with a resilient social structure have become essential objectives, turning model searches based on cross-scale assessments into a constant subject on the planning agenda. Cities, which are complex systems in terms of ensuring the effective continuity of planning and design decisions, point to developing design tools and practice structured under the concept of 'flexibility' to overcome unpredictable usage needs. The decision system of urban planning and design leaves its place to the new urbanism approach in which solutions are detailed in a flexible and even circular nature. This trend also opens the relevant legislation to discussion.

The need for improved services with population growth reveals the need for efficient allocation of resources, especially for the development and implementation of spatial standards from urban scale to rural. In this context, it has gained importance in the planning agenda to create alternative solutions that will establish the comfort of life and the functional and aesthetic values of the built environment by creating a model that will guide urban problems with a holistic perspective from rural to urban.

The model produced in the context of inter-scale relations in the "Development of Urban Spatial Standards" project, which is carried out in 2017 within the Mimar Sinan Fine Arts University (MSFAU), is one of the searches for answers. This model has been created with an approach that regulates the elements that classify new urbanism systems for the active use of cities and defines the required spatial standards from the city to the rural areas. However, the increasing effects of the climate crisis and the future indicators presented by the pandemic make it necessary to update the framework of this model.

In this study, smart codes, which play an important role in strategic spatial planning in order to answer the question of how to meet the expectations regarding living spaces, are considered as one of the tools that form the basis of preparations for the future. The proposed model for urban spatial standards prepared in the project also aimed to define new tools with the smart codes approach. With the research, which is the subject of this study, it is aimed to evaluate this model in line with the agenda brought by the concept and principles of flexible smart code at the scale of the neighbourhood-city.

The neighbourhood scale, which is perhaps one of the best areas to analyze the flexibility factor for adapting to ongoing natural changes like the pandemic, holds significant potential in terms of social conditions, cultural, and functional programs. Therefore, within the context of planning and design approaches with flexibility in interventions aimed at sustainable living standards during the process of urban environment densification and growth, developing an effective urban facility model and defining location-based smart codes will also provide a unique contribution to the relevant literature.

From this point of view, in this study, it is planned to (1) relate the concept and principles of smart code and development proposals with urban spatial standards in the context of planning-design-implementation; (2) define flexible smart codes for build-up environment design and place-making from urban scale to neighbourhood scale; (3) discuss the next generation standards within the framework of the urban spatial standards model.

The neighbourhood scale, which comes to the forefront more than ever, especially in our practice of urban studies, is an important focus. The neighbourhood, which guides spatial integration while providing social cohesion, draws attention to a new model structuring. The inter-scale approach of this new model defines the relationships at the upper scale extending from the region to the city. The lower scale, on the other hand, encompasses inclusive details and shapes the decisions that will ensure the meeting of the urbanized population and the space.

Urban spatial standards aim to develop an effective and participatory planning approach in practice, with strategic and holistic innovative tools across scales. For this reason, it must have a potential to guide and increase both the quality of life and the environment. While improving the quality of public space, it should also create platforms that can meet local dynamics to improve life with urban facilities and cultural infrastructure.

The meeting of smart codes that might be defined for conservation and renewal processes in cities, open spaces, environmentally sensitive spaces, different types of housing areas, front visual development areas and transformation areas, with standards reveals a comprehensive and innovative framework. Thus, urban spatial standards will coincide with the vision of the community rather than a summary of a particular urban form. But more importantly, it will encourage the structuring of the development framework in the local pattern. Consequently, urban spatial standards, with their flexible and character-oriented structure, will enable the presentation of theory and practice in lines that will preserve originality.

2. Conceptual Framework

Cities are places where interrelated issues of quality of life, social and environmental justice, economic productivity, urban safety, and health are often underestimated (Colavitti & Serra, 2019; Colavitti et al., 2020; Salzman et al., 2014). Therefore, in terms of addressing the impacts of increasing inequalities in cities and preventing potential crises, management contents are being discussed, particularly through the planning system in Europe. It is emphasized that the structured systems related to spatial planning and governance have been insufficient in ensuring effective public administration in "space production” within contemporary socio-economic contexts (Janin Rivolin, 2017).

Caldarice & Cozzolino (2019) similarly state that cities, along with their settlement processes, are affected by the depletion of outdated needs, especially for urban facilities, and the stagnation in demographic dynamics, which often invalidates growth predictions. As a result of these changes, there is less attention to measurable needs in the current planning discourse, while there is an increasing demand for quality, rendering quantitative urban welfare policies inadequate. In this context, the supply and management of urban facilities emerge as a significant institutional objective of planning (Hall, 2014). There is a need to highlight the tools of spatial planning that recognize specific areas where state intervention is necessary to guarantee the development of desired and needed facilities, working for the public interest (Moroni, 2004; Secchi, 2009).

At this point, it can be argued that spatial planning decisions regarding urban facilities require the concept of “smart growth”, which enables the development of strategies based on higher scales, and more. Particularly in terms of land use decisions, the smart growth approach significantly differs from the traditional planning perspective. Some studies have highlighted the need to transition from the typical traditional approach, which relies on pre-quantified types and minimum areas for common services and infrastructures, to a more innovative solution that provides sufficient qualitative public services and contextually guarantees the preservation and accessibility of the environmental system. However, the discussion on the localized flexibility of spatial standards is currently limited to a much narrower context (Colavitti et al., 2020).

However, the city needs the freedom to express and enrich its collective and individual needs for complementary or diverse activities, including gathering and socializing spaces for communities, creativity and cultural event venues, job opportunities, sports and entertainment facilities, and more. Therefore, the urban environment of today should evolve from serving fixed and limited specific functions to providing a broader range of services that cater to the desires and needs of city users. The goal of achieving fair and sustainable well-being, particularly in terms of renewing existing urban structures in the context of sustainability, leads urban planning to face the challenge of integrating the environmental paradigm with collective services, primarily based on principles of social equity and environmental justice. Flexibility in adapting to constantly changing social needs and expanding the supply of public services are essential in implementing this assumption (Colavitti et al., 2020; Siu, 2012).

The COVID-19 pandemic and even before that, the climate crisis, which has not lost its significance on the agenda, have clearly highlighted the issues associated with urban facilities that serve only specific purposes (Siu, 2012). This new conditions experienced globally invite us to reconsider traditional approaches to urban facilities planning and seek better and more diverse responses (Caldarice & Cozzolino, 2018). These circumstances also give rise to new discussions regarding the content of planning tools and their guidance in implementation. This issue is particularly crucial in cities where physical and social aspects are constantly evolving.

The European Union (EU) has recognized the key role of cities in addressing emerging challenges and, in response to the climate crisis, environmental degradation, and the social and economic crises, has approved a series of documents encouraging different member states to take sustainable measures. Before that, the United Nations (UN) had already published two important strategic documents as guiding principles for achieving a sustainable future: the 2030 Agenda for Sustainable Development and the New Urban Agenda (UN, 2015, 2017). Both documents highlight the need for appropriate implementation tools and include the use of assessment tools to support decision-making processes at different stages (De Toro et al., 2020). With the influence of these documents, in recent years, governments worldwide have recognized the importance of the quality of public spaces and have invested a significant portion of government funds in the planning, implementation, and management of urban facilities (Siu, 2012).

Although the literature on urban facilities is scarce, many studies (Addas, 2023; Colavitti et al., 2020; Garau & Pavan, 2018) focus on achieving good living standards in urban development by prioritizing the goal of creating a substantial amount of green and open spaces in the city. The European Green Deal (European Commission, 2019) has also been effective in the increasing prominence of green areas among urban facilities.

In the context of preserving all natural areas that provide ecosystem services, specific topics include increasing green spaces and adopting a compact city approach, which align with the principles of smart growth aiming to limit density and overcrowding by redefining urban areas with a renewed logic. The city will need to expand functionally through the supply of new services without physical expansion. In this way, the various demands for sustainability goals and liveability in urban areas lead to two interconnected themes, which prompt a different organisation of the city and a new interpretation of the role of urban/spatial planning standards.

Indeed, the complementary element that surpasses traditional urban planning standards, zoning movements, and construction criteria that do not align with the needs of contemporary society is the neighbourhood scale with flexible standards.

Within the framework of urban planning notion, the neighbourhood unit is defined at multiple scales based on its size, level of coherence, and shared services, with an emphasis on making physical components determinant (Perry, 1929; American Planning Association, 2006; Weiss et al., 2007; Park & Rogers, 2014). According to Galster (2011), the neighbourhood scale, shaped by the spatial qualities of residential clusters in connection with the land uses in their immediate surroundings and the city as a whole, constitutes a set of intertwined functions and relationships, in other words, the urban facilities system.

The neighbourhood is considered an integral part of the community definition (Sampson, 2003); a unit where space is organized along with the community (Fox et al., 1980; Farahani, 2016); a common area where social capital can be strengthened through social network relationships (Sampson & Graif, 2009); and an ‘interface’ where solutions to multiple urban issues can be developed at a more local scale across a wide range of disciplines. During the COVID-19 pandemic, the neighbourhood has been subject to increased scrutiny as a unit, becoming a valuable and essential (self) resource to provide vital continuity for urban residents, particularly for vulnerable social groups (Berkowitz et al., 2020). It has also become a living space where its inhabitants rediscover it with all its limitations and possibilities, aiming to maintain a safe and ‘healthy’ public life (Çılgın, 2020; Glover, 2020).

In the pursuit of creating healthy and sustainable cities, it is essential to focus on making neighbourhoods healthy and sustainable as well, in alignment with the goal presented by UN-Habitat and WHO (2020). This approach emphasizes the need to define unique spatial standards and neighbourhood planning practices that support physical activity, provide safe mobility and circulation, offer a healthy physical environment, and ensure accessible public spaces and services for everyone. Additionally, it calls for implementing high-quality design practices that cater to the physical and psychological needs of users.

To achieve these goals, a multidisciplinary approach is crucial, addressing socio-economic dynamics without creating spatial inequalities in the quality of life. This approach recognizes that the social and economic aspects of neighbourhoods should be considered alongside their spatial implications to create inclusive and equitable environments. By combining various disciplines and focusing on interdisciplinary solutions, it becomes possible to design neighbourhoods that promote well-being, foster community cohesion, and enhance the overall quality of life for all residents.

On the other hand, “urban sprawl,” triggered by economic development and resulting from intense urbanization, disrupts the balance of ecosystems, making them vulnerable and serving as a reservoir for numerous diseases (Frumkin, 2002; D’Alessandro et al., 2017). In contrast to this, the *compact city model* and, within this model, the significance of the neighbourhood unit, as briefly highlighted above, point to a targeted scale of importance in response to the aforementioned reasons and the experiences during the COVID-19 pandemic (Olgun, 2020). This distinction underscores the importance of concentrated urban planning and development that not only promotes health but also mitigates the adverse environmental and social effects associated with urban sprawl.

Therefore, there is a need for flexible standards that encompass and make decisions about urban facilities that will create optimal conditions for quality of life at varying scales, from individual dwellings to neighbourhoods and cities, ensuring both biological and socio-psychological well-being and life satisfaction.

Flexibility, in general, is defined in relation to concepts such as adaptability, bending ability, variability, responsiveness to changes, and readiness to adjust to different conditions. In the context of urban spaces, flexible urban space is perceived as a space that establishes an optimal size and appropriate form in a good relation with its characteristics and performance, while being consistent with certain limitations (Till & Schneider, 2005; Davic & Welsh Jr, 2004). Flexibility can be regarded as a strategy that ensures the most suitable utilization of resources for meeting and developing possible needs of cities. Especially in planning, design, architecture, and other related disciplines, flexibility means achieving spatial harmony and altering the human-space organization to adapt to new conditions, solutions, and applications. Adaptive spatial organization involves a plan that provides different patterns of behaviour at different times without requiring physical changes for flexible and multi-functional spaces (Einifar, 2003).

Flexibility, as a dynamic concept that allows urban planning to adapt to various changes in uncertain contexts, corresponds to the coordination of diversity involving all stakeholders, planning objectives, methodologies, etc. Within this defined framework, flexible planning has been proven to possess a strong alignment and guidance for urban development and rational allocation and utilization of resources in the context of a market economy (Xu & Zhang, 2013).

In urban planning, it is possible to define the concept of flexibility as the adaptability of planning thought and system to the spontaneous and daily needs of society. In order to maintain the stable development of urban structures, urban development strategies, land planning, zoning, and other planning formulations incorporate approaches with flexibility to address uncertainties from various perspectives, continuously producing more advanced scenarios. The increasing complexity and change characterizing contemporary urban societies require a more flexible approach to urban design. Henceforth, the concept of urbanism we envision should embody flexibility, aesthetic openness, reflexivity, active participation, and negotiation. This approach should encompass a set of tools capable of generating solutions, while acknowledging the distinctiveness of the "new urbanism" within the realm of urban theories.

Although flexibility does not mean establishment of urban facilities that can meet all needs for all users in every situation, everywhere, and forever, it is undeniable that it can provide solutions to current problems related to quality of life. While policymakers and designers in Western cities consider flexibility as one of the fundamental aspects in the design of urban public utilities, the need for flexibility in existing urban public utilities is experienced in three dimensions: Planning-design, implementation, and management (Siu, 2012). This need can be met with new spatial standards that are localized from the regional to the urban and neighbourhood scales.

3. Methodology

This study is based on the research and findings of the "Development of Urban Spatial Standards" project, which was carried out in collaboration with the Ministry of Environment and Urbanization of the Republic of Turkey and MSFAU in 2017. The model developed within this project has been re-evaluated in the context of today's circumstances, considering the need for spatial flexibility due to the pandemic, after 6 years. This study represents the outcome of this re-evaluation.

The current model consists of three parts: Sector-based regional scale, locally based urban scale, and structure-based neighbourhood scale. Each of these parts is addressed by relating them to the dimensions of planning (smart growth), urban design (smart codes), and implementation (spatial standards). Throughout the model, principles related to all scales and approaches to developing these principles are defined.

The nature of spatial development, describing its contribution to the urban whole, necessitates setting goals, establishing context-related relationships, and creating holistic effects, especially through smart codes and spatial standards. Considering the creation of urban identity, it is important to consider three factors that influence physical direction and contextual relationships: natural, cultural, and strategic context. These factors constitute the values of spatial development.

The natural context defines the relationship between natural values and topography, while the cultural context reveals the identity value of development in terms of social and cultural heritage dimensions. The strategic context, as the synthesis of the other two factors, represents the process of construction, design, and implementation, which is influenced by the specific legal and administrative framework, reflected in the city.

This type of model creates an opportunity to improve both the quality of life and the quality of the urban environment through inter-scale and contextual relations. This process also creates development methods that guide the physical space to create/increase the quality of life.

To develop a site-specific model, the content of this inter-scale and contextually related approach was first developed by examining examples from abroad, as it has not been widely discussed in the Turkish literature and, more importantly, has never been attempted in planning-design-implementation practice.

In the United States, the history of codes, the process of developing form-based codes, the transect approach, form-based regulations, and a comparison between traditional zoning and form-based codes were examined. In the United Kingdom, the process of developing design codes[1], their content, working scales, relationship with plans, and legal basis were analysed. In Germany, the place of design and coding within different planning levels, objectives and dynamics, implementation methods, opportunities and risks were extensively studied and discussed through examples. Finally, these approaches, implementation areas, objectives, expected benefits, challenges, and solutions were compiled and synthesized under the headings of smart codes' vision, national importance, relationship with planning, their

[1] In the United Kingdom, form-based codes are defined as "design codes".

role in creating facilities, their use in participation processes, and the flexibility and diversity options they offer. This provided an important basis for creating a local and specific model for Turkey.

Finally, the flexibility aspect of the model was emphasized in terms of connecting it with spatial standards in the context of planning-design-implementation and elaborating it up to the neighbourhood scale through smart codes, meeting new generation standards.

4. Findings and Discussion

4.1. Current Practice of the Urban Spatial Standards

The quality of life, which is the effectiveness of success criteria in today's and tomorrow's cities, for communities living in urban spaces is strongly influenced by shared resources, services, and infrastructure systems. Social aspirations associated with urban life should be addressed in a way that overcomes individual needs expressed by consumer society and fulfils higher urban rights (Colavitti et al., 2020). What is certain is the need for a planning and design approach that goes beyond single-parcel development and embraces an inclusive and holistic perspective in the organization of urban spaces, considering its economic vitality, distinctive and unique structure, and the comfort it offers for living. In this context, the tools used within the framework of the planning-design relationship, urban spatial development strategies, and urban standards and codes provide important references for applications in Turkey as well.

In Turkey, universal definitions based on minimum qualifications and per capita area ratios related to urban spatial sizes within the scope of zoning regulations constitute very general standards while often forming generalized usage patterns in the relationship between urban planning and design.

The first zoning regulation in Turkey, Zoning Law (No. 6785), which came into effect in 1957, did not include spatial usage standards. However, with the implementation of Zoning Law (No. 3194) in 1985, the spatial planning process began. Over the years, this law has undergone various changes, and within its scope, various standards related to space have been determined. These standards have been formulated to be taken into consideration, especially in urban, social, and technical infrastructure areas and relevant structures, through zoning plans. With the Spatial Plans Production Regulation, which came into effect in 2014 and detailed these standards, spatial plans have been categorized and defined within the planning system of Turkey (Table 1).

However, a fragmented legislative structure has emerged due to changes in both central and local government regulations, which directly affect this systematics (Dede & Şekeroğlu, 2020; Sönmez, 2017). This hinders the establishment of a ground that enables comprehensive decision-making between urban planning and design.

Table 1. Facility areas that can be included in zoning plans according to the Spatial Plans Production Regulation (MSGSÜ, 2017, pp. 243-246)

ANNEX-1ç Master Plan Demonstrations [Spatial Plans Making Regulation]	ANNEX-1d Implementation Plan Demonstrations [Spatial Plans Making Regulation]	Spatial Use Definitions and Principles [Spatial Plans Making Regulation and Planned Areas Zoning Regulation]
Municipal Service Area (BHA)	5. Among the uses within the scope of the Municipality Service Area, the use to be determined in the implementation development plan is indicated in parentheses. Municipal Service Area (BHA)	a. Municipal service area: It is the area where the facilities established to meet the local common needs required to provide the services within the scope of the duties and responsibilities of the municipalities and the facilities owned by the companies whose capital more than half belong to the municipality can be built.
13. Public service area includes the public institution and organisation area, the official institution area and the administrative facility area. Public Service Area (KHA)	The name of the public institution and organization that will be located in the area determined as the Official Institution Area is indicated in parentheses. Administrative Service Area (İHA) Governmental Institution Area	h. Official institution area: These are the areas where buildings and facilities belonging to public administrations within the scope of the general budget, administrations with special budgets, special provincial administrations and municipalities, or establishments whose capital more than half are met by these institutions, and public legal entities established by law or with the authority given by the law.
8. The education area includes public and privately owned educational facilities such as kindergarten, primary school, secondary school, high school, vocational high school. Education Area	7. Primary, secondary and high school can be built together or separately in the Education Area. However, the appropriate symbol of the training facility type is marked. Kindergarten Area (ANA) Primary School Area (İLK) Secondary School Area (ORTA) High School Area (LİSE) Special Education Area (Ö) Vocational Education Facility Area (MSLEK) Public Education Center (HEM)	f. Education area: These are the areas allocated in the master plan for schools and facilities belonging to public or real or legal persons to serve in pre-school, primary, secondary and higher education functions. Appropriate opinion of the provincial organisation of the Ministry of National Education is taken for the areas where special education facilities will be built.
Higher Education Area (Ü)	Higher Education Area (Ü)	

ANNEX-1ç Master Plan Demonstrations [Spatial Plans Making Regulation]	ANNEX-1d Implementation Plan Demonstrations [Spatial Plans Making Regulation]	Spatial Use Definitions and Principles [Spatial Plans Making Regulation and Planned Areas Zoning Regulation]
Municipal Service Area (BHA)	5. Among the uses within the scope of the Municipality Service Area, the use to be determined in the implementation development plan is indicated in parentheses. Municipal Service Area (BHA)	a. Municipal service area: It is the area where the facilities established to meet the local common needs required to provide the services within the scope of the duties and responsibilities of the municipalities and the facilities owned by the companies whose capital more than half belong to the municipality can be built.
13. Public service area includes the public institution and organisation area, the official institution area and the administrative facility area. Public Service Area (KHA)	The name of the public institution and organization that will be located in the area determined as the Official Institution Area is indicated in parentheses. Administrative Service Area (İHA) Governmental Institution Area	h. Official institution area: These are the areas where buildings and facilities belonging to public administrations within the scope of the general budget, administrations with special budgets, special provincial administrations and municipalities, or establishments whose capital more than half are met by these institutions, and public legal entities established by law or with the authority given by the law.
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Higher Education Area (Ü)	Higher Education Area (Ü)	

ANNEX-1ç	ANNEX-1d	Spatial Use Definitions and Principles
9. The health area includes all public and private health facilities. Health Area	Health Facility Area (S) Private Health Facility Area (ÖZEL) Hospital (HAST) Primary Care Clinic (ASM)	e. Health facilities area: These are the areas allocated in the zoning plan for real or legal persons or public facilities that serve in functions such as hospitals, health centers, primary care clinic, maternity homes, dispensaries and polyclinics. Approval opinion of the provincial organization of the Ministry of Health is taken for the areas where private health facilities will be built.
Social Facility Area	Social Facility Area Kindergarten, Nursery Area (KREŞ) Indoor Sports Facility Area Dormitory Area Elderly Care Centre Area (YBA) Care Centre (ŞEA)	j. Social facility area: These are public or privately owned areas that are reserved for functions such as kindergarten, courses, dormitories, kindergartens, orphanages, care centre for the elderly and disabled, rehabilitation centres, community centres, which the society will benefit from in order to increase the quality and level of social life.
Cultural Facility Area	Cultural Facility Area Library Area Convention and Exhibition Center Area (KSM)	f. Cultural facility area: Public or privately owned areas where functions such as library, public education center, exhibition hall, art gallery, museum, concert, congress halls, cinema, theater and opera are located c. Social and cultural facility area: Public or private areas reserved for uses such as libraries, exhibition halls, museums, cinemas and theatres.
Sports Area	Outdoor Sports Facility Area Indoor Sports Facility Area	b. Sports and playgrounds: Open or closed areas built on the different scale with the decision of the master plan. There may be open or closed car parks and commercial units for the needs of spectators and sportsman. ba. Stadium: Open or closed areas for sports competitions with the decision of the implementation plan. There may be facilities that meet the needs of sports, sportsmen and spectators. These complexes can cover the bottom of the roads and squares within the integrity of the stadium project, provided that they are clearly stated in the plan and are not subject to registration.

ANNEX-1ç	ANNEX-1d	Spatial Use Definitions and Principles
Private Social Infrastructure Area (Ö)		i. Social infrastructure areas: It is the general name given to education, health, religious, cultural and administrative facilities, outdoor and indoor sports facilities, open and green areas such as parks, playgrounds, squares, recreation areas, built by the public or private sector to meet the cultural, social and recreational needs of the individual and society and to increase the quality of life with a healthy environment.
10. For the use of the existing religious areas, the appropriate one of the symbols in the 1:1000 scale implementation development plan is used. Religious Area (İA)	Mosque Prayer room Church Chapel Synagogue	c. Religious Area: These are the areas where people gather for the purpose of worshiping and benefiting from religious services, the religious facility and its complex, provided that it is compatible with the architecture of the religious facility, the housing, library, food bank, rest hall, dormitory and course, outbuildings such as ghusl room, fountain and toilet, open or underground parking lots can be built.
Park and Green Space (PARK)	Park (PARK) Children's garden and playground (CB) Picnic Zoo Hippodrome Square View and Viewing terrace	a. Green areas: Playground, children's garden, recreation, excursion, picnic, entertainment and coastal areas reserved for the benefit of the society. Also, fairs, botanical gardens and zoo in the metropolitan scale and regional parks. aa. Children's playgrounds: These are areas that will meet the needs of the 0-5 age group. No facilities other than a buffet, pool, pergola and toilet can be built. ab. Parks: Parking lot and pool, outdoor sports and playground, public toilet, 1 floor, h 4.50 m. and floor area should not exceed 0.03 in total, and should be made of detachable material. Facilities such as an open tea garden, buffet, pergola, headman's office, security booth, taxi stop, and transformer can be built. They are the areas where the recreational needs of the people living in the city are met. (Annex:RG-1/6/2013-28664) 39. Square: It is a non-covered area that has social functions and whose boundaries are determined by architectural or natural elements such as roads, junctions, buildings, parks.

Another significant factor influencing this is the issue of authority between central and local governments. Although the 1985 Zoning Law transferred general planning powers from the central government to local governments, the 4th and 9th articles maintained the central government’s authority. In the Spatial Plans Production Regulation, it can be observed that the Ministry has taken on all powers, including granting condominium ownership. In addition to the expected responsibilities of local governments such as making, commissioning, and approving plans, the Ministry at the central level also possesses tasks and powers such as project approval, building permits, and occupancy permits. With its expanded powers in planning, the Ministry has deviated from the generally accepted principles and localization trends in urban planning in Turkey. However, in developing distinct places with potential local dynamics, local governments need to take on a more prominent role. The need for this authority arises from the consideration of planning tools specific to each location in relation to design.

The existing standards reveal the rigid and inflexible nature of the traditional approach. These standards often fail to provide sufficient flexibility to meet the rapidly changing spatial needs within the framework of evolving urban dynamics, and they lack a comprehensive approach that considers the diverse urban functions. Moreover, they seem to overlook the environmental dimension directly impacted by urbanization and do not appear to be sensitive to addressing environmental impacts. The current norms shaping the standards are not adequately inclusive of the city's social and cultural values, heritage, and identity. Accessibility and disability-related needs, which are often lacking in the standards, are also crucial considerations in terms of inclusivity.

When considering cities and the regions they belong to, the prevailing approach tends to treat every place as the same, lacking a perspective that can differentiate and individualize the dynamics of different localities.

Considering the problems created by current standards and recent experiences such as the pandemic, earthquakes, and climate crisis, it is evident that urban facilities and open-closed public spaces need to be re-evaluated. In this context, there is a clear need to develop new spatial standards that are flexible, proactive, inclusive, and integrated with a multifunctional structure, supporting an increase in service capacity to actively promote the use of these spaces at the neighbourhood scale.

From a social interaction perspective, Sanei et al. (2018) mention that the diversity and potential for change in public spaces lead to greater inclusivity and emphasize that flexible spaces with such variations can be more efficient and dynamic compared to traditionally designed spaces, directly influencing the motivation of society in creating its own presence.

The functionality of a space can has a significant impact on various aspects, such as the quality of the space, collective satisfaction, people's communication and social interactions, the longevity of the space, and the sense of vibrancy and dynamism. Therefore, one criterion for enhancing social sustainability is to ensure that a space serves multiple functions. To make an area flexible, it requires multiple design criteria and flexible standards to guide these criteria effectively.

In this regard, innovative studies should look towards the future by demonstrating the integration of planning, design, and implementation, and creating a comprehensive implementation tool that resolves all these relationships while preserving the spatial identity structure for cities. In this sense, national and international experiences become important reference sources that need to be examined in all their legal, administrative, and institutional dimensions in order to restructure the systematics, including solutions related to legislation.

The incorporation of these experiences will contribute to the development of a systematic approach that encompasses all aspects and provides comprehensive solutions, including revisions to the legislation. It is crucial for such innovative efforts to maintain the uniqueness of the spatial identity of cities while ensuring the integrity and harmony between planning, design, and implementation. By doing so, these studies can become valuable reference sources in reshaping the legal, administrative, and institutional dimensions, both on a national and international level.

4.2. The Proposed Model for Urban Spatial Standards

The model improved within the scope of the "Development of Urban Spatial Standards," revealed with a comprehensive perspective from rural to urban areas to guide urban issues, is based on the *smart code* system. The model framework includes approach explanations from the regional scale to the neighbourhood scale, where principles are emphasized first and then their implementation is addressed. Here, it is possible to clearly understand the *planning* dimension by focusing on the concept of smart growth, relating the urban *design* dimension to smart codes, and associating the *implementation* dimension with spatial standards. The scheme is structured into three sections vertically, and it follows the same three-section flow in the horizontal plane. At the regional scale, fundamental land decisions are defined; at the city scale, subunits under transition zones that are essential for the identity structure are considered; and at the neighbourhood scale, facilities standards to improve the quality of life constitute the stages of this approach (MSGSÜ, 2017) (Table 2).

In the model, regional plans, defining the higher scale, are described as tools focusing on integrated development, preservation of natural areas, and economic growth with the principles of smart growth, aiming to maintain continuity in the transition from urban to rural areas.

Table 2. The model developed within the scope of the "Development of Urban Spatial Standards" project (MSGSÜ, 2017, pp. 6-7)

	PLANNING "SMART GROWTH"	URBAN DESIGN "SMART CODES"	IMPLEMENTATION "SPATIAL STANDARDS"		THEORETICAL APPROACHES
Sector-based REGIONAL SCALE	1.1. MAIN CONCEPTS • Smart growth - Smart codes • Public-oriented planning and development • Urban identity • Regulating the quality of life with new urban spatial standards. • Urban spatial standards with transition zones as an innovative tools.	1.2. REGIONAL PLANS • A1: Protected Open Areas • A2: Reserved Open Spaces • B1: Current Development • B2: Controlled Development • B3: Limited Development • B4: Targeted Development	1.3. GIS IN SMART GROWTH AND SMART CODES SYSTEM 1.4. USE OF GIS IN THE DEVELOPMENT OF URBAN SPATIAL STANDARDS	GIS and REGION	1.5. NEW APPROACHES IN PLANNING; STRATEGIC SPATIAL PLANNING - FORM BASED APPROACH 1.6. NEW URBANISM 1.7. SMART GROWTH AND SMART CODES
Local-based URBAN SCALE	2.1. MAIN CONCEPTS • Mix-use • Using and creating urban dimensions in urban space • Development and innovations of planned units • Parking standards • Density in urban centers • Street standards and walkable spaces • Development areas • Green-blue infrastructures	2.2. LOCAL PLANS AND TRANSITION ZONES • District - Neighbourhood - Corridor • Transition Zones T1: Urban Core T2: Urban Center T3: Urban Area T4: Urban Periphery T5: Rural Area T6: Natural Conservation SA: Special Areas	2.3. URBAN SPATIAL STANDARDS: AN EVALUATION OF TURKISH PLANNING SYSTEM 2.4. EVALUATION OF URBAN STANDARDS IN THE FRAMEWORK OF SPATIAL PLAN MAKING REGULATION	GIS and CITY	2.5. IDENTITY 2.6. QUALITY OF LIFE 2.7. SUSTAINABILITY 2.8. PARTICIPATION
Construction-based NEIGHBOURHOOD SCALE	3.1. MAIN CONCEPTS • Street and block relationship • Building and its relationship with other buildings • Coexistence of scales and types • Relationship between building facade and public space • Form-based codes • Clear diagram and explanatory visual material • Construction-based development • Key principles driving identity and character	3.2. CONSTRUCTION-BASED PLANS • **Aims**: Image, Pedestrian and traffic flows, Parking lot, Comfort, Street landscape, Building height, Building blocks, Open space and urban facilities, Identity • **Neighborhood scale:** Boundary, Land use, Scale, Network, Public area • **Building scale:** Street, Building block, Building	3.3. URBAN FACILITIES AND STANDARDS • Construction Standards • Public Space Standards • Parking Standards • Street Design Standards • Landscape Standards 3.4. SUPPORTING STANDARDS • Sustainability • Architectural Standards • Street Furniture Standards • Urban Material Catalog	GIS and NEIGHBOURHOOD	3.5. NEIGHBOURHOOD AND SMART CODE 3.6. VISUAL TECHNIQUES

In the model context, the evaluation of smart growth at the regional planning level has a clear connection with the definition brought forth by the United States Environmental Protection Agency (EPA). The EPA defines smart growth through spatial development principles that make communities more attractive, economically stronger, and socially diverse while preserving the natural environment. The EPA emphasizes the importance of aligning these principles with conservation strategies for protecting nature (EPA, 2023). The ten fundamental principles of smart growth include protecting critical environmental areas alongside *agriculture*, achieving development through *compact settlement* within existing urban areas, and offering a comprehensive perspective for land use decisions at the regional planning scale and subsequent scales (Smart Growth Network, 2015).

The second part of the model, following regional plans, creates *transition zones* that define the required uses and develop character areas by identifying the sequence from natural areas to urban-scale construction (MSGSÜ, 2017) (Figure 1). These zones are designed to address specific needs and characteristics within different areas.

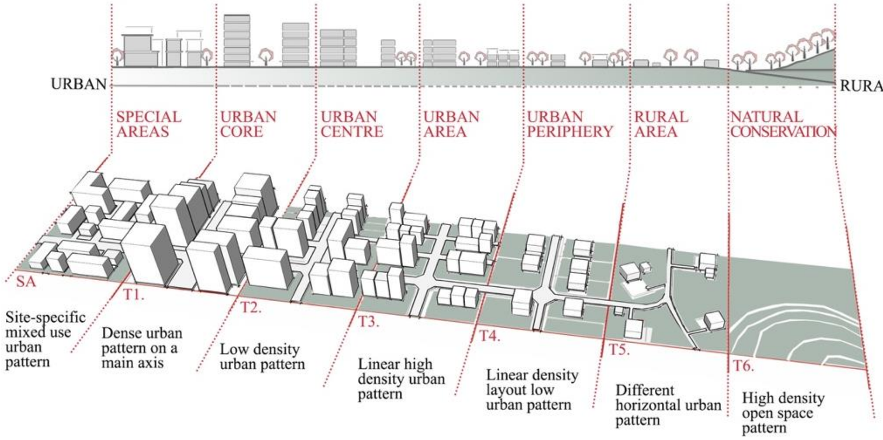

Figure 1. Transition zones defined through hypothetical spatial representations (MSGSÜ, 2017, p. 17)

When the sub-character areas defining the transition zones due to the complexity of relationships and functions between the natural and built environment are generally classified, *urban core*, *urban centre*, *urban area*, *urban periphery*, *rural area*, *natural area,* and *special area* characters stand out.

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Transition zones encompass a wide range of inclusive standards and subcategories related to sustainability, along with their surroundings and landscapes. They also present significant evaluations regarding urban facilities. When we return to the inter-scale transition, the relationship between settlement areas and open space regions classified on a sectoral-regional scale and the transition zones defined on a local-urban scale provides decisive criteria for spatial standards. Particularly, by introducing a character differentiation that can discern neighbourhood units and residential streets within the neighbourhood fabric in terms of accessibility criteria, it is possible to create diverse standards that vary based on the scale of facilities.

According to Addas (2023), urban standards should incorporate development principles and parameters that align with sustainable development. These principles should serve as references when formulating financial plans, spatial policies, development strategies, land use, and investment plans. This approach provides a clear assessment concerning the localization of standards as well.

The final section of the model defines the subject and function of the urban scale concerning character areas (transition zones) through smart codes and form-based codes based on standards. It highlights the determinants and contents related to the settlement structure that enable the preservation of local character and development (MSGSÜ, 2017).

Smart codes based on the concept of transition zones are important in terms of introducing a system that reconsiders traditional planning and development. This system represents an approach that needs to be reorganized for the improvement of environmental standards and consequently raising the quality of life. Additionally, smart codes have been developed as a system to direct the form of development and spatial design. Their characteristics can be listed as follows (MSGSÜ, 2017, p. 17):

- The urban and rural system is approached and integrated with a holistic perspective within the context of societal growth patterns. Planning scales are interconnected in an organized manner, ranging from the regional scale to the neighbourhood scale, and the system is reduced to a singular structure. The understanding of the natural environment includes the evaluation of preservation, open space and water quality, ecological balance, and, if there is any degradation, ecological restoration in an integrated manner.

- The model also considers redevelopment and transformation in the existing fabric as an integral part of the process, alongside development areas, and treats them under different categories. It defines character areas and evaluates urban spatial facilities specific to these subunits along with public infrastructure and standards. It places special importance on identity spaces related to the city's identity, defining unique architectural details, landscape standards, urban furniture, lighting elements, and information panels, which create a sense of place, individual quality, and ambiance, while also adding value to them. Additionally, it identifies and integrates all these components and their effects into the system.
- The smart code system places importance on public participation in the planning process. Announcing plan decisions, collaboration, agreements, and informative meetings for consensus building are integral parts of this planning process. This is particularly important for accurately identifying spatial needs and addressing usage requirements in an innovative framework.

After the definitions made regarding the transition zones at the urban scale, the neighbourhood, which is the complementary and final scale of the model, constitutes the main focal point of this study. The neighbourhood is evaluated within the framework of basic principles and criteria related to 'development', 'public space', 'street design', 'landscape', 'roads', and 'parking' topics based on standards. The meaning of this scale, especially with the pandemic, is now being discussed from a much broader perspective, necessitating the updating of principles in the model.

The pandemic process has brought to the forefront the need for multidimensional living spaces that facilitate social harmony starting from the individual and enable behavioural change, especially at the neighbourhood scale. The neighbourhood, with its core of commercial vitality, mobility, and necessary functions to meet basic needs, has shown through the pandemic that it requires much more than what is defined in the urban planning legislation regarding its scale and the need for facilities.

4.3. Updated Model: Urban Spatial Standards at the Neighbourhood Scale from a Flexibility Perspective

The development of micro-zoning approaches through urban transition zones, and even the structuring of mixed-use land use content at the neighbourhood scale based on settlement character, particularly tailored to each transition's end, brings forth much more suitable solutions. In projects that empower community-based temporary use preferences and can connect location-based user needs, facilitative solutions that enable appropriate investments' structuring make it possible to provide flexible standards at the neighbourhood scale.

As the settlement scale decreases, the importance of residents' perceptions and attitudes becomes evident in providing the necessary flexibility for spatial planning. To concentrate various functions in an urban area in a planned manner and to promote this effectively, designing a planning that takes into account both the characteristics of the settlement and its residents is now more important than ever. So, what is the 'appropriate' level of integration for different urban functions or the 'optimal' level of compactness for an urban area? Performance-based regulations allow the construction of urban utilities that are not permitted based on current land-use decisions, provided that these utilities meet specific requirements to ensure their performance. However, now the question arises, how can the "fulfilment of specific requirements" be objectively judged and evaluated? (Ishikawa, 2020)

Indeed, the structure of cities, shaped by population density, requires targeted decisions in land use, and it is observed that the most crucial need in this regard is at the neighbourhood level. In the spatial usage hierarchy, transitioning from individual dwellings to shared living spaces – with streets, public areas, neighbourhoods, districts, and cities being arranged in sequence – the neighbourhood scale stands out as the smallest common unit where socio-spatial needs and public services can frequently be met. It can also be referred to as the cellular core of the city, as it is the smallest unit where social needs and services are often fulfilled and forms the transition from individual dwellings to communal living spaces.

As a result, the necessity of defining a neighbourhood planning that supports physical activity, provides safe circulation and mobility, offers a healthy physical environment, includes accessible public spaces and services for everyone, and meets the physical and mental needs of users with quality design practices has emerged. This also implies the definition of unique spatial standards related to the neighbourhood planning.

The “compact city” model, advocated by the European Urban Charter and recently becoming a phenomenon, clearly highlights this necessity. In contrast to “urban sprawl”, the compact city model, and particularly the importance of the neighbourhood unit within this model, is being emphasized based on the experiences during the COVID-19 process. In this regard, it points to a targeted scale with significant importance. This scale is the neighbourhood scale, and the neighbourhood scale is important because it constitutes a set of interconnected functions and relationships, in other words, the urban facilities system, due to its nested nature.

However, despite the reconsideration and preparation of the Regulations on Principles Regarding Planning in 1985, as it could not enforce the standards related to facilities, the Spatial Plans Production Regulation also imposes the obligation to comply with minimum standards and area sizes determined according to the population of the settlement, which leads to many restrictions in practice and hinders the intended goals. When determining the facility standards for neighbourhoods with different geographical and morphological characteristics, physical and social structures, function distributions, and income levels, the determining and guiding nature of these differences should not be overlooked.

