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Citizen Design Science in the Context of Crowd-Creative Design Practices: Case of Izmir

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by

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Citizen Design Science in the Context of Crowd-Creative Design Practices: Case of Izmir

Abstract

Citizen Design Science is the new co-design strategy for urban systems through active design tools with the help of citizens' observation, experience, and local knowledge, which improves the planning, design, management, and regeneration of cities, urban living spaces, public spaces, and buildings. The approach combines the opportunity of crowdsourcing ideas, concerns, and knowledge by citizens on urban spaces.

Urban planning and design need to be human-centered by understanding citizens' experiences, concerns, and wishes for urban spaces. In the resilient city target, it is important to establish the relevant community that will ensure sustainability and runs the system from the bottom up. In the digital age we live in, instead of representative democracy, the digital revolution that enables direct participation and transcends distances makes possible smart communities. In parallel with this development, it is seen that the concept of governance instead of administration has become widespread on a global scale since the 1990s, with the effect of the political crisis into which representative democracy has entered.

This thesis aims to describe how the co-design process, which includes the spatial experiences, needs, and wishes of the citizens, truly turns into urban design through both digital and analog active design tools. In the thesis, two case studies were created at the same scale for crowd-creative design practices The first case study, Re-shaping

Küçük Park urban void, was developed as an academic research project in Bornova, Izmir. The second case study, Atakent Car park, was developed as an implementation project with the collaboration of Karşıyaka Municipality. Qua-kit (a map-based e-participation tool) and analog model were used as applications of this methodology. Both toolkits allow users to move geometries in given urban spaces and provide nonexpert participants to express their ideas for the urban space through design. Besides, departing from techno-creating urban design the shaping of the urban realm became a democratic process in which all stakeholders participate as co-designers.

For this purpose, the study applied objective science and subjective perception are combined in crowd-creative urban design. The study found that all participants including the citizens who have special needs could be able to contribute their experience and opinions throughout the active design tools and development process. A public commitment, constructive discussion, and high awareness of urban design projects are the results of this new model kind of co-design in the urban design process toward a resilient and sustainable city. This thesis offered a new participatory model for urban design studios and municipalities through practices. The circular model at the end of the study is proposed as a new form of data-driven governance and participation in the first quarter of the new millennium.

Keywords: Citizen science, citizen design science, co-design, participatory urban design, resilient city, hierarchical cluster analysis

Kitle- Kreatif Tasarım Pratikleri Bağlamında Vatandaş Tasarım Bilimi: İzmir Örneği

Öz

Vatandaş Tasarım Bilimi, kentlerin, kentsel yaşam alanlarının, kamusal alanların planlanmasını, tasarımını, yönetimini ve yenilenmesini geliştiren, vatandaşların gözlem, deneyim ve yerel bilgisi aracılığıyla aktif tasarım araçlarını kullanarak kentsel sistemler için yeni birlikte tasarım stratejisidir. Yaklaşım, vatandaşların kentsel alanlarda kitle kaynaklı fikirlerini, endişelerini ve bilgilerini birleştirme şansı yaratmaktadır.

Kentsel planlama ve tasarım, vatandaşların kentsel mekanlara yönelik deneyimlerini, kaygılarını ve isteklerini anlayarak insan merkezli olmalıdır. Dirençli kent hedefinde sürdürülebilirliği sağlayacak ve sistemi aşağıdan yukarı çalıştıracak ilgili toplulukların oluşturulması önemlidir. İçinde yaşadığımız dijital çağda, temsili demokrasi yerine doğrudan katılımı mümkün kılan ve mesafeleri aşan dijital devrim, akıllı toplulukları mümkün kılmaktadır. Bu gelişmeye paralel olarak temsili demokrasinin içine girdiği siyasi krizin de etkisiyle 1990'lı yıllardan itibaren yönetim yerine yönetişim kavramının küresel ölçekte yaygınlaştığı görülmektedir.

Bu tez, vatandaşların mekansal deneyimlerini, ihtiyaçlarını ve isteklerini içeren birlikte tasarım sürecinin, hem dijital hem de analog aktif tasarım araçları aracılığıyla gerçek anlamda kentsel tasarıma nasıl dönüştüğünü açıklamayı amaçlamaktadır. Tezde, kitle-kreatif tasarım uygulamaları için aynı ölçekte iki vaka çalışması

oluşturulmuştur. İlk vaka çalışması; Küçük Park kentsel boşluğunu yeniden şekillendirmek, İzmir Bornova'da akademik bir araştırma projesi olarak geliştirilmiştir. İkinci vaka çalışması olan Atakent Otoparkı, Karşıyaka Belediyesi işbirliği ile bir uygulama projesi olarak geliştirilmiştir. Bu metodolojinin uygulamaları olarak Qua-kit (harita tabanlı bir e-katılım aracı) ve analog model kullanılmıştır. Her iki araç seti de kullanıcıların belirli kentsel alanlarda geometrileri hareket ettirmelerine olanak tanımaktadır ve uzman olmayan katılımcıların tasarım yoluyla kentsel alan için fikirlerini ifade etmelerini sağlamaktadır. Ayrıca, tekno-kreatif kentsel tasarımdan uzaklaşılarak kentsel alanın tasarlanması, tüm paydaşların ortak tasarımcı olarak katıldığı demokratik bir süreç haline gelmiştir.

Bu amaçla, çalışmada uygulanan nesnel bilim ve öznel algı, kitle-kreatif kentsel tasarımda birleştirilmektedir. Çalışma, özel ihtiyaçları olan vatandaşlar da dahil olmak üzere tüm katılımcıların, aktif tasarım araçları ve geliştirme süreci boyunca deneyim ve görüşleriyle katkıda bulunabileceğini bulmuştur. Dirençli ve sürdürülebilir bir kente yönelik kentsel tasarım sürecinde bu yeni model ortak tasarımın sonuçları, kamusal bir taahhüt, yapıcı tartışma ve kentsel tasarım projelerine ilişkin yüksek farkındalıktır. Bu tez, kentsel tasarım stüdyoları ve belediyeler için uygulamalar yoluyla yeni bir katılımcı model sunmaktadır. Çalışmanın sonunda yer alan döngüsel model, yeni milenyumun ilk çeyreğinde yeni bir veri odaklı yönetişim ve katılım biçimi olarak önerilmektedir.

Anahtar Kelimeler: Vatandaş bilimi, vatandaş tasarım bilimi, birlikte tasarım, katılımcı kentsel tasarım, dirençli kent, hiyerarşik kümeleme analizi

To my dearest grandma,

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I was fortunate to have the opportunity to work with Dr. Johannes Müeller at ETH Zurich. I had the opportunity to work with him on the Re-Shaping Küçük Park Urban Void project. His knowledge and advice have influenced me a lot, in the way I perceive the philosophy of research and its meaning in practice. In terms of guidance, many thanks to Dr. Johannes Müeller. Also, I thank to him much for his contributions to analysis and for sharing the ETH Zurich's server with us for the project.

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List of Abbreviations

CDS	Citizen Design Science
CS	Citizen Science
ETH Zurich	Eidgenössische Technische Hochschule Zürich
GIS	Geographical Information Systems
IAP2	International Association For Public Participation
IZTECH	Izmir Institute of Technology
MOOC	Massive Open Online Course
NGO	Non-governmental Organization
PARTHENOS	Pooling Activities, Resources and Tools for Heritage E-research Networking, Optimization and Synergies
P.M.	Post Meridiem
SPSS	Statistical Package for the Social Sciences
OECD	The Organisation for Economic Co-operation and Development
TÜBİTAK	Türkiye Bilimsel ve Teknolojik Araştırma Kurumu
TUİK	Turkish Statistical Institute
VR	Virtual Reality
QUA-KIT	Quick Urban Analysis Kit
ZEYTINCE EYDD	Zeytince Association for Supporting Ecological Lives

List of Symbols

km^2	Square kilometer
m^2	Square meter

Chapter 1

Introduction

"Cities have the capability of providing something for everybody, only because, and only when, they are created by everybody. [1]*''*

Making cities and human settlements inclusive, safe, resilient, and sustainable is crucial that residents and other stakeholders participate in the urban planning and design process [2]. In the resilient city target, it is important to establish the relevant community that will ensure sustainability and runs the system from the bottom up. Thus, the importance of this engagement in the urban planning and design process has increased in recent years. [3]. Community involvement is now crucial to global planning and policy reforms in a movement advocating democracy, fairness, and sustainability. In contemporary urban planning and design, community involvement is seen as essential to attaining sustainable development and representative decision-making in the context of being resilience. Plans and designs are likely to be more closely matched with stakeholders' and citizens' needs, interests, and expectations when citizens actively participate in the planning, design, and implementation processes. This encourages them to help achieve socially and environmentally beneficial outcomes. Citizien involvement in urban planning and design has the potential for achieving better outcomes by bringing together information, expertise, and skills from varied backgrounds, achieving mutual learning and the participants' personal growth, creating a sense of ownership over the outcomes, generating agreement over solutions, and increase support for implementation.

1.1 Problem Definition

Standardized production, repetition, uniformity, monotony, and similitude are issues that affect our cities, neighborhoods, structures, and urban environments. There is a gap between industrially manufactured components of small-scale prototypes and extra-large buildings, urban environments, and cities in general [4]. Apart from other social difficulties like migration, poverty, and wider cultural or political crises, the ubiquitous standards, common production in the building industry, and set permanent solutions that are no longer actual can result in anonymous and distant lives and society in cities.

Modern urban planning and design are a highly specialized process that does not actively involve the users of these spaces in the design process and, as a result, to some extent ignores their needs and preferences as well as their local and lived knowledge of a place, all of which could be used to create environments that are more diverse, adapted, and adaptive. While generally applicable frameworks or process models, as well as the resources to support them, are limited or nonexistent, participatory procedures do exist and have occasionally been successfully implemented.

A pattern in the practice of design has been observed by Stappers and Sanders [5].

> *"Designers have been moving increasingly closer to the future users of what they design.* [5]*''*

Furthermore, the emergent design techniques' primary focus has changed. They are centered on societal and individual needs. These tendencies are ideal candidates for co-design principles, which encourage user involvement in the creation of design solutions for an audience or the entire society. Despite the fact that these practices appear to be recent, they have been in use for almost 50 years [5]. Participatory design research initiatives have been created in Europe since the 1970s.

The users evolve as a vital component of the co-design process even though they do not represent a specific discipline. They provide valuable insights about their experiences and knowledge. Sanders [6], an American academic and designer specializing in co-creation and participatory design explores the evolution of designers' conceptions of humanity. They began to be referred to as users, participants, and adapters in the 1990s, as opposed to customers and consumers in the 1980s. Also, it is seen that the concept of governance instead of administration has become widespread on a global scale since the 1990s, with the effect of the political crisis in which representative democracy has entered. People are invited to join in the real designing thanks to the participatory techniques of the 2000s, where they are viewed as co-creators. This might be a challenge for the co-design process because the knowledge of the users must be valued equally with the knowledge of the other professionals on the team (see Figure 1.1).

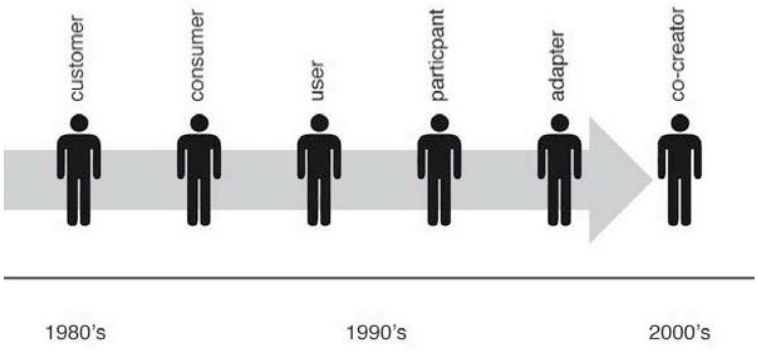


Figure 1.1: Changes in the way designers think about people [7]

In addition, the radical transformation in the understanding of the plan and planning is the development of a new understanding of participation, which comes into effect upon the elimination of the role of the planner who has the divine role and power. Thus, concepts such as bottom-up planning, tactical, and pop-up urbanism etc. were produced.

The assumption is that everyone is creative for co-creation. Especially in the business world, people do not generally accept this concept. For businesses that have held the

reins for a considerable amount of time, sharing and distributing control is not an easy task. Besides, co-design is sometimes viewed as an academic exercise with little to no use in the cutthroat economy [5]. Instead of a long-term plan and planning approach, which has poor adaptation and validity to change because it takes a long time to prepare and implement, the non-representational planning approach (Nigel Thrift) and the search for new data-based planning, which is transformed with the data it constantly collects and updates, has come to the fore.

Especially from the perspective of urban planning and design, the decisions have a significant impact on a city's life from many perspectives. The implications of the design run deeper into the experience of the citizens. Due to the difficulty of the issue, the impacts of some design decisions have not been thoroughly investigated. As a result, breaking down the issue into different components is frequent while working on urban design projects. Decisions are made largely without public communication, common-use participatory formats either follow the highly diffuse way of decision-making, or fall back onto limited methods such as voting or tally sheets while in conventional non-participatory approaches. However, the involvement of disadvantaged people is frequently repressed in a culture of strong political institutions where community contributions as token gestures. It is necessary to spread the new understanding of participation, which not only gives information and opinions but also aims to include the participant in every stage of the process and assumes the role of planner/designer as a stakeholder.

The role of the government is evolving along with the increase in citizen participation and significant, brand-new issues. Cities are comparable in that they are complex environments that change frequently. Many of the problems that cities are dealing with are infamously complicated problems with interwoven dependencies. They have dynamic, never-ending, or even contradicting requirements. This circumstance necessitates very different actions. However, up until now, the authority has mostly been the only party to approach services as a solution, despite the fact that in reality, services as a solution depends on the inclusive cooperation of both the authority and the citizens. Accordingly, eliciting knowledge from citizens' needs and ideas quantitatively can be beneficial to authority and experts’ design with structured information and shared features. The difficulty is the common language based on

continuous communication between the actors. Besides, it is crucial that citizens truly reflect what they need or think through design.