There is a need for comprehensive and effective standards regarding urban facilities that will optimize the qualities of places from individual dwellings to neighbourhoods and from neighbourhoods to the city, creating not only biological but also socio-psychological life satisfaction conditions. This approach is especially fundamental for developing flexible solutions through the neighbourhood scale and creating multi-functional new spatial standards to meet the requirements of contemporary urban life.

The flexible approach mentioned here involves defining one component in the context of urban facilities based on repetitive spatial configurations in urban space usage, and its relationship with another component. The goal is to develop a suitable definition for a design that fits well into the existing context by creatively manipulating urban components in a site-specific manner. At this point, the design objectives that provide such flexibility can also be linked to the vision of sustainable development in urban programming. Together with the neighbourhood scale, standardized facilities defined at all scales can be evaluated for different lifestyle patterns and locally specific usage needs, thereby enabling the content expansion of these flexible standards to accommodate varying programs.

In a period where the conditions shaping the urban environment are becoming increasingly complex and challenging, when evaluated through the analogy of a fragile metabolism, initiatives such as community gardens and urban orchards, even solely for ensuring access to food, serve as strong examples of the search for flexibility in urban space. Considering the potential of daily activities and unplanned encounters, the integration of such functions within the context of urban spatial standards strengthens the essence of urban life and enriches urban experiences in multiple ways. Developing similar approaches for many other facilities, contrary to the current regulations that rigidly separate functions and overlook shared program components, can be beneficial.

As a basic and inevitable component of cities, public spaces, including open areas oriented towards production, can play a crucial role in making cities more resilient to all kinds of events, and therefore it can be argued that they need to have high flexibility. This situation creates a distinct area of discussion regarding flexibility, especially in terms of how public spaces can be utilized as efficient and cost-effective urban tools in facing unexpected and unpredictable events in cities (Elewa, 2019).

The aim of creating flexible spaces is, in fact, to create new spaces for required functions through simple structural changes. The flexibility of an environment refers to its capacity to adapt to changes made by users, and the flexibility of the environment means that it is ready to accommodate the impacts of users. Therefore, the more responsive an environment is to changes, the higher its flexibility will be (Mahdavinezhad et al., 2011 & Turan, 2016 cited in Sanei et al., 2018). Especially at the neighbourhood scale, where flexibility can be more easily applied, it becomes possible to create usage areas that meet the needs without restrictive contracts or zoning rules that deviate from the current conditions, thus going beyond the capacity to offer only recreational options. With these "new generation" standards, opportunities and space can be provided not only to establish local businesses but also to increase the capacity to offer new services in line with changing needs.

Table 3. The transition zone codifications have been developed based on the tables within the “Development of Urban Spatial Standards” project, which are related to functions and uses (MSGSÜ, 2017, pp. 252-253)

	Social Facility	T1.	T2.	T3.	T4.	T5.	T6.	SA.
	Congress centre	■						■
	Conference hall	■	■	■				■
F	Exhibition hall	■	■	■				■
	Library	■	■	■	□	□		■
	Theatre	■	■	■	■	□		■
	Cinema	■	■	■	■	□		■
	Opera	■	■	■				■
	Museum	■	□	□	□	□		■
F	Open air theatre	■	■	□	□	□		■
F	Religious unit	■	■	■	■	■		■
F	Youth Centre	■	■	■	■	■		
	Public Service	**T1.**	**T2.**	**T3.**	**T4.**	**T5.**	**T6.**	**SA.**
	Fire department	■	■	■	■			■
	Security unit	■	■	■	■	■		■
	Cemetery			■	■	■		■
	Hospital	■	■	■				■
	Polyclinic	■	■	■	■			■
	Health centre	■	■	■	■	■		■
	Prison							■
	Neighbourhood centre	x	x	x	x			
	Village community centre					x		
	Administration	**T1.**	**T2.**	**T3.**	**T4.**	**T5.**	**T6.**	**SA.**
	Governorate-Provincial/District	■	■					
	City Council	■	■	■				
F	Headman’s office	■	■	■	■	■		
	Agriculture	**T1.**	**T2.**	**T3.**	**T4.**	**T5.**	**T6.**	**SA.**
	Crops storage				■	■	■	□
	Barn / Poultry house				■	■	■	□
	Stall				□	■	■	□
	Greenhouse/Polytunnel	□	□	□	□	□	□	□
	Agricultural building				□	■	□	□
	Community garden	□	□	□	□			□
	Public/Open space	**T1.**	**T2.**	**T3.**	**T4.**	**T5.**	**T6.**	**SA.**
F	Park	x	x	x	x	x		x
F	Playground	x	x	x	x	x		x
F	Recreational area	x	x	x	x	x		x
F	Fair and festival area	x	x	x	x	x		x
	Urban forest	x	x	x	x			
F	Sports facilities	x	x	x	x	x		x
F	Stadium							x
F	Square	x	x	x	x	x		
	Public art	x	x	x	x	x		x
	Public Residences	**T1.**	**T2.**	**T3.**	**T4.**	**T5.**	**T6.**	**SA.**
	Nursing home	■	■	■				
	Dormitory	■	■	■				
	Children’s home	■	■	■				
	Commercial	**T1.**	**T2.**	**T3.**	**T4.**	**T5.**	**T6.**	**SA.**
F	Open market	■	■	■	■	■		■
	Retail	■	■	■	■	■		□
	Restaurant	■	■	■	■	□	□	□
	Kiosk	■	■	■	■	■		□
	Mobile sales	□	□	□	□	□		□
	Shopping centre	■	■	■				
F	Big shopping mall							□
	Education	**T1.**	**T2.**	**T3.**	**T4.**	**T5.**	**T6.**	**SA.**
F	University	■	■		□			■
F	Vocational high school	■	■		□			■
F	High school	■	■	■	■			
F	Trade vocational school	■	■	■	■			
F	Secondary school	■	■	■	■	■		
F	Primary school	■	■	■	■	■		
F	Kindergarten	■	■	■	■	■		
F	Public education centre	■	■	■	■			
F	Mother-child education	x	x	x	x			

Key
■ Permission given as specified in the plan (with a license)
□ Use with special permission (change of plan)
x Areas that must be included in the transition zones.

With these “new generation” standards, opportunities and space can be provided not only to establish local businesses but also to increase the capacity to offer new services in line with changing needs. As seen in Table 3 with the letter "F," some example spaces that can be evaluated with the concept of “flexible space” have been defined; services such as neighbourhood houses, youth centers, multi-purpose community centres, mother-child units can be given as examples.

Another important point is related to the parts of the urban space that bear the quality of cultural heritage from the past. The presence of standards that facilitate the continuity of functions and relationships defined by these values as part of the dynamic urban context is crucial, along with adaptability to changing usage needs.

If the urban space struggles to adapt to changing needs and preferences, there is also a risk of expanding further away from the centre, towards areas with natural characteristics. This would require more investments in new infrastructure and would differ from the concepts of “smart growth” or “compact city” models. By implementing flexible standards, options can be created that facilitate the organization of sustainable and lovable cities, accommodating change without increasing the financial burden for settlements and residents. On the other hand, it is also essential to ensure that development areas are flexible enough to offer high-quality living environments for the future.

In this context, it is recommended that flexibility should be integrated into spatial standards based on four fundamental principles:

- Long-term and adaptable performance in the implementation of new uses for urban space,
- Site-specific qualities,
- Sustainable environmental management,
- Participatory planning and design.

Indeed, the concept of flexibility is approached with a strong framework in urban planning strategies in European cities. Drawing from these examples, relating the concept to standards as one of the planning and design tools within our country's legislation will provide a more effective approach.

5. Conclusion and Suggestions

Contemporary cities represent complex socio-economic systems that are exposed to various local and global influences and tend to behave unpredictably. In such a variable context, uncertainty is strongly connected to daily life in cities. Therefore, cities should be prepared to respond in an adaptable manner to unexpected and unforeseen events (Elewa, 2019).

In this context, along with rural, metropolis areas take the forefront in terms of sustainability and can be considered as more significant settlement areas in terms of ecological, socio-economic, and urban standards. Creating standards to improve urban lifestyle is a good transition towards sustainability; however, the planning of such standards benefits the most from the groundwork prepared by previous developments through new ideas and techniques.

In this regard, spatial planning standards can easily be defined as decisive, universal, long-term, and vision-focused changes for sustainability. A city designed with innovative standards facilitates meeting the needs, impacts social welfare, and promotes development (Addas, 2023). These types of standards create urban planning and design principles that can enhance the attention of adult city dwellers and reduce stress and disorders among children, while also protecting the environment.

With innovative approaches and solutions, urban spatial standards that will be improved have multidimensional and integrated potentials, considering all the aspects mentioned. Starting from the assumption that these standards primarily guide cities to be developed and designed in a more planned and organized manner, it is clear that they will contribute to achieving a harmonious comprehensiveness in the more effective planning of the physical structure of urban space and the functions to be determined within this structure to meet the needs.

As it includes the necessary measures to enhance the quality of urban life and essential public spaces, these standards also facilitate social interactions among various groups using the city, as well as meeting public (service) needs and allowing them to benefit quantitatively and qualitatively.

Standards can contribute significantly to guiding urban developments with the motto of “smart growth” in terms of environmental justice and sustainability, aiming to minimize environmental impacts. In this way, they can encourage the fulfilment of a wide spectrum of environmental goals, ranging from preventing uncontrolled sprawl to compact urban design, from energy efficiency to integrating green spaces into the city, and from water management to environmentally friendly buildings.

In addition to the environmental dimension, standards can play a role in creating unique spaces that reflect the social and cultural values of cities, thereby preserving the character and identity and supporting local culture. They can make space accessible for everyone by addressing the needs of communities that shape the urban spatial identity, as well as the requirements of accessibility, and thus increase participation in urban life. With the potential to offer various conveniences for urban mobility, prioritizing the needs and expectations of individuals and diverse social segments, it becomes possible to ensure equitable use of cities for everyone.

Standards, which are expected to support the creation of urban public spaces where various functions, uses, and communities can live together and interact, may also include necessary regulations to ensure the security and resilience of cities, considering their social and cultural diversity. In this sense, standards can enhance security and resilience not only by encompassing building-based decisions but also by addressing all the components required by vital scales like neighbourhoods, with a sense of placemaking, and considering issues related to disasters and public health through the principle of placemaking, thereby increasing safety and resilience.

The structuring of a resilient neighbourhood is important in terms of providing urban-scale solutions to crisis issues. For instance, in a process where concepts like community gardens, urban farming, or neighbourhood greenhouses gain importance, and new spatial formations such as neighbourhood houses support accessible mother-child education, it becomes necessary to re-evaluate the legend of the Spatial Plans Production Regulation (Table 3). This is because many types of uses that go beyond tactical urbanism cannot be defined within the existing legend, thus hindering the development of standards in a qualified manner.

The usage content of urban facilities defined in the legend also constitutes another important opportunity area that needs to be evaluated in this context. This way, new contexts can be created to produce responses based on flexible spatial reactions to the inadequate facility needs. Therefore, instead of defining urban facilities based on a single function in land use, it is recommended to create content related to flexibility.

The aim is to revitalize the public life of certain spaces within the dense urban fabric during specific time periods, by creating flexible spaces that adapt and cater to the changing needs of their contents and users. These flexible spaces are clearly marked and delimited, providing the opportunity to bring public vitality to these spaces throughout the entire temporal cycle.

Indeed, flexibility from an urban perspective is recognized in the literature as the innovative and creative spatial adaptability of urban public spaces that allows them to be arranged and modified to accommodate new conditions. It refers to the capacity of urban spaces to respond and adjust to changing needs, promoting their ability to be dynamic and versatile over time.

The natural consequence of the space-flexibility correlation is the demand for flexibility in limited spaces, while the performance of functions and actions demonstrates the usage needs. When we look at the interpretive flexibility of urban space, we encounter not only individual actions but also tactical community actions and conceptual ideas for use. As discussed in the conceptual framework, what is expected from the flexibility of urban space is for a single space to invite sharing with different program contents. In the creation and sustainability of these spaces, where the society is expected to recognize different usage and belonging opportunities for various subgroups, the guidance of standards is of crucial importance.

According to the literature, flexible spaces are considered as an intermediate path for planning between the two branches of traditional planning. Although the concept and use of flexible spaces often respond to vacant areas resulting from negative events such as disasters, population decline, abandonment, and economic deterioration, it remains relevant today for spaces that serve their campus for specific time intervals, such as educational buildings. In the urban environment, spatial uses that can be restructured during the experience and temporary spatial uses in terms of land use also require the redefinition of standards in a similar manner.

Figure 2. In the Beyoğlu District, where there is limited open space, the courtyard of a mosque is used as a playground by children (Archive of Benan Kaya, 2022)

As part of the scope of this study, the supporters of the proposed approach can actually be referenced to the five principles defined by

UN-Habitat (2014) for sustainable neighbourhood planning: Maximum land efficiency, social equity, walkability, local community, diversity in plot sizes, and interconnected streets. These five principles demonstrate a highly compatible structure with the flexible space approach.

As observed in daily life with examples like the mosque courtyard used as a playground by children (Figure 2), such instances are becoming more common. This alone highlights the inadequacy of existing standards' rigid and inflexible structure to meet the needs of various user groups for different functions.

In the current Spatial Plans Production Regulation, each open and closed public use area has specific standards. However, when considering a single function area as a flexible space, as in the example given above, it can be thought to open the possibility of transformation by different age groups. When the established standards for a space start to be changed by user groups taking initiative, it can be said that we return to the smart code approach, and it becomes apparent that codes reflect the ways they are used. After identifying the needs, it is essential to diversify the form codes related to those needs and develop them in a way that defines the usage content of the codes.

The development of flexible standards allows for an expanded approach to urban public space design without the need for negotiating the values and preferences of different social communities. In the relevant literature, we encounter the importance of participatory approaches, where local participants play a significant role in gaining flexibility in interpreting the program of a space. Local participants provide essential references in the process of gaining flexibility for social incentives. The participation process aims to determine the flexibility of how target local communities perceive and use the existing space, and to leverage this information during the design stages. As a result, new meanings and forms of use may be created in the design process.

On the other hand, the concept of “urban spatial standards,” by moving beyond the conventional meaning of the term *standards* which defines a set of principles limited by universal conventions, redefines it to encompass the minimum requirements tailored to the needs of the cultural context. This phenomenon of spatial standards with its expected flexible structure provides cultural codes that impact the performance of planners and designers as input. It should be noted that these standards, which fulfill the minimum spatial recommendations, guide planners and designers in establishing strong connections within the context, enabling them to meet the needs of culturally diverse social structures. However, it should never be forgotten that they do not impose a “restricted canvas,” allowing for an open and limitless approach.

As a result, we believe that flexible urban spatial standards, which provide planners and designers with guiding principles, will enhance the way society sustains its daily life and strengthen the human scale of the city within the neighbourhood unit, capturing the essence of the city. We are confident that these standards will be a significant component that adds value to the development of projects. Urban facilities, which we anticipate will consistently maintain a high spatial quality as part of the urban elements, will undoubtedly be more than just encouraged to foster resilient community life at the neighbourhood scale, but also substantially subsidized through the development of flexible standards.

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Evaluation of Area Management Plans in the Development Process of the Urban Conservation Approach

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1. Introduction

It is inevitable that the cultural products of civilizations interact and transfer with different cultures. One of the areas of interaction between societies that have been in contact with each other for religious, political, and economic reasons throughout history is architectural formation processes (Ateş, 2021). It has been of great importance to examine civilizations and transfer their heritages to the future within the scope of the conservation approach that emerged as a European-centered and spread all over the world over time. The journey to history, which is defined as tangible and intangible heritage over time, has succeeded in examining the changes and developments in the structure of societies and transferring them to future generations. In this way, cultures continued to exist by enriching.

The Venice Charter, the foundation of modern conservation, was developed in Venice in 1964. Once the Charter was formulated it has been used as the ethical guideline for the protection of architectural heritage throughout the world. The very basic tenet of the Venice Charter is to ensure the authenticity of the original of the monuments to be restored. The Charter declares its aim as being "to preserve and reveal the aesthetic and historic value of the monument and is based on respect for original material and authentic documents....” (Art 9). The consciousness about respect for the authenticity of the aesthetic and historic value of the monuments to be maintained appeared in the nineteenth century in Europe (Chung & Kim, 2010).

Since the middle of the 20th century, the concept of conservation has made a sharp transition from the approach of "protection at the scale of a single building" to the understanding of "protection with its environment" with the Venice Charter.

At the global level, considering urban heritage as urban sites instead of single monuments has appeared and put forward by different groups such as experts, academician, practitioners, and international organizations in recent years. There is no significant attention to central and historic areas in the development process before 1970s. After those years, some of the international organization put up efforts for integration of approaches for conservation of urban heritage (Sarvarzadeh & Zainol, 2012). International organizations such as United Nations Educational, Scientific and Cultural Organization (UNESCO), International Council on Monuments and Sites (ICOMOS), International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM), The Council of Europe (CE) etc. pioneered many studies such as conventions, charters, and recommendations; consequently, the concept of conservation has gained a different dimension. These studies on an international scale have started to be accepted around the world over time; In the 1980s, various legal arrangements were made for the protection of natural and cultural areas in Türkiye.

The protection-use balance has been tried to be achieved through legal-administrative regulations (agreements, etc.), which are the reflections of the European-centered protection approach that spread throughout the world over time in Türkiye. With many hot or cold wars in the history of the world, the importance of protection has increased over time. In parallel with the development levels of the countries, conservation efforts have gained momentum in certain periods (in France, Germany, Italy, England, etc.) and over time, they have presented applications that can be shown as an exemplary to the world. In Türkiye, as in the world, many regulations have been made so that they can be implemented in areas that have been deemed worthy of protection. Over time, many agreements (Athens Conference, Venice Charter, Convention for the Protection of the World Cultural and Natural Heritage, European Convention on Architectural Heritage, etc.) have been made in line with the regulations set forth in terms of international protection and protection legislation has been developed within this framework (Ahunbay, 2019).

Since 2005, many studies and practices have been developed in the context of tangible or intangible heritage in natural and cultural/historical areas within the scope of site management and management plan studies in Türkiye. “Relationship between conservation and planning” and “holistic conservation approach” have created “site management studies” by including different fields of expertise (urban planning, architecture, archeology, history, geography, etc.) within the scope of conservation studies.

The subject of this study is the examination of the success of the "management plan" studies on different grounds, which started from the single building scale of the conservation approach in the historical process and emerged at the stage of evolution to protection or integrated protection. It is aimed to reveal the similar and differentiating features of these three management plans, prepared in line with the UNESCO World Heritage legislation, and to explain their strategy development processes and the alignment of strategies with objectives thus, to understand their success levels and success criteria.

In this context, Florence (Italy) Historical City Center Management Plan, Old Bridge Area Management Plan of the Old City of Mostar (Bosnia and Herzegovina) and Istanbul Historic Peninsula Management Plans are discussed. Among three areas having Unesco World Heritage status handled in this study, ***Florence***, the artistic principles of the Renaissance were defined in, has a dominant influence on the development of architecture and the monumental arts. Thus, is home to world-renowned artistic values. The city also was Europe's first economic and political power between the 14th and 17th centuries. The renaissance of the old bridge and its surroundings and the boundless efforts of human solidarity for peace and strong cooperation in the face of overwhelming disasters, strengthened in the context of the symbolic power and meaning of the city of ***Mostar***. The city of ***İstanbul*** emerges as an extraordinary monument, architectural and building complexes that show the very distinct stages of human history. Throughout history, monuments in Istanbul have had a significant impact on architecture, art history and urbanization in both Europe and the East (URL 1; URL 2; URL 3).

The findings of the study are a guide to the stakeholders who are effective in the preparation of the management plan.

1.1. Conservation and Planning Relationship

According to the Turkish Language Institution, the word "protect" means "to keep, preserve someone or something away from external influences, danger, or a difficult situation" (URL 4). In the Turkish Language Institution's Dictionary of Urban Sciences, protection is defined as "securing monuments and natural beauties – like those living in the city today – with works of high contemporary and architectural value in certain parts of cities, against all kinds of destructive, aggressive and tentative actions for the benefit of future generations" (Ekinci, 2009).

Patrick et al. (2019) emphasizes that even though the terms 'preservation' and 'conservation' are often used as synonyms, in Ashworth's (2013) view they are not the same. The conservation discourse differs from the preservation discourse in two main ways: (1) the focus is widened from single monuments to ‘heritage ensembles’ and (2) the goal of heritage management is to ‘preserve purposefully’ rather than just preserve. Preserving purposefully is described as ‘not merely continued existence but continued useful existence, which often implies retaining or restoring the traditional appearance of buildings [. . .] but adapting the interior to modern uses’.

Urban conservation is the protection of historical and architectural areas, structures, and natural beauties in cities against all kinds of destructive, aggressive, and harmful actions, and transforming their existing values into a state that appeals to the needs of the age by ensuring their use in various ways. In this respect, the concept of urban conservation aims to “provide the functioning of a work or an area in an urban area with a dynamic integrity”; refers to operations involving physical, economic, social, technical, and scientific effort in a natural and cultural context (Bahçeci Başarmak, 2022).

Hasol (1995) defined the concept of conservation as “taking the necessary measures to sustain the lives of historical or artistic structures, natural values or parts of the city”. Feilden (1982), on the other hand, stated that with conservation, which is "an action aimed at preventing degradation", "it is aimed to transfer the continuing lifestyle and cultural accumulation from history to the next generations with both intangible and tangible values in the time period in which it is lived or for the future time periods" (Avcıoğlu, 2016).

ICOMOS-International Council on Monuments and Sites- defined the concept of conservation in 1994 as "all efforts to make sense of the historical process of understanding the cultural heritage, to ensure that it is protected according to material details, to preserve it as it should be and to develop the restoration process" (URL 5).

The concepts of "protection" and "protection" in Article 3(4) of the Law No. 2863 on the Protection of Cultural and Natural Assets, which came into force after being published in the Official Gazette in 1983 and which has been subject to many changes until today, are "conservation, maintenance, repair of immovable cultural and natural assets., restoration, function replacement processes; in movable cultural properties, they are conservation, maintenance, repair and restoration works" (URL 6).

Ashworth (1994) proposed a ternary classification consisting of heritage paradigms that have emerged over time – 'preservation', 'conservation' and 'heritage planning'. He argued that a key difference between these co-existing paradigms is their varying understandings of the nature of heritage values. These varying understandings mean that the paradigms result in different approaches to the objects of attention, the criteria used to assess heritage, which actors have authority in decision-making, and towards the objectives held by those actors (Patrick et al., 2019)

Recent documents by ICOMOS and UNESCO show signs of a shift towards the conservation and heritage planning discourses. For example, the Historic Urban Landscape approach redefines urban heritage areas by including 'the broader urban context and its geographical setting' (Patrick et al., 2019).

Most of contemporary conservation approaches have been concentrated on guidelines for building restoration. The conservation principles in societies, which have placed more cultural weight on the natural environment than on any structure itself, need to move further into considerations of protecting the surrounding natural environment too as the context for the building being conserved (Chung & Kim, 2010).

The inclusion of function to form in heritage management through preserving purposefully resulted in 'adaptive reuse' becoming the dominant view of heritage planners in Europe and North America. The inclusion of contemporary urban objectives, such as, urban regeneration, alongside protection in heritage management has brought urban planners into the decision-making processes of heritage sites alongside heritage experts from the preservation discourse (Patrick et al., 2019).

Protection is a constant practice. Works of historical value of each generation are transferred to the next generation by adapting to changing conditions. According to Uysal et al. (2019), refunctioning is one of the effective conservation-utilization strategies in maintaining the sustainability and the preservation of the structures that are part of the cultural heritage, thus the urban identity. However, as Ahunbay (2013) emphasized, in re-functioning studies, the new function of the building should not damage the architectural features and symbolic value of the building, its historical sustainability should be ensured, the old and the new should be blended correctly, the original should be adhered to and the building should be brought to urban life in the most beneficial way (Uysal et al., 2019).

1.2. Management and Planning of Cultural Heritage Sites

According to ICOMOS, "cultural heritage is all tangible and intangible assets that have survived to the present day and are described as a reflection of people's values, beliefs, knowledge, and traditions that are in constant change without being in a bond of ownership. Cultural heritage includes all the features of the environment resulting from the interaction between people and space over time" (URL 7).

Cultural heritage areas, which are the most active parts of the built environment in historical settlements, are tangible heritage areas that reflect the identity and social structure of the settlements where they are located, with the monumental and civil architectural elements they contain. The socio-cultural and socio-economic values of cultural heritage sites require that these areas be preserved and transferred to future generations (Polat et al., 2018).

To be included on the World Heritage List, sites must be of outstanding universal value and meet at least one out of ten selection criteria consisting (i) represent a masterpiece of human creative genius; (ii) exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design; (iii) bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared; (iv) be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history; (v) be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change; (vi) be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance. (The Committee considers that this criterion should preferably be used in conjunction with other criteria); (vii) contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance; (viii) be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features; (ix) be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals; (x) contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of Outstanding Universal Value from the point of view of science or conservation (URL 8).

The understanding of the protection and evaluation of cultural heritage sites within the scope of the principle of sustainability has led to the development of the concepts of site management and management plan all over the world. The fact that the UNESCO World Heritage Committee has required the management plan for the candidate sites for the World Heritage List since 2005 has emerged because of these developments (Aksoy & Enlil, 2012; Eraslan, 2021). Today, thanks to the improvements in economic and social policies, the importance given to protection is increasing day by day and the relevant legislation is updated and brought into line with international norms and standards. Although the protection of natural and cultural areas started with the protection of the building or object worldwide, a holistic understanding of protection with its environment has been adopted over time. The holistic / integrated conservation approach aims to transfer the tangible or intangible heritages that have completed their journey from the past to the present without any problems, to future generations, considering the balance of protection and use. The main purpose of this approach is to ensure the sustainability of the objects that have been decided to be protected. In line with the principle of sustainability, UNESCO and ICOMOS have introduced different concepts in sub-details within the scope of integrated protection. The most important of these concepts are "area management" and "management plan", which does not consider conservation in a single dimension, but examines it through a multi-disciplinary approach.

In Türkiye, the definitions of "area management" and "management plan" were included in the conservation legislation in 2004 with the Law No. 5226 “The Law on the Amendment of the Law on the Protection of Cultural and Natural Assets and Various Laws”. With the "Regulation on the Establishment and Duties of the Area Management and Monuments Board and the Procedures and Principles Regarding the Determination of Management Areas" prepared in 2005, the implementation principles regarding the effectiveness of the "area management" and "management plan" were determined in accordance with international standards and the management plan implementations came into force (Eraslan, 2021; Gülersoy, 2012). All these regulations allowed the management plans to be prepared not only for the areas to be nominated as World Heritage Sites, but also for all protected areas (Eraslan, 2021). The management plan has had a very important place in the protection and supervision of archaeological, urban, and natural areas along with the legal legislation over time.

The Management Plan is an implementation tool created by the UNESCO World Heritage Center for the values that will be included in the World Heritage List. The member states of UNESCO adopted the World Heritage Convention, which was prepared by the World Heritage Center in 1972 and presented to the public, to ensure that the outstanding universal value of the world's cultural and natural heritage is defined, preserved, and maintained in an understandable and acceptable manner as possible. Türkiye became a party to this convention in 1983 (Gülersoy, 2012).

The "Area Management" mechanism, which aims to eliminate serious pressures and threats on monumental and civil architectural elements and to transfer the historical texture to future generations in a healthy way, is the most powerful tool in the world and in Türkiye within the scope of conservation legislation. Area management, which is also described as the concept of cultural heritage management, is of great importance in terms of the protection, improvement, and development of our cultural heritage. A participatory policy should be adopted to consider the historical urban or archaeological texture with its environment, to keep it alive, to protect it, and to transfer these areas to future generations in a healthy way (Aksoy & Enlil, 2012). “Area Management”, also known as the administrative dimension of integrated protection, is a homogeneous combination of protection and management concepts. The method of systematically linking the protection, use, survival, and sustainability objectives in conservation areas (archaeological, natural, historical, and urban sites) is called "Area Management".

Area management can be explained as a coordination platform that can provide communication between the authorities authorized for protection in areas worth protecting, the local people and the groups that benefit from the area in different dimensions. “Area management” is a kind of communication system that creates a coordination and participation mechanism between administrative units in the city and other city-specific stakeholders (Ekinci, 2009).

The management of the areas to be protected should be carried out within the framework of a strategic vision by coordinating all institutions and organizations with responsibility in the area and other stakeholders based on a plan to be prepared. This plan is the "conservation management plan”, the "conservation management plan" or the general and short name in the conservation literature, the "management plan". Management plans are an administrative arrangement that envisages the management of the management area within the scope of certain principles and the contemporary conservation understanding of the management area (Güler & Ekinci, 2010).

In order for the draft management plan to be prepared to be successful, (1) "Definition of the Area: Location and Boundaries of the Area (Maps and Satellite Images), Historical Development Process (Maps and Photographs), Current Conservation Status of the Area, Analysis Related to the Area", (2) "Evaluation and Determination of Conservation and Conservation Policies: Determination of the Characteristics and Potentials of the Site (SWOT Analysis), Determination of Conservation Policies, Determination of Management Objectives", and (3) "Implementation and Monitoring: Projects, Action Program, Budget" and sub-titles (Bal, 2019).

The file to be submitted to the UNESCO World Heritage List Evaluation Committee should have as clear language as possible, research supported by maps and visuals, and a realistic budget and action plan. The management plan to be prepared should be prepared considering the planning hierarchy and in accordance with the provisions of the current zoning plan for protection, the implementation zoning plan, and the environmental plan at the upper scale. Under the leadership of the management plan accepted by UNESCO, a separate strategic plan should be prepared in accordance with the settlement-specific and planning hierarchy.

A successful management plan is prepared in 5 steps (Ekinci, 2009): (1) Preparation Phase: It includes the correct determination of the area boundary within the legal and administrative ground and the analysis based on the boundary determination. (2) Identification of the Area: It includes the determination of the spatial and functional characteristics of the area and the SWOT analysis to be prepared in this context. (3) Policy Development: It includes the decision making, implementation and supervision process for the field. (4) Implementation: Includes annual work programs and audit and monitoring processes. (5) Feedback: It includes the mandatory revisions to be made within the scope of the plan in line with the problems that cannot be foreseen within the scope of the plan.

2. Material and Method

In the study, three management plans that have been accepted to the World Heritage List by UNESCO are examined within the framework of a detailed literature study and "management plan" documents in the context of their similar and differentiating features. Within the scope of the example abroad, Florence (Italy) Historical City Center Management Plan and Old Bridge Area Management Plan of the Old City of Mostar (Bosnia and Herzegovina); From Türkiye, the example of the Istanbul Historic Peninsula Management Plan has been discussed. The most important factor in the selection of these three management plan examples is that they are among the rare and world-renowned settlements where urban and archaeological heritage and qualified landscape elements coexist (Table 1). In the three management plans examined, it is aimed to explain the issues of "(1) how the strategies produced in line with the adopted goals, "(2) how the objectives are developed and "(3) how these strategies are compatible with each other". For this purpose, the management plans handled in line with (1) the general and original characteristics of the area, (2) the goals and policies adopted in the management plan, (3) how the strategies produced in line with the adopted goals and objectives are developed, and (4) how the adopted strategies are compatible with each other. analysed in terms of their characteristics. Finally, in order to make a holistic assessment features of *"Date of Inclusion in the World Heritage List, Date of the First Management Plan, Presence of Urban Heritage Site, Presence of Archaeological Heritage Site, Existence of Buffer Zone, relevant UNESCO World Heritage Criteria, Theme/Target, Management Plan Revision Status, Boundary Revision Status, Tangible Heritage, Intangible Heritage, Coexistence with Inhabited Area, Staging, Participation and Accessibility"* have been evaluated comparatively.

Table 1. Reasons for inclusion of the examined management plans in the UNESCO World Heritage List

Florence (Italy) Historic City Center Management Plan		
Criteria number	1.	Florence's urban complex creates a unique artistic awareness and is home to world-renowned artistic values.
	2.	Florence had a dominant influence on the development of architecture and the monumental arts, and the artistic principles of the Renaissance were defined here.
	3.	Florence's historic city center is the most important and unique commercial city of the Middle Ages and Renaissance.
	4.	It was Europe's first economic and political power between the 14th and 17th centuries.
	6.	The fact that Florence is the birthplace of modern humanism, with the Renaissance having materially universal significance.
Old Bridge Area Management Plan of the Old City of Mostar (Bosnia and Herzegovina)		
Criteria number	6.	The renaissance of the old bridge and its surroundings and the boundless efforts of human solidarity for peace and strong cooperation in the face of overwhelming disasters, strengthened in the context of the symbolic power and meaning of the city of Mostar.
Istanbul Historic Peninsula Management Plan		
Criteria number	1.	Including unique monumental architectural structures that contain traces of Byzantine and Ottoman periods throughout the historical areas of Istanbul.
	2.	Throughout history, monuments in Istanbul have had a significant impact on architecture, art history and urbanization in both Europe and the East. Castle walls, Hagia Sophia, palaces and churches have influenced the emergence of artistic concepts belonging to many different branches in the east and west axis.
	3.	Istanbul has high quality works of art that contain a wide variety of interrelated building types. In this process, it offers extraordinary evidence of the Ottoman urban structure by witnessing the Ottoman and Byzantine civilizations uniquely.
	4.	The city emerges as an extraordinary monument, architectural and building complexes that show the very distinct stages of human history.

***** It was prepared using URL 1, URL 2 and URL 3.

3. Findings and Discussion

The three management plans discussed in this section are explained separately and holistically in line with the research objectives.

3.1. Florence (Italy) Historic City Center Management Plan

The city of Florence, a symbol of the Renaissance and founded on an Etruscan settlement, enjoyed cultural supremacy in the administration of the Medici lineage in the 15th and 16th centuries. The city of Florence has many cathedrals, churches, etc., built throughout the city by the world-famous great masters Michelangelo, Botticelli, Giotto and Brunelleschi. It is one of the rare settlements that can transfer its rich and qualified cultural heritage of approximately 600 years (Figure 1) (URL 1).

Figure 1. View from Florence (URL 9, URL 10)

The historical city center of Florence, where the 1st, 2nd, 3rd, 4th, and 6th criteria (Table 1) for inclusion in UNESCO's World Heritage List come to the fore, were accepted into the UNESCO World Heritage List in

1982 (URL 1). With the addition of the concept of "management plan" to the world literature by UNESCO, the preparation of a management plan became mandatory; The first management plan was prepared in 2006 for the historical city center of Florence. While concentrating on the whole of the historical city center in the Management Plan, decisions were also made within the scope of the impact area (buffer zone) of the historical city center (Figure 2). This management plan was revised in 2008.

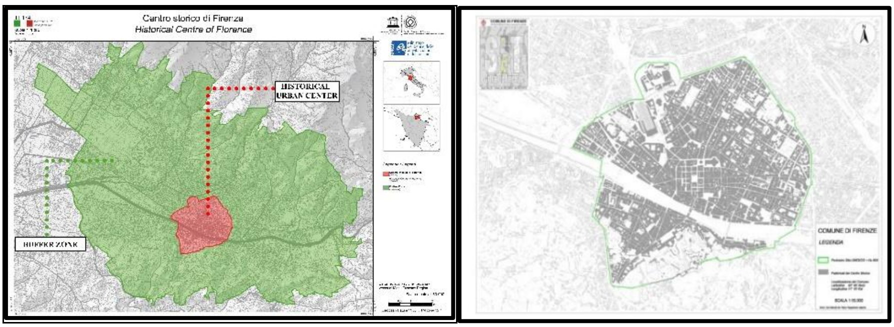

Figure 2. Florence historical city center (URL 1)

During the preparation of the Florence Historic City Center Management Plan, technical personnel formed within the Florence Municipality worked to produce more effective and correct decisions. In this plan, it is aimed to implement the strategies more easily by producing long-term policies. The management plan consists of four main parts: In the *first part*, the general framework and approach of the plan, in the *second part* a case study, in the *third part* the determination of the purpose, target and strategies, and in *the last part* the coordination and supervision dimension of the plan are discussed. This prepared plan was revised again in 2014 and the borders of the buffer zone and the historical city center were redefined (URL 1).

In the Florence Historical Center Management Plan (URL 1);

(1) *In the first part*, the place of the historical city center of Florence in the world heritage list, its identity, protection and influence limit, plan stakeholders, etc. explanations are included,

(2) *In the second part*, the tangible and intangible cultural heritage features of Florence Historical City Center and its surroundings are revealed; spatial and socio-economic analyzes were made; An effective situation analysis was made with the SWOT synthesis prepared in line with these analyses, and

(3*) In the third and fourth parts,* action plans for the city in general were created in the focus of the historical city center and the coordination and control units were explained in this direction.

To achieve success in the planning process of the Florence Historic City Center Management Plan, experts from different disciplines such as city planners, architects, economists, archaeologists, art historians, lawyers, etc. actively participated in the process via field studies, planning process, financing determination etc. (URL 1). Therefore, the Florence Historic City Center Management Plan is a study that adopts a participatory approach that allows the evaluation of different perspectives.

The action plan was shaped in line with the analyzes made during the management plan process, SWOT synthesis and basic strategies. In this context, basically four main action plans have been created (URL 1):

(1) *Action plan based on the protection and development of tangible and intangible cultural heritage* (civil architectural examples, monumental items and customs and traditions reflecting the traditions and customs of the region throughout history were determined and decisions were made on issues such as restoration, education, planning, etc.). (2) *Research and information-based action plan* (decisions to reach accurate information and to establish an archive and library system in the context of documentation). (3) *Action plan based on transportation and environment* (minimum vehicle connection in the historical pattern and pedestrian priority action decisions by adopting sustainable transportation policies). (4) *Tourism-based action plan* (it has a lot of diversity in terms of cultural tourism and there are action decisions on issues such as tourist profile, carrying capacity, etc.).

3.2. Old Bridge Area Management Plan of the Old City of Mostar (Bosnia and Herzegovina)

The historical settlement of Mostar (Bosnia and Herzegovina), covering a valley of the Neretra River, appeared as an Ottoman border city in the 15th and 16th centuries and continued to develop during the Austro-Hungarian Empire in the 19th and 20th centuries. The city, which has been known throughout history with the old Turkish Houses and the Old Bridge (Stari Most), was named the city of Mostar after the "Stari Most" bridge, which is integrated with the historical city today, gave its name to the city. During the conflict that took place in Europe and the

Balkans in the 1990s, many points of the historical city and the Old Bridge, designed and built by Mimar Sinan, were destroyed. The historical bridge, which was destroyed, was restored in 2004. In the recent past, many structures that were destroyed in the historical city center were rearranged in line with the restoration projects prepared by an international scientific committee established by UNESCO. The historical bridge and its surroundings appear as a multicultural urban settlement with pre-Ottoman, Eastern Ottoman, Mediterranean and Western European architectural features (Figure 3) (URL 2).

Figure 3. View from Mostar (general view on the left URL 11, Mostar bridge on the right Simovic & Bıogradlıja, 2018)

The Historical City of Mostar was accepted to the list in 2005, depending on the application made by Bosnia and Herzegovina to UNESCO in 1998 to be included in the World Heritage List. It was accepted to the Heritage List in line with the reasons included in the 6th criterion determined by UNESCO (Table 1), and the most important factor in the acceptance process was the successful restoration work completed in 2004 for the old bridge and historical settlement of Mostar (URL 2).

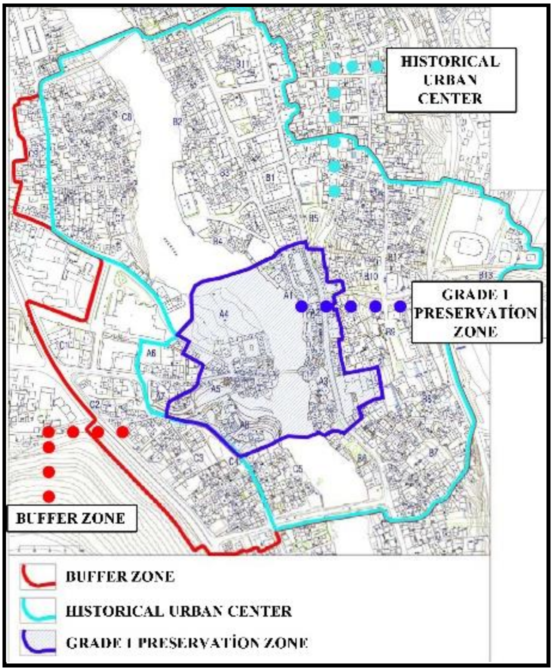

Figure 4. Mostar city centre (Adapted from URL 2)

The Old Bridge Area Management Plan of the Old City of Mostar, which was accepted by UNESCO in 2007, consists of four parts: management, finance, planning and implementation. In the Management Plan (URL 2);

(1) In the "*Management*" section; The "Old City Agency" was established, which will play an active role in the execution of the business and operations of the historical city center. This agency has taken important decisions to protect the historical environment, reduce destruction, continue restoration works and determine the additional income that will come to the city in line with tourism, and has guided

other processes. (2) In the “*Finance*” section, in line with the coordination between the City of Mostar, Investors, Local People, Tourists and the Agency, the rent, tax, grants to be received within the scope of projects, income from visitors, donations and loans are collected and administered within the scope of the agency. (3) In the “*Planning*” section, the current situation analysis has been made and the plan decisions have been started to be produced. In line with the situation analysis, the planning work is divided into five sub-regions. The Detailed Planning Region and the Priority Buildings Region were determined first, and point decisions were taken that should be intervened in the short term. Afterwards, the distribution of functions within the region is defined. In the third part, the forms of intervention to the structures and the region and the definitions of improvement are given. In the last part of the planning work, decisions regarding transportation and infrastructure were made and a quiet and efficient transportation system with pedestrian priority was prioritized. (4) In the "*Implementation*" section, intervention and cost projections were determined within the scope of process operation by integrating with the plan decisions in line with the periodical work program prepared by the Old City Agency.

3.3. Istanbul Historic Peninsula Management Plan

Strategically located as a Bosphorus Peninsula between Europe-Asia and the Black Sea-Mediterranean, Istanbul has been the capital of the

Eastern Roman and Ottoman Empires for centuries and has been intertwined with very important events in terms of political, religious and art history (URL 3).

The Historical Peninsula of Istanbul (Buyukseçgin, 2021), which dates to BC.8000-8500 years, is surrounded by ancient walls built by Thedosius, which has a very important strategic location with the Golden Horn, the harbor, the Bosphorus and the Sea of Marmara. The Historic Peninsula is a geography where inter-civilizational interaction and 'cultural continuity' are experienced to an impressive extent. The unique integration of architectural works reflecting the meeting between Europe and Asia for centuries and the unique view of the city of Istanbul created by the creative genius of Byzantine and Ottoman architects constitute its outstanding universal value for UNESCO (URL 3).

Traditional Turkish houses are indispensable structures of traditional culture with their interior spaces and fine building elements as well as with their original architecture. Many factors such as geography, external effects, land structure, street-landscape relationship have affected the design of traditional Turkish houses (Saka & Kahraman, 2020). In Istanbul Historic Peninsula, which is a multi-layered area, ethnic elements have been physically and hierarchically separated from Muslim neighborhoods from the conquest to the 1839 Edict of the Tanzimat, by being positioned both locally near the city's less neglected city walls and at lower elevations due to topography. These areas have survived with their original architectural texture of the 19th century (Büyükseçgin, 2021) (Figure 5).

Although the houses that were in the majority in the city in the 18th century in Istanbul (modern-day Istanbul's historical peninsula) differ from each other in terms of the number of floors, they appear as a single building with several floors ranging from 1 to 4 and without any partitioning. In addition, two or three-storey houses with two separate sections and a different spatial arrangement from other houses are encountered at a rate of approximately 20%. The houses are surrounded by two different street types, public and private, in terms of privacy. There is a gradual transition from public space to residential space. Despite the density of the city, the increase in the number of floors and the small size of the plots, courtyards, and gardens etc., albeit small open spaces are space components found in most Istanbul houses in the 18th century (Özkaya, 2020).

Figure 5. View of Istanbul Historical Peninsula from Galata Tower (URL 3)

Istanbul Historic Peninsula was included in the UNESCO World Heritage List in 1985 with its unique values, and the first management plan was approved in 2011 and entered into force. The Istanbul Historic Peninsula Management Plan was accepted in line with the reasons (Table 1) in the 1st, 2nd, 3rd and 4th criteria determined by UNESCO during the inclusion of the UNESCO World Heritage List. In 2017, the management plan was revised in line with the reasons presented by UNESCO (URL 3). Within the scope of the management plan (Figure 6), the current situation in many different areas has been analysed and the region has been discussed. Stakeholder participation was prioritized by creating a SWOT synthesis in line with the current situation analysis.

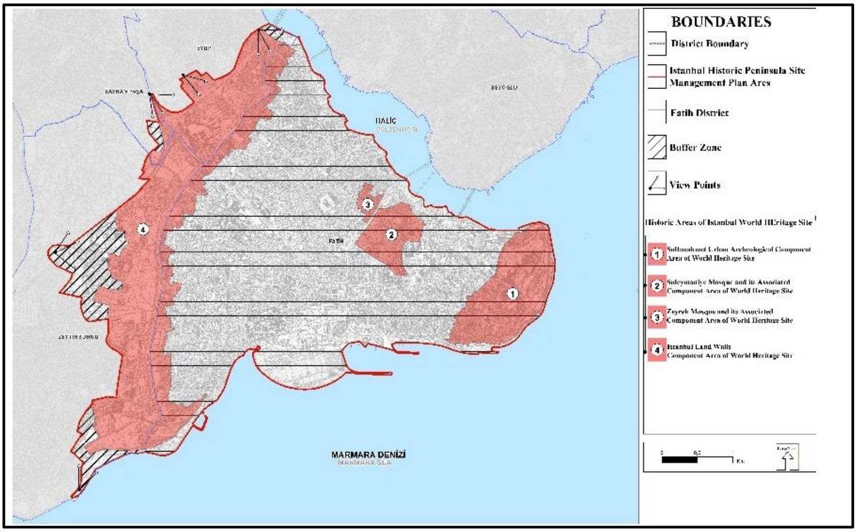

Figure 6. Istanbul Historic Peninsula Site Management Plan Boundaries (Adapted from URL 3)

Seven main themes were identified in the Management Plan (URL 3): (1) Management and Coordination, (2) Conservation and Planning, (3) Conservation and Restoration, (4) Accessibility, (5) Education, Awareness and Participation, (6) Visitor Management and (7) Risk Management. Under the leadership of these seven themes, objectives, strategies and responsible institutions and other organizations for strategies were determined (Akça, 2017); action decisions have been made.

(1) *Management and Coordination*: The experts who will be involved in the process within the scope of the management plan and the sub-specialties that these people will be involved in are included. In order for the management plan to progress in a healthy way, ensuring

supervision was prioritized. (2) *Conservation and Planning*: Due to the existence of archaeological, urban, and historical site boundaries within the study area, it was deemed necessary to deal with the region in a compact way; It is aimed to prepare an accurate and effective conservation plan by including different fields of expertise (urban planner, archaeologist, architect, art historian, etc.). (3) *Conservation and Restoration*: It is aimed to have the survey and restoration projects prepared and put into practice as soon as possible by determining and registering the monumental items and civil architectural examples in the archaeological and urban heritage areas within the scope of the conservation plan. (4) *Accessibility*: It is aimed to ensure that all regions within the management area can be easily accessed through pedestrian-vehicle-public transportation integration. (5) *Education, Awareness Raising and Participation*: It is aimed to raise awareness and ensure effective participation of the people in the process management by explaining the sustainable conservation approach, which prioritizes the conservation-use balance, to the people of the region through different methods. (6) *Visitor Management*: It is aimed to minimize the destruction of protected areas by considering the carrying capacity of tourism by creating different scenarios according to the profile of tourists who want to visit tangible and intangible cultural heritage sites. (7) *Risk Management*: It is aimed to take measures in different dimensions to minimize the damage that will occur in the protection areas in the face of natural disasters.

3.4. Holistic Evaluation of Examined Management Plans

Three sample management plans selected from Türkiye and abroad are seen comparatively in Table 2 in terms of "Date of Entry to the World Heritage List, Date of First Management Plan, Existence of Urban Heritage Site, Existence of Archaeological Heritage Site, Existence of Buffer Zone, UNESCO World Heritage Criteria, Theme/Target, Management Plan Correction Status, Border Correction Status, Tangible Heritage, Intangible Heritage, Association with the Inhabited Area, Staging, Participation and Accessibility" features.

(1) In the context of *the Date of Entry to the World Heritage List,* Florence and the Historic Peninsula of Istanbul were included in the World Heritage List before 2000. (2) In terms of the *First Management Plan Date,* Mostar (1 year; 2006) became the area where the Management Plan was prepared as soon as possible after it was included in the World Heritage List. This period has been 25 years in Florence and 26 years in the Istanbul Historic Peninsula Management Plan. (3) *Urban Heritage Site Existence*, (4) *Archaeological Heritage Site Existence,* and (5) *Buffer Zone Existence* are present in all the samples examined. (6) Among the examples examined in terms of *UNESCO World Heritage Criteria*, Mostar has only 6 UNESCO World Heritage criteria. While Florence and Istanbul include all criteria 1,2, 3 and 4,

there is also criterion 6 in Florence. (7) In terms of *Theme/Target,* the Istanbul Historic Peninsula Management Plan has been the most diverse management plan with seven targets. Visitor management, risk management, education, awareness, and participation are the targets that are not included in other management plans. While transportation/accessibility was the targets emphasized in the Florence and Istanbul management plans, the financial targets were only considered in the Bosnian management plan. Tourism was emphasized within the framework of Florence management plan objectives. (8) *Management Plan Revision Status*: While the Istanbul Historic Peninsula Management Plan was revised within 6 years, the revision in other management plans took place within 1-2 years. (9) *Boundary Correction Status*: Boundary corrections were made in all three management plans. (10) *Tangible Heritage* is present in all three management plans reviewed. (11) *Intangible Heritage* is present in all three management plans reviewed. (12) *Association with the Inhabited Area* is present in all three management plans reviewed. (13) *The staging* was done in all three management plans examined. (14) *Participation* is present in all three management plans reviewed. (15) *Accessibility* is discussed in all three management plans examined.

Table 2. Holistic evaluation of examined management plans

Features	Florence (Italy) Management Plan	Mostar (Bosnia and Herzegovina) Management Plan	Istanbul Historic Peninsula (Türkiye) Management Plan
Date of Entry to the World Heritage List	1982 year	2005 year	1985 year
Date of First Management Plan	+ (2006 year)	+ (2006 year)	+ (2011 year)
Existence of Urban Heritage Site	+	+	+
Existence of Archaeological Heritage Site	+	+	+
Existence of Buffer Zone	+	+	+
UNESCO World Heritage Criteria	1-2-3-4-6	6	1-2-3-4
Theme/Target	-Cultural heritage -Research -Transport -Tourism	-Management -Finance -Protection -Planning	-Management and Coordination, -Conservation&Planning -Conservation&Restoration - Accessibility -Education, Awareness and Participation -Visitor Management -Risk management
Management Plan Correction Status	+ (2008 year)	+ (2007 year)	+ (2017 year)
Border Correction Status	+	+	+
Tangible Heritage	+	+	+
Intangible Heritage	+	+	+
Association with the Inhabited Area	+	+	+
Staging	+	+	+
Participation	+	+	+
Accessibility	+	+	+

***** It was prepared using URL 1, URL 2, and URL 3.

4. Conclusion and Suggestions

The cultural heritage consisting of tangible and intangible values from the past to the present reflects the accumulation of the society in which it is located and develops and lives with the society it belongs to (Akça, 2017). Urban conservation as an action to prevent the deterioration of cultural heritage (Feilden, 1982) so that they can survive (Hasol, 1995), to protect historical and architectural areas, structures, and natural beauties in cities against harmful effects, to ensure their use in various ways and to protect existing ones. values are best preserved and transformed into something that appeals to the needs of the age (Bahçeci Başarmak, 2022). Modernization movements have resulted in cultural heritage areas becoming economic and attraction centers in cities, their carrying capacity being exceeded or their value lost due to misuse. For this reason, cultural heritage areas need to be protected in the most accurate way and functioned for improvement and survival (Akça, 2017).

The understanding of protection and evaluation of cultural and natural heritage sites with a sustainable and integrated approach has led to the development of the concepts of site management and management plan all over the world (Eraslan, 2021); Since 2005, the UNESCO World Heritage Committee has made the management plan mandatory for the candidate sites for the World Heritage List. The "Area Management" mechanism is the most up-to-date tool in the world and in Türkiye, with its legal and administrative dimensions, as the most powerful tool in the conservation agenda, to ensure the sustainability of cultural heritage management in the provision of urban protection and to ensure the transfer of our historical texture and artifacts to future generations (Akça, 2017; Aksoy & Enlil, 2012).

Pursuant to the "Regulation Amending the Regulation on the Procedures and Principles Regarding the Establishment and Duties of the Area Management and the Monuments Board and the Determination of the Management Areas" published in the Official Gazette dated March 26, 2021 and numbered 31435 (URL 12); the management plan aims "to ensure that the management area, which consists of protected areas, ruins, registered immovable cultural assets and interaction-transition areas, etc., is effectively protected, kept alive and evaluated in its natural integrity". These plans are the plans that are reviewed every five years, including the annual and five-year implementation stages and the budget of the conservation and development project, which is created by considering the operation project of the management area, the excavation plan and the landscaping project or the conservation plan.

In this study, which aims to examine the success of the "area management plan" studies, which started from the single building scale of the conservation approach in the historical process and emerged at the stage of evolution to protection or integrated protection with its environment, three different management plans were examined in detail in the example of the cities of Florence, Mostar and Istanbul. When the reviewed management plans are evaluated in general terms,

The Florence Historic City Center Management Plan is a successful strategic plan that prioritizes participation with a comprehensive preparation process, adopts a multidisciplinary approach, and combines approaches to protecting tangible (urban and archaeological sites) and intangible cultural heritage values. Florence, which is an important cultural center in the world, is one of the rare cities that has been able to implement the protection-use delegate at the highest level by producing detailed action plans on the themes of protection, tourism, and cultural heritage.

The Mostar Management Plan could not prevent the destruction of the whole area due to the wrong applications resulting from the restoration works carried out with a hasty approach to conserve the historical city center developing around the historical bridge, monumental structures and examples of civil architecture holistically. The most important factor in the process of inclusion of the area in the world heritage list has been the successful restoration work of Mostar's old bridge and historical settlement, which was completed in 2004. To prevent this destruction, UNESCO prepared reports warning the management plan studies and declared that restoration works should be carried out in line with the right strategies and approaches and changed the management plan boundary. However, due to the mistakes made in the process, the historical city center has lost its former glory and visuality.

In the context of *Istanbul Historic Peninsula Management Plan*, the historical city, where urban, archaeological, and historical heritage coexist and important events that shape world history took place, were included in the World Heritage List by UNESCO in 1985; however, the first management plan of the area was approved in 2011. In this process, different protection policies of monumental structures have been developed and put into practice. After 2011, a detailed management plan was put into practice in which sub-action decisions were created by focusing on seven different themes and by revealing the risks related to protection, planning, transportation, tourism, and the area.

In general, when the three management plans are examined in detail in the context of common points and divergences (Table 2), it is seen that the integration with the existing city, which includes the management plans and the urban and archaeological sites, is ensured correctly and effectively, successful restoration practices are implemented, and budget planning as financing is rationally formed. Florence Historic City Center Management Plan, on the other hand, is more successful and more successful since it is comprehensive compared to other plans, it is a study prepared with the maximum participation under the leadership of the local government, rapid results were obtained from the conservation targets, and it was applied with maximum efficiency in terms of correct and effective planning and restoration practices. It can be said that it is a guide for the plan preparers.

In the light of all these determinations it has been concluded that for successful management plans; (1) it is necessary to take into account various problems, perspectives and ideas in a clear and comprehensive manner in the planning process with a holistic point of view, (2) paying attention to the participation from the preparation stage of the management plan will increase the feasibility and reduce the need for plan revision, (3) the plans do not end with the preparation of the plan, they continue with the implementation and beyond, (4) the strategies to reach the targets should be determined according to the changing conditions, (5) the risks and avoidance measures for the area should be handled in a multi-faceted manner, (6) it should be prepared in accordance with the provisions of the conservation plan, keeping the site-specific features in the foreground.

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Discussing the Human-Centered Urban Planning in the Post-Pandemic Era

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1. Introduction

Since the first attempts of urban planning practices, the goal has always been to find "effective city planning practices" that can address the challenges of each era. From the late 19th and early 20th centuries to present day, modern urban planning is the most important driver of urban development, it has always been a tool to create a certain level of life quality for the inhabitants. It can be determined that urban planning paradigms used to have two basic break downs: 1. after industrial revolution, the period when environmental problems begin to increase and reach a level that threatens human health and 2. after World War II, a period of heavy destruction in cities due to war, when urban identity and social resistance suffered a heavy blow. Apparently, COVID-19 outbreak was the third break down for urban planning theories, as being an unfortunate consequence of the human domination over nature which brought about many discussions of the changing meaning of space, altering social relations and the recognition of the importance of urban planning policies.

As Florida et al. (2023) mentioned, no previous pandemic lessened the importance of major cities in civilization, despite the devastation they wrought and the profound changes they had on culture, politics, and urban planning. Their ascent and preeminence have never been able to be permanently stopped by a plague, a natural disaster, or a conflict. Since it is the first pandemic to occur while there is a readily available substitute for in-person engagement and a substitute for doing one's own shopping, there are number of statements that "this time is different" (Florida et al., 2023). Besides, Riddell (2013) also determined, there is consensus that humanity is experiencing an overshoot period in which our combined actions are wreaking havoc on ecosystems, depleting natural resources, and fundamentally altering planetary cycles. To avoid potentially catastrophic overshoots of crucial planetary boundaries, radical changes in ecosystem management, significant reductions in energy and material throughput, as well as extensive modifications in systems of production and consumption, will be required (Riddell, 2013). Accordingly, while existing urban challenges became more complex throughout this period, urban planning scholars concentrated on the formation of effective urban policies as well as urban planning concepts and processes to address these issues-basically and initially from natural protection perspective.

Since industrial revolution, natural protection problems and natural disasters have been analyzed to handle effectively. Surely, the easiest way could have been putting urban development in balance with natural protection from the very beginning of urban planning practices. However, it has never been that easy to control the massively increasing urban growth. Looking back, we can see that the unifying purpose in the development of various approaches, which sometimes contradict (such as compact city-sprawling city) or complement (such as ecological city-sponge city) each other, is still to construct the “ideal city” and recover from the harsh environmental consequences.

In the meanwhile, with the pandemic, concerns like health, human welfare, and resilience have risen to the top of the priority list in urban planning paradigms as well as natural protection. Hence, it can be argued that the idea to maintain a “human-centered approach in urban planning” should become also widespread. Relatedly, in his work *“Towards a Theory of Participation in Architecture—An Examination of Humanistic Planning Theories”*, Albrecht (1988) explained that planning expanded by creating theoretical ideas like “humanistic planning theories”, which can act as a role model for participatory design comprehending societal guidance and social learning. Furthermore, Amartya Sen's "capacity approach" is based on the idea that improving people's living conditions is essential to lead longer, healthier, and more fulfilling lives. This approach draws inspiration from Adam Smith's analysis of necessities and living conditions, Karl Marx's emphasis on human freedom and liberation, and Aristotle's concept of eudaimonia (human flourishing) in political distribution. Sen argues that it is more important to assess the overall quality of life in a society, including education and healthcare, rather than solely focusing on economic measurements. This perspective which has brought a fresh outlook to the measurement of human welfare (Sen, 1993; Sen, 2000; Clark, 2006; Ranis & Stewart, 2000; Uğur, 2017).

It can be suggested that human and environmental wellbeing must be prioritized together in urban planning approaches. The relationship between people and nature can be highlighted by putting people at the center of urban planning procedures since a healthy natural environment is essential for wellbeing. Therefore, to develop more human-centered cities, it is important to put people at the center of urban planning processes. Although we have not fully recovered from the effects of the pandemic, the aim of this chapter is to generally interpret the prominent attributes of human-centered urban planning in this post-pandemic period. First of all, this chapter intends to explore the tools, assets, and governance of this advanced urban planning strategy. By examining these components, we can obtain a better understanding of the principles required to create a resilient and sustainable post-pandemic urban development paradigm.

2. Material and Method

The chapter is consisted of two basic parts and an overall conclusion. The first part has three sections. The first one concentrates on the urban planning tools that are essential to the execution of such an advanced urban planning approach. Future cities will be shaped by technological developments, which have become potent allies in this endeavor. For instance, incorporating smart city technologies can boost better resource management, or improve transportation infrastructure. Also, innovative approaches and augmented reality for urban design visualization are changing how we plan cities. So, urban planning tools should benefit from addressing novel urban planning solutions.

The following section delves into the assets that help an advanced urban planning strategy. The most important assets that must be contemplated including socio-economic values, infrastructure development, and land use decisions. Green spaces should be given top priority and natural resources should be used as efficiently as possible. Besides, urban growth should be supported by sufficient and efficient infrastructure and transportation networks. Also, a city's socio-economic background must be understood well to reduce inequalities and promote equitable growth. Comprehending both socio-economic and spatial concerns, the urban planning assets should certainly refer to sustainability.

The improvement of the governance and the urban planning processes of this advanced urban planning approach is the focus of the third section. Engaging and working together with a variety of stakeholders, such as government agencies, community organizations, businesses, and individuals, is necessary for successful implementation. Transparent decision-making, active engagement, and accountability are all ensured through efficient governance structures. A sense of community ownership can be promoted by including stakeholders in participatory processes and open consultations, which can aid in incorporating different viewpoints. Eventually, an urban planning process formulated with such a strong background of governance capacity firmly implies to resilience.

The second part of this chapter investigates how we can define the planning vision for the "post-pandemic city" or so called the “future city". The challenges posed by the COVID-19 pandemic have taught us important lessons about constructing resilient and sustainable cities promoting public health. From these perspectives urban planning ideas need to be reassessed. Finally, the chapter concludes with an overall evaluation.

This chapter was carried out using a thorough literature research and conceptual analysis. A theoretical framework is developed by conceptual analysis after the literature review builds the knowledge basis. The literature review provides an information base for investigating the complexities and subtleties of elevated urban development. The conceptual analysis is also a crucial methodology to comprehend a theoretical framework.

3. Human-Centered Urban Planning Perspective in the Post-Pandemic Period

Richardson (2020) described pandemic as "the linking of humanity through contagion," and it is now deeply established in a degree of urban connectivity that has never previously been observed in history. During the period when people were confined to their homes due to quarantines, they gained a better understanding of the importance of social solidarity, living together, spending time in public spaces, participating in social life and belonging to the city. According to Ali et al. (2022), as living in cities, the ailments people experience is virtually certainly unique to urban cultures. The urban is a collection of architectural, social, and natural ecosystems connected by urban ideals and lifestyles rather than a collection of distinct towns and cities. This can be interpreted as the unity of humanity in this time of crises. At the end, although there are social and cultural differences amid societies, the need to ensure social welfare and meet basic needs offers a common denominator. From this point of view, Alnusairat et al. (2023) raised an important to question whether this pandemic could provide a chance to plan communities that consider the psychological-human behaviour effects of crises important. Accordingly, today, urban planning practices require to be based on a more human-centered perspective than ever before (Figure 1).

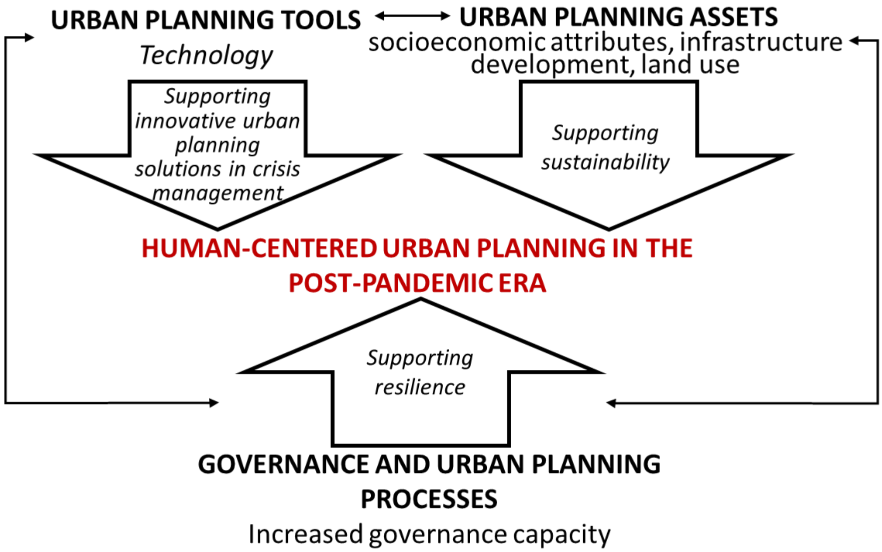

Figure 1. Basics of the human-centered urban development in the post-pandemic era

During the pandemic, to keep a certain level of life quality, "human-centered urban development" has to deliver minimum loss of life, maximum health services, maintained socio-economic opportunities, social equity and healthy living conditions. At this point, what needs to be questioned is how a human-centered development approach can be preserved in times of crisis such as pandemics by building a proper planning system. In this context, this study emphasized that from a human-centered point of view, the necessity for planning tools to benefit from technology to support innovation, the need to develop planning values such as socio-economic qualities, infrastructure development and land use in a way to ensure sustainability, and the planning processes to be designed together with the aim of an increasing governance capacity to enhance resilience in urban planning are all vital (Figure 1). Moreover, it is predicted that the future cities planned with the intersection of these three inter-related focal points will be more resistant to future crises.

Slaus et al. (2013) suggested that the internet has emerged as the first genuinely worldwide social organization, bringing us nearer to the underlying idea guiding our growth: our interactions with one another. This worldwide social network gives people the capacity to access resources and make contributions to the improvement of their social capabilities. The study of social science in the future has to take into account all facets of human existence, such as political, economic, organizational, technical, social, psychological, cultural, and ecological factors. Therefore, using the technology tool in urban planning practices is becoming increasingly fundamental.

Additionally, COVID-19 pandemic had an abrupt influence on our understanding of the "urban-scape" (urban environment) in addition to having an impact on many aspects of life. There is a growing understanding of the significance of the "human-scape" and how human capital, social challenges, and livability considerations will increasingly lead urban development conversations because of shifting user-values and user-needs (Cilliers et al., 2021). For this reason, the future of the urban and human-scape together, which is far more complicated and fragile than previously believed, will depend on our capacity to properly manage the urban planning assets from human-centered point of view.

Besides, creative leadership is currently humanity's most pressing requirement. Effective leadership in action requires courageous thought beforehand. An endless horizon of uncertainty exists beyond everything that we understand and know, posing fresh threats to our sense of security and knowledge. All human activity is an attempt to control risks and conquer uncertainty via more knowledge and more efficient social organization, and the rules regulating society and its growth are always changing (Slaus, et al., 2013). Thus, it is necessary to define "in which area we have sufficient capacity" and "in which area we should develop capacity" at all levels of the governance. Starting from the neighborhood scale to the national scale, an effective urban and rural monitoring system should be established to determine the needs.

Along these lines, by taking these three factors into consideration in planning practices, important steps can be taken to develop a more human-centered approach. In the following sections, they are discussed more in details.

3.1. Urban Planning Tools

Urban planning influences the overall layout of an urban area, or the top level of the urban morphology; the design of the urban networks and the function-based zoning, which affects the built environment's density, and the urban infrastructure, along with various sectoral planning instances. When deciding on a city's form and purpose, not only political and legal frameworks, as well as the forces that drive urban growth, all come into play (Baganz et al., 2020), but also effective urban planning tools have to be included in the process.

As Stead & Albrechts (2023) noted, societies have already faced with substantial changes and challenges before the pandemic, many of which increased the need for planning. Examples include growing regional and global environmental pressures, socio-spatial injustices, lengthened production and distribution chains, crises in representative democracy, the globalization of culture and the economy, migration, population aging, labor shortages, and energy shortage. These innovations and difficulties call for new planning techniques, technological advancements, and innovative solutions. Traditional planning tools and methods are occasionally unsuitable for processes of urban and regional transformation, and they are frequently insufficient to manage such changes and issues in situations of large and rapid change, because they were designed for situations with stability and certainty (Stead & Albrechts, 2023). In order to meet the populations' present and future demands, data and technology are used to improve the use of resources, assets, and services as well as to empower citizen engagement (Veddeler et al., 2023).

However, as Hall and Tewdwr-Jones (2019) reminded only a few of the most recent developments that will affect our cities and regions included the debate over "smart cities" in the twenty-first century and the development of an "Internet of Things" that incorporates digital technology into urban life and planning. They added that the future city planning, management, and governance will be significantly impacted by these technological developments.

From this point of view, when discussing today's planning paradigms, it is necessary to consider how the use of technology as an advancement for planning tools can be beneficial when proposing a human-centered planning approach (Figure 2).

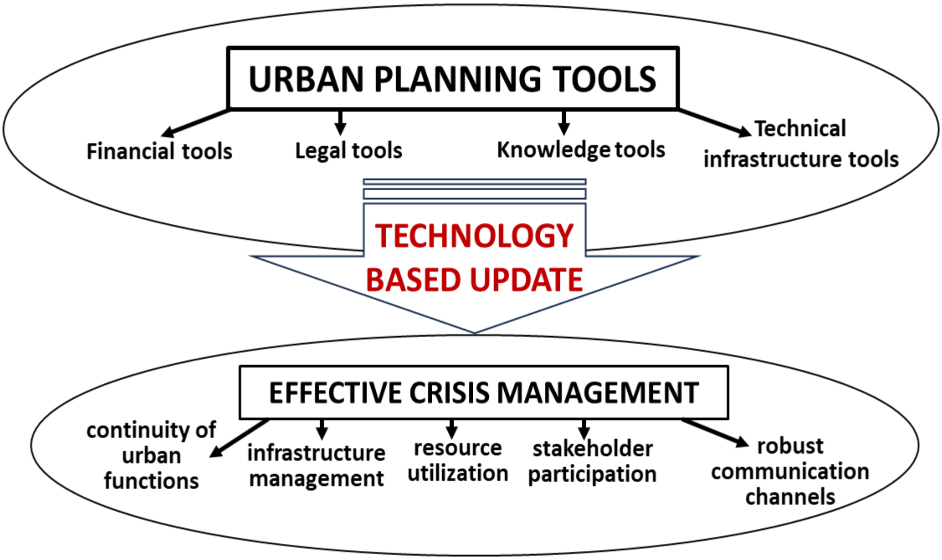

Figure 2. Urban planning tools and their impact in the post-pandemic era

Considering the pandemic and the appearance of unexpected risks, particularly those linked to the environment in current urban planning practices, it can be put forward that the most noteworthy role of technology for planning tools lies in effective crisis management. The utilization of technological support verifies serious benefits in addressing numerous aspects, such as the continuity of urban functions, efficient infrastructure operation, optimal resource utilization, scenario analysis proposals, even enabling a virtual platform for stakeholders to come together in emergencies and robust communication channels pre, during, and post-crisis. Surely, the use of technology in this context should be incorporated by all urban planning tools such as financial mechanisms, legal instruments, knowledge databases or technical infrastructure and should also be included in upper-scale planning decisions and urban development visions to serve better for the society. To secure both immediate and long-term advantages, along with social and economic development, the urban planning tools should support innovative urban planning solutions.

3.2. Urban Planning Assets

Bearing in mind the re-examining of the urban planning assets for a human-centered approach, we should have a clear path about how we can discover new ways to live, work, play, and learn in the post-COVID environment and what adjustments to urban planning and design are necessary. Human needs should be the primary consideration when imagining urban futures, along with various levels and interactions.

Starting with the specific requirements of the pandemic on spatial configuration, Hean (2021) suggested to rethink efficiency versus contingency as a first step. The land and multipurpose spaces that can be quickly transformed into dorms, medical facilities, or even quarantine facilities in the face of a pandemic are needed. In addition, to allow for additional freedom in land use, zoning regulations may need to be modified. In contrary to compact urban design, Hean (2021) recommended that planning should strive to lessen the population density in important places like the CBD and the number of peak-hour journeys on public transportation on a national basis. The key is to implement a more decentralized spatial approach, which entails segmenting the city into numerous autonomous zones. There may be more independent neighborhoods at the district and neighborhood levels. The necessity for people to travel to other locations for amenities is reduced because each area effectively functions as a self-sufficient zone (Hean, 2021). These ideas of lowering density, supporting transit-oriented development, and planning smaller living units with all the basic facilities brought about many urban concepts such as 15-minutes cites, 20-minutes cities or many other neighborhood design concepts including natural protection concerns.

On the other hand, it can be inferred that during the pandemic, de-densification and the spread towards the countryside were the two contradictory movements. Due to their secondary dwellings outside of the city center, high-income individuals were started to empty their houses to be isolated from potential infection sources. Besides, the growing attraction of high-income groups towards low-density areas (countryside or rural areas) has resulted in an uncontrolled urban sprawl to those areas, causing them getting denser, worsening the spatial contrast among those who are obliged to live in high-density areas for proper access to urban facilities and services, and those principally residing in poor quality housing zones. Long-term effects of this uncontrolled expansion will be seen not only in the dynamics of the city's development but also in the development procedures, as it will result in the construction of new infrastructure and transportation systems. Undeniably, addressing these inconsistencies necessitate a laborious process to manage population density effectively, determine urban design priorities that are specific to the requirements of densely populated areas and develop strategies for building more livable and healthier cities by acknowledging a wide variety of options.

In their work titled *"From Urban-Scape to Human-Scape: COVID-19 Trends That will Shape Future City Centres"*, Cilliers et al. (2021) described "urban-scape" and "human-scape", as mentioned in the previous part. Urban-scape refers to the physical environment, or landscape of the built environment, whereas human-scape refers to the social and cultural system and how humans socially engage with their physical environment. Improvements in public health, social cohesiveness, social equality, and economic systems assessing urban capital are just a few examples of how the interaction between the physical and the human environment shows itself through the complementary and antagonistic effects that they have on one another. The problem, however, is although the human-scape, which includes the societies that live in, is growing more dynamic, the urban-scape has a reputation for being a gradually changing environment. By causing the fast-changing needs of the human environment, which are brought about by the increasingly dynamic and changing needs and preferences regarding social, sustainability, and economic issues, the pandemic has contributed to the challenges given by a slow-changing urban environment (Cilliers et al., 2021).

Moreover, as Cilliers et al. (2021) remarked that COVID-19 pandemic showed the vulnerability of cities when the human-scape is disrupted, and it provided a fresh perspective on shifting societal requirements. The COVID-19 pandemic reaffirmed the value of the human landscape, which Lynch (1981) had recognized but which had been eclipsed by the agglomeration economies and associated technology-driven production processes of the modern city center. For this reason, to reconsider the land use practices, it is useful to recall Lynch's five fundamental criteria for measuring a city's performance: 1.how form affects vitality; 2.how form affects human sense; 3. degree to which form meets people's needs; 4.how people access activities and services; and 5. degree to which people have control over services, activities, and spaces.

It is crucial to construct urban assets that serve as the cornerstone of a human-centered planning strategy that is in line with sustainable urban development, drawing on Lynch's core ideas. This calls for encouraging socioeconomic justice, making sure there are adequate and effective infrastructure facilities, and using an urban land use design strategy that actively incorporates people having a voice in the planning activities (Figure 3).

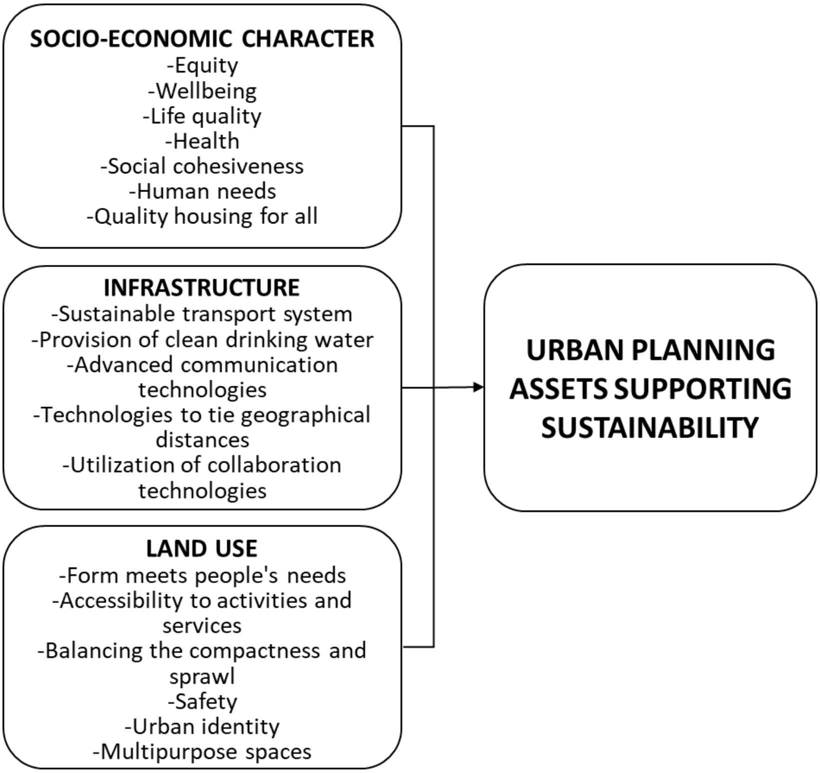

Figure 3. Urban planning assets in the post-pandemic era

It has to be emphasized that urban planning tools with innovative arrangements can help redefine urban planning assets, but it's also important to pay attention to the planning processes and governance that make it possible to create and advance the tools and the assets.

3.3. Governance and Urban Planning Processes

As Stead & Albrechts (2023) pointed out, power imbalances, control networks, social inequalities, and regional disparities must all be addressed to assign current and future planning processes. Traditional discourses, market methods, technology, and old-fashioned behaviors are insufficient to deal with these issues. As opposed to these, a broader search for fresh paradigms and methods are necessary, challenging the political and economic pillars on which planning is built. Cities stand out as key focus points for inclusivity, safety, sustainability, and resilience within the context of the Sustainable Development Goals of the United Nations. These objectives cover people, participation, prosperity, peace, planet, and location, highlighting the significance of each in establishing sound policies (Kourtit et al., 2023). Establishing legitimacy and regulating processes, giving voices to individuals and communities, and effectively communicating changes become essential for navigating the difficulties of dynamic urban transformation. According to Hall & Tewdwr-Jones (2019), future planning should be flexible enough to allow for emerging development opportunities, a variety of intelligence and data flows, systems for citizen involvement, and non-elected government planning bodies.

The COVID-19 pandemic exposed considerable policy conflicts that hampered outbreak response and the equitable distribution of resources, especially among vulnerable groups. Multicultural organizations, institutional frameworks, and intergovernmental resource allocation revealed weaknesses, impeding the development, and functioning of successful urban policies. Regarding municipal response plans, intercity networks, state hierarchies, international coordination, response systems, and crisis management in urban contexts, the significance of urban governance within the larger context of global health governance became clear. Urban global health governance is now a forefront topic for debate because of these changes (Ali et al., 2022).