1.2 Aims of the Thesis

This study aims to examine the co-design process of selected urban area samples through analog and digital active design tools using the 'citizen design science' method. Within the scope of the study, two leftover spaces as urban void in Izmir are selected and aimed to carry out a participatory urban design process through analog and digital design tools.

Thus, a new organizational model was aimed at the regeneration of the urban space with 'data-driven governance and management'. This regeneration aimed to organize a qualified and multi-functional public space, which is produced from the collected spatial data of the needs, wishes, and experiences of the citizens.

Citizen participation is more than technology and methodology. In this study, a preliminary case study and a main case study were implemented. The described method was carried out in a preliminary case study with some addition to the digital tool and an empirical setting for the first time and an analog tool was developed to fulfill the goal. It is aimed to answer the following questions in this research (see Figure 1.2):

- How does the co-design process, which includes the spatial experiences, needs, and wishes of the citizens, turn into urban design?
- Can citizens' design truly reflect what they want and be translated into a common design language in urban design?
- How does collecting design ideas from citizens be inclusive for data-driven governance and management in urban design?

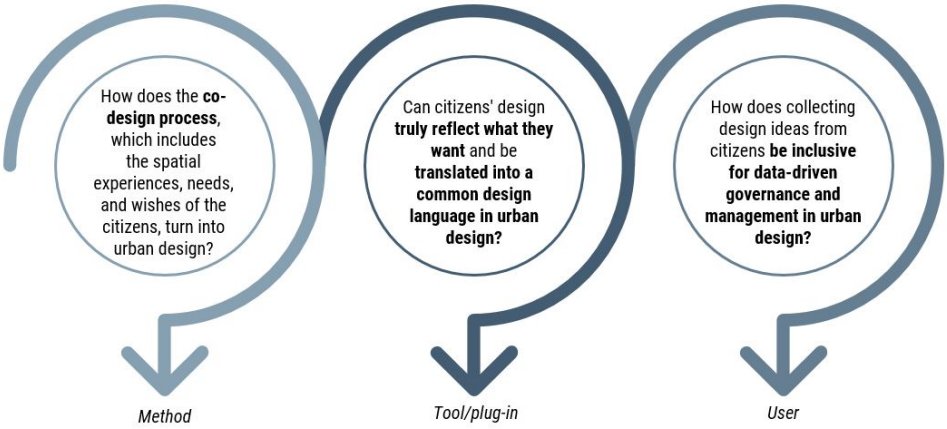


Figure 1.2: Reseacrh questions of the study

The following chapters illustrate the implementation of the co-design studies, methods, and findings of design ideas evaluations and further research.

1.3 Method of the Thesis

Following a review of the literature, the proposal's nature and the traits of the agents led to the consideration of a framework that is in many ways consistent with the so-called Citizen Design Science as shown in Figure 1.2. As designers, we bridge the gap between ‘objective science’ and ‘subjective perception’ in crowd-creative urban design.

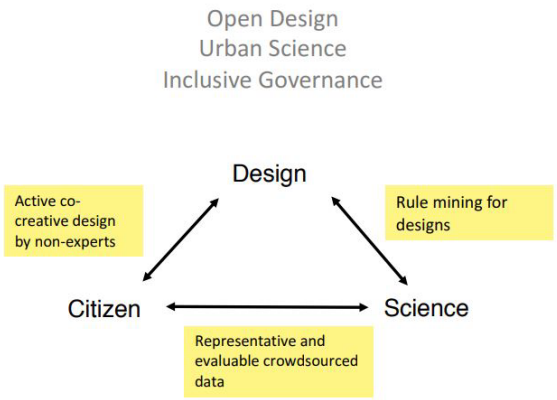


Figure 1.3: Citizen Design Science [8]

‘Citizen Science’ provides scientific data with the participation of the public in scientific research. Beyond these studies carried out in various disciplines, the 'Citizen Design Science' method, which produces data for design science by making use of the experiences of citizens about the environment they live in, is a new strategy developed for the participation of citizens in urban design [9]. In the method based on the communication between scientists, citizens and designers; work together in the project design process (crowd-creative) instead of traditional participation methods as public hearing, comment writing, citizen-based committee, participation of representations, etc. It is a method in which innovative and active tools are used in participatory design approaches in urban planning and design using today's information and technology.

Citizens (the users) were seen as non-expert designers and creators of primitive models for their neighbourhoods. Cognitive toolkits help people create maps and 3D models can show how they perceive and understand a place, as such tools force people to think and express themselves in novel ways [10]. The experts interpreted the knowledge from citizens for urban planning and design through these ways. In this method, citizens were involved not only as simple sensors, but also they actively participated in the urban plan and design projects through design scenarios. This initiative, by strengthening the role of citizens, connects the bottom-up and top-down decision-making processes in urban design. Citizens’ competences and experiences can produce better strategies and plans for the regions they live in [9].

The method used in the study is a design strategy for urban systems that enhances the planning, design, management and transformation of cities, urban living spaces, public spaces and buildings, with citizen participation and active design tools through human observation, experience and local knowledge. The method has participatory aspects and aims to collect design-oriented data.

This study was developed in three interrelated stages as seen in Figure 1.3.