Like Coaffee & Lee (2016) indicated we must get past solitary governing strategies. Policies should include innovative and creative approaches that encourage multi-scalar and multi-sectoral action, based on the diverse expectations of a wide range of partners. Cities can develop a more unified system of urban planning processes by embracing the concepts of urban resilience, one that unites elements like smart zoning, strong building rules and standards, or integrated urban plans that can handle numerous hazards at once.

At this point, as Moroni (2023) reminded, recognizing the historical development of planning as a civic endeavor and the function of the urban plan as a transformative instrument is essential. Although regulatory interventions and infrastructure interventions were traditionally considered to be the same thing, it is important to relearn the importance of planning and the knowledge besides abilities they require. New approaches, skills, and techniques for leveraging different regulatory tools should also be examined concurrently. It is crucial to have a more nuanced grasp of the range of laws that control land use and development (Moroni, 2023).

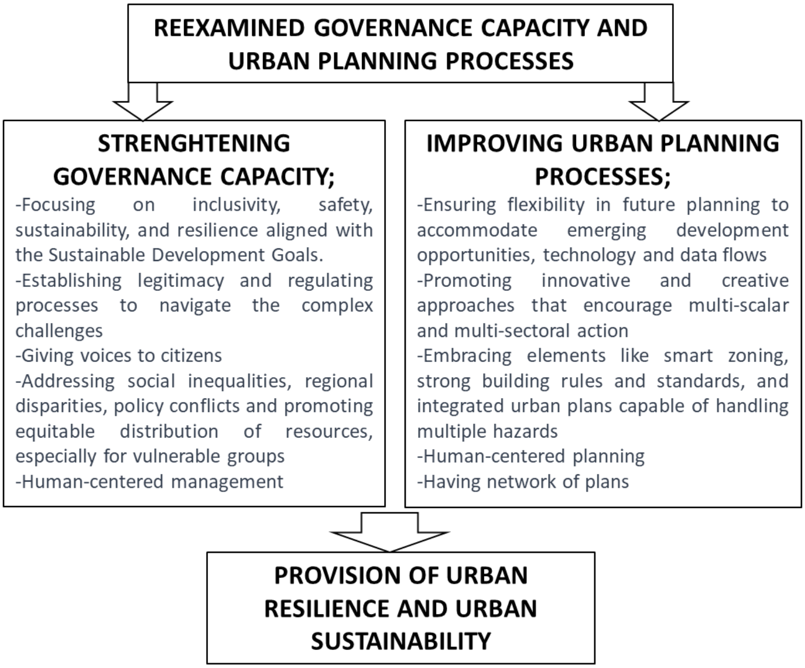

Figure 4. Governance and urban planning processes in the post-pandemic era

From now on, we have the chance to reassess and alter urban planning methods to successfully face the issues that lie ahead by adopting a comprehensive approach. This calls for a radical rethinking of how we approach urban development, a strong focus on resilience in both urban planning and governance, and a prioritization on sustainable growth. It also calls for increasing stakeholder collaboration and knowledge sharing, utilizing the possibilities of technology and innovation, and bearing in mind the social, economic, and environmental aspects of urban life. These are preconditions for strengthening governance capacity. By making these improvements, we can work to build more resilient and sustainable cities that put the welfare and fulfillment of their citizens first while also enhancing their resilience in the face of upcoming uncertainty (Figure 4). We can build cities that are better prepared to handle the difficulties of an uncertain future by learning from the past and utilizing our combined experiences.

4. Planning the Post-Pandemic City-the City of Future

After the overwhelming impact the COVID-19 pandemic had on cities, it is now important to assess what aspects of the pandemic city were not resilient and sustainable and how to formulate the fundamental urban planning principles that are necessary to reduce the risk triggered by the pandemic. Therefore, currently the most important issue urban planning paradigms need to focus is all about the planning of the "post-pandemic city" or so called the “future city”. The goal stays the same while developing the city of the future since urban planning methods aim to create the ideal city in accordance with the circumstances of each era.

The importance of managing unforeseen and unpredictable risks and the need to improve ability to manage these threats have become clear with the onset of the pandemic. When talking about post-pandemic urban environments, it is urgent to give priority to the ongoing development of the cities' dynamic capacities. Consequently, the major objectives for designing the post-pandemic city should be learning from the past, employing governing capacity, and enhancing current capabilities. There must be compensation for any elements found in the pandemic city that were not resilient and sustainable.

Surely, some spatial configurations must be reconsidered. According to Hashimoto (2020), cities in the future ought to adopt an urban design that is dynamic and open in both time and space. Geographically, the cities would inevitably include rural and agricultural areas and would even cross international borders if necessary. Temporarily, they should include linkages with rural areas as well as urban morphology changes, metabolism, growth, and extension of urbanized areas (Bharule et al., n.d.).

On the other hand, Florida et al. (2023) indicated that future work and shopping in the city after the coronavirus would undergo dramatic adjustments. According to their evaluation, the popularity of remote labor will increase, endangering the existence of streets doing high level of business. In hotspot cities, increased price gradients may lead to new usage, thwarting gentrification and promoting social exclusion. Future events in the post-pandemic city may move from being commercial hubs to being held in civic and cultural centers, with more outdoor activities. Low housing costs may attract young people, artists, and other creatives, altering communities. However, because of the economic effects, cities can become even more unequal. There will always be a winner-take-all economic geography in cities. Even if the suburbs and nearby small towns function substantially better than the city centers, the underlying winner-take-all topography of cities will persist. Most medium-sized cities and rural areas, especially those that are far from thriving economic centers, could suffer (Florida, et al., 2023). In this sense, it is essential to create cities which provide easy access to amenities, enhanced mobility and let people show their high productivity. People would be more content with this human-centered approach.

Additionally, Alnusairat et al. (2023) outlined three basic stages in the creation of a methodology for future cities which are 1. triangulating the goals of a future city, 2. developing indicators of the assessment framework, and 3. establishing policies and laws of implementation. At the first stage, basically, it should be aimed to address economic, social, cultural, and political needs. Physical and psychological actions can be categorized under these objectives to achieve sustainability goals. The physical goals should support principally environmental actions as well as relying where necessary on local expertise and technology, and base development on a scientific methodology that considers and is driven by environmental, economic, and social factors. The psychological goals should ensure supporting increased access to land, adequate housing, public services, finances, information, technology, and communications with enhancing increased levels of education and awareness, including consciousness of sustainable development, inclusive development processes, and benefits (Alnusairat et al., 2023). At the second stage, the indicators must be founded on thorough investigation and critical evaluation. Three continually occurring cyclic steps make up the approach: defining the context; establishing the indicators and evaluating the indicators. Finally, the third stage concentrates on how different levels of government promote planning of the sustainable cities and motivate citizens or businesses to move forward with this objective. Building legislation and regulatory frameworks to facilitate the execution of urban initiatives are crucial at this stage (Alnusairat et al., 2023).

All urban planning processes and urban planning policies that we can construct try to establish the post-pandemic city- that is the city of the future- as the most livable city on a humanitarian basis. Therefore, any approach that is designed based on a human-centered point of view, that can increase the quality of life in every perspective by providing maximum benefit for all segments of society, and that will create a sustainable environment and a resilient city as well as a resilient society will constitute one of many dimensions of the future city (Figure 5).

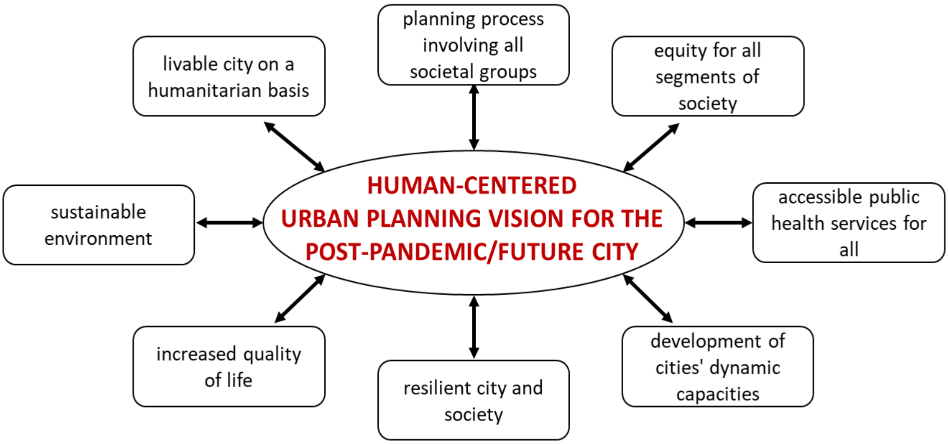

Figure 5. The post-pandemic city

A human-centered approach prioritizing social and inclusive measures to mitigate the effects of the pandemic should be at the forefront of planning. It is crucial to consider the specific needs of different age groups and populations. Meeting people's psychological, educational, social, health and wellness needs should be the ultimate goal. In order to achieve this, each country should develop specific indicators for its cities that are in line with the common goals and in accordance with the cities' own identity, values and needs. In addition, plans should be designed to empower people with coping skills to ensure that their well-being remains intact, even in the face of unforeseen risks and their associated vulnerabilities. By placing planning efforts around people's basic needs and sustainability, we can create more resilient and thriving societies in the future.

5. Conclusion

The post-pandemic era can be defined as the period when urban planning practices should address how to "reshape cities of future" using a “human-centered approach to urban development”. Uncertainty surrounds the cities’ destiny after the outbreak. We have already experienced some COVID-19 short-term effects, but we are yet unsure about the pandemic's long-term effects on urban planning, design, and even daily life. It will be more than just a design challenge to rethink urbanization. Politicians, governors, and urban planners may have an opportunity to act in response to the COVID-19 pandemic by developing the post-pandemic city as a sustainable, sociable, green, smart, and safe that also addresses other pressing issues of the day like environmental issues or climate change (Jasiński, 2022).

Cities all over the world have the potential to rebuild better and put the lessons from the COVID-19 catastrophe into practice in the post-pandemic period. A positive outcome of the crisis is that it has encouraged urban planning stakeholders to build smarter, greener, and healthier cities. The constant spirit of solidarity shown in difficult times inspires the emphasis on being more compassionate and sharing. There has never been a better opportunity to reconsider urban areas and alter the direction of human history than it is now. Cities should take advantage of this opportunity to highlight resident welfare and create environments that are more ecologically and economically sustainable. To guarantee that the city is returned to people and constructed to satisfy their needs, the human-centered city concept acts as a compass. The major objective is to create more livable communities with convenient access to facilities like healthcare, education, entertainment, and all other basic needs of the society. It is obvious that there is a unique opportunity to better plan the physical environment with the human involvement in the post-pandemic world. Planners may take advantage of this by advancing all urban planning process elements by putting people's overall wellbeing first and fostering a thriving urban environment. We can capitalize on the momentum generated during the crisis by developing cities that are smarter, greener, healthier, more compassionate, shared, sustainable, and resilient.

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Author Contribution and Conflict of Interest Declaration Information

The book section has a single author and there is no conflict of interest.

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Assessment of Commercial Zoning Decisions Using Betweenness Centrality Index

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1. Introduction

Urban morphology includes numerous studies that analyze urban form and dynamics qualitatively (Conzen, 1960; Moudon, 1997; Whitehand, 2001), and it is also developing with quantitative methods of analysis that allow objective observation and comparison of morphological structure. These quantitative methods mainly investigate the relationship between urban morphology and environmental behavior, perception, walkability, land use, etc. at street, building, and plot levels. D'Acci (2019) claims that the mathematical treatment of urban forms provides an efficient scientific language to evaluate environmental behavior. Streets are considered in the context of accessibility using spatial syntax analysis or network analysis in GIS (Hillier et al., 1989; Entwisle, 1997; Kwan, 1998; Ratti, 2004; Crucitti et al., 2006; Batty, 2009).

Accessibility helps define and evaluate land use strategies, urban planning, and sustainable transportation (Liu & Zhu, 2004b, Ford et al., 2015). Measuring pedestrian accessibility is an ongoing debate that seeks to understand the nature of walking. Hansen (1959) described accessibility as the "*intensity of opportunity for interaction*" that makes the accessible place more valuable and superior to other places in cities. Given the potential uses of urban public space, identifying these areas is one of the most important considerations in land use decisions in urban planning. Land use decisions are made based on the spatial distribution of existing uses. However, urban systems contain potential interaction zones that could not be discovered through field research or historical process measurements.

Urban planning is spatial decision-making after analysis and synthesis. In the analysis phase, in addition to determining the existing situation, it is also very important to determine the spatial potentials. Planning decisions should be based on objective data and not on intuitive considerations, whereas quantitative methods help to find the potential hidden in the complex structure of cities. This study is significant in that it shows the extent to which commercial planning decisions overlap with the potential zones identified by the method.

Previous studies show that potential flows and movements can be identified through centrality indices in network analysis (Porta et al., 2006a; Porta et al., 2006b.; Sevtsuk, 2010; Sevtsuk & Mekonnen, 2012; Sevtsuk, 2014). Identifying urban areas with high intersection potential will increase the efficiency of urban plans in practice. According to Sevtsuk (2014), the betweenness index of buildings is usually not considered in retail location solutions. However, this index is useful for understanding potential traffic flows, which is an important analysis for commercial areas.

Thus, this study seeks answers to two questions:

- Where are the buildings that have more potential to be passed in the city?

- To what extent do commercial zoning decisions and high betweenness values overlap?

The paper primarily addresses the background and discusses accessibility, the attractiveness of commercial areas, and potential pedestrian flows in cities. It is noted that street networks are primarily examined in studies to determine pedestrian flows. In studies of street networks, the betweenness index is related to commercial areas. The methodology includes data generation and analysis from UNA in GIS. The final section addresses the evaluation of the results for the city as a whole and commercial plan decisions.

2. Background

Accessibility to commercial areas is primarily evaluated in the context of stores, retail space, retail goods and services, corner shops, small or local shops, and shopping centers. Although the name of the unit has changed, the common goal of the studies in this area is to identify the factors that influence the location of the commercial area. Understanding the potential flows in the city is at the heart of commercial area studies. Buzzacchi et al. (2021) said that instead of asking “where people live”," asking “where people move” is the key to planning commercial areas.

Attraction and commercial land use have already been studied as factors that influence each other. Hillier’s (1996) theory of the multiplier effect is based on the reciprocal relationship between commercial areas and pedestrian movement. While commercial areas already have high levels of pedestrian movement, these locations increase pedestrian movement by attracting commercial functions. Setswuk (2010) mentioned retail and food establishments as exchange activities, which were described by Weber & Friedrich (1929) as combining the two supplies of producer demand and consumer demand. The retail and food establishments are usually located in close proximity to customers. Oner (2017) found that the accessibility of retail areas is associated with the attractiveness of cities. Jayasinghe et al. (2017) mentioned that commercial land use is one of the factors that influence the volume of travel demand. George & Kattor (2013) found that the number of commercial establishments is one of the independent variables for estimating travel demand.

The other research on commercial areas focuses on the location choice and attractiveness of the areas in terms of population density. According to Jensen (2006) and Buzzacchi et al. (2021), stores are generally located in easily accessible and densely populated urban areas. High population density means high consumer potential. Jensen (2006) also demonstrated this relationship quantitatively, that locations with higher population density attract more retail stores.

Urban and commercial area morphological factors have been studied by economists, geographers, tourism experts, urban planners, and urban designers from different perspectives. Jensen (2006) claimed that the visibility of stores (corner stores, etc.) is an important factor in retail location choice. Aguirregabiria & Suzuki (2016) state that street networks and the shape of the local market are idiosyncratic geographic characteristics and should be studied empirically. Oppewala & Holyoake (2003) investigated the relationship between the agglomeration of buildings and retail stores and the propensity to purchase by examining factors such as the number and proximity of stores.

One of the most important phenomena in urban design studies is that pedestrians tend to take the shortest route from one point to another in the city. Betweenness centrality refers to the probability that buildings are located on the shortest paths between any origin and destination in a settlement. Betweenness index provides a way to study the probability of intersections and pedestrian flows, which is in line with Hansen's (1959) definition of accessibility. Sevtsuk & Mekonnen (2012) mentioned that the betweenness index can be used to predict the potential movement of the network. In addition, Buzzacchi et al. (2021) mentioned that the betweenness index is useful to analyze attractive parts of cities. Freeman (1977) mentioned point-based betweenness centrality for human communication, describing the betweenness centrality of a point as "central to the extent that it is on the shortest path between pairs of other points".

The concept of "betweenness" in a network is mathematically the same as "choice" used in space syntax studies (Hillier & Iida, 2005). Zhang et al. (2021) found that local choice is correlated with the quality of commercial zone. Looking at the technical developments of the models, Sevtsuk & Mekonnen (2012) determine potentially frequented zones based on points such as every building to every building in urban network analysis (UNA), while early models such as the shortest distance measure, Gaussian measure, gravity measure, and cumulative opportunities measure guided accessibility points for houses to stores (Guy, 1983). The earliest studies of store accessibility used aerial distance (Guy, 1983), and more recent studies use network distance for retail and grocery store accessibility (Jensen, 2006; Sevtsuk, 2010). UNA provides not only a citywide perspective but also the ability to uncover hidden potential zones. According to Sevtsuk (2014), some streets would attract more movement if perfect symmetry is not established in both land use and street geometry (Figure 1).

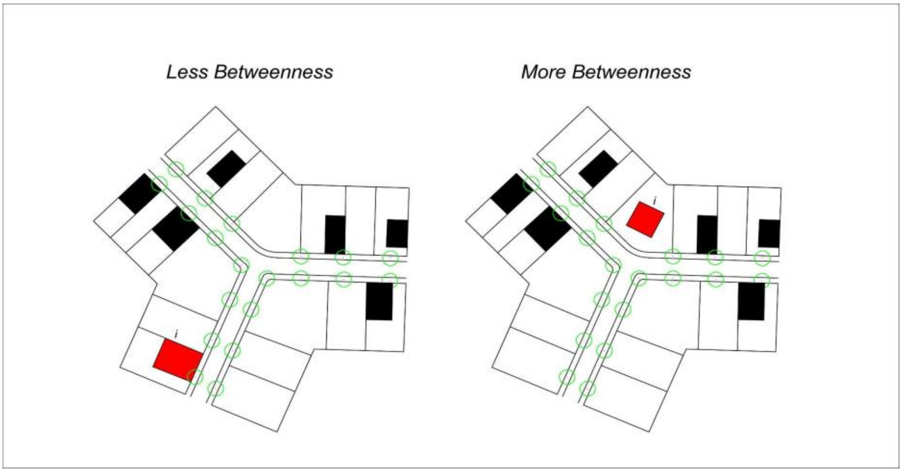

Figure 1. Less betweenness and more betweenness (adapted from Sevtsuk, 2014)

Critics of the betweenness index have primarily raised concerns regarding the assumption that individuals only consider the shortest routes when making choices. Pengyao et al. (2016) emphasize that people tend to prefer familiar roads in addition to the shortest paths. Tomko et al. (2008) further add that non-structural elements such as landmarks or shopping arcades also significantly influence street selection, although evaluating their impact can be more challenging.

3. Material and Method

This study employed GIS (Geographic Information Systems) to analyze data consisting of manually drawn streets and buildings converted to point data. The spatial distribution of the commercial zones outlined in the current zoning plan was examined. By overlaying these datasets, the results of the betweenness index were evaluated at both the city-wide and commercial zone scales.

3.1. Street Segments in GIS

The streets were digitized using GIS, employing vector data generation. To represent pedestrian potential directions, lines were created. These lines were placed through the center of the streets, and in squares, the lines were extended to encompass the shortest potential directions that pedestrians could take from one corner of the square to another. Two-way streets in modern areas were depicted with double lines.

It is important to note that streets drawn by hand in GIS can contain errors. The accuracy of network analysis greatly depends on the smoothness of the data. Topology refers to the arrangement that defines how point, line, and polygon data share overlapping geometry. With GIS, topological relationships, errors, and omissions can be visualized using layers, and data can be corrected using tools for querying, analyzing, and rectifying topologies (ArcGIS for Desktop - Topology in ArcGIS, 2016). Upon examining the topology created from the drawn street layer using the "must not have dangles" rule, it was discovered that there were 48 incorrect drawings.

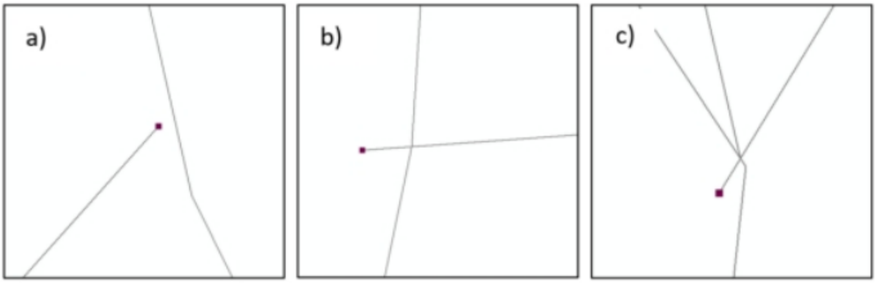

Figure 2. a) unconnected streets, b) extended lines, c) non-intersecting corners (Kahraman, 2023)

As seen in Figure 2, topology errors that separate as a) unconnected streets, b) extended lines and c) non-intersecting corners have been corrected.

Figure 2. Bayındır's street network (Kahraman, 2023)

3.2. Assign Buildings to the Network

Urban network analysis in GIS involves the utilization of two types of data. The first type comprises street data represented by lines, while the second type consists of buildings that can be represented by polygons or points. To enhance the accuracy of calculations, it is crucial to establish the relationship between the street network and the buildings by determining the specific points on the streets where the center points of the building alignments coincide. This necessitates creating a point-based representation of the polygon-building data on the network, as depicted in Figure 3.

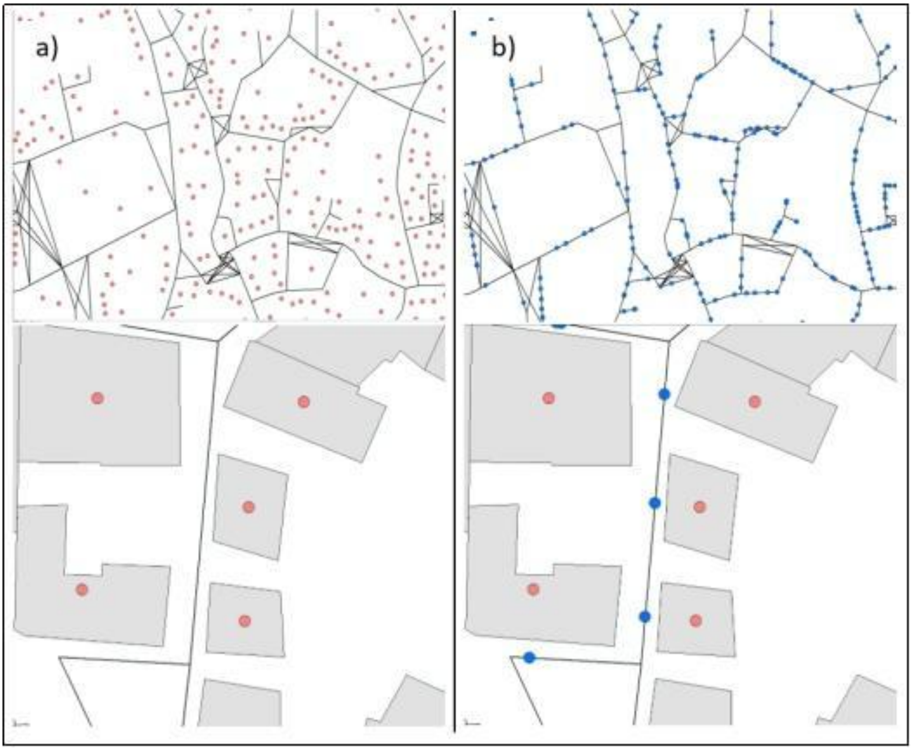

Figure 3. Point data (buildings): building midpoints on the left (red), building points on the network on the right (blue) (Kahraman, 2023)

In the GIS analysis, the buildings were transformed from polygon data into point data using the WGS 84 / UTM zone 35N projection system. The point data was then positioned at the center of the building floor areas and aligned with the nearest network. The network, derived from data containing lines running through the middle of the streets, served as the reference for positioning the building points. By utilizing the "calculate locations" tool within the analysis section of the "network analysis tool," the X and Y coordinates of the building midpoints were obtained at the nearest snapping points on the network. The conversion process from buildings to points was further completed on the network by employing the "make X Y event layer" functionality with the coordinate table. It is crucial to determine an appropriate research radius to avoid generating erroneous results, particularly for buildings that are significantly distant from road connections. Ultimately, the point data representing the midpoints of the buildings were successfully obtained on the network, as illustrated in Figure 4.

Figure 4. Point data (buildings on the Bayındır’s street network (Kahraman, 2023)

3.3. Measuring Betweenness Index in GIS

Centrality measures play a crucial role in assessing the relative centrality of each graphic element in relation to its surrounding elements. Utilizing mathematical calculations, the significance of each node in the graph is determined (Sevtsuk & Mekonnen, 2012). To facilitate this analysis, Sevtsuk & Mekonnen (2012) developed the urban network analysis toolbox (UNA toolbox) within the GIS framework. Within this toolbox, buildings can be incorporated as nodes within the network structure. By quantitatively analyzing the city, UNA establishes a binary relationship between the edges or connections (represented as edges in the graph) and the nodes or intersections (represented as nodes in the graph), as illustrated in Figure 5.

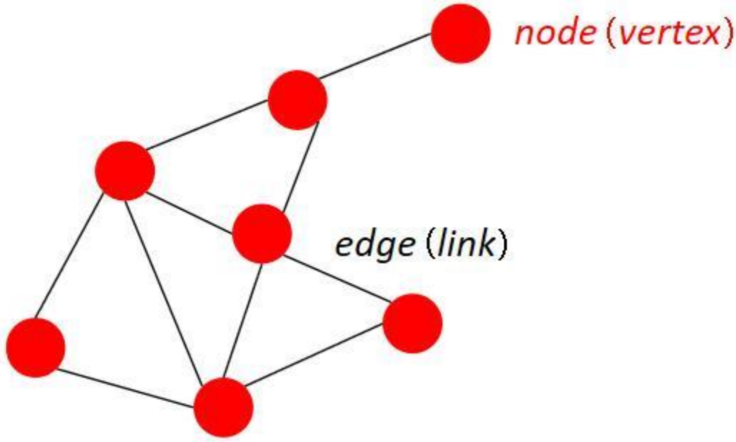

Figure 5. Edge and node representation in a graph (Kahraman, 2022)

UNA could calculate the reach, betweenness, gravity, closeness, and straightness indices. Betweennes index measures the probability that buildings are located on any possible route or between any possible origin and destination point. The formula for betweenness can be written as (Sevtsuk & Mekonnen, 2012):

$$Betweennes\,[i] = \sum_{j,k \in G-\{i\};dj,k \leq r} \frac{n_{jk}[i]}{n_{jk}} W[j]$$

i = the building in question,

G= chart

$d_{[i,j]}$= the shortest distance between buildings i and j,

$W_{[j]}$= weight of building j (weight; the size of the building, number of households, etc.)

β= exponent (0.00217 meters; 0.000663 feet; 2,175 kilometers; 3,501 miles; 0.1813 minutes)

n_{jk}= shortest paths between buildings j and k

$n_{jk}[i]$=the subset of shortest paths between buildings j and k

$\delta[i,j]$= bird flight distance between buildings i and j

Search Radius: Determines the study area. The radius can be determined in two ways; one is the metric radius and the other is the circle radius. UNA is based on network radius. In GIS, all buildings on the map are taken into account in the calculation by selecting the default infinite radius in the urban network analysis toolbox (Figure 6).

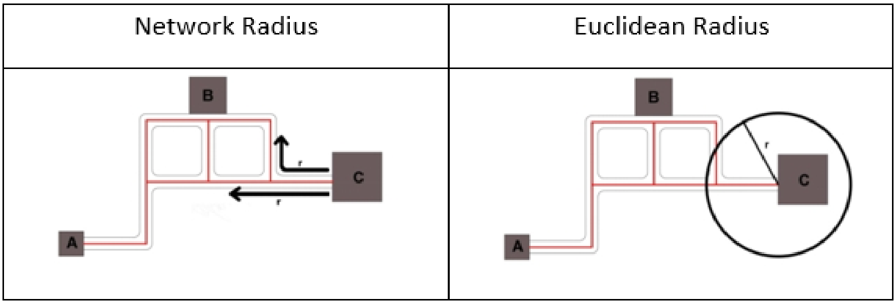

Figure 6. Search Radius (Kahraman, 2023)

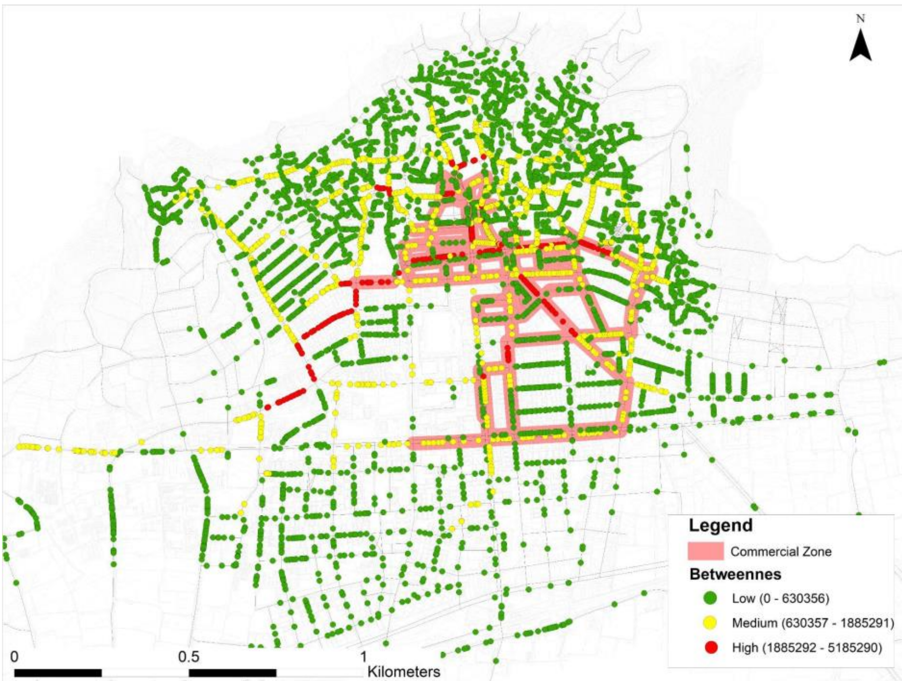

Figure 7. Betweenness index values of buildings as point data

Betweenness values were calculated numerically by the GIS-UNA Toolbox and visualized as point data (Figure 7). The histogram chart in Figure 8-a displays the betweenness values for each level. This histogram illustrates the frequency or count of different betweenness index values on the horizontal axis, while the vertical axis represents the number of occurrences or observations for each specific betweenness index value. Similarly, the histogram displays the distribution of logarithmic betweenness values across the dataset in Figure 8-b.

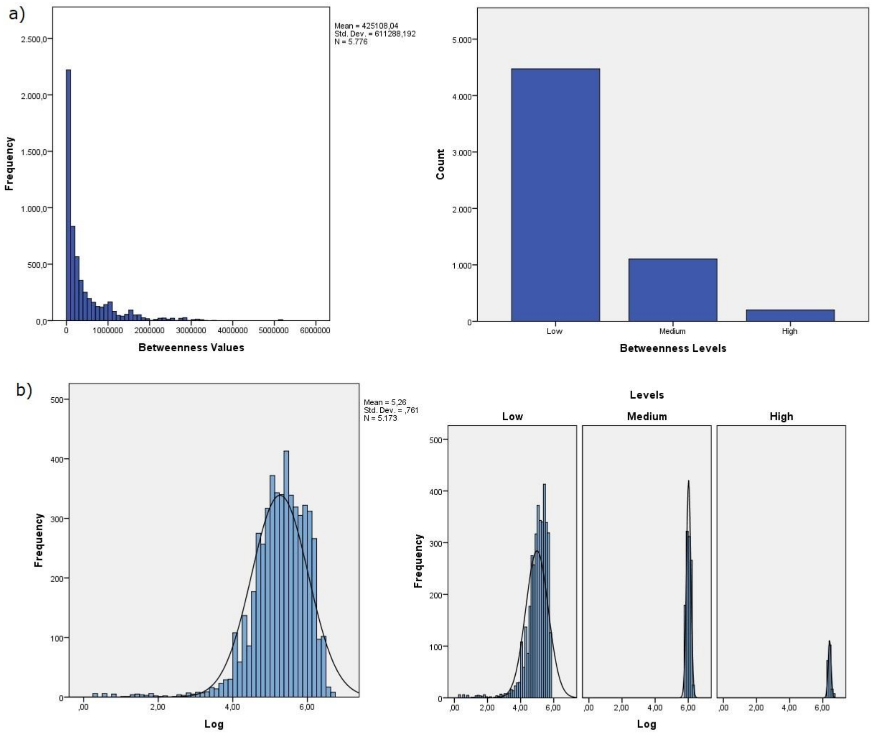

Figure 8. Histogram of betweenness index values

3.4. Commercial Zones in Bayındır

The study area for this research encompasses the commercial areas within the Bayındır district of Izmir province. Based on data from the address-based population registration system for the year 2021, the population of Bayındır district is reported to be 40,049 individuals (Turkish Statistical Institute, [TUIK], 2021). The district primarily relies on the agriculture and livestock sectors as its main economic activities, and it is socio-culturally interconnected with Torbalı and İzmir (Kahraman, 2023).

According to Figure 8, it can be observed that a proposed commercial area spanning 15 hectares was included in the master plan for Bayındır. The most recent comprehensive zoning plan for the Bayındır district was approved in 1998 and remains in effect, albeit with minor modifications implemented in specific sections. This designated commercial area accounts for approximately 7% of the total urban area, which spans 198 hectares and is situated at the geometric center of the city. Additionally, it is worth noting that 39% of the commercial areas are integrated within the same buildings as the lower floors of residential structures (Kent Araştırmaları Bayındır, 2018).

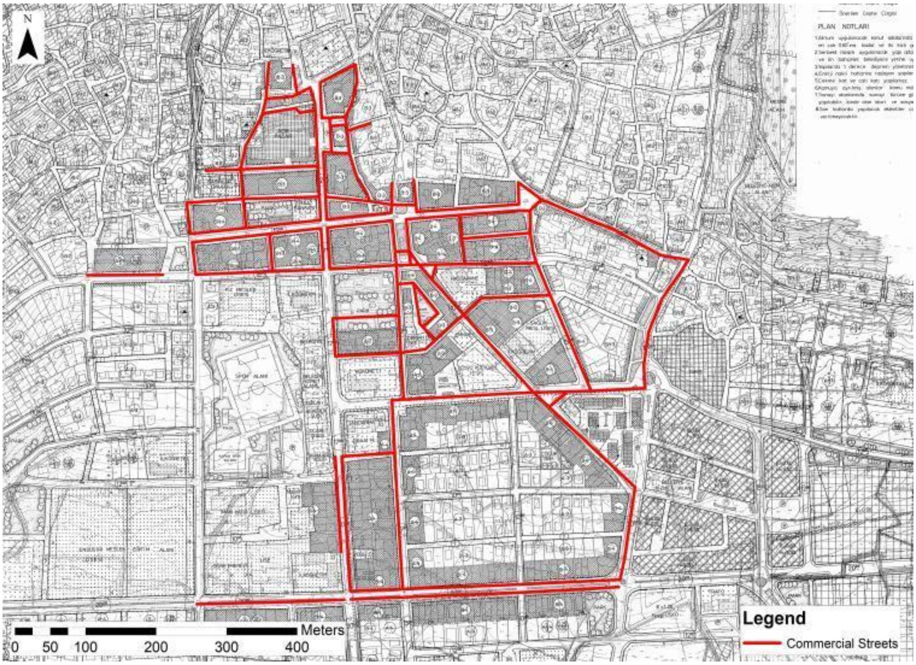

Figure 9. Commercial zoning decisions 1998 plan

As part of the study, the commercial areas identified in the 1998 plan were examined and analyzed using GIS based on street data. This process is illustrated in Figure 9.

4. Findings and Discussion

The study's results were analyzed and presented in two main categories. Firstly, the betweenness values were assessed for the entire city, providing a comprehensive understanding of the city's overall connectivity and the importance of its street network. Secondly, the betweenness values specifically within the streets designated as commercial zones were evaluated, allowing for a focused examination of the commercial areas. The findings from both analyses were presented through tables and maps, providing visual and quantitative representations of the betweenness values in these areas.

4.1. Findings at the City Scale

The UNA analysis produced a map displaying the betweenness values for each point. Initially, the map consisted of points, but later it was transformed to represent buildings as polygons, with colors indicating the betweenness values. The buildings with the highest betweenness values in the city were found to be positioned in the geometric center, particularly in the transitional zone between the traditional and modern urban patterns. On the other hand, buildings with medium and low betweenness values were observed in both the organic and modern areas of the city (Figure 10).

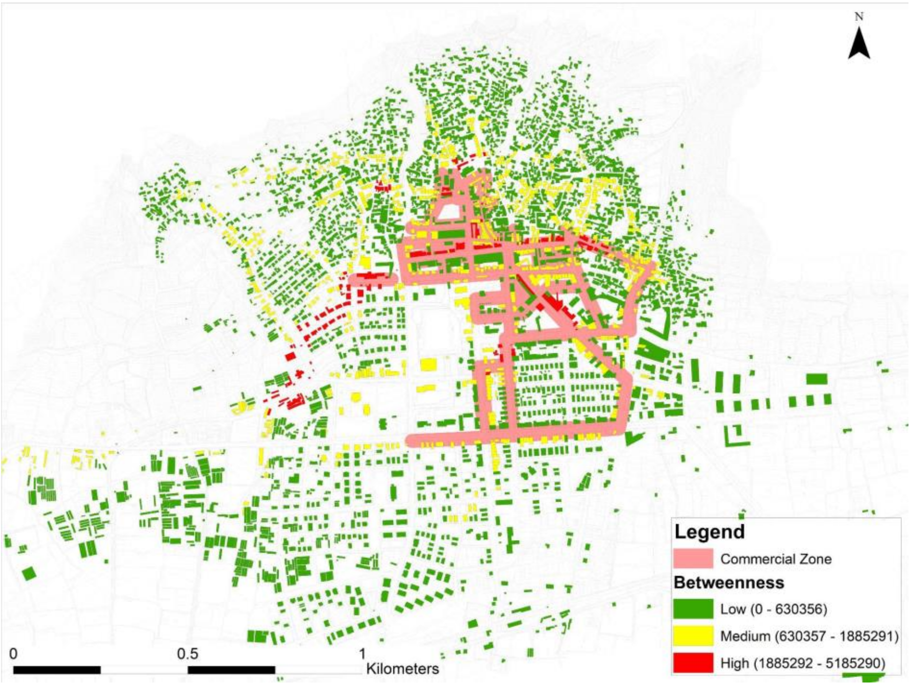

Figure 10. Betweenness degrees of buildings as polygon data

Based on the findings of the study, the buildings with the highest betweenness degree, depicted in red, account for 3.4% of the total number of buildings (198). The buildings with a middle betweenness degree, shown in yellow, make up 19% of all the buildings (1103), while the buildings with a low betweenness degree, represented in green, constitute 77.6% of all buildings (4476). This implies that there are relatively few buildings located on the shortest paths with a high potential for pedestrian traffic passing in front of them, and they are primarily concentrated in the central areas along a specific line or axis.