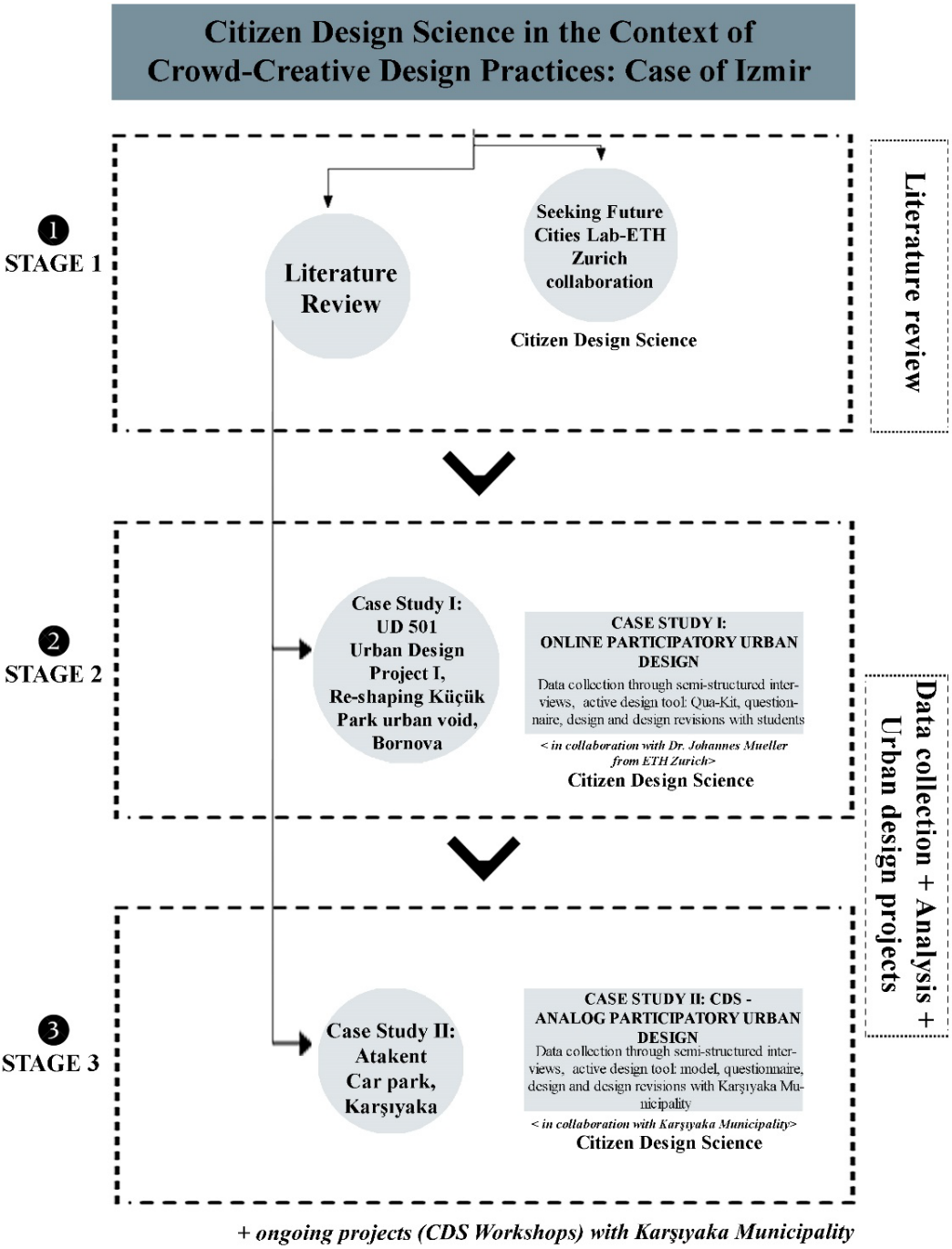


Figure 1.4: The outline of the research methodology

First, after completing the literature review, the researcher encountered a practical issue; how to overcome the problematic aspects of involving citizens in participatory decision-making. The theoretical perspective, which is an abstract method to view the world and comprehend how it relates to humans, was then connected to this investigation. This stage deals with knowledge and explains why theoretical

perspectives are influenced by epistemological understanding by means of various epistemological methods, or, to put it another way. Effective citizen engagement would benefit society, and digitization is occurring and is viewed as a potential solution, especially in the context of resilience. Thus, the first stage of this research was a systematic literature review conducted to determine and relate how citizen design science can potentially play a role in the context of a smart city and being resilient regarding advancing social sustainability. The conclusions of this stage and the context in which this real-life problem was first consulted have opened the door to additional inquiries. Then, we sought Future Cities Lab-ETH Zurich collaboration for Citizen Design Science method.

The second inquiry, citizen design science approach is used for the preliminary case study, UD 501 Urban Design Project I, Re-shaping Küçük Park urban void at IZTECH. We collaborated with Dr. Johannes Mueller from ETH Zurich. Data collection through semi-structured interviews and active design tool (online); Qua-Kit and questionnaire were statistically and subjectively analyzed. Then, expert designers (graduate students) use this data set to design the public space. They also revise their designs through the design science data set. This framework was used and tested in the preliminary case study and its' design revisions.

Third inquiry, citizen design science approach is used for the main case study, Atakent Car park in the context of collaboration with Karşıyaka Municipality. Data collection through face-to-face semi-structured interviews, citizens' design layouts on active design tool: analog model, and questionnaires were statistically and subjectively analyzed. Then, expert designers use this data set to design public space in Karşıyaka Municipality. After completing concept urban design projects, the participant citizens voted on the alternative projects. The most preferred project is being implemented.

1.4 Structure of the Thesis

The thesis is organized over five chapters. After this introductory chapter, Chapter 2 aims to provide a theoretical framework for the thesis research. The chapter discusses citizen science and the concept of citizen science and adopts a participatory approach to science in the first chapter. It is finalized with insights from the literature concerning an improved scheme for a citizen science process. In the second section of the chapter,

citizen science is discussed with respect to its levels and classes. The advantages and limitations of approaches of citizen science are discussed with respect to the methods in the third section of the chapter. The chapter is finalized by evaluating the literature in terms of insights into a citizen science process.

Chapter 3 details participatory urban planning and design with respect to the participation methods and techniques, and participation levels. Besides, some international and national cases are given. The chapter is finalized with 'citizen design science': citizen participation in participatory planning and design in the context of the citizen science sphere.

The citizen design science studies have been carried out in Izmir both in Bornova and Karşıyaka. Chapter 4 is organized into three sections regarding to data-driven urban design process for those projects. The first section provides general information on the preliminary case study according to the stages of the urban design process identified to carry out an analysis and design for urban design study with students. Therefore, the urban design process of Küçük Park Urban Void is described with respect to preparation, preliminary studies, and design. The second section provides general information on the main case study; Atakent Car park, according to the stages of the urban design process identified to carry out an analysis, design, and implementation stages of urban design for the study. An interactive tool, the Quick Urban Analysis Kit (Qua-Kit), and analog interactive design tools are introduced to conduct these case studies.

Finally, in the concluding section, a general evaluation is provided to make inferences concerning insights from the preliminary and main case studies for data-driven governance and management for the urban design process.

Chapter 2

Citizen Science

This chapter provides a theoretical framework for the thesis research. The chapter discusses citizen science. It is finalized with insights from the literature concerning an improved scheme for a citizen science process. Besides, citizen science is discussed with respect to its levels and classes. The advantages and limitations of approaches of citizen science are discussed with respect to the methods. The chapter is finalized by evaluating the literature in terms of insights into a citizen science process.

2.1 The Concept and Process of Citizen Science

> *"Simply generating and communicating scientific knowledge is not sufficient. ... Knowledge of traditional and 'ordinary' citizens (brings) possibilities for innovation.* [11]*"*

The term "citizen science" is a buzzword that refers to the scientific activity carried out by members of the general public, typically in collaboration with or under the guidance of professional scientists and scientific institutes. A "citizen scientist" is a scientist whose research is distinguished by a sense of responsibility to advance the interests of the public sphere; (b) a member of the public who would do scientific research, often in cooperation with or under the supervision of professional scientists and academic institutions; an amateur scientist [12]. Citizen science is described as general public participation in scientific research activities when citizens actively contribute to science either through their intellectual effort, their surrounding knowledge, or their instruments and resources in the European Commission Green

Paper [13]. The area of citizen science is emerging legitimately and rapidly expanding. Often citizen science expands public engagement in science and promotes alternative forms of knowledge generation. It is seen as a series of activities lying under a larger canopy of concepts, including such "open science" and "open innovation [14]. Citizen science has a wide range of definitions; including community-based monitoring, volunteer-based monitoring, participatory monitoring, public engagement, do-it-yourself science, crowd science, etc.

The terms "citizen science" is attributed primarily to ornithologist Richard Bonney and science policy analyst Alan Irwin [15], [16]. Irwin's initial notion was very different from Bonney's [15] and, more importantly, from how it is being used. The term "citizen science" "conveys both notions of the interaction between science and people," according to Irwin's [16] book; Citizen Science: A Study of People, Expertise, and Sustainable Development [17]. The proposals in the book are mostly centered on the first idea, with the goal of making science policy more "democratic" by making it more sensitive to people's "understanding" and "concerns" [16]. The idea of "citizen science" according to Richard Bonney [18] proceeded in a different direction. An alternative perspective was provided by Richard Bonney's concept of "citizen science". Bonney [18] described "citizen science" as scientific research in which "amateurs" contribute observational data (such as bird spotting) for researchers and, in response, learn new scientific techniques.

According to Rick Bonney [13], [19]; citizen science means that making nonexperts an integral part of the scientific process. Especially some leaders of the scientific community, use the term ‘citizen scientist’ or ‘civic scientist’ to define as working scientist who participate actively in public debates on scientific and technological issues [20]. Alan Irwin and colleagues [21] have used to define the term; citizen science as ‘participation buys non-experts in the governance of society when dealing with technically.

Bruce V. Lewensteins [22] defines citizen science and citizen scientist have at least three meanings. The first one is that the participation of nonscientist in the process of collecting the data according to specific scientific protocols and interpreting that data. Second one is that the engagement of non-scientists in true decision making about policy issues that have technical or scientific elements. Besides, the third meaning is

the engagement of research scientist in the democratic and policy process which make them partner directly in creation of decent knowledge about the world [22].

Citizen science helps increase stakeholder involvement, bring in some new ideas and knowledge, as well as new collaborations. Many initiatives are introducing cutting-edge scientific disciplines to new audiences, allowing for a wider discussion of the social implications of fields like gene editing and synthetic biology. In this sense, citizen science initiatives are often started to solve a current issue or research topic while also enhancing the public ability to engage in science and influence long-term policy implementation [14].

Citizen science projects provide remarkable success in scientific knowledge and improvement from citizen scientists that provide a wide range quantity of data about species occurrence and distribution around the world. Most citizen science projects assist participants to learn about the inanimates by observing and knowledge of the process in those scientific research is conducted. Indeed, developing and implementing public data collection of citizen science projects require serious effort due to the scientific and educational outcomes of these [23]. Many people would participate in science at different levels each taking part in scientific knowledge.

The goals of citizen science projects also include supporting scientific research carried out by academic institutions, governmental organizations, and non-governmental organizations, contributing to the body of scientific knowledge through publications, providing data and analytics to help inform management plans and policies and raising public awareness of science and promoting an interest in it [13].

According to Ramaley [24], some inference from information leads to deeper understanding or an ability to incorporate scientific knowledge into better decision-making. It is crucial that communication is a process of mutual interaction and a seeking of understanding rather than simply a means to transmit knowledge implicitly to the public. It would fail to deeper into questions of identity and personal experience when science is not emotionally satisfying. This will be rejected in favor of less reliable sources of information and advice and citizen science stands for it.

Citizen science models of public participation in scientific research represent a growing area of opportunity for many fields. Due to its continuous success, "citizen

science," a category of participatory strategies for including citizens as partners in scientific research, is becoming increasingly popular. citizen science is well developed in disciplines like ecology to astronomy, where nonprofessionals have a long history of providing significant contributions to the existing body of scientific knowledge [25].

Citizen science includes strengthening scientific research by engaging with a range of topics and data sources. Citizen science can enlarge stakeholder participation and introduce new viewpoints as well as new cooperations. Many projects are coming up with cutting-edge areas of science. At this point, they become to address immediate problems or the research question’s answer while also building the capacity or communities to participate in science and shape policy decision-making and implementation in long run. These projects related to public policy matters are affecting today's order from environmental protection to health and education to research and innovation. Besides, the rich history of citizen science goes beyond lots of areas such as astronomy, biology, geology, archaeology, biodiversity, monitoring, public health, etc. These projects led to collaboration across the rainbow of science, medicine, and engineering disciplines and the social sciences. Public policy-related citizen science initiatives currently address a wide range of priorities, including environmental preservation, health and education, research, and innovation. Those meant to encourage innovation have in particular sparked cross-disciplinary cooperation in the social sciences and the fields of science, medicine, and engineering. A small amount of contact between practitioners, significant society stakeholders and public officials is also encouraged by citizen science [14].

The systematic works of amateur naturalists have been determined to be the historical roots of *citizen science*. The first records of public participation in scientific research date back 1.918 years to Chinese locust outbreaks and this trend could be traced throughout recorded history [26]. The growth of citizen science in the 20th century has been described as one that brings science and the public together. Some of the developments include civil society's public health and environmental research in the 1970s, participatory science and society policies such as consensus conferences or science shops in the 1980s, and the emergence of citizen science in the 1990s thanks to the innovative work of sociologist Alan Irwin and ornithologist Rick Bonney [27]. Public participation in scientific research has substantially increased recently and now

is known as "citizen science." [13]. It is simple to consider citizen science to be a modern phenomenon. It has more ancient origins, though, which have been revitalized by cutting-edge digital technology like networked mobile devices that connect individuals quickly and efficiently with their peers and the scientific community. The desire of the fact most people to participate actively in scientific processes has also contributed to the emergence of citizen science. Recent sociological developments, such as the growth in higher education and the exalted status of science, as well as the desire to actively contribute to the production of data to aid in the management of pressing societal issues, may be responsible for this [14].

In 1995, Alan Irwin was one of the first to introduce the phrase "Citizen Science" to refer to the knowledge of laypeople [28]. This phrase was shortly changed to refer to a research method that collects or analyzes scientific data from the general community [13]. Irwin [16] described two dimensions of the relationship between citizens and science. The first dimension is science should be responsive to citizens' concerns and needs. The second dimension is that citizens themselves could produce reliable scientific knowledge. Around the same time, Rick Bonney started using the same phrase to describe several initiatives at the Cornell Lab of Ornithology in the US that involved the general public in bird research [15].

Golumbic and others [29] developed a model of the key characteristics of citizen science that includes three essential components: citizenship participation in the scientific process; public contributions to research; and reciprocity or two-way contact between scientists and the public (see Figure 2.1). The essence of citizen science lies in the active participation of citizens in the scientific research process. It has been demonstrated that public-private partnerships advance science, the environment, society, and governance. The use of a deliberate approach is thought to strengthen interpersonal relationships, advance knowledge of the value and applicability of science to daily life, and assist tailor research to societal requirements. [29].

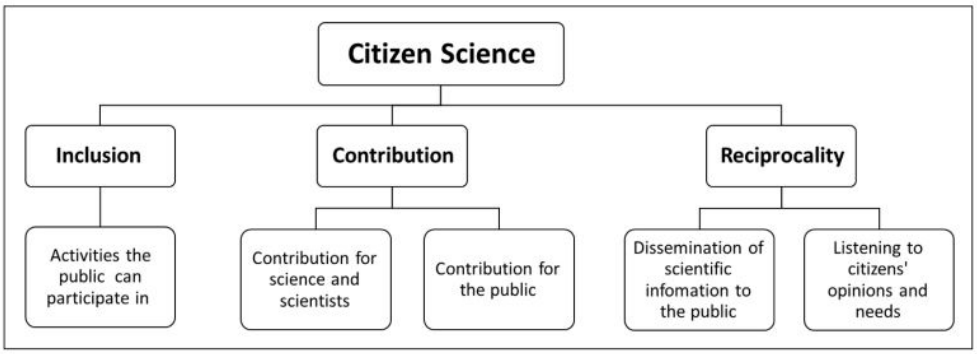


Figure 2.1: Three fundamental elements of citizen science [29]

The European Citizen Science Association has established 'Ten Principles of Citizen Science' as an addition to the concept of citizen science [14]. In order to promote quality in all aspects of citizen science, The Ten Principles of Citizen Science offer a framework for evaluating both new and current citizen science programs. The Ten Principles provide governments, decision-makers, researchers, and project leaders with a common set of fundamental guidelines to take into account when funding, developing or evaluating citizen science projects at a time when the field is rapidly growing but has not yet been mainstreamed within traditional research or policy processes [30].