Table 1. Number of streets and betweenness values

	Betweenness			Total
	High Betweenness	**Medium Betweenness**	**Low Betweenness**	
Number of the Streets	33	188	741	962
Percentage	% 3.4	% 19.5	% 77.1	100
Number of the non-commercial Streets	15	139	673	827
Percentage	% 1.8	% 16.8	% 81.4	100

The analysis reveals that streets with high betweenness values constitute a small percentage (3.4%) of the total, while streets with medium betweenness values make up a larger portion (19.5%). The majority of streets (77.1%) exhibit low betweenness values. The streets characterized by high betweenness centrality and a non-commercial nature constitute a mere 1.8% of the total street network, predominantly situated along the commercial planned axis in the western vicinity of the city. In contrast, streets with medium levels of betweenness values, comprising approximately 16.8% of the total, are primarily located within the historic districts of the city, primarily in the northern region. These streets not only possess potential for commercial land use but also play a crucial role in enriching the cultural district by fostering economic development through the adaptive reuse of historic street infrastructure (Table 1).

4.2. Findings at the Street Scale

In the GIS program, the commercial streets recommended in the 1998 plan and the building data with betweenness values were overlapped (Figure 11).

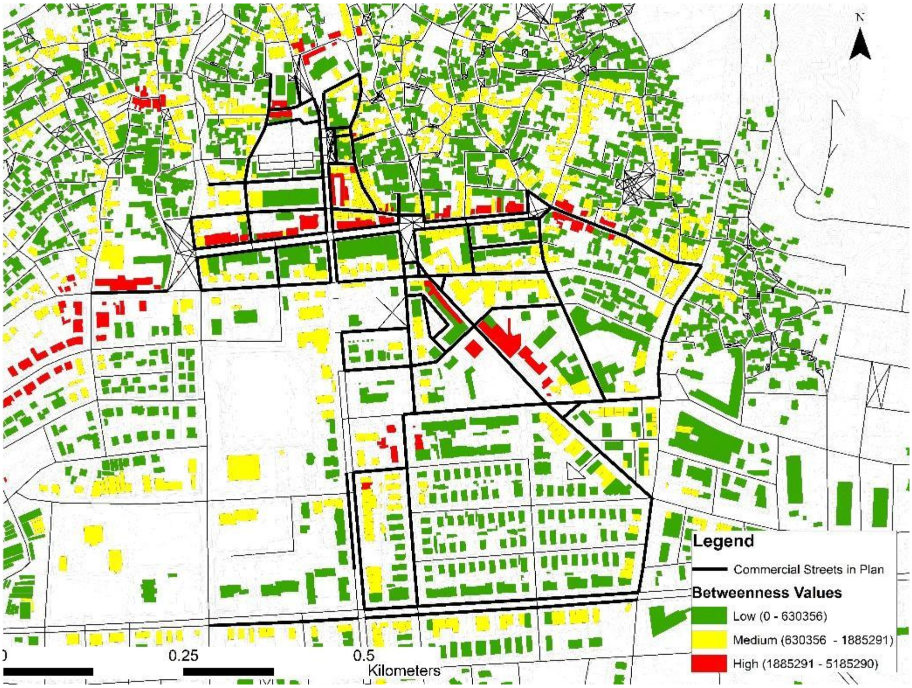

Figure 11. Overlapping the commercial street and building data

In figure 12, commercial zones in the plan were converted to street data. Betweenness values were converted to street data at this stage. During the conversion to street data, the betweenness values were processed on the streets at the alignment of the building in question.

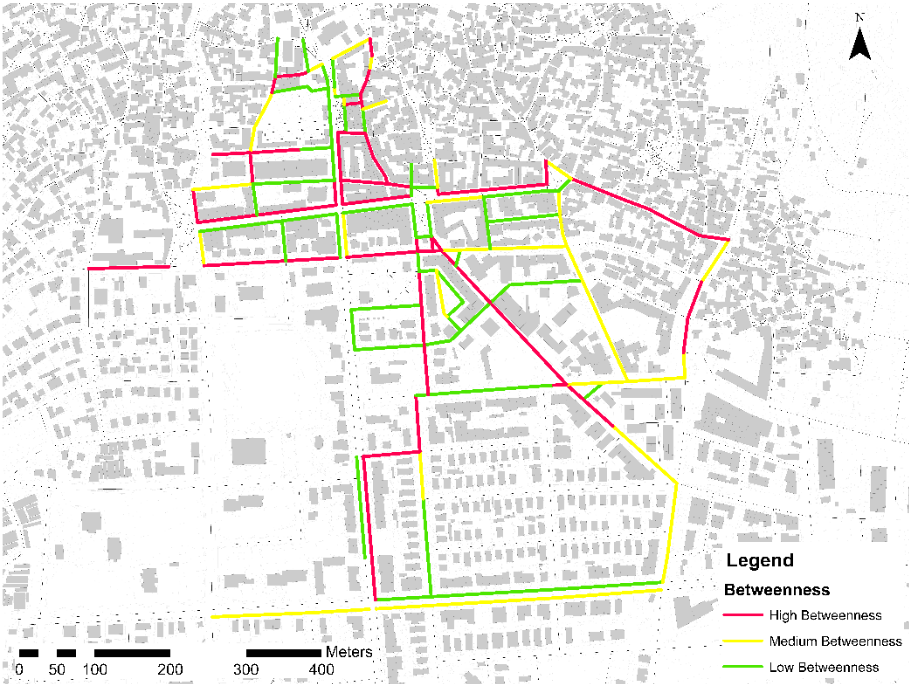

Figure 12. Betweenness values on commercial streets

According to the zoning plan, 41.1% of the commercial streets have a high betweenness value, 26.2% have a medium betweenness value and 32.6% have a low betweenness value. On the other hand, 36.3% of the total street length planned for trade has a high betweenness value, 27.6% has a medium betweenness value, and 35.9% has a low betweenness value (Table 2).

Table 2. Number of commercial streets and betweenness values

	Betweenness			Total
	High Betweenness	Medium Betweenness	Low Betweenness	
Number of the Commercial Streets	58	37	46	141
Percentage	% 41.1	% 26.2	% 32.6	100
Lenght of the Commercial Street	2802	2132	2775	7709
Percentage	% 36.3	% 27.6	% 35.9	100

5. Conclusion and Suggestions

The research results show us that UNA is a useful tool for analyzing potential commercial areas. An important finding is that 41% of the commercial areas planned by decision-makers overlap with high betweenness index values. The study also shows that there are streets with high betweenness index values that are not planned as commercial areas. It is obvious that the potential of these areas has not been analyzed by the decision-makers. Although not located in the center or near the existing commercial area, the strategic placement of commercial establishments facilitates the promotion of economic activity and fosters development along the extended course of the existing commercial axis. Non-commercial streets exhibiting high and medium betweenness levels not only present opportunities for commercial land utilization but also assume a pivotal role in the enhancement of cultural districts. This is achieved through their capacity to stimulate economic development by means of the adaptive reuse of historic street infrastructure.

On the other hand, there are streets that are planned as commercial areas because they are “in the center" or "near the existing commercial area" but have low betweenness index values. In this case, the following question suggests itself. It would be an exaggerated conclusion if only the betweenness values were sufficient for planning commercial areas. Thus, it can be seen that the factors "betweenness: being on the way", "proximity to the existing commercial area" and "being in the city center" should be considered together when planning commercial areas. On the other hand, as in Oppewala & Holyoake (2003), the agglomeration effect on betweenness should be investigated in future studies for commercial areas.

Betweenness values mean the more a building is located on the shortest routes, the more likely people will visit it. If there is a high probability of passing shops on a route, the usefulness of those shops is high. Network analysis helps to unlock the hidden potential of the cities. Quantitative and objective methodologies should be applied for planning studies as Aguirregabiria & Suzuki (2016) and D'Acci (2019) suggest. Likewise, the research of Sevtsuk, (2010), Sevtsvuk (2014), and Buzzacchi et al. (2021), this study approves the usefulness of the betweenness index in identifying commercial zones. Handy and Niemeier (1997) state that accessibility measurements are essential for urban planners and decision-makers to ensure better strategies and investments for residents' daily lives. This study contributes to urban morphology studies by comparing planning decisions and the degree of betweenness of buildings.

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All authors contributed equally to the book chapter. There is no conflict of interest.

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Sustainable Approaches in Urban Landscaping: Climate Change and Urban Ecosystems

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1. Introduction

The rapid process of urbanization is impacting individuals in diverse manners, with certain populations becoming increasingly susceptible to the repercussions of climate change. Urban regions frequently demonstrate markedly elevated air and surface temperatures compared to their rural surroundings, giving rise to phenomena known as urban heat islands (Li, Stringer & Dallimer, 2006).

Priority is given to assisting low-income communities in managing heat-related challenges. Proposed remedies involve strategies rooted in land use and land cover alterations, along with the implementation of blue-green infrastructure. However, additional investigation is imperative. Urban centers sharing comparable urbanization trajectories, geographical attributes, and climatic circumstances can derive advantages from collaborative interdisciplinary research aimed at tackling the intertwined consequences of swift urbanization and climate shifts (Van de Valle et al., 2022).

Conversely, the detrimental impacts of noise, visual monotony, and the absence of aesthetic appeal within urban settings adversely influence human psychological well-being. Evidently, the forthcoming urban landscape is poised for a departure from its current state. The intricate interplay of economies, cultures, and institutions on both a global and local scale, the synergistic engagement of stakeholders, and the dissemination of information and communication through the intricate web of networks resulting from this interplay all underscore the forthcoming urban differentiation. As cities rapidly expand and urbanization escalates, the burgeoning potential of metropolises housing populations exceeding 10 million, predominantly in developing nations, underscores the likelihood of encountering novel and significant urban challenges in the years ahead. Against this backdrop, an exploration is conducted into the historical evolution of urban landscapes and contemporary advancements.

The unnatural rise of greenhouse gases primarily stems from human socio-economic and ecological activities. This phenomenon is fueled by factors such as heightened energy consumption, industrial expansion, deforestation, and urban development. The cumulative impact of escalating greenhouse gas emissions leads to significant alterations in the atmosphere, contributing to a noteworthy surge in the average global surface temperature (Tuğluer & Çakır, 2019). Consequently, these changes trigger notable shifts within ecosystems. Given this scenario, the significance of embracing sustainable urban design practices becomes paramount. Sustainable cities are cities that develop environmentally sensitive. And these cities can meet their own needs. Sustainable cities aim to develop socially, economically and ecologically (Ekren, 2017).

Selection of plant species is extremely important in landscape design and planning studies, and it is necessary to frame the main problems faced by densely used urban areas such as campuses and city parks (Hatipoğlu & Ekren, 2022).

These practices play a crucial role in addressing the intricate web of challenges posed by greenhouse gas emissions, enabling us to navigate a path towards a more ecologically balanced and resilient urban future.

2. Concepts

In order to reveal the relationship between urban planning and global climate change, some concepts need to be clearly understood.

2.1. The Concept of 'Urban Landscape'

Urban landscaping is a topic of increasing significance and consideration in today's rapidly growing population and urbanization. Factors such as diminishing natural spaces, urban sprawl, traffic, and industrial activities adversely affect urban ecosystems. As a result, the sustainability of urban landscaping holds great importance. Sustainable urban landscaping necessitates balanced and long-term planning and implementation from environmental, economic, and social perspectives.

Sustainable approaches in urban landscaping emphasize the relationship between climate change and urban ecosystems, highlighting the importance of preserving natural ecosystems in urban areas and efforts to adapt to climate change. These approaches encompass practices such as strengthening green infrastructure, enhancing water management, and promoting green roofs and afforestation. Additionally, they underscore the significance of scientific research and societal awareness to comprehend the impacts of urban landscaping on climate change and enhance the resilience of urban ecosystems (Ramyar & Zarghami, 2017). These approaches are employed in urban planning and landscape design with the aim of improving the quality of life for urban residents and contributing to the conservation of the natural environment.

2.2. The Concept of 'Global Climate Change'

Global warming can be defined as the increase in the average temperature of our planet. This phenomenon affects the natural balance and cycles of Earth's climate systems, leading to changes in the chemical composition of the atmosphere and oceans, rising sea levels, and disruptions in ecosystems (Zillman & Sherwood, 2017).

The primary cause of global warming is the accumulation of greenhouse gases in the atmosphere, a result of human activities. Activities such as fossil fuel use, industrial processes, deforestation, and agriculture contribute to the emissions of greenhouse gases like carbon dioxide, methane, and nitrous oxide. These gases trap solar radiation in the atmosphere, causing an increase in the planet's temperature and disrupting natural equilibrium (IPCC, 2021).

Global warming results in a range of negative impacts. These include rising sea levels, melting glaciers, more frequent extreme weather events, disruptions in ecosystems, reduced agricultural yields, and diminishing water resources. These effects profoundly impact human lives and economic activities, underscoring our responsibility to leave a sustainable world for future generations. To mitigate the effects of global warming and combat climate change, international cooperation and diverse measures are essential. Transitioning to sustainable energy sources, improving energy efficiency, reducing greenhouse gas emissions, preventing deforestation, and raising awareness and action among individuals and communities are crucial steps (Liu et al., 2022; Gilardi et al., 2023).

2.2. The Concept of 'Sustainability'

Sustainability is a multifaceted concept that encompasses environmental, social, and economic dimensions. Essentially, it revolves around the principle of creating a balance and long-term lifestyle that meets the needs of current generations while enabling future generations to meet their own needs. Sustainability involves strategies aimed at preserving natural resources, maintaining ecosystem balance, reducing environmental pollution, ensuring social justice, and sustaining economic well-being (UN, 1987; Gedik, 2020). Landscape and sustainability are linked in numerous ways (Çakır, 2021).

In order to ensure sustainability in urban landscape planning and design, many factors must be provided. Purvis et al. (2019) examined the concept of sustainability in these 3 classes. These concepts are given in Figure 1 and are defined in a few sentences in this section.

Figure 1. Types of urban sustainability concept

Environmental sustainability emphasizes the conscious and balanced use of natural resources. This includes preferring renewable resources, energy efficiency, waste management, and environmentally friendly production processes. Preserving biodiversity and maintaining the healthy functioning of ecosystems are also crucial aspects (Aktaş, 2017; Köşker & Gürer, 2020).

Social sustainability aims to enhance the quality of life for all members of society. Equality, justice, human rights, and social welfare are among the key concerns in this context. Meeting basic needs such as healthcare, education, housing, and security is a fundamental component of social sustainability (Bosselman, 2010; Purvis et al., 2019).

Economic sustainability seeks to strike a balance between economic growth and the depletion of natural resources. This entails promoting sustainable production and consumption patterns, reducing income inequalities, and using resources without jeopardizing the economic well-being of future generations (Basiago, 1999).

Sustainability requires an integrated approach to address all these dimensions. By collaborating across communities, businesses, and governments, the goal of leaving a more livable world for future generations can be achieved.

In the light of these concepts, the concept of *'Urban Sustainability'* should also be explained. 'Urban sustainability' refers to the vitality of a city as a complex system, the quality of life of its citizens, or its capacity to support nature's activities. Urban sustainability involves considering environmental, social, and economic aspects in urban planning and development. Its goal is to address environmental challenges caused by rapid urban growth, aiming for a livable future. Collaboration among stakeholders, long-term planning, and sustainable policies are crucial. The objective is to create healthier, balanced cities that meet the needs of current and future generations (Crane et al., 2021). This approach enables the harmonious addressing of environmental, social, and economic requirements, ultimately enhancing the quality of urban life.

3. Relationships Between Urban Ecosystems and Global Warming

In order to make the concepts more understandable, the concepts that directly affect the urban landscape should be explained. These are urban heat islands, greenhouse gas emissions, air pollution, water management, albedo and adaptation importance. In this section, these concepts are examined.

3.1. Urban Heat Islands

Urban heat islands, are phenomena where cities experience higher temperature values compared to the surrounding rural areas. This phenomenon is a result of surfaces like concrete and asphalt absorbing and retaining solar radiation. Urban heat islands are associated with increased energy consumption, vehicular traffic, and industrial activities, and they can have implications for local climate, air quality, and energy consumption. The heat island is the most documented phenomenon of climate change. Rising urban temperatures have a significant impact on the energy consumption of buildings, especially during the summer period. (Feng et al., 2022).

This issue highlights the need for greater integration of approaches and tools to comprehensively understand the impact of heat stress on plants from global warming. It also highlights the growing importance of linking plant responses with tissue temperatures, summarizing how plant energy budgets affect tissue temperature and discussing the importance of using leaf temperature versus air temperature in heat stress studies. In addition, the need to investigate the effects of heat stress on plant reproduction, particularly at less explored stages such as floral meristem initiation and development, is highlighted. The authors highlight the importance of incorporating heat stress recovery into breeding programs to increase plant heat stress tolerance. Overall, the article identifies important research gaps in plant heat stress and offers recommendations for addressing these gaps to increase plant heat stress resilience (Jagadish et al., 2021).

High temperatures can significantly impact photosynthesis, disrupting cellular energy balance and causing stress. Photochemical reactions in chloroplast thylakoid lamellae and carbon metabolism in chloroplast stroma are particularly vulnerable at elevated temperatures (Hu et al., 2020). Heat stress can lead to issues like reduced photosynthesis, stomatal conductance, and growth, ultimately resulting in leaf loss and necrosis. Prolonged, frequent, and severe heat stress can even lead to tree mortality.

Soil moisture plays a crucial role in mitigating the impact of heat stress on trees. Adequate soil moisture enables trees to endure short periods of temperatures exceeding 40°C by facilitating leaf cooling through transpiration and convective trunk cooling via heat transfer (Kolb & Robberecht, 1996). Assessing heat stress effects on urban trees depends on stress diagnosis capacity. For instance, heat stress can limit carbohydrate availability, impede nutrient uptake, and lead to symptoms like leaf yellowing and necrosis (Percival, 2023).

Climate models consistently predict that escalating temperatures will lead to annual catastrophic consequences. Heatwaves pose a significant threat to global urban tree populations. Urban heat islands vary in intensity across seasons due to solar intensity, ground cover changes, and weather. These islands peak in summer, particularly under clear skies and calm winds. Cloud cover and wind can mitigate warming and reduce temperature differences between urban and rural areas (Oke, 1982).

Urbanization diminishes vegetation, leading to decreased shade and humidity, contributing to higher surface and air temperatures. Forests and trees in urban areas play a major role in reducing the amount of greenhouse gases. It is known that the most important source of harmful gases released into the atmosphere is urban areas. The most important component of the carbon pool in cities is trees in cities (Tuğluer & Çakır, 2021). Trees offer cooling benefits, making them a valuable tool in mitigating urban heat islands. Urban heat islands elevate energy demand, air conditioning costs, pollution, health issues, and water quality concerns. Atmospheric urban heat islands are less pronounced during the day and strengthen after sunset due to slow heat release from urban infrastructure. Urban landscape and vegetation play a pivotal role in this cycle.

3.2. Precipitation Variability

Rainfall variability is considered a significant component of climate systems. These variations refer to changes in the amount and distribution of rainfall that occur in different geographical regions and time periods. Rainfall variability is closely linked to climate change and can occur naturally as well as be influenced by human activities (Deitch et al., 2017).

Variations in rainfall in a region can stem from various factors. These include ocean currents, wind patterns, local topography, ocean temperatures, and atmospheric pressure systems. Additionally, climate events such as major ocean temperature anomalies like El Niño and La Niña can impact rainfall patterns (Trenberth, 2011).

The consequences of rainfall variability are substantial. They particularly affect areas such as agriculture, water resource management, ecosystem health, and water transportation. For instance, prolonged periods of drought can adversely affect agricultural crops, deplete water resources, and disrupt ecosystems. Similarly, excessive rainfall can increase the risk of floods, lead to soil erosion, and damage infrastructure (Bhaga et al., 2020; Seleiman et al., 2021).

With the advent of climate change, rainfall variability has become even more intricate. Rising temperatures can enhance evaporation, potentially increasing the risk of drought in some areas while triggering heavy rainfall events in others. Consequently, understanding rainfall variability and adapting to these changes are of critical importance in addressing climate change (Trenberth, 2011; Ebi et al., 2021).

In conclusion, rainfall variability represents a significant aspect of climate systems. Its effects can impact a wide array of sectors and require increased attention in the context of climate change. Scientific research and adaptation strategies can aid societies in becoming more resilient to rainfall variability.

3.3. Sea Level Rise

The relationship between sea level rise and urban landscaping is closely interconnected. Sea level rise is a consequence of global climate change and represents a significant environmental challenge that affects coastal regions. Urban landscaping refers to the arrangement of cities' environmental design, green space design, and organization in line with sustainability principles (Kamal-Chaoui & Robert, 2009). Sea level rise can increase erosion in coastal areas, leading to the retreat of the shoreline. This can jeopardize the infrastructure, buildings, and other structures in urban areas. Especially cities located at low elevations and along the coastline are among the settlements most affected by rising sea levels (Almeida & Mostafavi, 2016).

Urban landscape planning should encompass designs that are resilient to sea level rise. For instance, implementing coastal protection measures in coastal areas can mitigate the damage caused by regular floods and storms. Similarly, green infrastructure design can assist in the natural absorption of water. Furthermore, sustainability-focused urban landscape planning can help limit the effects of climate change by reducing greenhouse gas emissions. This can indirectly contribute to controlling the pace of sea level rise. In conclusion, sea level rise is a significant factor influencing urban landscaping. Urban landscape planning should include measures against the adverse impacts of rising sea levels to support urban development and sustainability in coastal areas.

3.4. Albedo

The relationship between the albedo effect and urban landscaping is closely interconnected. The albedo effect measures how much sunlight a surface reflects. Urban landscaping encompasses the arrangement and design of cities. The relationship between the albedo effect and urban landscaping refers to the impact of the surface characteristics and design of cities and urban areas on heat absorption and reflection. In urban areas, surfaces such as asphalt and concrete tend to absorb sunlight and retain heat. This phenomenon contributes to the formation of urban heat islands and subsequently leads to increased temperatures and energy consumption. Therefore, considering the albedo effect in urban landscaping design is crucial (Korkut et al., 2016; Yuan et al., 2017; Yılmaz & Öztürk, 2023).

Urban landscaping design aims to manage the albedo effect by altering surface characteristics. For example, using lighter-colored surfaces and increasing green spaces can reflect more sunlight, limiting temperature rise. Similarly, practices such as rooftop gardens and green roofs can have a positive impact on the albedo effect. The relationship between the albedo effect and urban landscaping highlights the potential for positive effects in sustainable urban planning, including energy consumption reduction, mitigating the effects of heat islands, and influencing microclimates.

Another important issue in this regard is shadow. Many of the anatomical and morphological adaptations of shade plants are attractive to the human eye and increase the ornamental value of the plants. Their glossy structures, dark green leaves, red undersides and asymmetrical leaf shapes add ornamental value to the plants. Low light intensity encourages vegetative growth in contrast to flower and fruit yield and makes the leaves of shade plants attractive (Çakır & Tuğluer, 2019).

Designing urban landscapes with a focus on the albedo effect involves strategic planning to maximize the reflection of sunlight and reduce heat absorption. Here are some key considerations for incorporating the albedo effect into urban design:

a) Surface Material Selection: Choose light-colored and reflective materials for surfaces such as pavements, roads, and rooftops. Light-colored materials have higher albedo values, which means they reflect more sunlight and absorb less heat compared to darker materials.

b) Green Spaces: Incorporate vegetation, such as trees, grass, and plants, into the urban landscape. Vegetation not only provides shade but also contributes to higher albedo by reflecting sunlight off leaves and surfaces. Green roofs and living walls can also enhance albedo and provide additional cooling benefits.

c) Cool Roofs: Implement cool roof technologies that utilize reflective roofing materials or coatings. Cool roofs have a higher albedo, reducing heat absorption and lowering indoor temperatures in buildings.

d) Urban Layout: Plan the layout of buildings, streets, and open spaces to maximize shading and create shaded corridors. This helps reduce the amount of direct sunlight hitting surfaces and lowers heat absorption.

e) Cool Colors: Opt for light-colored coatings, paints, and finishes for outdoor structures and surfaces. These coatings have higher albedo values and can significantly contribute to heat reduction.

f) Albedo-Aware Landscaping: Incorporate albedo considerations into the selection of landscaping elements. Choose light-colored mulches and gravels for pathways and garden beds to enhance albedo.

g) Educational Initiatives: Raise awareness among urban planners, architects, and the public about the benefits of the albedo effect. Encourage the integration of albedo-conscious practices in urban design projects.

4. Conclusion and Suggestions

The relationships between urban ecosystems and global warming necessitate a crucial role for cities in combating climate change and fostering sustainability. The efforts towards sustainability in urban areas hold paramount importance in mitigating the impacts of climate change and creating a livable environment for future generations.

This chapter has underscored the intricacy and significance of the relationships between urban ecosystems and global warming. Urban areas, hosting a significant portion of the global population, are particularly vulnerable to the effects of climate change. Research indicates that cities will experience the impacts of temperature rise more intensely, highlighting the pivotal role of urban sustainability efforts in combating climate change.

The endeavors for urban sustainability must be supported through various measures and policies. These measures encompass enhancing energy efficiency, promoting green infrastructure, establishing sustainable transportation systems, and improving waste management practices.

Moreover, urban planning and design processes should consider the ramifications of climate change and incorporate measures that enhance urban resilience. Especially, the expansion of green infrastructure and the preservation of natural spaces can mitigate the warming effects in cities. Parks, gardens, afforestation, and water bodies contribute to the temperature regulation of urban ecosystems.

Additionally, priority should be given to climate-friendly and energy-efficient building designs in urban planning and design. Future recommendations should focus on strengthening cities' sustainability visions and devising comprehensive strategies. Collaborative efforts among city administrations, local communities, academia, business sectors, and civil society can yield comprehensive and effective solutions. Additionally, raising awareness about climate change and organizing educational programs can empower communities to make informed decisions in this regard.

In conclusion, the relationship between urban ecosystems and global warming should remain at the core of urban sustainability efforts and the fight against climate change. Adopting climate-friendly approaches in urban planning, design, and management processes will serve as a fundamental step towards constructing livable and resilient cities.

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The Role of Urban Design and Planning in the Process of Urban Image Creation

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1. Introduction

Today, with the local and global developments and changes, the place has gained a different meaning. The factors shaping the space have pushed human needs, culture, society and value judgments into the background. This has severed human-human, human-space relations and created physically and socially problematic environments.

Urban design is a trend that has emerged to meet the 'things' that modern urbanism has left incomplete.

Although urban deconstruction takes into account the visual dynamics and aesthetics of streets and buildings, it should also deal with the interfaces between natural and cultural environments, the interaction of public and private spaces, the integrity of the urban form influenced by the political and socio-economic forces that drive the production and consumption of urban spaces (Alkım, 2006).

Urban form is what we experience and where we see it. This perspective of urban form includes buildings, houses, offices, schools, commercial and social facilities, suburbs, streets, parks, open spaces, highways, pathways, routes, etc. the form is the result of the work of all the people of the city produced together.

Urban design deals with the social and physical aspects of the urban environment. In this way, while providing urban development, it is also used as a powerful tool to improve social welfare. However, the contemporary understanding of the city offers a challenging context for urban design.

Cities are complex structures with administrative, social, cultural, economic, physical and functional dimensions (Eren & Koçyiğit, 2020). They have been a constant center of attraction by creating a dynamic structure by gaining different forms and meanings in the process that has developed throughout history and according to the conditions they are in (Özkok, 2016; Sarı & Kındap, 2018). In this context, cities have gained unique qualities by being shaped by physical, cultural, socio-economic, historical and formal factors over time. However, this original image formed over time has changed and even weakened over time (Oğurlu, 2014).

Image for cities; natural, cultural, social, economic etc. with the effect of many factors, they create different environmental, physical and visual effects, causing an increase in the spatial quality of cities and even creating brand value. While Martinidis (2011) stated in his study that urban aesthetics plays an important role in reflecting and shaping national identity, Berleant (1986) mentioned that the historical physical and social components of the city provide clues for the future aesthetic structure of the city. Sternberg (1991) states that time and needs shape urban aesthetics, while Porteous (1996) states that; stated that creating aesthetic value is a goal in traditional urban designs (Alan & Kiper, 2020).

The deteriorating quality of life in urban areas is one of the most pressing concerns faced by many disciplines, especially architecture, urban design and urban planning.

The aim of the study is to underline the unity of urban projects and urban design after briefly mentioning the emergence of the concept of urban design. To reveal the carrier role of planning and design processes in urban development processes.

2. The Emergence of Urban Planning and Design Concepts

Cities are also referred to as physical settlement areas where physiological, economic, social and cultural needs that can be met in societies with a certain population in terms of human relations are met at certain levels, each country determines its criteria according to its own historical past and economic characteristics. Sociologists look at the emergence of cities through the eyes of the birth of civilizations and try to explain the history of civilization by looking at the history of cities (Kayan, 2015). Therefore, it can be stated that cities are not just a settlement place, but a settled, developed and ideally advanced social pattern (Aytar, 2005).

Urban planning and urban design works are generally perceived as two different occupations, one with an emphasis on technique and the other with artistic emphasis. However, these two elements are different stages of the "city development" business; Even if it is done by separate experts and teams, they are involved in the same process. It is known that urban development is not only a work that includes the analysis and synthesis methods and creative designs of science and social sciences, but also a process that includes the methods and political preferences of different disciplines (Vardar, 2005).

Planning is a term of the 20th century and emerged as an intervention tool in the market economy. The economic, scientific, technological, social and environmental changes experienced in the 20th century have been influential in the development of the concept.

Planning is a tool that aims to bring the system in which societies live, the order of living and production further and better, and each plan is a chain of decisions in the future. All kinds of long, medium and short-term measures, resource use and protection suggestions are a plan decision (İller Bankası, 2000).

"Urban planning" aimed at establishing the relations between abstract urban planning and concrete architectural projects in order to shape the urban physical environment. The concept of "design" entered our language with the translation of the English concept of "urban design", which has the same meaning. From the relevant literature, it is seen that this concept was discussed for the first time in the current sense in the urban design conference held at Harvard University in the USA in 1956, where the physical dimension of planning was emphasized. Later, this concept was brought to the professional public with the publications of the American Institute of Architecture in 1957. It spread to wider circles through the work of Kevin Lynch and Jane Jacobs in the 1960s, and by Chistopher Alexander, Leon and Rob Krier, Robert Venturi, and others in the 70s (Vardar, 2005).

The reason for the emergence of urban design discussions in the USA is explained as a reaction to the "modern" architecture and planning approach applied in US cities in those years and an urban planning practice whose physical dimension was neglected. In these discussions, the main theses expressed by Jane Jacobs, who was not a planner herself, played a decisive role. According to Jacobs, in order for cities to be lively and livable, the following conditions, which were neglected in those days, must be fulfilled (Wickersham, 2001):

- High density should be provided in the urban texture,
- The mix and diversity of urban functions should be targeted,
- Small scale constructions that prioritize pedestrians should be planned,
- Old buildings should be considered and evaluated in the planning process.

According to Jacobs, economic and social diversity, which is vital for supporting urban life, can be realized through physical planning, that is, urban designs.

2.1. Cities Transformed by Globalization

Today, globalization is seen as an irresistible development from the point of view of both developed and developing countries.

Developments in the field of transportation, communication, communication and technology have turned the world into a small village. Globalization is a multidimensional process that causes changes in the economic, social, political and cultural spheres of cities. Since cities are at the focus of the globalization process, change, transformation and reconstruction in cities attract attention, and change and transformation in cities come to the fore with the globalization process (Kayan, 2015).

The globalization process has affected local and regional dynamics and has revealed the increasing importance of cities. In addition, competition between cities attracts attention as a result of globalization. Dec. Developed countries such as the USA, Great Britain, Germany and Italy, which have managed to overcome their national economic recessions by activating their local and regional dynamics, are now indexing their national development strategies to the sum of urban (regional) developments. (Sert, Karpuz & Akgun, 2005). Such approaches of developed countries pave the way for globalization.

Globalization is generally stated as the fact that capital, goods and labor of a certain nature know no borders, the removal of obstacles to their circulation in the world, their entry into any area they deem profitable, the ability to produce and sell anywhere in the world. Such an approach includes nation-states as well as regional organizations, local governments and cities.

The transformation of cities is explained by the capacity of industrialization dependent on technology. However, today, the fact that the energy sources used in industrial production are almost completely met by non-organic sources, and due to the development of technology in both transportation-communication and information systems, the fact that production should be a priority in cities has been abandoned, and a consumption-oriented urban cycle has been preferred instead.

With the new communication systems that develop and shape today's information age, cities are now more connected to each other. Although this situation applies to the act of communication, when looking at urban space, it leads to the fact that the convenience provided by communication systems and the functions in the space do not need to be positioned close to each other. This situation, on the other hand, reveals a new city structure today, which is called the communication and information age (Çetintahra, 2011).

It is necessary to discuss globalization before understanding the city that is being built depending on information and communication.

Although globalization is not a new process, the experience experienced today shows qualitative differences from the past. While the most important dimension of globalization appeared as economic interaction in the past, the defining feature of globalization today is presented as the fitting of different cultures, civilizations, political and economic structures into a single world system.

Today, in the process of globalization, goods, capital, knowledge, ideologies can reach every corner of the world by crossing national borders. Since the 1980s, it has been observed that capitalist capital, which directs the world economy, has become globalized rapidly by overcoming the obstacles in front of it. After the spread and globalization of the capitalist Sunday to the world scale, technological developments, especially in the communication, informatics and transportation sectors, regulations that minimize the trade restrictions imposed by the GATT agreements, are considered as efforts to overcome the general crisis of the capitalist regime in central countries that began in the 1970s (Ersoy & Sengul, 1998).

With the increase of technological developments experienced in the period of modernity and the development of globalization, which is the other side of the industrial revolution, a period of uncertainty has begun, which is sometimes expressed in literature as postmodernity and sometimes as a transformed state of modernity. Globalization, which causes the ’shrinking of the world‘ and the ’shortening of distances with time', emerged in the 1980s when the point of view that a new kind of world is being experienced gained popularity in academic and popular discussions. Another factor was that the latest technological innovations opened a new era in global-based communication and therefore spread rapidly around the world (Thorns, 2004). There are often criticisms about globalization regarding the economic and cultural structure.

However, when we look at spatial changes, it is seen that space has changed a lot depending on the economy. The city that was born with modernity and transformed by globalization, which is the cause of the postmodern period due to its consequences, has taken the form of an information city with the spread of economy and production based on knowledge and the rapid and effective acceleration of communication. Spatial boundaries have lost their importance. The capital, on the other hand, has taken on a more slippery structure. Cities had to create an attractive environment for the development of capital (Aslanoğlu, 2000). This situation has revealed the deconfliction between cities.

2.2. The Importance of Urban Image in Creating Competitive Cities

Cities can be defined as common living spaces where social, political, cultural, administrative and economic space exists for all citizens (Akkoyunlu, 2007). The city is a collective settlement unit that is in constant social development and meets the needs of society such as settlement, housing, work, recreation, few of them work in agricultural jobs, the population is denser than the rural part, and neighboring units are added to each other. According to another definition, the city is defined as a human settlement where agricultural production and non-agricultural production are controlled, distribution is coordinated, the economy is based on non-agricultural production, the organization, specialization and division of labor brought about by technological change are at an advanced level, have a heterogeneous society structure and a high level of integration, a complex and dynamic mechanism is constantly functioning (Kayan, 2015).

In today's world, where the global economy has entered a new global era, global market forces have dragged cities into a competitive arena. In such an environment, cities participate in global competition under the influence of various factors beyond their control. The increase in capital and labor force, rapid technological development and scientific advances have been effective in affecting the economic balance of societies and in society's participation in global competition. Technological developments provide many advantages to companies in the global economy, which is turning into an increasingly complex structure, but also provide important opportunities for competitive countries to develop (Başer, 2015).

Urban competition is progressing in an integrated manner with competition in the social, environmental and economic dimensions. It is possible for cities to reach a higher level of competition and ensure competitiveness in global competition not only with their economic development, but also with their social and environmental development. Cities that are determined to maintain urban competition have to realize a balanced development in these three dimensions (social-environmental-economic) (Başer, 2015).

One of the sub-goals determined in order to enable cities to gain a share of capital by standing out from other cities in the globalized space is to create images belonging to the city.

The concept of image carries the meaning of ”what is designed in the mind and longed to be realized, dream, illusion". At the same time, an image is defined as “something that presents an object in a way that directly serves to reintroduce it, a concrete or intellectual copy of something that has been perceived with the sensory organs”. From these definitions, it can be said that the image does not exist in reality, but is understood as a phenomenon that is being tried to be embodied by being grasped with perception. Thus, it can be assumed that the image is related to thought, politics or ideology.

The city image is related to the visual quality of the city and according to the above definition, it can be expressed as the shaping of the city in accordance with a policy or ideology. Lynch (2010) assumes that the city image consists of identity, structure and meaning components. In order for an image to be operable, it must define an object, distinguish that object from others, and be considered an entity, which creates its identity. The spatial or textural relationship of the image with those who observe the object and other objects is established by the structure. The object must have a practical or emotional meaning for the observer

(Lynch, 2010). All these components constitute the basic phenomena of the city image. In short, it can be said that the city image consists of structures that give the city an identity and add meaning for its user. For this reason, based on the concept of image, a new look can be given to the city by making changes to the structures in order for the desired ideology to shape the city.

Efforts to create a city image have begun to develop with the modern period. Of modernity, 17. the forms of social life and organization that started in Europe in the century and later influenced almost the whole world Giddens, (1998), have created some disadvantages in urban space and caused deformations, especially in the areas where the working class lives. These deformations are the problems that cause the formation of unhealthy urban spaces such as environmental pollution, irregular construction, low-standard housing. These developments have initiated urban renewal interventions to renovate, regulate and solve the problems of the city (Akkar, 2006).

Urban renewal movements have started with increasing public spaces. The first example of this is the ’parking movement'. Then came the ‘Haussmann plans’, which allowed the opening of wide boulevards. Apart from these developments in Europe, the ‘Beautiful City’ movement has started in America at a parallel time. 20. the ‘Garden City Movement’, the ‘New Cities Movement’ and the ‘Modernist Movement’, which emerged in the first half of the century, also pioneered the renewal movements in cities. After the Second World War, 'urban development', and in the early 1960s and 1970s, 'urban improvement' and 'urban renewal' strategies were given importance. the projects and plans implemented since the 1980s have been made with the content of urban transformation and have also been frequently used in the marketing of cities. In the 1990s, the legal basis for urban transformation was regulated (Akkar, 2006).

These strategies, which are effective in the image of the city, have been influenced by important periods experienced in the world. Before the 1980s, the city, which grew up encompassing rural areas, where the urban individual's 24 hours were planned for living-working-entertainment functions, production and consumption took place, turned into a place of indicators and images after the 1980s, which coincided with the new breaking point of urban development (Aslanoglu, 2000).

Tekeli (2009) Postmodernism, assuming that the belief that external reality can be represented objectively and decisively is a delusion, stands with suspicion in the face of all decisive discourses. Although there is debate about the fact that postmodernism is not yet a transformation that has taken place, the effects it has had on the city are evident. Postmodernism does not look at the community as integrity, homogeneity, continuity and determinations, but as fragmentation, difference, indeterminacy, chaos, impermanence, discontinuity. This situation has also been reflected in the urban space and has led to an increase in the importance of urban design that corresponds to postmodern discourses (Çetintahra, 2011).

3. Planning and Design as Urban Development Tools

The most obvious effects of globalization are seen on cities, as in many areas. It is seen that the physical space of the city, lifestyles in the city, consumption habits, changes in the economic, social and political structure bear the traces of policies and practices influenced by globalization.

It is known that consumption has an important role in shaping our life. Not only the physical and social conditions of urban life determine our living space, but also the preferences of individuals are an important factor in this formation. In recent years, there has been a new period in which consumption habits have changed, human relations have been replaced by relationships with objects, and globalization is driving this process.

Today, consumption has moved away from being an activity carried out for the rational satisfaction of natural needs, as in the past, and has become a determinant of social status, an indispensable tool for psychological satisfaction, and an activity that allows the evaluation of leisure time. Consumption makes its presence felt as an economic, social, political and cultural process in all societies.