These principles are [30]:

- Citizens are actively involved in scientific projects that provide new knowledge or understanding through citizen science programs. Citizens may participate in the project as contributors, collaborators, or project leaders and have a significant role.

- Scientific evidence is produced via citizen science initiatives. For instance, responding to a research question or influencing management choices, environmental policies, or conservation efforts.

- Participation benefits both the expert scientists and the citizen scientists. The publishing of research results, educational possibilities, leisure activities, societal benefits, and satisfaction from contributing to the scientific body of

knowledge, for instance, to address local, national, and worldwide challenges, all have the potential to be advantages.

- Each stage of the scientific process can be engaged in by citizen scientists if they so choose. The establishment of the research topic, method design, collection and analysis of data, and distribution of the findings are a few examples.

- The research provides input to citizen scientists. For instance, how their data are being utilized and what the effects are for research, policy, or community.

- Similar to any other research strategy, citizen science has flaws and biases that need to be taken into account and managed. On the contrary, citizen science offers the chance for more public participation and the democratization of science.

- Data and information from citizen science projects are made available to the public, and results are published in open-access formats wherever it is practical. Unless there is security or privacy issues that forbid it, data exchange is authorized both during and after the project.

- Publications and project results acknowledge citizen scientists.

- The scientific output, data quality, participant experience, and broader social or policy effects of citizen science projects are all evaluated.

- Leaders of the citizen science initiatives evaluate the legal and moral aspects of any activity, including copyright, intellectual property, data-sharing agreements, confidentiality, attribution, and environmental impact.

The changes in science and society policies on public participation in relating to science, technology, and society have an impact on citizen science. Prior political discourse on public understanding of science (PUS) was characterized by a deficit model focused on the dissemination of condensed scientific information from expert scientists to the receiving public through a variety of channels, such as the media [31]. Participatory science and society politics refer to public involvement with science that has been defined by a dialogue model focused on the participation of the public with

their knowledge and concerns to the collaborations with professionals on topics relating to science and society. An aspect of public involvement with science is citizen science, which has been defined as public participation in scientific research. The prospect of coexistence has been mentioned for both the deficit models [27]. In order to have an influence and increase the relevance of policies, the three main components of citizen science - citizen scientists, science, and socio-economics interact with the legislative process are required. Each phase of the policymaking process can benefit from citizen science: Policy formulation (specification of the framework of the policy); policy implementation and monitoring (putting policies into force or documenting their execution); problem definition (identification of new environmental concerns or development of new hypotheses about existing issues); measures to encourage, monitor, and enforce compliance with current environmental regulations, such as inspections, penalties, and warnings; compliance assurance; policy analysis (assessing the outcomes of policy interventions) (see Figure 2.2).

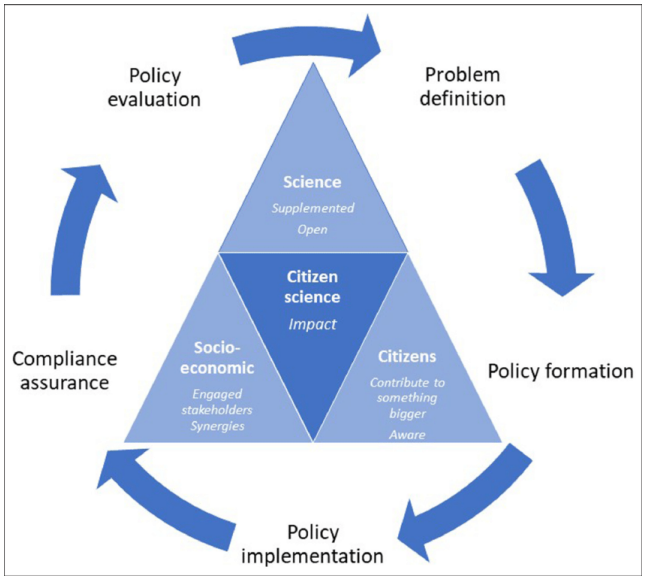


Figure 2.2: Three key dimensions of citizen science [31]

The real involvement of nonscientists in the research process and a genuine desire to utilize data to address important issues with conclusions that withstand peer review are what distinguish citizen science from other types of research [32].

The Citizen Science Central developed a citizen science project toolkit which is published in Cornell Lab of Ornithology [33]. It provides a step-by-step guide for project design, from the research question to the evaluation of the project (see Figure 2.3).

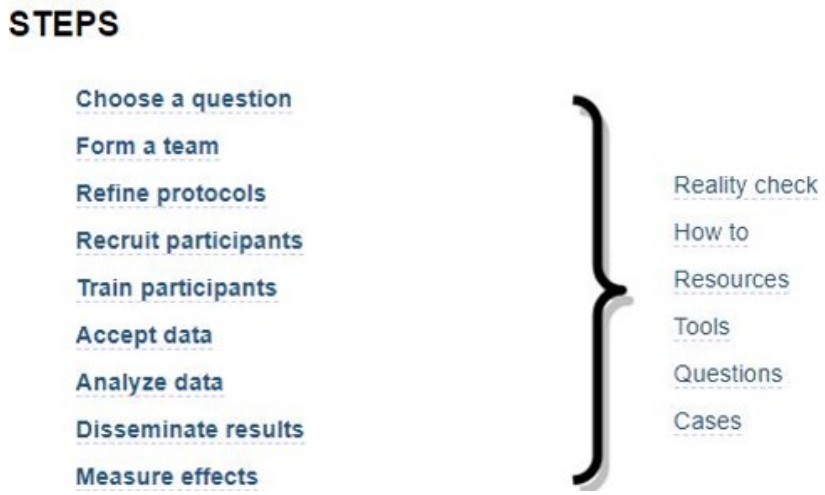


Figure 2.3: The steps of Citizen Science Toolkit, The Cornell Lab of Ornithology [33]

The Christmas bird count project, which has been in existence for more than a century, was one of the first citizen science projects [34]. Parallel to this, citizen science is receiving growing attention and acceptance in the scientific community as a scientific research strategy for addressing particular research issues and achieving scientific requirements. Millions of citizens participate in thousands of scientific initiatives, devoting a significant amount of time, effort, and money to research that is aided by new technology [35]. For instance, SETI@home is a citizen science project that asks participants to analyze radio telescope data [36]. eBird transforms citizens' bird sightings into science and conservation that coordinated by Cornell Laboratory of Ornithology and National Audubon Society [37]. Sound Citizen project is based on the citizen and student research that exposes the presence of measurable quantities of previously undiscovered human-made chemicals in the environment [38].

By engaging members of the public in real research experiences at various stages of the scientific process and utilizing contemporary communications methods to attract

and keep participants, citizen science also profoundly addresses larger social implications. The emergence of citizen science has been greatly aided by a number of new developments in information science over the past 20 years, particularly in data informatics, graphical user interfaces, and geographic information system-based web applications that can now be ported to smartphones and other hand-held devices as well. Prioritization and sustainability problems in citizen science projects raise the topic of how government financing and collaborations may help maintain public interest in research for society [39].

2.2 Classes and Levels of Citizen Science

There are several names that fall under the larger category of citizen science due to the variety of areas in which citizen science can be applied as well as the various organizational and cultural settings of such practices. Community science, participatory mapping, community remote sensing, locally-based monitoring, and community-based monitoring are a few examples [40].

There are several categories under which citizen science projects can be categorized. Based on the nature of volunteer engagement, these initiatives were first classified by ornithologist and citizen science leader Rick Bonney and his colleagues [23], [41], [42]:

- *Contributory*, in which individuals assist in data gathering, data analysis, and result dissemination.
- *Collaborative*, in which participants analyze samples and data and occasionally assist in the study's design, data interpretation, concluding, and dissemination.
- *Co-created*, where participants from the community take part in all phases of the project, from identifying the questions to generating the hypotheses to discussing the findings and coming up with new questions.

Contributory projects refer to primarily crowdsourced data collecting, collaborative projects, which include citizen data collection and analysis, and co-creative projects, in which academics and citizens collaborate on the majority of the steps of a scientific project [43].

Later, the classification was expanded to include "contractual" projects, in which communities compel scientists to conduct research and inform them of the findings, and "collegial contributions," which are defined as amateur scientists' scientific works that need to be acknowledged by institutions or professional scientists [44].

A contemporary categorization based on the duties of citizen scientists has been offered by Strasser and others [45]. These include "sensing," which describes data gathering by citizen scientists using technological tools, "computing," which describes accumulating computer resources for scientific research, "analyzing," which describes crowdsourcing online citizen science projects, "self-reporting," which describes sharing personal data for scientific research, and "making," which describes conducting science in do it yourself laboratories [44].

Education-based citizen science is one of four categories defined by Bonney et al. These include "data collection projects," in which citizen scientists collect data for scientific research in a similar way to contributory projects, "data processing projects," such as online crowdsourcing citizen science projects, which the authors consider to be contributory types, "curriculum-based projects," which refer to student participation in education-based or other citizen science projects under the supervision of a teacher or an adult, and "community science," which refers to research conducted by citizen scientists in a manner similar to contributory projects [15].

Wiggins and Crowston [46] proposed an alternative classification for particular citizen science initiatives and selected the five independently exclusive and exhaustive categories of projects as follows:

- Volunteers establish action projects that are intended to stimulate intervention in local issues like enhancing the water quality in their neighborhood stream [47].
- Natural resource management objectives are addressed via conservation programs, such as one that monitors the kind and amount of beach trash [47].
- Investigational studies focus on achieving specific scientific objectives in a real-world environment, such as a thorough analysis of California's otter population trends [48].

- Virtual projects, as Galaxy Zoo, where volunteers identify and categorize galaxies, are likewise centered on scientific research objectives but are entirely based on information technology [49].
- Education projects that are frequently carried out in the classroom or on school property as part of the scientific curriculum, such as a monitoring study of butterflies and ground squirrels [50].

Another method of categorizing the citizen scientific initiatives was based on the discipline being researched, such as biology, archaeology, or astronomy [46].

The definition of citizen participation has been widely adopted in the domains of geography, environmental studies, urban studies, development studies and public policy, among others, thanks to Sherry R. Arnstein's [51] "A Ladder of Citizen Participation." The concept of participation is described through the so-called ''Arnstein Ladder'' using words with strong moral impications. Arnstein begins her analysis with levels of "nonparticipation," including therapy and manipulation, then shifts to "degrees of tokenism," including education, consultation, and acceptance, before arriving at "degrees of citizen power," including collaboration, delegated authority, and citizen control. It is obvious that Arnstein gives a strong value judgment, in which nonparticipation should be discouraged and complete citizen power is the ideal, even without delving into the meaning of these levels (see Figure 2.4).

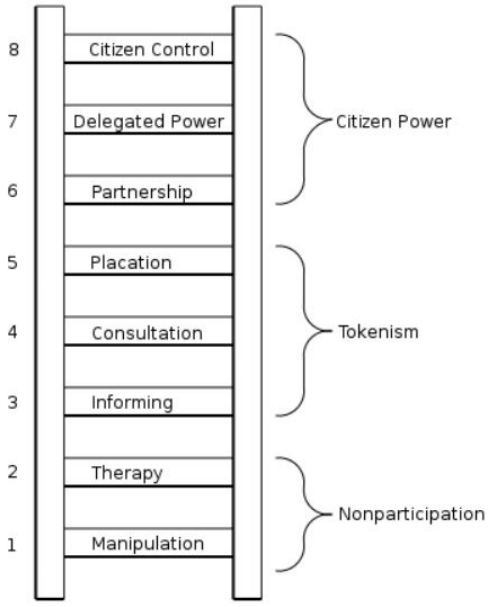


Figure 2.4: Eight rungs on the ladder of citizen participation [51]

This intended simplification of the ladder's focus on political power dynamics is what accounts for its enduring appeal. Arnstein's ladder inspired the creation of various typologies, although being contested throughout time. Additionally, Haklay [52], specializing in citizen science, is in charge of what appears to be a ladder of participation in citizen science [52] (see Figure 2.5).

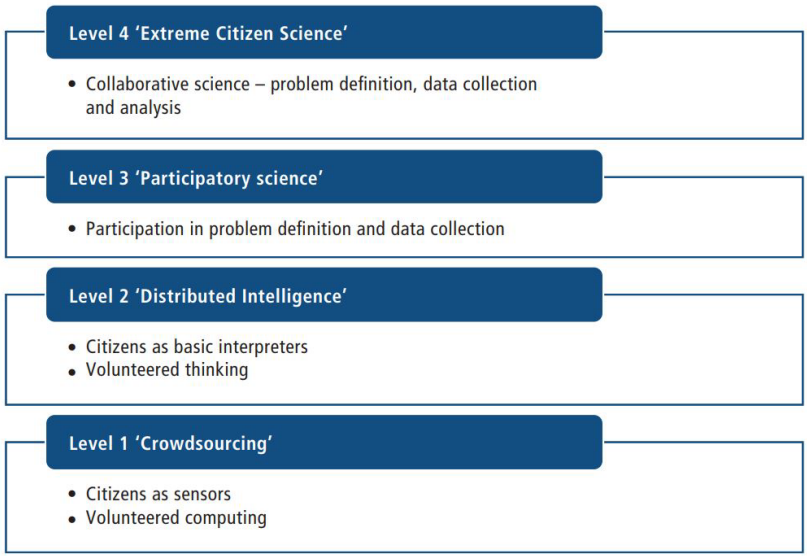


Figure 2.5: Levels of participation in citizen science [52]

This classification is similar to Arnstein's "ladder of participation". There are eight steps on the ladder of citizen engagement, each representing a different level of participation. Steps explain the degree of public participation and the level of influence required for the process and results to be determined from the bottom to the top. The ladder makes sense for characterizing the policies and programs that reference participation. The phrase "the powerful and citizens" were brought up by Arnstein as a screenplay, but she underlined that neither class consists of characters who are all equal in terms of power [51].