The consumer society is also commodifying human relations, and the understanding of ”use and discard" is increasingly disrupting the nature of human relations. The meaning of a ”use and discard" society is not only to discard manufactured goods; it also means that values, lifestyles, stable relationships, commitment to things, buildings, places, people and learned ways of being/being can be discarded.

The change in the understanding of consumption, urban spaces are also taking their share, housing, recreation-entertainment and work spaces are increasingly integrated with consumption. The fact that different regions of urban centers increasingly resemble each other can be defined as one of the indicators of the reflection of globalization on space.

Today's cities are the areas where global economic, political and social decisions are made and they affect the whole world. The population of some megacities continues to grow, doubling the population of many countries, and continues their urban expansion. The decision-making power and functions of some cities even exceed those of countries. Global cities are distinguished from other cities by their economic, social, political, cultural and spatial characteristics. The management and service centers of international companies and political associations are concentrated in these cities. When evaluated in the context of cities, it should be remembered that global cities affect the world as much as global capital, culture and developments affect the city (Kaya, 2020).

The necessity of accelerating the globalizing and time-competing urban competition has created a situation that the planning implementation process cannot meet. Although urban design has principles that focus on the relationship between people and urban elements and aim to improve the quality of human life, contrary to these principles, it has been seen as an intervention tool where capital can get faster results. Dec. In order to Deconstruct the contradiction between the principles of urban design and the needs of capital, urban design has been tried to overlap with urban transformation projects. Therefore, the process we are in has turned to urban design because planning can no longer serve the purpose, and it is trying to use urban design with urban transformation, renovation and similar 'drawing tools' to position the capital of the city image in urban space (Çetintahra, 2011).

Urban design expresses far-reaching thinking. Contemporary urban design;

- improving neighborhoods,
- to calm the traffic,
- minimizing the negative effects of new development,
- to diversify while expanding housing options,
- protecting the open space,
- to improve the street views and
- generally deals with issues such as creating more humane environments.

In summary, it can be seen that urban design applications can be made from the neighborhood scale to the scale of a major city part and even to the metropolitan area in a wide perspective.

Urban design is similar to what used to be called **“community planning”**. **"Urban design"** is usually **a more humane, more accessible means of organizing space.**

Urban design is a three-dimensional, multidisciplinary approach that aims to create/reveal safe, functional and aesthetically appropriate public environments for societies. It takes place alongside other techniques such as strategic planning, cultural planning, regional development and economic strategies. It can also be seen as an application tool that can express them in three dimensions rather than replacing other techniques and applications. (Olszewski & Pudlowski, 2001).

The concept of planning is defined as ”the act of balancing requirements and resources by complying with certain intellectual prerequisites for long periods in order to achieve certain goals with scarce resources" (Keleş, 1998). According to this definition, the arrangements made for a wide period of time within the framework of rationalism in line with the policies express the planning action.

Therefore, the word meanings of the concepts of ’planning‘ and ’design' show that these concepts work not separately from each other, but as a complement to each other.

As can be understood from the definitions, *urban planning plays a legitimizing role in determining the direction of the system's relationship with the city (and even other cities) rather than urban and urban needs, while urban design provides functionality and aesthetics in an urban area or area.* Moreover, from these definitions, it is understood that planning, although it produces decisions for a similar time perspective as urban design, needs a longer process in practice (Çetintalha, 2011).

19. the fact that planning in the century is "slowly, not centered on people, projected to function as an abstract fictional system and shaped according to the economy that experienced its brightest period in the same century" (Ergin & Çukur, 2007) means that it will fulfill the requirements of the economy as a whole of the city in the universal approach of the modern period. He has tried to realize this by using zoning plans, which are a tool that can shape the space in two dimensions, so that he can intervene as quickly as possible due to the fact that it involves a long process.

Urban design, on the other hand, has a faster implementation process both because it acts in accordance with the top decisions and because it works in a designated area.

Nowadays, cities are constantly competing with each other in order to attract tourists, investors and companies to them. Place (city, destination, etc.) marketers, for this reason, are trying to create attractive places as brands for different target groups. However, in terms of physical planning and urban development, it is emphasized that spaces focus on the social and economic functioning of an area based on the goals determined by a certain social and political society (Başer, 2015).

Although the branding of places as products is considered very complex, it is emphasized that the practice of space (city) branding has become widespread in recent years. Because today, it is stated that cities are constantly in competition for elements such as tourists, population, prestige, wealth, power, trade. It is also emphasized that national and cultural barriers can be overcome with a strong brand. In this regard, there are important issues focused on the concepts of city image and branding. The image of the city, which is expressed as an important element in the branding of the city, is shaped by a wide variety of elements. These elements are expressed by Beerli & Martin (2004) in the form of natural resources, general infrastructure, tourism infrastructure, entertainment venues, culture-history and art, political and economic factors, natural environment, social environment, and the atmosphere of the city (Beerli & Martin, 2004).

Since cities are expected to change, or because they have significant identity and development potentials, such rare areas that are desired to change more "regularly" than other segments deserve even more careful planning. These unique urban sections that will be the subject of the design should be considered in the collective design processes in terms of both the correct evaluation of the potentials they offer and the determination of the common goals between the people and organizations that will invest in these areas. All actors who can play a role in the realization of the desired joint design have to make their own contributions within the framework of the common goals determined in the staged process. The success of the implementation of the resulting design depends on the joint performances of the actors in the team game. While the care in design is measured by the quality achieved both in the content and in the process, the main determinant of the quality is the result of the application.

4. Findings and Discussion

Cities are the most important places that have an impact on people's social life. It provides people with opportunities for both coexistence and to establish the bonds of social life. Dec. Streets, squares, urban open green spaces, parks, gardens, children's playgrounds, known as urban spaces, are areas where individuals will spend time together, socialize, create a sociocultural structure, express themselves. The meanings of urban spaces are one of the basic elements of communication Decoupled between society and the individual.

Today, the fact that urban space is a livable and shareable social consumption and production space, as well as being a means of accumulation, reveals a serious tension.

Due to social change, the nature of the transformation in urban spaces also brings with it the problem of the controversiality of the claims of these spaces to publicness." The problems that arise in the public space are mainly due to the change in urban practices and the change in the use and status of various spaces.

In cities and urban environments that are in the process of change and development, the historical environment and urban fabric often disappear, or highly qualified livable / identity urban and urban environments cannot be created. In this process, the human scale is disappearing in cities, the memories of cities are weakening or even disappearing, and the ties between the city and people are Decaying more and more. The process of making the city where people live more peaceful includes a series of studies that start with planning approaches and find their place in the third dimension with urban design applications. In this context, urban design plays an important role in the formation and maintenance of a city's identity.

Although the city cannot be formed at the designer's table with all of it, important contributions can be made to the formation of the city with design. Many issues related to the formation of the city at the micro and macro levels can be improved by design, more livable, identity-based urban environments can be created.

Some people may show urban design as a luxurious activity aimed at painting the eyes, against holistic planning, especially in pursuit of aesthetic goals.· This is a wrong assessment. Urban planning is not only the documents that determine how far the future of ne is determined, but also the documents that guide how it will come. The answer to the question of how can only be sought within the framework of urban design. Besides this, planning is not only the process of Decanting plots of land, but also the process of arranging how structures will come on the plots. Because urban planning plays an active role in the urban development process (Vardar, 1997).

All these mentioned processes will be able to take place in conditions where the integrity of urban design and planning can be ensured.

In this context, the best way to create successful and sustainable cities should be to think about urban design from the very beginning of the planning and development process. It is necessary to define urban design and urban planning processes not as independent activities from each other, but rather as closely related phenomena.· Without understanding the urban planning process, it becomes quite difficult to understand the concept of urban design and its role in shaping space.

It is seen that it is almost a general opinion that planning efficiency alone is insufficient in creating urban environments (Ulusoy, 2001). Urban planning and urban design are two phenomena that do not complement each other both in terms of scale and in terms of urban busboys. Therefore, leaving urban design at the end of the planning process creates uncertainty and an unnecessary source of conflict. As a result, it becomes impossible to get a good result. Good design should include the entire development process and should be encouraged everywhere, and it should not be neglected to support the construction plans targeted in the zoning plans with urban design plans.

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The Impact of Walkability in Sustainable Cities

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1. Introduction

Walking is one of the most basic movements that people do to carry out their daily activities. Walking is also the easiest, cheapest, and least harmful to the environment mode of transportation. Movement in urban and rural areas is carried out by walking. While walking increases the interaction between people, it also contributes positively to economic and social relations and improves the quality of life. Many researchers and scientists have revealed as a result of their research that the act of walking has many contributions to human life, such as health, socialization, integration, and enrichment of human activities (Cervero & Kockelmann, 1997; Leyden, 2003; Pucher & Dijkstra, 2003; Tekel & Tamer, 2007).

The term walkability is a scale that expresses how well the built environment is suitable for walking. Walkability can also be defined as how friendly the built environment is for people walking in terms of access to all services in people's working lives or recreational time. In general, it can be concluded that the definition of walkability is a measure of whether a city encourages people to walk (Wang & Yang, 2009).

The concept of walkability is defined as the built environment providing an environment that supports and encourages walking by providing visually interesting vistas that will enable pedestrians to reach certain points in a safe and comfortable way (Southworth, 2005). When it is desired to be defined in a different way, walkability is an expression of space quality. Walkability is a measure of how well a built environment is suitable for walking, shopping, visiting, or having fun. It gives information about the physical and social characteristics of the environment in urban built areas. Walking is also good for people, both physically and mentally, and it heals them. Studies have shown that diseases such as heart disease, hypertension, diabetes, stroke, obesity, and cancer are seen later in people who walk regularly. In addition, it has been determined as a result of the research that the act of walking mentally keeps people away from mental diseases, protects them from depression, increases the quality of life, and brings them into society (VTPI, 2009; 2023). Physical inactivity and outdoor urban air pollution are among the most important causes of the deterioration of health in cities. It has been suggested that moderate daily exercise (such as walking to the bus stop or grocery store, horticultural activities) can have significant public health benefits (Marshall, Brauer & Frank, 2009; Arslan, Kalaylıoğlu & Ekren, 2018).

Walking is the oldest, simplest, least environmentally damaging, and cheapest way that people use for transportation in their daily lives. The act of walking is also defined as a social phenomenon in which people increase their communication with each other. At the same time, walking can be expressed as a socializing, unifying, and positive activity in order to lead a healthy human life (Tekel & Tamer, 2007).

In order to understand the importance of walkability, it has been started to investigate how necessary the act of walking, which is the oldest, cheapest, and simplest physical activity of people, is for places to become living and lively places and what factors affect this situation (Demir, 2019). The act of walking also enables people to integrate with their environment. The fact that people are constantly moving in a region or a place and changing their position causes them to interact with the place and other people. Evidence-based concepts, theories, and models are needed to generalize knowledge about walking and walkability. This is the only way to reveal the order and the important differences in the apparent chaos. The fact that an activity as old as human history is being done by groups of people in every culture makes its generalizable structure even more effective (Yazıcıoğlu Halu, 2010). In understanding the livability and measuring the quality of life in a city, physical features first come to the fore, and with this, the senses are activated, people come together, activities increase, and socialization increases. For this, people need to live in a walkable city (Nazifoğlu, 2016). Studies on walkability have largely focused on the positive externalities of walkable cities and have demonstrated how they contribute to public health through physical activity, the environment by providing a clean mode of transport, and society at various levels by promoting a sense of belonging (Erol & Görmez, 2021). The diversity and richness of a city's public spaces, being open to everyone, accessible, and walkable, and providing representation of different segments of society, make that city and its public spaces livable (Dumbaugh, 2005; Akkar Ercan & Belge, 2017). For this reason, it is important for cities to be walkable in order to be culturally and ecologically livable and sustainable.

2. Relationship Between Walkability and Sustainable City

Sustainability is an approach that tries to minimize environmental negatives and adopts the protection of natural resources (Bekar & Bal, 2022). The concept of sustainable urbanization has brought with it the concept of "livability", which is an extension of the quality of urban life, and livable cities have brought new understandings of cities. According to the “new urbanism” theoretical approach, a high-quality pedestrian environment enhances opportunities for interaction between urban spaces and their inhabitants. This interaction shapes the city characters depending on the relationship between people and their living environments. (Konakoğlu & Bekar, 2021). With this understanding, it is argued that working, recreation, shopping, and residential areas should be within walking distance of each other, and the automobile should no longer be a necessity (Duany & Zyberk 1992; Gündoğdu & Dinçer, 2020). The sustainability of cities can be defined as the sustainability of societies. Human communities are directly affected by the place they live. Ensuring the sustainability of cities means ensuring continuity by increasing the quality of life of those living in them and those who will live there in the future (Atıl, Gülgün & Yörük, 2005; Tuğluer & Çakır 2021). According to Baldemir, Kaya & Şahin (2013), sustainable urban development is considered in parallel with sustainable social development. A sustainable city essentially means a harmonious relationship between a city and its environment (Hatipoğlu & Ak, 2020; Ekren, 2021). In this sense, sustainable cities are urban areas where economic, social, and physical systems are not burdened on the environment, based on a social basis and with the right policies.

The basis of sustainable cities is walkability. Walking is a means of transportation, just like cycling. Walking has a positive effect on the environment by reducing energy consumption and air and noise pollution. It is a fair means of transportation because it does not make any difference in social terms (Forsyth & Southworth, 2008).

Creating walkable environments provides people with recreational opportunities while providing solutions to reduce environmental pollution (Lee, 2021; Alkan & Yeşil, 2022). Walking is a "green" mode of transportation. Therefore, the increase in walkability contributes to the urban ecology by reducing the use of motor vehicles. In this way, it also reduces the emission of harmful gases in the city and contributes to the fight against global warming.

Walkable cities have an important role in the issue of climate change resulting from global warming and form the basis of sustainable cities. Because in this way, traffic decreases, fossil fuel use decreases depending on the decrease in traffic, and it plays a major role in reducing air and noise pollution. At the same time, since it is a type of transportation open to all segments of society, it does not contain class discrimination and provides a fair transportation service. Therefore, walkability is necessary for the formation and development of more livable, cleaner, and sustainable cities in cities where population density is high, construction is high, mixed-use methods are used together, and public transportation is required.

The main reason for climate change phenomena in the world today is urbanization and industrialization (Tuğluer & Çakır, 2019). In the face of increasing environmental problems, people have begun to turn to environmentally friendly and sustainable approaches that support green. (Kutlu, Bekar & Şimşek, 2022). According to a United Nations survey, by 2050, about 70 percent of the world's population will be living in cities. The rapid growth of cities in terms of economic and social development is the cause of major development problems in many countries around the world (Ak & Hatipoğlu, 2019). Efforts to improve contemporary urban community life should be taken seriously because social values in the urban area are characteristically different from those in the rural community. In addition, one of the main problems of urbanization is the increasing dependence on motor vehicles. The main mode of transportation in cities is private cars because it has become a habit for citizens to use motor vehicles instead of walking. Increasing walkability in cities means that planning and design must be improved for more sustainable living (Azmi & Karim, 2012).

3. Conclusion and Recommendation

One of the greatest possibilities that people use to ensure their integration with the environment is the ability to move. In this context, the concept of walkability gains importance. Creating walkable environments and providing a safe and comfortable environment for all kinds of pedestrians, especially disadvantaged groups such as the disabled, the elderly, and parents with young children, is important for all citizens to participate in public life and to live a healthy life (Gündoğdu & Dinçer, 2020). Walkability is one of the most basic activities that people do in their daily lives. However, recently, the act of walking has been replaced by motorized transportation vehicles due to the lack of walkable areas or the deterioration of their structure, the inability to ensure their safety, the irregularity of road networks, and the inadequacy of access to services. This situation, in addition to causing some physical and mental disorders in individuals, has been one of the factors that causes climate change due to the continuity of fossil fuel use. Because, thanks to walking, the incidence of diseases such as cancer, obesity, diabetes, and depression decreases, and at the same time, the use of fossil fuel-consuming transportation vehicles such as cars, buses, and trams in society is minimized. Therefore, it is necessary to look at it from a holistic perspective in order to create accessible, safe, well-maintained, and comfortable walkable areas in society. In this way, more useful, sustainable areas that can respond to the wishes of individuals will be created.

The act of walking is one of the actions that are and should be in every area of life. It has many benefits for both mental and physical health. The concept of walkability has thus become a frequently heard concept in recent years. Walking is one of the most convenient, accessible, and less harmful transportation methods. Thanks to walking activity, the use of fossil fuels will decrease, and in this context, an important step will be taken to prevent climate change. Therefore, it is necessary to create walkable areas in cities. While designing these areas, accessibility, safety, easy access to all services, and ease of use by all segments of society are among the main topics to be considered. Just being comfortable or accessible in walkable areas is not enough in terms of walkability. The materials used and the designs applied in these areas should also be sustainable. It is necessary to approach it from a holistic perspective to create walkable areas. In this way, more useful, functional, and sustainable areas will be created.

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Comparative Solar Access Analysis on Building Surfaces, Determination of the Relationship Between Solar Radiation, SVF, and Sunlight Duration

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1. Introduction

Urbanization is a rapidly accelerating total phenomenon, particularly in developing countries. This trend is largely driven by factors such as rural-urban migration, natural population growth and the attraction of economic opportunities in cities. According to the latest data from the United Nations, more than half of the world's population lives in urban areas, which is 57% (Anonymous, 2022). This proportion is expected to increase to 66% by 2050. In 2045, there will be approximately 6 billion city dwellers (World Bank, 2023). Considering these statistics, it is evident that measures need to be taken for future urban development strategies across several domains. In this context, energy in the urban environment is a crucial aspect and warrants significant attention.

One of the most important challenges associated with energy consumption in urban areas is the need to balance energy demand and supply. With more people living and working in cities, there is a greater need for energy to power homes, businesses, and transportation. The energy consumption of buildings in urban areas is a significant issue that requires attention due to the high demand for energy and the resulting environmental impact. Buildings account for a significant portion of the world's energy consumption. Buildings contribute to roughly 32% of global final energy consumption, 17% of direct CO_2 emissions, and account for one-third of indirect emissions (Skillington et al., 2022). In particular, buildings in urban areas consume more energy than those in rural areas, making the urban building sector a crucial area for energy efficiency improvements. One of the primary reasons for the high energy consumption of buildings in urban areas is the need for heating and cooling systems. According to a study by the International Energy Agency, the energy used for heating and cooling buildings in urban areas accounts for approximately 60% of total building energy consumption (Anonymous, 2017).

The energy consumption of buildings in Turkey has been a major concern for the country due to its increasing population and urbanization. The construction industry in Turkey accounts for roughly 34% of the nation's total energy consumption and the energy usage in this sector is steadily rising each year (Anonymous, 2021). Consequently, endeavors aimed at boosting energy efficiency in the construction sector are becoming increasingly crucial. Heating accounts for 55% of the total energy consumption in housing in Turkey. The remaining distribution of energy consumption is as follows: 19% for hot water production, 4% for cooking, 3% for lighting, and 19% for household appliances (Anonymous, 2018). The predominant source of energy consumption in housing is derived from fossil fuels. For instance, in 2018, natural gas consumption in Turkish households accounted for 25.7% of the total consumption (Kabakçı, 2018). Turkey, under the scope of the "Climate Change Action Plan 2011-2023," aimed to ensure that at least 20% of the annual energy demand of new buildings from renewable energy sources starting from the year 2017 (Kabakçı, 2018). Despite this action plan, the objectives have not been fully achieved. The utilization of renewable energy sources, such as solar and wind energy, in the energy consumption of buildings, has not yet reached sufficient levels.

Among renewable energies, solar energy holds significant potential for utilization in buildings. The simplest method, known since antiquity, is the passive method. Utilizing solar energy passively does not necessitate advanced technology. Passive solar systems are designed to maximize the amount of solar radiation entering a building while minimizing heat loss. At the building scale, passive solar design strategies primarily aim to harness solar energy to achieve thermal comfort in buildings by minimizing the need for electrical or mechanical equipment (Stevanović, 2013). Active solar systems are another type of solar energy system that can be used in buildings. Unlike passive solar systems, active solar systems require the use of mechanical and electrical components to capture and store solar energy. In both cases, the buildings must have sufficient access to sunlight during the day. In the urban environment, the performance of building solar systems is strongly linked to urban density. In the present study, solar access in urban areas was analyzed on building façades in Konya, Turkey. The solar gain potential of a point on a façade differs according to the urban context. To compare the solar gains of different locations and draw conclusions, the selection of points was based on the characteristics of the immediate urban environment. The objectives of the study are as follows:

- To determine the total solar radiation received at the selected points on the building façades, which have different urban contexts, and to compare and understand the reasons for the differentiations between these points.
- The second objective of this study is to define a mathematical model based on the results obtained regarding solar gains. This mathematical model can precisely define the relationship between the built context and the total solar radiation received. It can be used in built-up areas with the same climatic context as Konya. Additionally, it could be valuable for acquiring fundamental knowledge about the potential for solar gain, particularly in the early stages of urban and architectural design.

2. Solar Access in Urban Environment

Solar Access can be defined as the continuous availability of direct sunlight a building has without obstruction by another property (Kettles, 2008). It refers to the amount of direct sunlight that a building receives without obstruction from surrounding structures. Solar access is an important consideration in urban planning, especially during the early stages of design when street layouts and building masses are being shaped (Czachura et al., 2022; Capeluto & Shaviv, 2001). It's a critical factor in sustainable urban design (Mohajeri et al., 2019). This availability of sunlight is vital for many aspects of building performance, including energy efficiency, thermal comfort, and indoor air quality

In densely populated urban areas, the layout of buildings and the orientation of streets can greatly impact solar access. Buildings that are overshadowed by other buildings or surrounded by tall structures may have limited access to sunlight, which can reduce their potential for solar energy generation and natural lighting. This can lead to increased reliance on artificial lighting and HVAC systems, which consume significant amounts of energy and contribute to carbon emissions. The ability to harness sunlight has the potential to significantly reduce energy consumption and greenhouse gas emissions in buildings, which are major contributors to climate change. This not only reduces energy consumption and carbon emissions but also saves costs for building owners and occupants.

On the other hand, solar access in urban environments can also significantly improve the health and well-being of urban inhabitants (Fernández, Gentili & Campo, 2022). Sunlight exposure has been shown to have a range of health benefits, including improved mood, increased productivity, and reduced stress levels. Access to natural light is, therefore, an important factor in creating healthy and livable urban environments (Kanters, Gentileand & Bernardo, 2021).

Studies on solar access in the urban environment are a topic of continued interest in scientific research. Urban areas are major contributors to total energy consumption, and the need for sustainable energy solutions in cities is increasingly recognized. In a general context, the scientific approaches carried out on solar access in urban studies can be described as follows:

1-Simulation and modeling: Studies that employ computer simulations and models to analyze the impact of various urban form factors on solar access, such as building height, density, orientation, and shading. These studies use tools such as geographic information systems (GIS) and building energy simulation software to evaluate the potential for solar energy production and assess the impact of shading on energy consumption and occupant comfort. The study of Compagnon (2004) is a good example for the simulation method to determine solar access. In this research which is one of the pioneers in the field, a method to assess the potential for active and passive solar heating, photovoltaic electricity production, and daylighting on façades and roofs of buildings in urban areas was developed in Fribourg, Switzerland (Compagnon, 2004). In another study, a methodology was developed to assess the potential for photovoltaic energy generation in an urban area using open-source solar radiation tools and a 3D city model implemented in a geographic information system (GIS) (Hofierka & Kaňuk, 2009). In 2007, the simulation software named Suntool was developed by Robinson et al. (2007) to support urban designers to optimize the environmental sustainability of their master planning proposals (Robinson et al., 2007). It is also possible to mention Townscope, and Heliodon as computer tools with which it is possible to analyze solar access (Iommi & Losco, 2016; Teller & Azar, 2001). To have exhaustive knowledge about solar simulation software, the study of Jakica (2018) can be examined. It represents a comprehensive review of solar design tools from a multidisciplinary perspective (Jakica, 2018).

2-Measurement and monitoring: Studies that use field measurements and monitoring to collect data on solar access in the urban environment, such as solar radiation levels, shading, and solar energy production (Huang, Ooka & Kato, 2005). These studies often employ sensors and data loggers to collect data on the performance of solar energy systems in urban areas. For example, measurements of total solar radiation and direct normal radiation were carried out at Universiti Teknologi Petronas (UTP), Seri Iskandar, Malaysia (Mohammad et al., 2020). In this study, the great potential for using solar energy was determined in the campus area (Mohammad et al., 2020). In another study, the solar energy gain on vertical surfaces for heating and cooling systems in big cities of Turkey has been estimated for different orientations using hourly solar radiation measurements (Şaylan et al., 2002).

3-Policy and Planning: Studies focus on the development of policy and planning strategies to promote solar access in the urban environment (Akrofi & Okitasari, 2022). These studies may examine the role of zoning regulations, building codes, and incentives in promoting solar energy systems in urban areas and may provide recommendations for urban planners and policymakers. In the early stages of the expansion of the modern movement in architecture, it is important to cite the ideas of Le Corbusier regarding the consideration of sunlight in city planning. Le Corbusier was a prominent architect and urban planner known for his innovative ideas and contributions to the field. One of his famous concepts was the heliothermal axis, which refers to the orientation of buildings to maximize sunlight exposure (Siret, 2006). This concept was a key component of his urban planning philosophy, emphasizing the importance of sunlighting in urban design. On the other hand, it is important to mention the solar envelope method developed by Knowles, which is practicable in architecture and urban planning (Knowles, 1981). The concept of the solar envelope refers to a zoning regulation that limits the height and location of buildings based on the sun's path (Topaloğlu, 2003). The solar envelope is designed to pens access to sunlight for buildings and outdoor spaces. Knowles' approach is based on the idea of solar rights, which is the principle that all individuals and communities have the right to access and benefit from solar resources. The solar envelope serves as a tool to enforce these rights and ensure that buildings and urban spaces are designed in a way that maximizes solar access and minimizes the impact on the environment (Canan & Bakır, 2008).

Several significant policy initiatives like "The Photovoltaic Power Systems Programme (IEA PVPS)" and "The POLIS2" projects have been implemented to encourage the use of solar energy in urban planning. The Photovoltaic Power Systems Programme (IEA PVPS) was among the initial endeavors to encourage the use of solar energy in urban planning. The program was initiated by the International Energy Agency (IEA) in 1997, and in 2002, the IEA reported on the efforts of Task 7, which focused on integrating PV systems in the built environment (Akrofi & Okitasari, 2022). The project ran from 1997 to 2001, and it included 21 countries, mainly from Europe, the UK, Asia, and America. The EU initiated the POLIS2 project (Identification and Mobilization of Solar Potentials via Local Strategies) in 2009 intending to identify and utilize solar potential through local strategies. This project was similar to previous projects in that it aimed to identify best practices in solar urban planning and create more organized planning and legislation practices for solar developments. Additionally, the International Energy Agency's (IEA) Solar Heating and Cooling (IEA SHC) project established a specific task force (TASK 51) in 2013 to support urban planners and architects in integrating solar PV in urban areas (Akrofi & Okitasari, 2022).

4-Design and innovation: Studies that explore innovative design strategies and technologies for maximizing solar access in the urban environment, such as building-integrated photovoltaics, solar façades, and sun-tracking systems. These studies may also examine the potential of emerging technologies such as energy storage and smart grids to improve the efficiency and effectiveness of solar energy systems in urban areas.

3. Material and Method

3.1. Study Area

The city under study is Konya (37°52′ N, 32°29′ E), situated at an elevation of 1016 m above sea level in the Konya province of southwestern Central Anatolia, Turkey (Figure 1). The population of the city is 1.3 million. The city holds significant importance as a cultural, economic, industrial, and educational center.

Figure 1. The geographical location of Konya

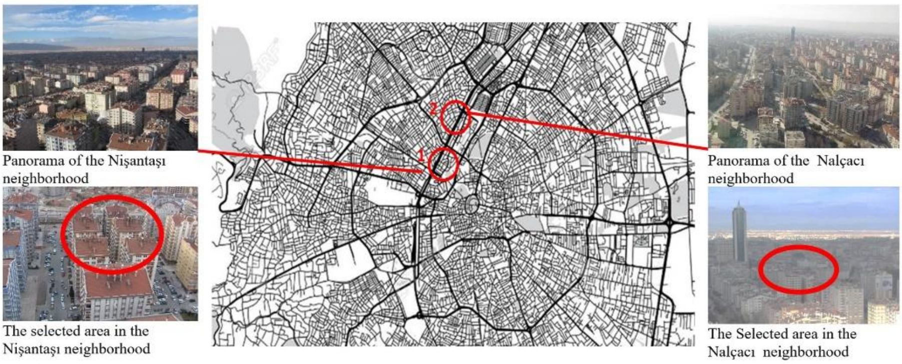


Figure 2. Selected areas in the city of Konya

Two neighborhoods were selected to carry out the solar access analyses: Nişantaşı (1) and Nalçacı (2) (Figure 2). They are both located in the new center of the city. Since the 1990s, the Nişantaşı neighborhood has experienced significant construction and densification. The Nalçacı neighborhood represents the first significant extension of the city towards the Northwest towards the end of the 1960s (1966 master plan). The first high-rise buildings constituting dense construction blocks appeared in this district. The avenue that bears the same name as the neighborhood is a very important artery of the city. Both neighborhoods have a mixed-use profile, featuring commercial, business, and residential functions. Notably, some of the most important office buildings are located here. Their urban morphology is characterized by high block density, which reflects a high level of built-up area and limited open space. Two construction blocks have been selected in these neighborhoods.

3.2. Methodology

The total solar radiation is determined by the sum of direct, diffuse, and reflective radiation. In this study, total solar radiation has been taken into consideration to quantify solar access, which refers to the availability and potential for solar gain. To assess the variation in solar gain, specific points were selected based on their immediate urban environment. The orientation and characteristics of the nearby urban environment are major factors influencing solar access on a building façade. Moreover, these two parameters (obstruction and sky opening) also vary depending on the height of the point on the façade.

In this study, the sky opening (or sky view factor) has been retained to define the effects of the close environment on the results of solar access. The Sky Opening, also known as the Sky View Factor (SVF), is a quantitative measure of the visible portion of the sky. It is expressed as the ratio of the unobstructed sky area visible from the point of interest to the total visible area of the hemisphere above it, as described by Canan (2017). The SVF ranges from 0 (no visible sky) to 1 (completely unobstructed sky) (Lyu, Buccolieri & Gao, 2019).

SVF is a crucial metric in solar access analysis in urban areas, as it affects the amount of the total solar radiation received by the location. The more unobstructed sky visible from a point, the more direct and diffuse solar radiation it can receive. On the other hand, the use of this parameter requires some attention. The SVF should not be analyzed as an isolated parameter (Krüger, 2011). The orientation of the studied point affects the result of the solar gain. Two points that are oriented differently but have the same SVF value will have unequal solar gain results. This is due to the differentiation of the solar path in the visible sky. The visible solar trajectory of a point varies according to the urban morphology (obstruction) but also according to the orientation. The visible solar path defines the duration of sunlight and therefore affects the amount of direct solar gain received by a point.

The determination of solar access, sunlight duration, and sky opening was carried out with Townscope software. Townscope calculates the total solar radiation from a point on a surface and can separately calculate direct, diffuse, and reflected radiation. The total solar radiation for each hour between 7:00 AM and 5:00 PM was obtained for representative days (December 21st, March 21st, June 21st, and September 21st) using records from the Konya provincial meteorological station. Clear sky conditions were assumed for the calculations of solar radiation. The diffuse radiation calculation assumed a perfectly isotropic sky luminance distribution. The surface reflection coefficient of the building façades was assumed to be 0.30, representing the average value for the buildings in the city of Konya. 3D urban models of the selected areas were created and imported into the Townscope software. In the initial stage of the analysis, the total solar radiation values were calculated for the predetermined points on building façades. To draw conclusions, comparisons were made between the total solar radiation values calculated for these points. The variation rates of total solar radiation values were determined based on the orientation, sky opening, and height. In the second stage, the relationships between total solar radiation values and the variables of sky opening and sunlight duration were investigated. Mathematical models were developed to estimate the total solar radiation values (dependent variable) using the sky opening and sunlight duration variables (independent variables).

4. Findings and Discussion

4.1. Solar Access Analysis on the Building Façade

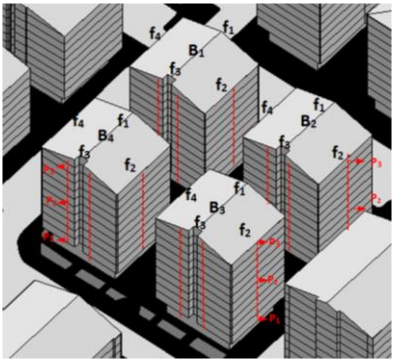
The aim is to calculate the Total Solar Radiation (TSR), Sunlight Duration (SD), and Sky View Factor (SVF) of the selected points on different façades.

4.1.1. Analysis in the Nişantaşı Neighborhood

The 3D model and photos of the selected area and construction blocks are shown together in Figure 3. Three points at different heights were placed along an axis at the center of each façade to determine the gradual changes in solar radiation values, sunlight duration, and sky opening, as shown in Figure 4. Given a large number of possible evaluations, only typical points were selected to obtain significant conclusions, as presented in Table 1. The typical points selected on the building façades aim to demonstrate the significant differences in solar access, sunlight duration, and sky openings (SVF). They were chosen to highlight differences on the same façade by height and changes on the same height due to orientation and nearby surroundings.

a b

Figure 3. The 3d model (a) and the aspect photo (b) of the selected area (Nişantaşı)



P1 = 7.40 m (at the window level on the 1st floor)

P2 = 19.40 m (at the window level on the 5th floor)

P3 = 34.40 m (at the window level on the 10th floor)

Exemplary classification for determining a point:

B1_F1_P1: Point P1 on the façade F1 of the building B1

B3_F2_P3: Point P3 on the façade F2 of the building B3

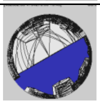
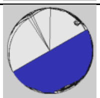
Figure 4. Determination of the points at different heights for the analyses (Nişantaşı)

Table 1. The selected points for the analysis in the Nişantaşı neighborhood

Same orientation and different heights (effect of the height).	
B1_F1_P1: North-East orientation.	B3_F3_P1: South-West orientation.
B1_F1_P2: North-East orientation.	B3_F3_P2: South-West orientation.
B1_F1_P3: North-East orientation.	B3_F3_P3: South-West orientation.
Same height, different orientation, and nearby environment (effect of orientation and nearby environment).	
B1_F1_P2: North-East orientation.	
B1_F2_P2: South-East orientation.	
B1_F3_P2: South-West orientation.	
B1_F4_P2: North-West orientation.	
Effect of orientation in 4 different buildings.	
B1_F1_P2: North-East orientation.	
B2_F2_P2: South-East orientation.	
B3_F3_P2: South-West orientation.	
B4_F4_P2: North-West orientation.	
Same orientation but different nearby environments (Height: 7.40 m, 1st floor). The effect of the nearby environment is analyzed in two different cases. All points are at the same height.	
B4_F3_P1: South-West orientation.	
B1_F3_P1: South-West orientation.	
B4_F1_P1: North-East orientation.	
B1_F1_P1: North-East orientation.	

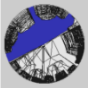
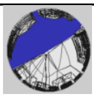
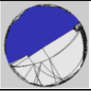
The façade 1 (F1) of building 1 (B1) has a northeast orientation. On December 21st, it was observed that the 10th floor (h=34.40m) receives 87% more TSR (total solar radiation) compared to the 1st floor (h=7.40m). Similarly, the 5th floor (h=19.40m) receives 30% more TSR compared to the 1st floor (Table 2). These gains in solar energy are diffuse and reflected as there is no direct radiation. The varying heights and neighboring buildings create obstacles, resulting in significant differences in solar energy gain along the northeast-facing façade (Table 2).

Table 2. Determination of the height effect on the total solar radiation (TSR). Same orientation, different heights. The building B1 is selected with a northeast orientation

Points	Received Total Solar Radiation (TSR, wh/m^2)				Sunlight Duration (SD, in hours and minutes)				Sky Opening (SVF, %)	
	21/12	21/03	21/06	21/09	21/12	21/03	21/06	21/09		
$B_1\_F_1\_P_1$ (h=7.40 m)	215	581	1108	623	0:00	1:36	2:54	1:42		%55.2
$B_1\_F_1\_P_2$ (h=19.40 m)	281	801	1583	851	0:00	2:00	3:39	2:03		%70
$B_1\_F_1\_P_3$ (h=34.40 m)	403	1376	2917	1533	0:00	2:42	5:21	2:48		%94.2

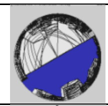
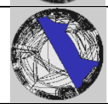
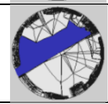
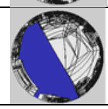
The solar access of the points on a south-facing façade is described in Table 3. The differences between the selected points are particularly pronounced for December 21st on surface 3 (F3) of building 3 (B3). There is a 280% difference in TSR between the 1st and 10th floors and a 171% difference between the 1st and 5th floors. On June 21st, the differences are minimal, with only a 95% difference between the 1st and 10th floors in this orientation, as all points receive direct radiation. In densely built areas, it is evident that points at different heights on buildings receive unequal intensities of solar radiation. The distribution of TSR on floors, even for the same orientation and façade, is strongly influenced by the nearby environment. The height and position (relative to the study points) of neighboring elements significantly affect the TSR.

Table 3. The solar access of the points for a south-facing façade

Points	Received Total Solar Radiation (TSR, wh/m^2)				Sunlight Duration (SD, in hours and minutes)				Sky Opening (SVF, %)	
	21/12	21/03	21/06	21/09	21/12	21/03	21/06	21/09		
B_3_F_3_P_1 (h=7.40 m)	777	1451	1678	1652	2:12	4:45	8:18	4:54		%56
B_3_F_3_P_2 (h=19.40 m)	2110	2298	1776	2429	5:39	7:09	8:24	7:09		% 70.2
B_3_F_3_P_3 (h=34.40 m)	2954	2835	2120	2863	8:09	8:42	8:12	8:42		%93

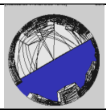
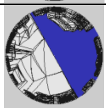
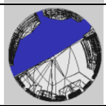
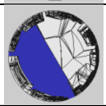
All orientations of the façades of Building 1 (B1) were analyzed at a height of 19.40 meters (5th floor) within the built environment. The effect of orientation and the nearby environment on TSR was determined (Table 4). Based on the results obtained (Table 4), the points B1_F1_P2 (Northeast) and B1_F4_P2 (Northwest) have almost identical sky openings, allowing for a direct understanding of the orientation's effect. Despite the close proximity of the eastern orientations, differences in TSR can be observed. Compared to the B1_F1_P2 point (Northeast), the B1_F4_P2 point (Northwest) receives 55% more TSR on December 21. This point is slightly more advantageous as it receives direct solar radiation, unlike the B1_F1_P2 point. The B1_F3_P2 point, despite its southwest orientation, does not receive direct solar radiation due to surrounding obstacles (in winter). Even though this orientation is considered good for the city of Konya, the surrounding buildings prevent direct solar flux penetration on a critical day. On June 21, the proportional differences are found to be less significant.

Table 4: The effect of the orientation and the nearby environment in the B1 building

Points	Received Total Solar Radiation (TSR, wh/m^2)				Sunlight Duration (SD, in hours and minutes)				Sky Opening (SVF, %)	
	21/12	21/03	21/06	21/09	21/12	21/03	21/06	21/09		
B_1_F_1_P_2 (h=19.40 m)	281	801	1583	851	0:00	2:00	3:39	2:03		%70
B_1_F_2_P_2 (h=19.40 m)	255	620	1497	651	1:24	2:09	3:52	2:09		%45.2
B_1_F_3_P_2: (h=19.40 m)	175	1100	1592	1199	0:00	4:12	8:39	4:18		%48.6
B_1_F_4_P_2: (h=19.40 m)	437	1051	1781	1041	1:39	2:57	4:18	3:03		%72.6

The analyses presented in Table 5 demonstrate the effect of building façade orientations on four buildings located on the outer edges of the construction block. The sky openings for all four points are almost identical (70%). On December 21st, the point B2_F2_P2 (Southeast) and the point B3_F3_P2 (Southwest) receive a significantly higher amount of TSR compared to the two other points oriented toward the northwest and northeast. The greatest difference on December 21st is observed between the point B3_F3_P2 (Southwest) and the point B1_F1_P2 (Northeast), with an approximate difference of 651%. Despite having a similar sky opening, the point B1_F1_P2 does not receive direct solar radiation, while point the B3_F3_P2 receives it for 5 hours and 39 minutes. On March 21st, the difference between these two points is 187%. In the summer, on June 21st, the largest difference occurs between the point B2_F2_P2 (Southeast) and the point B1_F1_P2 (Northeast). The point B2_F2_P2 receives 139% more TSR compared to the latter.

Table 5: Effect of the orientation in four buildings

Points	Received Total Solar Radiation (TSR, wh/m^2)				Sunlight Duration (SD, in hours and minutes)				Sky Opening (SVF, %)	
	21/12	21/03	21/06	21/09	21/12	21/03	21/06	21/09		
$B_1\_F_1\_P_2$ (h=19.40 m)	281	801	1583	851	0:00	2:00	3:39	2:03		%70
$B_2\_F_2\_P_2$ (h=19.40 m)	1756	2742	3791	3249	2:06	5:57	7.09	6:00		%70
$B_3\_F_3\_P_2$ (h=19.40 m)	2110	2298	1776	2429	5:39	7:09	8:24	7:09		%70.2
$B_4\_F_4\_P_2$ (h=19.40 m)	367	1311	1760	1225	0:00	4:03	4:18	4:09		%72

The analyses presented in Table 6 were conducted to demonstrate the effect of the nearby built environment. The selected points are located on the first floor (7.40m) of the building façades, all with the same orientation. The immediate surrounding environment has a significant impact on the TSR values of these points (Table 6). Factors such as the distances between neighboring construction blocks, the width of the streets, and the heights of neighboring buildings affect directly the results.

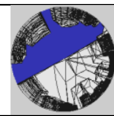
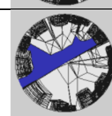
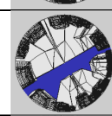
The analysis conducted on the south-west orientation (points B1_F3_P1 and B4_F3_P1):

The point B1_F3_P1 is oriented toward the southwest and faces the inside of the construction block. On December 21st, it does not receive direct solar radiation, resulting in a total solar radiation (TSR) of 118 Wh/m2 for the day. Similarly, the point B4_F3_P1 is also oriented toward the southwest but faces the outside of the block. The width of the streets, distance between construction blocks, and the location and height of neighboring buildings all influence the TSR results of these points. On December 21st, compared to point the B1_F3_P1, the point B4_F3_P1 has a TSR value that is 633% higher. The TSR difference between the two points is 103% on March 21st, 25% on June 21st, and 121% in September. Both south-west oriented points exhibit considerable percentage differences in TSR. The built environment outside the block offers greater advantages for solar access.

The analysis conducted on the north-east orientation (points B1_F1_P1 and B4_F1_P1):

The Point B1_F1_P1 is oriented towards the northeast and faces the outside of the construction block. Conversely, the point B4_F1_P1 is also oriented towards the northeast but faces the inside of the construction block. Sky openings are larger for the points facing the outside of the construction block, while the environment within the block reduces the sky opening for building facades. On December 21st, the point B1_F1_P1, benefiting from a larger sky opening, receives 65% more TSR throughout the day compared to the point B4_F1_P1, which is oriented towards the inside of the construction block. This difference is 42% on March 21st, 62% on June 21st, and 38% on September 21st.

Table 6. Same Orientation but different close nnvironment (Nalçacı)

Points	Received Total Solar Radiation (TSR, wh/m²)				Sunlight Duration (SD, in hours and minutes)				Sky Opening (SVF, %)	
	21/12	21/03	21/06	21/09	21/12	21/03	21/06	21/09		
B_4_F_3_P_1 (h=7.40 m)	866	1603	1651	1826	2:09	5:03	8:33	5:15		%59.2
B_1_F_3_P_1 (h=7.40 m)	118	789	1318	825	0:00	3:03	6:39	3:00		%33.6
B_4_F_1_P_1 (h=7.40 m)	130	408	683	450	0:00	0:48	1:39	1:00		%32
B_1_F_1_P_1 (h=7.40 m)	215	581	1108	623	0:00	1:36	2:54	1:42		%55

4.1.1. Analysis in Nalçacı neighborhood

At the urban scale, the "Nalçacı" zone presents a variety of obstructions, with urban spatial voids largely obstructed by building alignments (Figure 5). The distribution of densities is quite unequal, with certain dwellings benefiting from good sky exposure and orientation, while others do not.

The Selection of the buildings and the points for the analyses in the Nalçacı neighborhood is shown in Figure 6 and Table 7. Table 8 shows the effect of the height on TSR and SD.

a b

Figure 5. The 3d model (a) and the aspect photo (b) of the selected area (Nalçacı)

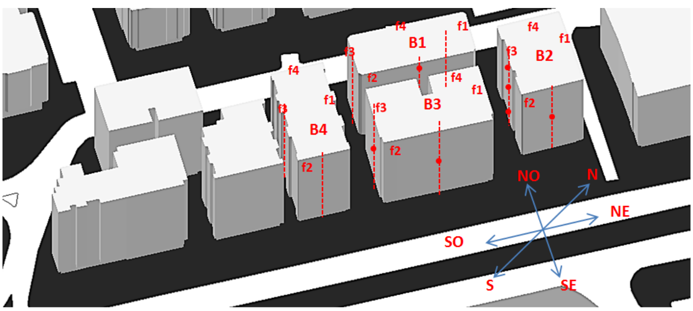


Figure 6. Determination of the points at different heights for the analyses (Nalçacı)

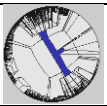
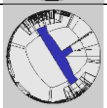
The results obtained at the points B1_F2_P1 and B1_F2_P2 (Table 8): The TSR values are higher in December, March, and September at the point B1_F2_P1, which is at a lower height (5.20m), compared to the point B1_F2_P2 (17.20m). The results are influenced by the higher reflection value at the point B1_F2_P1. The diffuse radiation, which is

109 Wh/m2 at the point B1_F2_P2 (17.40m), is significantly higher than the point B1_F2_P1 (5.40m), which is 7 Wh/m2.

Table 7. Selection of the buildings and the points in the Nalçacı neighborhood

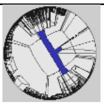
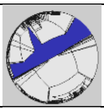
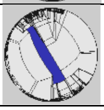
B1_F2_P1	(h=5.40 m)	South-East	Significant masking effect on the SE façade of building B1, façade: (B1_F2). The analysis was carried out to determine the solar access according to the heights.
B1_F2_P2	(h=17.40 m)	South-East	
B1_F2_P3	(h=35.40 m)	South-East	
B1_F2_P2	(h=17.40 m)	South-East	Determination of solar accesses at the same height according to different orientations in a very dense urban context.
B2_F3_P2	(h=17.40 m)	South-West	
B3_F4_P2	(h=17.40 m)	North-West	
B4_F1_P2	(h=17.40 m)	North-East	
B3_F2_P1	(h=5.40 m)	South-East	Determination of solar access on opposite façades: very limited sky view factor and unobstructed sky view factor. Solar access was studied on the façades facing the avenue and the obstructed side, taking into account the difference between the obstructed and unobstructed areas, as well as the orientation.
B3_F2_P2	(h=17.40 m)	South-East	
B3_F2_P3	(h=35.40 m)	South-East	
B3_F4_P1	(h=5.40 m)	North-West	
B3_F4_P2	(h=17.40 m)	North-West	
B3_F4_P3	(h=35.40 m)	North-West	

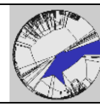
Table 8. The effect of the height on TSR and SD (B1, F2)

Points	Received Total Solar Radiation (TSR, wh/m^2)				Sunlight Duration (SD, in hours and minutes)				Sky Opening (SVF, %)	
	21/12	21/03	21/06	21/09	21/12	21/03	21/06	21/09		
B1_F2_P1 (h=5.40 m)	146	301	437	332	0	0:48	0:48	0:48		9.4 %
B1_F2_P2 (h=17.40 m)	116	263	547	173	0	00:42	02:18	00:57		19 %
B1_F2_P3 (h=35.40 m)	2440	2935	3386	3714	5:42	6:18	7:09	6:36		86 %

The analysis conducted in Table 9 aimed to determine the variations in TSR values among the points located at the same height in the dense urban texture, where the obstacle effect is high and SVF values are low, based on different directions. The largest difference in TSR values on December 21st was observed between the point B2_F3_P2 (southwest direction) and the point B3_F4_P2 (northwest direction). Due to the higher SVF value and appropriate direction, the point B2_F3_P2 had a significantly higher TSR value compared to the point B3_F4_P2, with a difference of 1948%. Similarly, comparing the TSR values of the point B3_F4_P2 (northwest direction) and the point B1_F2_P2 (southeast direction), which had similar SVF values, highlighted the impact of direction more accurately. On December 21st, the TSR value of the point B1_F2_P2 in the southeast direction was 213% higher than the point B3_F4_P2 in the northwest direction. The values for other seasons are provided in Table 9. The Points with low SVF values and unfavorable directions do not receive direct solar radiation. This can be observed by examining the "sunlight duration" values. The Points with a sunlight duration of zero can still benefit from solar energy gain through reflection and diffuse radiation, although these values are quite low.

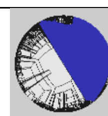
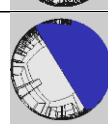
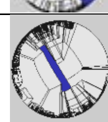
Table 9. TSR values of the points located at the same height in the dense urban texture

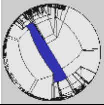
Points	Received Total Solar Radiation (TSR, wh/m^2)				Sunlight Duration (SD, in hours and minutes)				Sky Opening (SVF, %)	
	21/12	21/03	21/06	21/09	21/12	21/03	21/06	21/09		
B1_F2_P2 (h=17.40 m)	116	263	547	173	0:00	00:42	02:18	00:57		19 %
B2_F3_P2 (h=17.40 m)	758	1044	1532	1161	2:45	3:00	5:42	3:00		42.6 %
B3_F4_P2 (h=17.40 m)	37	141	297	145	0:00	0:48	1:12	0:48		17.4 %

B4_F1_P2 (h=17.40 m)	248	303	453	343	0:00	2 02	1 :45	2:01		27.4%

In Table 10, the TSR values of all points on the two opposing surface orientations (F2 and F4) of Building B3 were analyzed. The significant differences in TSR values between the two façades at various heights can be observed. There are significant differences between all points on the two opposite façades: an unobstructed view with a southeast orientation (F2) and a northwestern façade with significant obstruction (F4). At the first-floor level (5.20 meters), there is a difference of 4617 Wh/m2 in solar access between the point B3_F2_P1 (unobstructed view, good orientation) and the point B3_F4_P1 (poor orientation, significant obstruction).

Table 10. TSR analyze in all points of the two opposite surface orientations (F2 and F4) of the B3 building

Points	Received Total Solar Radiation (TSR, wh/m^2)				Sunlight Duration (SD, in hours and minutes)				Sky Opening (SVF, %)	
	21/12	21/03	21/06	21/09	21/12	21/03	21/06	21/09		
B3_F2_P1 (h=5.40 m) SE	4691	4813	4405	5761	6:48	7:21	7:21	7:21		93.6 %
B3_F2_P2 (h=17.40 m) SE	4643	4768	4686	5699	6:51	7:21	7:48	7:21		97.2%
B3_F2_P3 (h=35.40 m) SE	4684	4851	4930	5775	6:51	7:21	7:51	7:21		%99
B3_F4_P1 (h=5.40 m) NW	74	160	313	183	0:00	0.00	0:54	0:36		%8.8

B3_F4_P2 (h=17.40 m) NW	37	141	297	145	0:00	0:48	1:12	0:48		% 17.4
B3_F4_P3 (h=35.40 m) NW	395	1232	2081	1139	2:09	3:51	5:30	3:51		%90

4.2. Relationships Between Variables and Model Generation

In the present study, data on total solar radiation, sunlight duration, and sky openings were collected from 25 different points on building façades in two neighborhood of the city. Sunlight duration and sky openings have a significant impact on the total solar radiation received. A wide range of total solar radiation values was obtained, enabling the establishment of correlations between the dependent variable (total solar radiation, TSR) and the independent variables (sunlight duration, SD, and sky openings, SVF).

The relationships between the dependent variable (TSR) and the two independent variables (SD and SVF) were separately analyzed using regression for all seasons. Firstly, the relationship between total solar radiation (TSR) and sunlight duration (SD) was examined. Secondly, the relationship between total solar radiation (TSR) and sky opening (SVF) was investigated (Figure 7).

The distribution of points in a set can influence the type of relationship and the choice of the appropriate regression model. In both categories of analysis, the distribution of points on the graphs allowed for the creation of exponential and linear regressions. Both types of regression are shown on all graphs (Figure 7). The linear regression model is presented in Equation 1, while the exponential regression model is presented in Equation 2 (Figure 7). For all seasons, the relationship between TSR and SVF variables could be more robustly explained by exponential regression models than linear regression models. Regarding the relationship between TSR and SD variables, apart from the winter seasons, exponential regression models provided the best explanation for the relationships in all other seasons. The obtained exponential regression models can establish the relationship between the variables with some precision. Based on the results, exponential models can provide more appropriate predictions.

It was determined that the predictive power of the models produced to determine the relationships between TSV-SVF and TSR-SD varied according to the seasons. The explanatory power of the models can be classified based on the R^2 values (coefficient of determination). By considering the R^2 values, the predictive power of the models produced for each season can be classified. A higher R^2 value indicates a better fit, suggesting that a larger proportion of the variability in the dependent variable is explained by the independent variables. In other words, the independent variables have a greater impact on the variation in the dependent variable. Conversely, a lower R^2 suggests that the model does not capture much of the variation in the dependent variable.

The strongest relationship between TSR (dependent variable) and SVF (independent variables) was observed during the summer season, while the weakest relationship was identified during the winter season.

$R^2_{\text{(Summer)}} > R^2_{\text{(Spring)}} > R^2_{\text{(Autumn)}} > R^2_{\text{(Winter)}}$

The strongest relationship between TSR (total solar radiation; dependent variable) and SD (solar duration; independent variables) was observed during the spring and summer seasons, while the weakest relationship was identified during the summer season.

$R^2_{\text{(Spring)}} > R^2_{\text{(Autumn)}} > R^2_{\text{(Winter)}} > R^2_{\text{(Summer)}}$

Except for the summer season, it is observed that predicting TSR (total solar radiation) using SD (sunlight duration) is more suitable for all seasons. In other words, for the winter, spring, and autumn seasons, the use of TSR-SD models would be more appropriate for estimating TSR. In TSR-SD models, TSR results are influenced by environmental obstacles as well as the daily sun path and orientation. When the SVF values are taken into account, orientation and the sun's path are ignored. However, the obtained TSR-SVF models do not have very low predictive power and can still be used. In this sense, the best result was determined for the summer season.

Multiple regression models were attempted to predict TSR for each season. In other words, the predictability of TSR using two independent variables (SVF and SD) was investigated. Good R-squared values were found for each model. The R-squared values for the winter, spring, summer, and autumn seasons were determined as 0.83, 0.79, 0.70, and 0.74, respectively. However, the P value of one of the independent variables in each season was not significant (P > 0.05), which means the results were considered statistically insignificant. Therefore, the equations corresponding to these models were not included in the study.

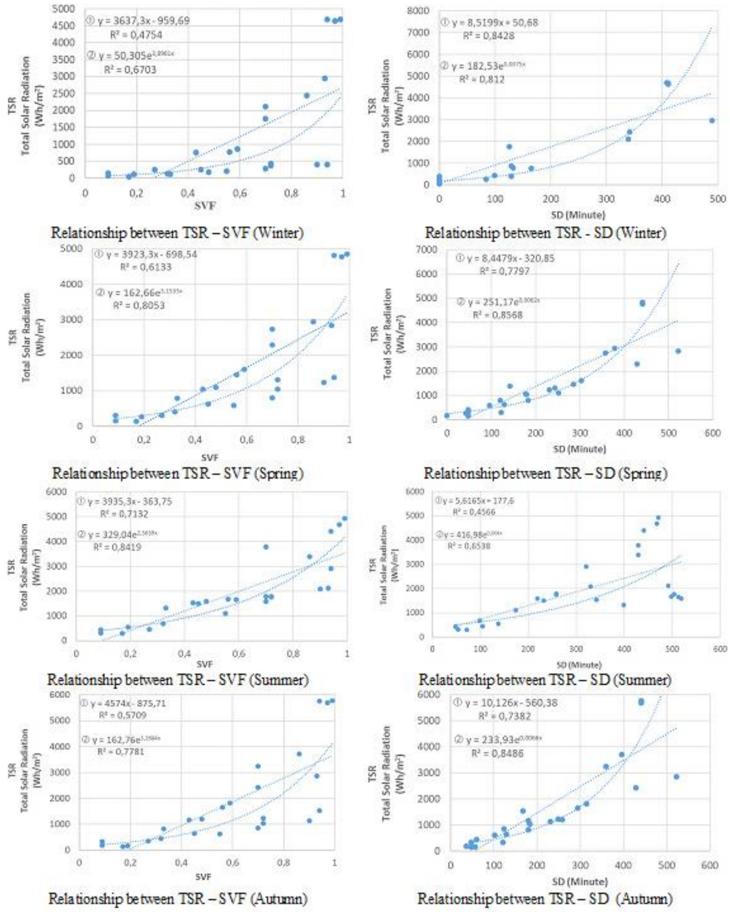


Figure 7. Relationship between TSR-SVF and TSR-SD in all seasons

4. Conclusion and Suggestions

Among renewable energies, solar energy has great potential for use in cities. Firstly, urban surfaces can be utilized to obtain solar energy. The utilization of solar energy in urban areas is only possible if sufficient solar access is ensured. To demonstrate the impact of the urban context on solar gain potential, various points on the façades of buildings in the city of Konya, Turkey, were selected. The obtained results significantly demonstrate the effects of obstacles, height, sunshine duration, and orientation on the TSR (total solar radiation) of a point on the façade. On the same façade, the TSR obtained at different points is closely correlated with their respective heights. In summer, on the façade of building B1 (Nişantaşı), the TSR at the highest point (34.40m) was 2.63 times higher than at the lowest point (7.40m). Conversely, during the analyses in the Nişantaşı neighborhood, on December 21st, with nearly identical sky openings of two buildings, the effect of orientation was significant. The difference between the point B3_F3_P2 (southwest) and the point B1_F1_P2 (northeast) was approximately 651%. The obtained results also demonstrated that good orientation alone is not sufficient. The sky view factor (SVF) is an important parameter that highlights the effects of obstacles on solar gains. Additionally, it is crucial to consider sunlight duration (SD) simultaneously. This is because the duration of sunshine varies based on the orientation of the studied façade.

It was found that Total Solar Radiation (TSR) varies as a function of Sky View Factor (SVF) (sky opening) and Sunlight Duration (SD). The prediction models for TSR were obtained using linear and exponential regression. The relationship between TSR and SVF variables could be more robustly explained by exponential regression models in all seasons. Apart from the winter season, in all other seasons, the relationships between TSR and SD were also best explained by exponential regression models. Predicting TSR (total solar radiation) using SD (sunlight duration) is more suitable for the winter, spring, and autumn seasons. On the other hand, for the summer season, predicting TSR using SVF is much more convenient.

From the perspective of sustainable development, it is necessary to establish common strategies between the architectural and urban scales if energy-efficient buildings, districts, and cities are to be planned. This subject concerns architects, town planners, landscape architects, and, above all, municipal authorities.

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Sustainable Matrix Relationship Between Green Infrastructure Applications and Ecosystem Services

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1. Introduction

In the changing world order, many balances of nature have been disturbed. This balance has many factors such as changing human needs, increasing population rate, urbanization, increasing technological uses. Many studies are being carried out to prevent and stop this deterioration and to minimize its damages. These studies vary from country to country. Each country develops strategies according to its own climate and geographical conditions. Humankind can solve these problems with rational and realistic planning and design approaches and goals in harmony with nature.

These solutions have been handled with approaches such as ecological city, cittaslow, Nature Based Solutions, sustainable city, smart city, resilient city, etc. In each approach, livability was sought with similar principles. These strategies scientifically intersect with "green infrastructure (GI)" practices (Onur & Gülpinar Sekban 2021; Onur & Gülpinar Sekban, 2022; Gülpınar Sekban, et al., 2019).

Green infrastructure (GI) designs, strategies developed with the aim of restoring the natural balance of urban parts whose order or balance is disturbed, the continuity of their features and strengthening their connection to the city are supports. Green infrastructure applications can be said to be urban green networks in a different way. These green networks allow the creation of natural and semi-natural areas for many habitats around the world, which are beneficial in ecological, economic and social areas. These practices provide to the conservation of biodiversity by increasing the balance and resilience of the ecosystem (Naumann et al., 2011; Gülpınar Sekban et al., 2019).

Green infrastructure uses tanks to collect rainwater in buildings and hard floors, while in natural areas biodiversity and soil are used to handle rainwater where it becomes. Vegetative elements are of great importance in design to make the sustainability of rainwater and facilitate infiltration with the water collection strategy (Dereli & Cay, 2020; Gülpınar Sekban & Acar, 2021a). The European Commission explained the concept of green infrastructure in its statement as follows (European Environment Agency, 2015);

- It is a solution that makes ecological, economic and social advantages with solutions based on nature,
- It helps to understand the benefits that nature offers to human beings,
- Mobilizes sustainable and developing investments (European Environment Agency, 2015);

Green infrastructure encompasses all green areas in the inner city, suburbs and natural areas as a whole, without distinction between private and public areas such as wetlands, woodlands, wildlife habitats, national parks, farms, greenhouses, parks, gardens and small green patches. The green infrastructure network is; considers these ecosystems and landscapes as habitat foci, in connection. In this direction, green corridors and links are created and connections are made with green areas. Connections are made to parts of the green area that have remained in the construction. This ensures ecological continuity (Ahern, 2007; Benedict & McMahon, 2006; Gülpınar Sekban & Düzgüneş, 2021; Gülpınar Sekban & Acar 2023).

1.1. Advantages of Green Infrastructure Applications

The advantages of green infrastructure applications are many. These benefits are on humans and ecologically. Within the frame of the study, the benefits were analyzed in 2 groups. These are some of psychological benefits and ecological benefits.

Table 1. Benefits of green infrastructure

Psychological benefits	Reduces of stress Contributes to childhood development. Allows recreational activities Supports welfare Enables positive thinking Regulates heart rhythm Provides mental development
Ecological benefits	Absorbs of rain water Support high air quality Supports biodiversity Shelter for animals Supports pollination Holds carbon. Provides shade Reduces the heat island effect

10 basic criteria for green infrastructure applications have been put forward (Benedict & McMahon, 2006; Parlak, et al., 2022). These criteria are presented in Table 2.

Table 2. 10 criteria of green infrastructure applications (Benedict & McMahon, 2006)

10 Criteria of Green Infrastructure Applications	
1.	Connectivity must be taken into account.
2.	Content is key.
3.	For implementation, the green infrastructure content should be scientifically designed and made in accordance with land use planning and practice.
4.	Green infrastructure applications should be a common framework by considering conservation and development decisions.
5.	Before development, green infrastructure should be established and designed. Afterwards, these decisions should be preserved.
6.	Green infrastructure work must be financed in advance.
7.	Green infrastructure should be considered to benefit nature and people.
8.	Consideration should be given to the needs and wishes of green infrastructure landowners and other partners.
9.	Green infrastructure should link with activities within the community.
10.	Green infrastructure should bring long-term returns.

1.2. Relation of Green Infrastructure Applications with Ecosystem Services

Plants, animals, and other living organisms are impacted by climate change. Climate change affects the habitats of these creatures. This change is a risk to biodiversity, ecology and ecosystems. In this reason climate changes the system and perform of ecosystems. It provides that natural circulation contribute to association (Díaz et al., 2019). Finding the effect of ecological feedback makes human communities to better prevent these changes and make suitable as needed (Weiskopf, et al., 2020).

Ecosystem services have many interactions with green infrastructure applications. Within the scope of this study, it has been made under 4 main headings: improving air quality, support climate regulation, contributing to pollenization and water management (Coşkun Hepcan, 2019).

1.2.1. Improving air quality

Air pollution has become a common problem of many cities today. Air pollution is among the factors that reduce the property of life of people and increase the risk of catching many diseases. There have been many scientific studies on this relationship in the world (Remy et al., 2011; Lelieveld et al., 2015; Xing et al., 2016; Yang et al., 2020; Guercio at al., 2022; Zhu et al., 2023; Nielsen et al., 2017; Tomson et al., 2021; Xue et al., 2022). An important part of the studies are on the pollution caused by the emission of harmful particles and gases of the fossil fuel used for heating / cooling (Romanello et al., 2022; Rezaei Sadr et al., 2022). Among these gases, the most important gas responsible for 60% of the climate change impact is Carbon Dioxide-CO_2 (Lukac et al., 2010; Özsoy, 2023). PM2,5 and PM10 are very fine particles and affect the heart and respiratory tract (Xing et al., 2016; Yang et al., 2019; Yang et al., 2020; Cui et al., 2022; Zhu et al., 2023), Carbon monoxide-CO reduces the oxygen rate in the human body (Saxena & Naik, 2019). Polluted air causes many health problems, especially respiratory and cardiovascular diseases. People living in cities have a higher incidence of these disorders. Especially the elderly and children are at risk in these disease groups (Coşkun Hepcan, 2019).

1.2.2. Support climate regulation

Many cities in the world experience natural disasters due to climate change. The decrease in green areas is among the main reasons for this. Green areas are amongst the most important developments that can reduce the impact of climate crisis in cities. Green spaces are very important in the resist to climate change.

Because urban landscape areas; They make shadow, water retention and vaporization opportunities by diminishing the urban heat island effect in cities. Heating demands makes a breeze and coldness effect on vegetated surfaces on sunny days. It balances the temperatures held by the heat islands. Filters out harmful components, carbon and pollutants (APA, 2007). Balances heating and cooling load. Thus, it reduces the amount of energy consumed for heating and cooling. This provides economy in energy.

Green spaces are an important factor in controlling urban temperatures. Plants, especially trees, affect the climate of their environment (Coşkun Hepcan, 2019).

1.2.3. Contributing to pollenization

Animals are among the most affected living groups in the disturbed balance. The benefits of "animals", which are a very important part of living spaces and ecology, are quite high. Pollenization is an important part of this setup. The presence of green areas on the ecosystem contributes to "pollenization" as well as providing shelter for the fauna. In this change, the died out or deduce of biodiversity, plants also affects pollenization. As a result, this means that the distribution areas of the species that provide important ecosystem services are changing, the ecosystems are deteriorating and the services they provide are also decreasing or disappearing. This is a chain.

Ecosystems are the life support systems of living things. These are the natural formations that will be most affected by temperature increases with the biological richness they contain in this system. These changes damage many habitats and habitats and reduce ecosystem services from natural ecosystems (Çepel & Ergün, 2002; Aksoy & Arslan, 2022).

1.2.4. Water management

Global economic and population growth causes many problems related to water resources. Changing water standard has become one of the most common problems in the world. Water quality problems cannot be considered inseparable from sustainable economy strategies. Consequently, for the sustainability of the ecosystem, water resource quality must be improved through appropriate, optimum wastewater management. Can set and monitor wastewater contaminant levels (Yang et al., 2023).

In this case, the role of ecosystem services is very high in order to supply the management and continuity of water (Pearlmutter et al., 2021; Bekar et al., 2020; Gülpınar Sekban 2022a; Gülpınar Sekban, 2022b). Undoubtedly, every measure taken is already a parameter of ecosystem services.

1.3. Research Aim

The main objectives of the study are listed as follows:

- Emphasizing the main objectives and benefits of the green infrastructure concept,

- Evaluating these designs through applied studies,

- To be able to demonstrate the relationship between sustainable design approach and green infrastructure practices with examples.

For these purposes, green infrastructure applications are discussed with various inquiries made in the field of landscape architecture. In line with these inquiries, results suitable for the purpose of the study were obtained.

2. Findings

As a result of the researches, it is seen that ecosystem services, green infrastructure applications and sustainable studies are actually a whole. The common goal of each is to ensure a better ecological future. The largest overarching concept goes in the form of sustainable practices, ecosystem services and green infrastructure practices. We can say that they are applications that support each other. Applications that each serve the same purpose. In line with the literature information researched within the scope of this study, some examples focusing on the relationship between green infrastructure and sustainability were examined.

Through these examples, their objectives and application diversity have been revealed.

Park Royal Singapore: It is a design practice located at Park Royal Singapore that addresses green infrastructure applications and ecosystem services. As examined in Figure 1, it provides savings in heating and cooling, thanks to the roof garden and water infiltration at 1 point, shaded transition areas at 2 points, and vegetation applied at 3 and other places. At the same time, this effect is supported by the water element and waterfalls in the region 4. In practice, 50 different plant varieties were used. At the same time, different shade-loving plants are included in order to adapt to the changing shade angles of the sun. All plants in zone 3 and all other plants absorb heat, create a shadow effect and evaporative transpiration increases air quality (Figure 1) (URL-1, 2).

Figure 1. Park Royal Singapore (URL-1)

Chulalongkorn University Centenary Park: Due to increased urbanization, Bangkok has been gone down by two centimeters each year. Instead, it is being converted into a public park. The park is the first part of critical green infrastructure (GI) with green infrastructure and ecosystem services to reduce harmful ecological problems and the risk of urban flooding. Applications are designed by taking advantage of the power of gravity. It can co-operate, risk and absorb water sustainably to reduce urban flood hazards in all areas. Not even a single drop of rain planned on a sloping ground is wasted. Applications include many ecological approaches, including a green roof, wetlands, detention grass, and holding pond. Rain, currents have established a complete water circulation system (Figure 2) (URL-3).

Figure 2. Chulalongkorn University Centenary Park (URL-3)

Haikou Meishe River Greenway and Fengxiang Park: It provides recycling of the water drainage system with its green sponge system. The blocked waterway was reconnected to the ocean to allow the tides to re-enter the city. Pedestrian routes are designed especially for the circulation of pedestrians. With this project, flora and fauna were brought back to the area. For example, the fish came back, the birds came again. The project is a very successful project in terms of many features such as nature-based solutions, water recovery is not provided, and it creates an environment for fauna. Water standart is preserved and supported as much as possible (URL-4).

Figure 3. Haikou Meishe River Greenway and Fengxiang Park (URL-4)

3. Conclusion and Suggestions

Green infrastructure is essential for a sustainable life. Both are inseparable from each other. The protection and development of the green tissue and its maintenance are realized through green infrastructure systems. In cities and regions, the many benefits of implementing green infrastructure plans will be reflected in areas where we exceed. Many studies show this result effectively when compared before and after the application. For example, after the implementation of the Haikou Meishe River Greenway and Fengxiang Park project, the return of birds and the return of fish is a very important result. This result actually shows how important the moves to be made are for nature.

Especially its effects on air quality have been proven by many studies. As stated in all stages of the study, it is seen that green infrastructure applications are in a win-win dilemma (Hewitt et al., 2020; Nieuwenhuijsen, 2021). For example, while keeping the city away from some harmful pests, it provides shelter for many faunas.

In order to turn ecosystems into sustainable resources, projects for green infrastructure systems should be implemented. While making these applications, it should be designed in a way that will ensure the connection of the users with the green area texture. Planning and design decisions should be such that they cover and affect the whole city.

While doing all these, walking paths that will provide different recreation opportunities for the user should be planned and designed.

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Detecting Spatio-Temporal Trends of Urban Heat Islands in İzmir City Metropolitan Area: Space-Time Cube Approach

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1. Introduction

The Urban Heat Island (UHI) effect, characterized by higher temperatures in urban areas compared to the surrounding rural areas, is a well-known phenomenon observed in many cities worldwide leading to significant socioeconomic and environmental hazards. Previous research revealed that UHI is increasing in urban zones, particularly in zones lacking cooling water surfaces and green spaces since the evaporation effect of water bodies and green spaces. Besides, the distribution of UHI in these zones is dynamic and varies over time. Recent approaches like Space-Time Cube (STC) have revealed that UHI can exhibit persistent and intensifying trends in certain zones, while its influence may decrease in others (Deng et al., 2023).

Space-time cube analyses have been widely applied in various fields to explore trends and dynamics. For instance, wildfire trends in six cities (Lemoine-Rodríguez et al., 2022), to predict future wildfires in California (Moanga, 2020), to examine the impact of mining and drought in China (Xu et al., 2021), to visualize archaeological events in Puerto Rico (Santiago, 2008), to study air pollution in Houston, Texas (Fang & Lu, 2011), to identify emerging roadkill hotspots on Korean expressways (Kim & Lee, 2023), Covid-19 cases (Mo et al., 2020) and to analyze spatiotemporal narratives of Christopher Nolan's film Dunkirk (Miles, 2019).

However, less attention is paid to understanding the spatial dynamics and spatiotemporal aspects of urban heat by space-time cube analyses. The study by Deng et al. (2023) is a pioneering paper that focuses on urban heat and by applying space-time cube analyses for the relatedness between the urban heat and the urbanization in the Guangdong-Hong Kong-Macao greater Bay area of China, for the period of 2000-2020.

With these regards, this study aims at uncovering the time-varying spatial patterns of UHI in urban areas, focusing on the Izmir metropolitan area. The STC approach is utilized to analyze the temporal and spatial characteristics of urban heat for providing valuable insights to policymakers and decision-makers for the development of urban heat stress mitigation policies. By utilizing and applying the STC approach, the results yielded by this research are persistent and intensifying UHI hot spots and the regions where the UHI influence is decreasing over time (cold spots) in order to contribute to UHI resilient urban environments.

The next section belongs to the literature review, in section 3 the study area is explained, in section 4 data and the methodology is discussed, section 5 belongs to the findings and discussion, and section 6 concludes.

2. Literature Review

The STC framework is useful to integrate spatial and temporal dimensions of the data for enabling a comprehensive understanding of the dynamics and trends embedded in the spatial data. The ability to uncover the dynamics and trends embedded in the spatial data makes STC analyses a valuable tool for analyzing the complex and multilayered interactions between space and time in different spatial data categories and for different urban settings. Further research with the tools like STC can provide a more complex understanding of the spatial temporal patterns of urban heat and contribute to the development of effective strategies for urban planning and mitigation of heat-related fragility in expanding dense urban areas. Besides, public resources are limited and tools like STC also can provide a strategic allocation of scarce sources to the zones that need urgent interventions and priority (Deng et al., 2023).

Inostroza et al. (2016) claim that South American cities are expanding at an average rate of 20 m^2 per minute. It would not be wrong to accept that the growth pattern in cities worldwide is faster nowadays which leads to increasing urban heat in urban environments. This trend leads to cities serving as persistent and intensifying hotspots for urban heat islands since the transformation of natural environments (water, land, vegetation) into developed urban settings, including infrastructure, residential areas, roads, industrial zones, airports, and other impermeable surfaces. Rapid urbanization and its impact on the natural environment require the implementation of UHI-sensitive urban planning strategies for reducing the vulnerability of the urban zones and adopting more resilient urban environments across the cities. Urban planning science has a unique responsibility for improving the quality of life and reducing the adverse effect of UHIs in poorly planned and disorganized urban areas. Therefore, the adoption of resilient urban planning approaches is essential to mitigate the negative impacts of UHIs in rapidly growing poorly planned urban settings.

Dai et al., (2018) suggest that urban heat islands (UHIs) have a significant impact on life quality and increase health risks. During peak periods, UHIs can be particularly dangerous and even result in loss of life (Shedrian, 2004; Semenza, 1996; Robine et al., 2008; Revich, 2011). Exposure to high levels of heat stress can lead to increasing energy consumption for the cooling effect of the air conditioners which in return air conditioners can increase the energy consumption and lead to more global warming. The more global warming, the more air conditioning as a cycle lead to the emergence of the trends of urban heat in cities like persistent and intensifying urban heat zones. The relatedness between urban heat stress exposure and rapid urbanization and lack of land use reduces the urban heat stress by the cooling effect can reduce the life quality of the inhabitants and all living organisms and can lead to mortality (Li et al., 2018).

Some studies indicated the mortality effect of UHIs in different parts of the world. Sheridan (2004) reported approximately 10,000 deaths in the U.S. in 1980. Semenza (1996) reported the loss of 700 lives in Chicago in 1995. Robine et al. (2008) reported the death of 70,000 people across Europe during the summer of 2003. Similarly, Revich (2011) noted that 54,000 people lost their lives during the summer of 2010. The New York Times (2018) and The Japan Times News (2018) reported that 25 people died in Tokyo between July 17 and 25, 2018, while 57,534 individuals were affected by heat-related illnesses during that same summer, highlighting the increasing impact of heat stress.

These dramatic examples highlight the urgent need for UHI-sensitive urban planning approaches that can effectively address, mitigate, and reduce the impacts of UHIs. As urban planning plays a crucial role in shaping the future of cities, it has the potential to provide high-quality, resilient urban environments for city inhabitants. Implementing UHI-reducing urban planning strategies is essential for adaptation and enhancing the resilience of cities. By applying these strategies, urban plans can be designed to create resilient and less vulnerable urban environments.

Collaboration and cooperation among various stakeholders are key to reducing the adverse effect of UHIs in cities. Policymakers, urban planners, and decision-makers must work together with NGOs and community organizations to develop zone-specific mitigation strategies in urban planning processes. Once detected the mitigation strategies should differ in terms of whether the zone is intensifying or persistent regarding the urban heat. Adopting zone and category-specific UHI-sensitive urban planning approaches can address and reduce the detrimental effects of UHIs.

Numerous studies in the literature have focused on understanding urban heat islands (UHIs) in a static manner, considering factors such as land use, urban vegetation, and building footprints (Petralli et al., 2014; Tang et al., 2017; Weng et al., 2007). These studies approached to the existence of urban heat in cities as that urban heat is homogenously distributed in areas lacking cooling water surfaces and green spaces. However, cities are complex and consist of dynamic systems and sub-systems, and the spatial accumulation trends of urban heat are constantly evolving across the cities.

New approaches reveal that urban heat tends to persist and intensify in certain areas over time, while the impact of the urban heat is decreasing in other areas, particularly in cold spots.

In line with the discussion so far, this study applies the STC approach to examine the spatial patterns of urban heat in the urban areas of the Izmir metropolitan region. This study aims at providing insights into the time-varying spatial trends of urban heat islands in cities.

We use data for the city of Izmir. Izmir is a Mediterranean port city on the west coast of Turkey. İzmir City is characterized mainly by the fast-growing urban environment, increasing population, and unequal spatial distribution of urban heat stressors. And surely, the city has differing city forms and urban morphologies across its built-up boundaries. Studying the spatiality of urban heat stress in İzmir provides some advantages, initially, it is a Mediterranean city that has hot summer seasons exceeding 40 ^{o}C. It is growing more than the national average and similar size cities across Europe will host further heat stress in the near future. In this regard, we discussed the dynamics of the study area in the next part.

3. Study Area

The study area covers the metropolitan zone of the city of Izmir in Turkey which consists of 12 districts located at the core of the metropolitan region. Çiğli, Karşıyaka, Bayraklı, Bornova, Konak, Balçova, Narlıdere, and Güzelbahçe. districts are located around the Gulf of Izmir. These districts have a cooling effect since their proximity to the gulf and the coastal environment. On the other hand, the four districts, namely Bornova, Karabağlar, Buca, and Gaziemir, are not directly adjacent to the sea and these districts are the most populated districts of İzmir.

The city of Izmir exhibits a unique urban form characterized by a linear design that extends parallel to the Mediterranean Sea. This urban layout is shaped by a coastline and mountains, creating a distinctive spatial pattern in which the coastline and mountains shape the city's texture.

Additionally, the Gulf of Izmir has a key role in the historical development of the city and its land use (Erdem et al., 2021).

Figure 1 illustrates the location of Izmir city and its spatial determinants. A better understanding of the form and texture of İzmir city including land use management, and infrastructure development may reveal the differing urban heat stress trends across the city and may help decision-makers to develop zone-specific mitigation strategies.

Izmir has long been a port city, playing a pivotal role in its economy and development, primarily driven by trade. In addition to its rich historicity, the city underwent a transformative shift towards a Western-oriented paradigm following the establishment of the new republic. As a result, Izmir has consistently emerged as one of the most expanding cities in Turkey, particularly along the Mediterranean coast, offering rich opportunities for trade, tourism, industrial growth, and attractive prospects, especially for residential and commercial investments (Erdem et al., 2021).

As of 2019, the city of Izmir boasted a population of 4.36 million, in 2023 the population of the city increased to more than 4.5 million. More than 3 million residents of the population of İzmir city inhabit the study area, accounting for a significant three-fourths of the total population. The urban landscape of Izmir is shaped by four distinct development axes (Erdem et al., 2021).

The first axis is the north development axis. This axis involves differing types of residential areas, well-structured industrial zones, fertile lands, and natural reserves and protection areas. The second axis, located in the eastern part, involves major industrial zones, universities, and residential neighborhoods (Erdem et al, 2021).

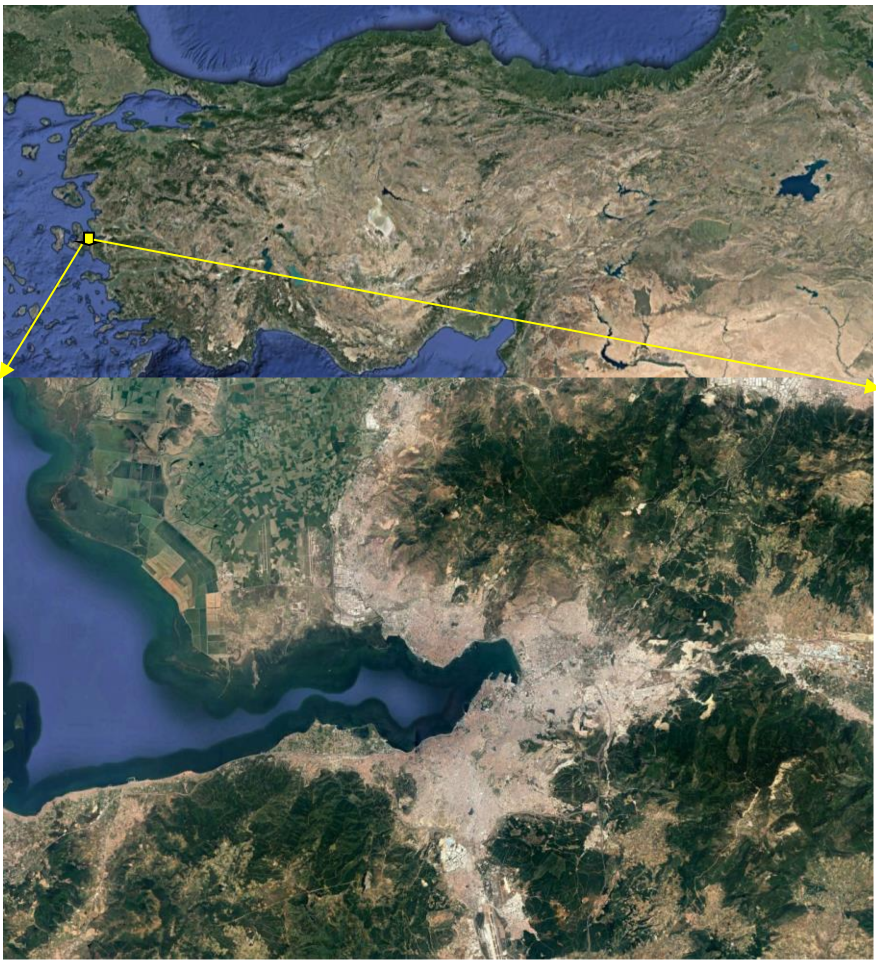


Figure 1. Study area İzmir city (Google Earth, 2023)

The third axis is the south development axis. This axis involves heat stress generator land uses and urban elements such as the international airport, "free" industrial zone, and commercial and residential areas. Lastly, the western axis is distinguished by its tourism zones, low-density residential areas, and agricultural lands (Erdem et al., 2021).

A harbor, central business district, historic town center, and the ancient city of Smyrna form the urban fabric at the center of the city. The texture of the city consists of these land uses involving diverse land utilization, greenery and parks, and a complex urban morphology, resulting in varying levels of heat stress across the zones of the city. The growth rate of Izmir is more than the national average and more than the similarly sized cities in Europe, which the Izmir city will host higher urban heat stress near future. In these regards, the emergence, and adverse consequences of Urban Heat Islands (UHIs) undoubtedly pose a significant predicament for the city's sustainability and well-being not only for Izmir but for all cities around the globe (Erdem et al., 2021).

4. Data and Methodology

4.1. Data

The Land Surface Temperature (LST) data is produced by processing an image-based methodology. The image-based remote sensing techniques to create and analyze LST data are extensively used in the literature. This study focuses on quantifying Urban Heat Islands (UHIs) using LST data derived from the four summer months for four years (12 images) of Landsat-8 imagery sourced from the United States Geological Survey (USGS). The selection of these specific images is driven by various factors.

The USGS provides freely accessible imagery data with a resolution of 30 meters, offering free and detailed spatial information. Utilizing images from summer months is preferred due to their provision of more reliable temperature data compared to colder seasons. Additionally, images from summer months offer advantages such as reduced cloud cover and minimal blurring, higher image quality, and resolution for remote sensing applications (Erdem et al., 2021).

Vegetation plays a crucial role during summer as it reaches its peak density, resulting in a significant canopy effect. Conversely, urban areas experience reduced greenery and water bodies, leading to diminished heat absorption and intensified heat effects (Erdem et al., 2021).

Considering limitations in image availability, the study employs twelve images from June, July, and August spanning 2019 to 2022. By using images from three months for four years we aim at approaching the urban heat stress of İzmir City as the comprehensive examination of temporal and spatial LST trends.

Land Surface Temperature

The calculation of Land Surface Temperature (LST) involves an image-processing method using the ArcGIS 10.7 environment. The guidance on deriving LST from satellite imagery is well documented in the literature. The process begins by transforming the thermal infrared bands of the satellite images into radiation values at the top of the atmosphere (TOA). These TOA values are then converted into Satellite Brightness Temperature, taking into account band-specific rescaling factors. After calculating the satellite brightness temperature, the Land Surface Temperature is further adjusted to account for the emissivity of the landscapes. This correction ensures a more accurate representation of the true land surface temperatures.

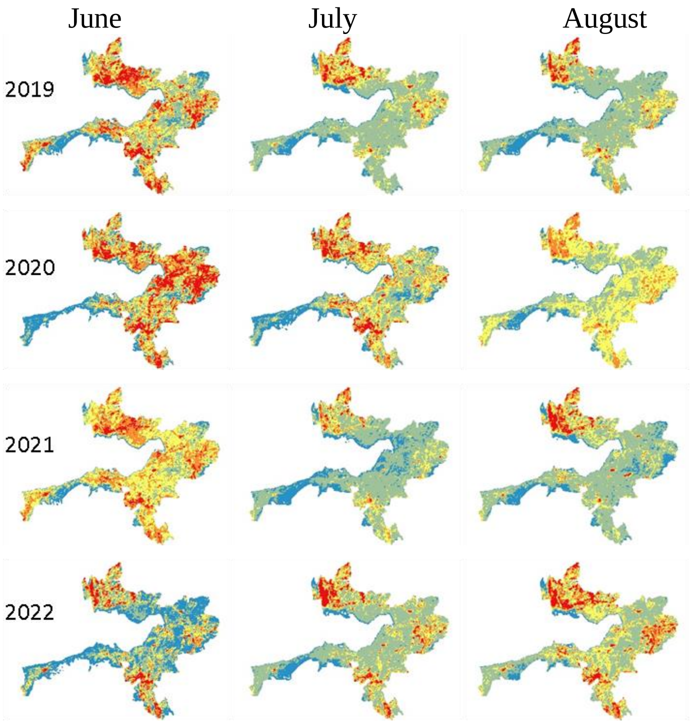


Figure 2. Land surface temperature map of İzmir city

The entire process is repeated for 12 iterations, analyzing images captured over four years. The resulting LST data is obtained by combining the temperature from all 12 images within the study area (Figure 2). The range of LST values obtained from the images reflects the temperature variations observed, spanning from 23.57 °C to 42.26 °C (For a more detailed understanding of the algorithms and equations employed in the calculation of surface temperature please see Erdem et al. (2021)).

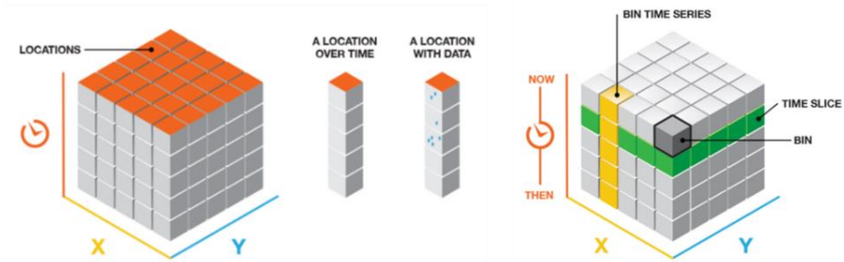
4.2. Space-Time Cube Analysis

The data related to urban heat, containing both its spatial and temporal aspects, is processed and organized into spatiotemporal bins. These bins are stored using the NetCDF (Network Common Data Form) format within the space-time cube (ArcGIS Pro, 2023a). In this case, the spatiotemporal bins represent specific locations and time intervals, allowing for the aggregation and analysis of urban heat data. Each bin is defined by its spatial dimensions (*x* and *y*) and its temporal dimension (*t*), which determine its fixed position within the STC (ArcGIS Pro, 2023a). In cases where bins overlap spatially, they are assigned a shared location ID. This enables the integration of overlapping bins into a time series, capturing the complete temporal evolution of urban heat in a specific location (bin). The count value assigned to each bin reflects the frequency of events or records occurring within that location during the designated period (ArcGIS Pro, 2023a).

It provides an accurate measure of the intensity or occurrence of urban heat, processing in the analysis and understanding of its spatial and temporal patterns and processing the STC and NetCDF format facilitates the urban “big” heat data (ArcGIS Pro, 2023a). The three-dimensional STC provides examination and extraction of the relevant information for the analyses. This capability provides a comprehensive understanding of the spatiotemporally of urban heat, involving insights into its distribution, trends, and dynamics across the city.

Figure 3-A displays the structure of a space-time cube and the time and space dimensions of the bins. Thanks to the time and space-variated distribution of the heat for 12 samples, the analyses can capture the spatiotemporal trends of the urban heat for each bin. This is important since the ability to observe and analyze urban heat patterns and changes over time can help spatial planners and policymakers to perform urgent actions against urban heat stress. Figure 3-B is from the samples of the tool and Figure 3-C is the sample of the space-time cube that is applied for water leaks for the water utility in White House, Tenn.

Using the STC and NetCDF format, researchers can accurately analyze the spatial and temporal characteristics of heat and heat stress, gain a deeper understanding of data change and data behavior, and come up with more consistent and locally specific solutions for the future (ArcGIS Pro, 2023a).



(A)

(B)

(C)

Figure 3. A - Structure of space-time cube (ArcGIS Pro, 2023a), B and C samples of space-time cube (ArcGIS Pro, 2023b; Russell, 2023)

The local outlier analysis method, when applied to the study of urban heat and other fields, has a strong power to assess the data clustering and identify outliers. Its power is based on the Kernel Density Estimation in both spatial and temporal dimensions. By adding spatial measures such as neighborhood distance and time series measures like time step neighborhood parameters specific to urban heat analysis to the estimation process, this method can capture the statistically significant spatiotemporal locations within the research area and its immediate surroundings.

The core of the analysis is based on the Space-Time Kernel Density Estimate, which is represented by Equation 1 (We adapted Equation 1 from (Nakaya and Yano, 2010)).

$$\hat{f}(x,y,t) = \frac{1}{nh_s^2 h_t} \sum K_s \left(\frac{x-x_i}{h_s}, \frac{y-y_i}{h_s}\right) K_t \left(\frac{t-t_i}{h_t}\right) \qquad (1)$$

in this equation *f(x,y,t)* represent the density estimate at a particular location (*x*, *y*, *t*). The variable *n* denotes the number of events, while h_s and h_t are the spatial and temporal bandwidths parameters, respectively. The estimation is carried out using the spatial kernel function K_s and the temporal kernel function K_t (For more information please see Nakaya & Yano, 2010).

By applying this equation, the method estimates the data density in both the spatial and temporal dimensions. It quantifies the concentration or extension of urban heat within specific spatiotemporal bins. This allows the detection of areas with high or low heat densities across the cities. The detection of the clusters, where the higher urban heat is densely concentrated and where the lower urban heat is densely concentrated, reveals the variety of the urban heat stress emerging across the cities (Nakaya &Yano, 2010).

Therefore, Space-Time Kernel Density Estimate allows for the identification of statistically significant spatiotemporal locations where urban heat is highly concentrated or deviates from average patterns. These are the clusters of intense urban heat, such as urban heat islands, or cold spots, where lower urban heat is concentrated (Nakaya & Yano, 2010).

Of course, the detection of the clusters is not sufficient solely for reducing the effect of urban stress in cities. Once the clusters are detected, more detailed analyses should be done for uncovering the cooling effect embedded in the zones. Cities are approached by some schools as complex living organisms. It is not possible to model every determinant of the complex living organisms in the estimations. However, thanks to advanced statistical tools like STC like big data, machine learning, etc. researchers can gain valuable insights into the spatial and temporal characteristics of urban heat by urban planning, and environmental management with climate change mitigation efforts.

5. Findings and Discussion

The analysis of emerging hot spots reveals important and significant results for the trends of the urban heat in İzmir city. This analysis examines the clustering patterns of point densities in bins for providing insights into the concentration and spatial variations. And detects the clusters of hot and cold urban heat.

The Emerging Hot Spot Analysis tool processes time-varying spatial urban heat data. This tool employs the Getis Ord statistic to assess each individual bin within the space-time cube. The analysis considers the Neighbourhood Distance and Neighbourhood Time Step parameters when applying Kernel Density Estimation to determine the clusters (Gates, 2017).

The detection of hot and cold spot trends is based on the Mann-Kendall test. This test detects the persistence of the trends over time and determines whether they exhibit increasing, decreasing, or persistent patterns by combining the statistical analyses, a comprehensive understanding of the spatial and temporal patterns of emerging hot spots can be obtained (Gates, 2017).

The results of the analysis are presented using seventeen distinct (for more information on the categories of the analysis please see (ArcGIS, 2023) categories for avoiding the oversimplification of the results into a few categories. This approach provides a detailed categorization of the statistical significance of hot or cold spots and the observed trends at each location over time. Thanks to this categorization and statistical significance of the clusters allow for a comprehensive assessment of the distribution and dynamics of urban heat within İzmir City.

Figure 4 displays the results of the emerging hot spot analyses applied to the urban heat of İzmir. The results of these analyses are remarkable, revealing that urban heat is not evenly distributed throughout the city but rather concentrated in specific hubs. This spatial concentration of urban heat highlights the presence of urban heat islands, where certain areas experience significantly higher temperatures compared to their surroundings. The emergence of hot spots within these areas indicates localized and persistent and intensifying concentrations of high urban heat.

Furthermore, the analysis uncovers that the concentration of urban heat is not static, but rather dynamic over time. These suggest variations in the intensity and spatial distribution of urban heat, which may be influenced by factors such as land use, vegetation cover, and anthropogenic activities of the urban settings in cities. Understanding these spatial and temporal persistent trends is crucial for effective urban planning, climate change mitigation, and adaptation strategies.

As expected, the cold spot bins, including new cold spots, intensifying cold spots, and persistent cold spots, tend to cluster along the west development axes of İzmir City. This pattern can be attributed to factors such as winds, water bodies, and land cover characteristics that contribute to cooler temperatures in these areas. Three main hot spot clusters appeared as the results of the emerging hot spot analyses (Figure 4). The persistent hot spot bins, intensifying hot spot bins, and new hot spot bins exhibit clear concentration along the north, east, and south development axes of İzmir City. These areas experience higher temperatures due to factors such as increased urbanization, industrial zones, and heat-absorbing surfaces.

However, what is particularly surprising is the scale of the hot spot clusters formed by a substantial number of hot spot bins. This indicates the existence of large urban areas with consistently high urban heat. These intense hot spot clusters may correspond to densely built urban areas, industrial zones, or areas involving limited green spaces and high anthropogenic heat emissions.

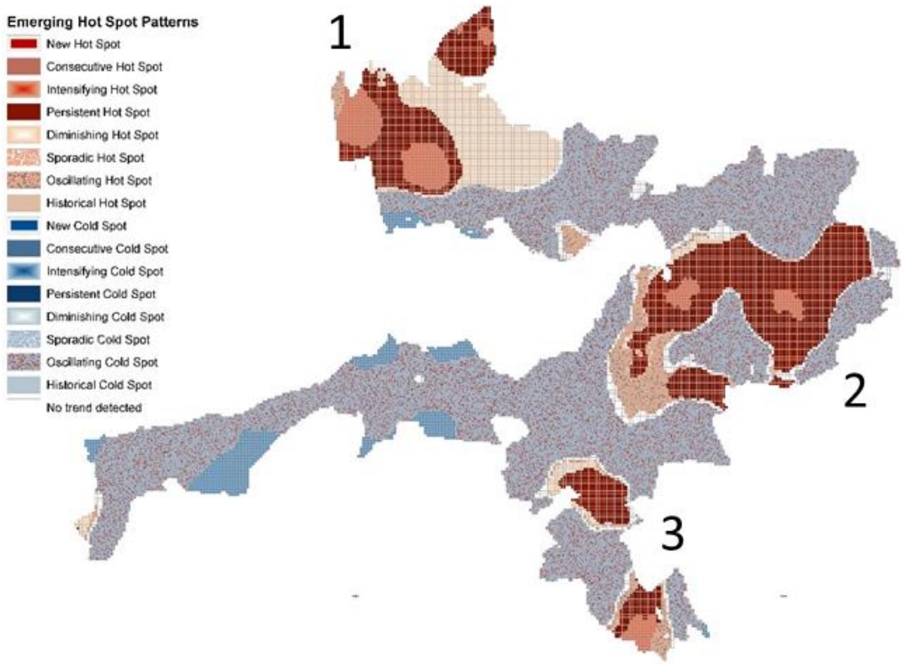


Figure 4. Time Space Cube Analysis of urban heat of İzmir city

Once the intensifying and persistent hot spots are detected, more attention should be paid to the temporal changes of the urban heat in clusters. The temporal changes in the clusters may give insights into the changes in the build-up areas. In short, there must be some spatial factors that trigger the heat trends in the hot spot, especially in intensifying hot spots and these spatial factors should be deciphered with detailed spatial and temporal analysis.

The results of the emerging hot spot analyses provide unique information for policymakers, urban planners, and stakeholders to develop policies fostering climate change adaptation and urban heat mitigation. By identifying and understanding the spatial and temporal dynamics of urban heat hot spots locally, place-specific strategies, and interventions can be developed to mitigate the adverse effects of high temperatures and improve the overall thermal comfort and livability of İzmir city.

Shorty, the analysis of the hot spots emerging in the city of Izmir using the space-time cube approach revealed significant results and information regarding the spatial and temporal patterns of urban heat. The dynamic patterns of urban heat are revealed. These findings may contribute to understanding of the heterogeneity of urban heat distribution and inform the decision-making processes that aim to manage and mitigate the effects of urban heat in İzmir.

6. Conclusion and Suggestions

The use of Emerging Hot Spot Analyses with space-time cubes provides valuable information about the distribution and dynamics of urban heat in the city of Izmir. The existence of UHIs has significant implications for the socioeconomic and environmental well-being of the city. As access to green spaces such as parks and recreation areas, water bodies are unevenly distributed. Besides, income inequalities especially those with low-income or poor backgrounds prevent many people from affordable access to air conditioning units and the cost of cooling becomes out of reach for those in the lower socioeconomic classes.

Results from emerging hot spot analyses with space-time cubes have the potential to provide critical information for the formulation of strategies aimed at reducing urban heat. These strategies can include initiatives to address spatial inequalities in green spaces and ensure equal access for all residents. Additionally, they can facilitate the implementation of affordable cooling solutions that meet the needs of low-income groups.

The analysis of emerging hot spots in Izmir reveals that urban heat is not evenly distributed across the city but is concentrated in specific areas consistently with the results of Deng et al. (2023). The identification of these hot spots provides critical information for prioritizing interventions and allocating resources to areas with the highest heat stress.

Many spatial and social factors can play a critical role in the formation of the intensifying and persistent hot spots in İzmir City. Morphological factors like sky view factor, the volume of the footprints of the buildings, urban settlement density, type of residential areas, height and closeness of the buildings, continuity, width, and length of the roads, the shape and size of parking lots without green design elements like trees and etc., the volume of surface cover, the volume of land cover, the canyon effect, the urban greenhouse effect, the anthropogenic heat derived from the industrial areas, and other urban design parameters can lead to or increase the effect of the heat stress in cities. Further research should be done for uncovering the spatial dynamics that are embedded in these hot spots.

By focusing on these hot spot areas, policymakers can implement targeted measures to reduce the negative impacts of UHIs, such as increasing green spaces, improving building insulation, and implementing cool roof initiatives.

What we learned from the İzmir case in this study is urban heat tends to intensify and be persistent in zones involving industrial areas or closer to the industrial areas, and lack of urban green areas. Closeness to the seashore for these zones is not a factor that is able to reduce the effects of urban heat.

The space-time cube approach allows for a comprehensive assessment of the temporal dynamics of UHIs in Izmir. By analyzing the spatial and temporal patterns of heat distribution, policymakers can identify areas where UHIs are becoming more persistent and intensifying, as well as areas where their influence may be decreasing. This knowledge is crucial for adaptive urban planning, as it helps anticipate future heat-related challenges and devise appropriate strategies to address them.

Using the space-time cube approach, we aim to show the urgency of developing policies that act against the impact of urban warming in Izmir. Through this study, policymakers and city planners in Izmir can gain a deeper understanding of the spatial and temporal patterns of UHIs, enabling them to implement targeted strategies to reduce heat-related challenges and improve the urban environment.

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The book section complies with national and international research and publication ethics.

Author Contribution and Conflict of Interest Declaration Information

The book section has a single author and there is no conflict of interest.

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Sustainable Approaches in Urban Furniture Design

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1. Introduction

The sustainability approach, which requires the protection and development of resources in an environmental, social, and economic framework, is expressed as "meeting human needs without harming the ecosystem" and "the ability to maintain valuable things or qualities in the physical environment" (Zeren & Nakıboğlu, 2009). A sustainable society or ecosystem needs to be able to continue its function without uninterrupted deterioration or overloading the main resources that are vitally connected with the system (Sarıkaya & Kara, 2007). Sustainability, which is a concept aimed at meeting the needs of both today and future generations, is important in terms of ensuring continuity in all areas of life (Tuğluer & Çakır, 2021; Kutlu et al., 2022). In the field of design, sustainability has been introduced in order to minimize the environmental impact of the product, and then it has become a design phenomenon that will cover the entire life cycle of the product.

According to McDonough & Braungart (1992), sustainable design is the conceptualization and realization of an environmentally responsible and responsible expression as part of nature's evolving matrix. According to Brooker and Stone (2012), sustainability in design means "… the use of natural resources and materials without destroying these resources in an unnecessary and wasteful way". Sustainability also aims to maximize environmental quality while minimizing negative effects on the natural environment (McLennan, 2004; Hatipoğlu, 2021). Sustainable design is a subject that concerns every aspect of life today, and it is a subject that is examined at various scales, from product design to interior design, from architectural design to urban design.

The city is an area consisting of a combination of spaces, such as "a puzzle that is considered unfinished when its parts are missing and has to complete its own dynamic cycle with the increase in the needs of the city residents" (Akyıldız, 2020). In line with the actions carried out in the city, urban-scale planning and design studies are diversified. Urban comfort and quality of life should be considered when designing urban areas at city scale (Tuğluer & Çakır, 2019). In studies comparing climate parameters, it has been observed that urban areas have different climate types compared to rural areas (Metin & Çağlak, 2022). The concept of sustainability, which has been mentioned frequently, especially with the effects of globalization has an important place in the design of urban areas. Sustainable urban solutions, which are included in the livable city phenomenon, include criteria such as creating a balance between the natural, rural, and urban environments and increasing the environmental quality (Whitehead, 2003; Hatipoğlu & Ak, 2020). The phenomenon of urban sustainability is one of the most challenging and rapid solutions that humanity frequently encounters today. The compliance of the urban equipment in the common areas of the city with sustainability criteria and identity is very important in terms of the meaning and role of the city.

The concept of sustainability, which was based on the "Report of Our Common Future" in 1987, became an approach in which the developmentalist ideology of the 1960s and the environmentalist ideology of the 1970s were compiled and developed under the umbrella of a consensus (Tekeli, 1996). Sustainable developments aim to change the quality of life by stimulating growth, increasing resources, and ensuring that the environment and economy are involved in the decision-making process to produce ecological solutions for a permanent world (UN, 1987). These ecological solutions, which include social, economic, environmental, and institutional dimensions, include developments that ensure the continuity of the natural environment (Arkun, 2020; Metin & Gül, 2020). Although these developments vary according to priorities and perspectives, they represent a common critical struggle. The perspective of the future, green and eco concepts, environmentalist, and sustainable definitions of the short, medium, and long-term plans within the scope of the city is now up-to-date (Şatır, 2015). In short, sustainability is the constant movement of a situation without the need for change (Aras, 2019).

Open public spaces, which are shown as the heart of the city, providing communication and interaction for society, should be designed with the advantage that they can be integrated into the built environment. Open public spaces, which are popular with their ability to solve or reduce many negative environmental problems, have turned into a fast and powerful movement for urbanism today with their potential social and spatial benefits (Akyıldız, 2020). In order for this movement to have a positive outcome, it is important that the urban equipment, which helps to meet the functional, physical, psychological, etc. needs in urban areas, provide a sustainable balance. The design of urban equipment, which is necessary for the livability of urban areas, is very important.

Urban equipment is the element that responds to the needs of users such as comfort, entertainment, and information in urban areas such as streets, roads, squares, streets, parks, and gardens (Bekar, Konakoğlu, & Bulut, 2021). In other words, it is all of the objects that make urban areas functional or enable them to perform their functions as they should (Özaydın et al., 1991). In addition, in places surrounded by areas reserved for personal use, such as buildings and business centers, they are also important resources in terms of enriching the space by revitalizing it in terms of use and reducing the effects of spiritual pressure on the users of the unnatural environment (Aykut, 1997). Urban furnishings that facilitate the lives of the residents, provide and strengthen communication between the users, add aesthetic and functional meanings where they are used and define, limit, and complete the space (Bayrakçı, 1991) plays an important role in increasing the quality of urban life.

Urban equipment, which has been the subject of research by experts on the subject for many years, has been classified in various ways by different researchers according to their usage types, functions, technical equipment, decoration of public areas, and where they are located. Yıldızcı (2001) examined urban equipment according to their functions as "floor coverings, seating units, lighting elements, sign and information signs, limiters, water elements, top cover elements, sales units, artistic objects, playground elements, and other elements". On the other hand, Çubuk (1991) classifies urban equipmen according to the purpose of placement in the urban space as "protection, information, sign, decoration, accommodation, entertainment, play and rest, sale or shopping purposes".

Urban equipment, which is a pioneer in meeting its functional and aesthetic values, makes an important contribution to the formation of a sustainable environment as well as facilitating social life. In this study, it is aimed at investigating sustainable approaches to urban furniture design. As a result of the study, the importance of urban furniture that meets the physical and psychological needs of social life for a sustainable environment has been emphasized and the importance of material, durability, functionality, aesthetics and technology criteria in ensuring sustainability in urban furniture has been revealed.

2. Material and Method

The study, which investigates the effects and importance of sustainable approaches on urban furniture consists of three stages. In the first stage, a theoretical infrastructure was created by making a literature review on the concepts of sustainability, urban furniture and types of urban furniture. In the second stage, sustainability criteria were created for urban furniture designs, depending on the literature. In this context, sub-criteria in the studies on sustainability in spatial design, furniture design and product design were used. Based on all these, within the scope of the study, sustainability criteria in urban furniture design are discussed under five headings: material, durability, functionality, aesthetics and technology (Figure 1).

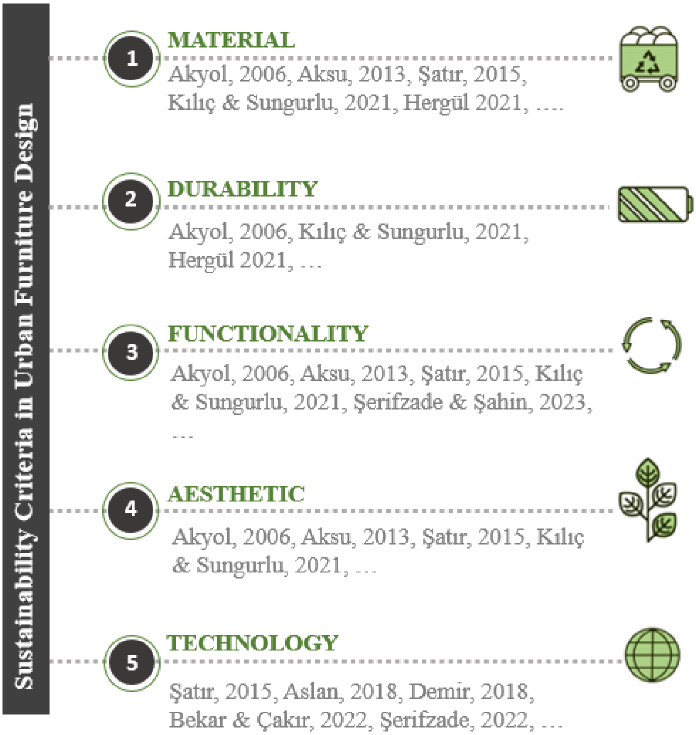

Figure 1. Sustainability criteria in urban furniture design

In the third stage, the concepts of material, durability, functionality, aesthetics and technology in the sustainability of urban furniture are explained through examples. Then, suggestions for sustainable approaches to urban furniture were presented.

3. Sustainable Urban Furniture and Design Principles

People are affected by the environment and places they live and their quality-of-life changes to this extent. In this context, urban equipment that helps meet the needs of the city is extremely important in providing a livable environment (Özgüç Erdönmez & Aslan, 2017). Urban furniture, which has users with many different characteristics such as age, gender, education, life view etc. is mostly fixed service equipment and structures for many different functions in all open spaces of a city. Urban furniture, with its many different rich features, consists of criteria to meet the developing and increasing needs of users as a result of a certain process (Bingöl, 2017). In order for urban furniture to make a difference and have a meaningful association with the environment, it must have a sustainable infrastructure and a conscious design system.

In order for furniture to be considered sustainable, it must have a positive relationship with the city, perform its function easily, provide high potential to the city, be produced from ecological and recyclable materials, be robust and reliable, be easily maintainable and be aesthetic (Kılıç & Sungurlu, 2021; Bekar & Kutlu, 2022). In this context, in the study, sustainability criteria in urban furniture design were investigated through the concepts of material, durability, functionality, aesthetics and technology and explained with examples.

3.1. Material

Sustainable materials are defined as materials that cause minimal damage to the environment and provide maximum benefit. The materials chosen are one of the most important criteria for a city to be described as sustainable. Ecological materials are described as healthy, durable, local, economical, recyclable and low-maintenance materials (Kılıç & Sungurlu, 2021). Considering the effect of climatic conditions on the organization of the space in design, direct fulfillment of purposes such as the efficient use of energy, water and resource flows are among the effects that make up the sustainable approach (Güney Yüksel & Kapritaş, 2019). The selection of materials according to sustainability principles not only reduces the negative effects of design on the natural environment but also increases energy efficiency, reduces operating, maintenance, and repair costs and provides healthy and comfortable environments for users (Güner, 2017). Material design is among the most important criteria affecting urban furniture design. The materials used in urban furniture designs should not contain harmful chemicals and should be sensitive to the environment and resource consumption. The type of material increases the visual quality as well as the functional benefit it provides. The material has a great impact on the product's ability to have the imagined features to produce it and thus achieve design intent (Aksu, 2012). The desired effect on the users and the weather conditions of the city should not be ignored in the selection of materials for urban equipment. Casting, drawing, bending and welding production methods are used with selected materials that can be permanent outdoors. The modular urban furniture produced by Enormo Studio using ceramic and metal materials is an example of the use of different materials (Figure 2).

Figure 2. Modular urban furniture (URL-1, 2023)

The psychological effects of the materials used in urban furniture on the users should not be ignored. For example, the wooden material used in urban furniture gives a sense of peace to the user and the visual and tactile richness of natural stone, while the ceramic material gives an invigorating effect on creativity and imagination (Aksu, 2012).

3.2. Durability

While choosing urban furniture, it is necessary to pay attention to the durability of the material used and the construction technique. Thus, it is ensured that it has a longer life, is not easily damage and is resistant to accidents and environmental factors. Therefore, before urban furniture is used, the materials and construction techniques to be used in the selected furniture should be thoroughly researched, experienced in use, registered and guaranteed by regional or international standardization institutions (Akyol, 2006).

Since urban furniture is used in public spaces by people with many different characteristics, it may be exposed to vandalism from time to time. Therefore, those are the factors that play an important role in the sustainable feature of urban furniture that can provide easy maintenance and repair. In order to prevent vandalism, urban furniture should be produced with materials mounted on a durable structure and mounted on the floor (Şatır & Korkmaz, 2005).

The urban furniture designed by Vestre, which defines itself as the first company to produce climate-neutral outdoor furniture, is an example of durability with its strong steel base and wood material design that can be assembled vertically or horizontally (Figure 3).

Figure 3. Vestre urban furniture design (URL-2, 2023)

3.3. Functionality

Functionality is one of the important factors in urban furniture design in achieving its purpose and providing ergonomic and comfortable use. Creating products suitable for user comfort conditions constitutes the basis of sustainability (Güney Yüksel & Seçer Kapritaş, 2019). The functionality of urban furniture is directly related to the sustainability of the design. Urban furniture, which can respond to functional requirements according to the space and its purpose, allows the sustainable use of both the space and the furniture. The criteria for determining the human relationship with any object forms the functional criteria. Human physical characteristics and movement characteristics are the most important design criteria for the design of all kinds of urban furniture (Zülfikar, 1998). In urban furniture design, functionally appropriate forms should be chosen (Aksu, 2012). Various examples of urban furniture designed according to its location and environment are given in Figure 4.

Figure 4. Examples of urban furniture designed in different environments (URL-3, 2023)

Another issue that increases the functionality of the furniture is that it can serve different functions besides its basic function and provide flexible uses for urban furniture. An example of this is 'Just a Black Box', designed by Max Boano and Jonas Prismontas. Furniture that is a semi-private seating area during the day can be transformed into a sideboard for commercial or public use at night (or when desired). The box transforms with its own hidden hydraulic system. Thus it becomes a customizable area that can be used for retail, cafes, ticket sales etc. (Figure 5).

Figure 5. “Just a Black Box” designed by Max Boano and Jonas Prismontas (URL-3, 2023)

3.4. Aesthetic

Urban furnishings are important for the city because of their characteristics that define, determine and customize their environment (Aksu, 2012). According to Vitruvius (2005), the success of a product is one of the most important criteria for the concept of aesthetics. A good urban furniture design should attract the attention and appreciation of the users and aim to leave a strong and memorable image. They should be designed in line with the principles of visual perception so that they can be easily perceived by individuals.

Although urban furniture meets the basic requirements and organizes the public space, it has the potential to support the urban identity or cause confusion with its design (Güneş, 2005). Adapting urban furniture to the environment will increase the quality of space by creating unique architecture for the city background (Şatır & Korkmaz, 2005). Thus, in the place where it is located, it is not only equipment but also an identity element of urban identity. The red phone booths, which have become iconic in England, are one of the most obvious examples (Figure 6).

Figure 6. Phone booths as an identity element in the UK (URL-4, 2023)

Texture, color lighting, layout, and graphic indicators are among the factors that enable the perception of urban furniture (Meriç, 2012). An aesthetically successful urban furniture design strengthens the communication between the user and the space. The psychological effects of colours, textures, lighting and other visual elements have a crucial impact on the lasting impression for visitors. In Figure 7, examples of urban furniture designs that are visually striking in their environment by being designed in various colors and forms are given.

Figure 7. Examples of furniture design in various colors and forms (URL-5, 2023)

3.5. Technology

Today, when technology is rapidly entering our lives, urban equipment used in urban areas and gives the city a functional and aesthetic identity. As a result of this, the effect of technological developments on urban furniture is seen. The use of smart technologies in urban furniture is seen as an important issue in terms of the quality of urban areas, sustainability and environmental effects (Bekar & Çakır, 2022). Smart city equipment, which supports the use of renewable energy sources, saves energy and displays an environmentally friendly approach. Following technological developments and integrating smart systems into furniture, in addition to design, facilitates the ability of urban equipment and spaces to respond to future needs.

The use of renewable energy sources in the design and use of urban furniture is becoming increasingly common. With smart devices, which are one of the necessities of daily life, and the need for charging units, charging units have started to be integrated into various urban facilities. Today, it is seen that features such as lighting elements, seating elements, garbage cans, etc. and urban equipment such as internet access, charging and rentable bicycle and vehicle stations have become widespread (Figure 8). Thus, a sustainable approach can be followed by increasing the quality of urban areas.

Figure 8. Smart bike rental unit (URL-6, 2023), smart information sign (URL-7, 2023), smart lighting elements (URL-8, 2023)

4. Conclusion and Suggestions

The rapid and unconscious consumption of resources maintains its importance in urban furniture designs as well as in all areas of design. The sustainability of products is only possible when considered at the design stage of the product. In urban furniture design, issues such as designing the furniture in the life cycle and beyond, considering the ecological elements, choosing the right material, making minimal use of materials, considering renewable energy sources, meeting the user's needs at the optimum level, being durable and long-lasting and making designs that can attract the attention of the user visually are among the requirements.

- When choosing urban furniture in urban areas, instead of choosing furniture used in all cities, the weather conditions and physical and semantic dimensions of the city should be taken into account in order to be sustainable.

- Considering the wishes and suggestions of the users, urban equipment should be preferred, where they can interact more, increasing the visual quality and supporting the imagination.
- When choosing urban furniture, measures should be taken to prevent vandalism by taking into account users with many different characteristics such as age, gender, education, life view etc.
- Various features of urban furniture, such as color, texture, form, and lighting enable the furniture to be perceived in the city and become an identity element over time. At this point, aesthetic features as well as functional and technical features should be taken into account in the design of urban equipment.
- Contemporary and sustainable urban furniture that can keep up with current and technological developments such that is open to innovations should be preferred.
- The use of smart technologies in urban furniture is seen as an important issue in terms of the quality of urban areas, sustainability and environmental impacts. The use of smart technologies is important in order to the needs of both today and the future. At this point, the use of smart technologies in urban furniture should be explored further.

- In order to ensure the sustainability of urban furniture, public training should be given to raise public awareness.
- Designers and users need to be aware of sustainability and make sustainable decisions at every stage of design. At this point, the research is thought to be a guide for future studies on urban furniture.

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