According to a four-level structure of participation, Haklay [53]'s system categorizes citizen science initiatives based on the extent of their involvement with volunteers (see

Figure 2.3). At level 4, or so-called extreme citizen science, participants are actively involved in the project's growth and strive toward achieving their own objectives. Extreme citizen science includes initiatives where the study is driven by the public and professional scientists have no role at all. Participatory science is Level 3. From issue formulation through data collection, participants are involved in guiding the research's path. Distributed intelligence is included in Level 2. Galaxy Zoo [54] and eBird [37] are two projects that might give participants some fundamental knowledge before asking them to gather and analyse data in Level 2. Level 1 is known as crowdsourcing. These are the least inclusive programs and rely only on volunteers to gather data from distributed sensors or to supply the processing power [55].

Powerful actors utilize various forms of non-participation at the bottom of the ladder to promote their agendas. When participants discover interventions and express their thoughts about them, power-holders are said to have received input. Participation does not lead to change, however, so the participant's voice will not have any impact on the intervention. At the top of the scale, citizens have more authority to consult with and influence status. The voices of the participants are addressed and recognized. The steps and obstacles needed to climb the ladder from one level to the next are not shown. In real-world circumstances, however, there could be a lot more levels, and participants might move up and down the ladder over time within the same intervention [51].

Haklay's third taxonomy groups citizen science projects according to the degree of volunteer engagement. According to Haklay [52]; there are six types of citizen science projects; passive sensing, volunteer computing, volunteer thinking, environmental and ecological observations, participatory sensing, and community science. Participants in the project must provide a resource they already own in order for passive sensing to work. The sensors are used to gather the data. The scientist uses the data later on for analysis. Volunteer computing is the practice of participants providing their unused computing resources on their own computers, tablets, or cell phones. Level four is the most inclusive and level one is the most fundamental in terms of how participation in scientific research is seen as engagement in all phases of scientific inquiry. Therefore, it is simple to mix up the meaning of participation for the participant and project owner with participation in the sense of taking part in various stages of a process. Instead, it's

important to explore what involvement means in citizen science and to have a deeper understanding of it [52].

These classifications, some of which overlap, have been merged by Broeder [56] into a unified descriptive framework of Citizen Science project characteristics (see Figure 2.6).

Characteristic	Description
Aims	1) Investigation: aimed at answering scientific questions 2) Education: aimed at educational goals 3) Collective goods: public health, management of infectious diseases, protect and manage natural resources. 4) Action: citizens and scientists collaborate to address local concerns
Approaches	A. Extreme Citizen Science. Citizens in charge from problem definition, data collection and analysis, to interpretation and knowledge development B. Participatory science: Participation of citizens in problem definition and data collection C. Distributed intelligence a) Citizens as basic interpreters b) Volunteered thinking D. Crowd sourcing a) Citizens as sensors b) Volunteered computing
Size	i) Local ii) Mass

Figure 2.6: Citizen Science descriptive characteristics [56]

According to Figure 2.4; the aim of citizen participation is the first attribute. The goal of conservation has been expanded to include the generation of "community goods". The amount of engagement, which can range from crowdsourcing to "extreme" Citizen Science, is the second characteristic. Size is the third characteristic, and it can be either mass or local. She has removed the contradiction between on-site and distant operations from the original typologies. The number of remote projects will probably increase in the near future, while local projects may also be conducted virtually. Furthermore, this characteristic overlaps with "size".
As contexts and circumstances dictate the requirement for research capability, which is not a key quality of citizen science projects in and of itself, Broader has also excluded the "thoroughness" characteristic [56].

2.3 Benefits of Citizen Science

Building societies where knowledge creation techniques are not managed to keep secret from the public, allowing citizen science to thrive, is a wise investment and a real example of a win-win. Beyond the obvious benefit of producing new information that advances both science and society, there are countless other advantages for society, research, and the participants themselves. According to Parthenos (Horizon 2020 project funded by the European Commission); the benefits of citizen science are divided into titles according to their actors as below [57]:

2.3.1 Benefits for Participants

- The need of having access to scientific information to serve as the foundation for discussions on pressing topics like the climate catastrophe, the global health crisis, and the crisis of democratic principles has never been more important. A key weapon against false news is a deeper and more comprehensive grasp of how science works.

- An example of concurrent learning and knowledge creation is citizen science. Citizens are capable of expanding their scientific literacy in fields that are crucially relevant to them.
- Citizens can enhance their participation in and commitment to scientific and research issues by taking part in citizen science projects.

- Communities are given the ability to change their environment and so improve their social well-being.

- The strength of people who are driven by curiosity or the desire to advance research is harnessed through citizen science, and these individuals are then connected to projects that profit from their commitment and energy [57].

- People become more informed, directly interested, and worried when they are participating in science activities and later in the development of measures. Thereby, citizens may identify which problem-solving techniques are most straightforward, affordable, and effective [58].

2.3.2 Benefits for Researchers

- Occasionally, the amount of paperwork that researchers and government agencies must deal with makes it difficult to see how complicated issues might have straightforward answers [58].
- A finding that; a research group can not ever make can result from making research procedures alone. The most challenging aspect of any project in the past was gathering huge data samples for research. Thousands of individuals from all over the world can still remotely contribute to a study and provide, analyze, or report data that researchers can use thanks to today's linked world.
- Through citizen science, scientists may look more closely and broadly at the research problems they are interested in. Researchers may produce enormous data sets and complete labor-intensive activities considerably faster and more effectively by including interested citizens in the gathering and analysis of their data.
- Researchers may get unexpected insights from the inputs of non-experts, leading them to propose new research topics and potential opportunities for research.
- The inclusion of citizen science components into a project conveys the idea that researchers are concerned with the social effects of their work and how it benefits the general population.
- Citizen science creates avenues for recognizing the value and significance of humanities study [57].
- Citizens are increasing their own knowledge and understanding of science. Scientific literacy is improved with the help of citizen science.

2.3.3 Benefits for Society

- Citizen science promotes societal confidence in science by ensuring that scientific goals are properly linked with major social concerns. It also assists funding organizations in making better investments in open innovation and research development.
- It is a potent instrument for improving the transparency and permeability of the relationship between academics and citizens.

- Social mobility benefites from the democratization of knowledge creation and access.
- People are encouraged to become involved in the world around them through citizen science [57].
- Citizen science increases public participation in scientific research and strengthens ties between the public and scientists. Therefore, it is expected that an informed populace would contribute significantly to influencing more significant decisions regarding science policy. Citizen science makes ensuring that citizens have a better understanding of scientific research.

2.4 Challenges of Citizen Science

As citizen science advances, the expectations of various stakeholders for public participation in scientific research impose new demands on researchers and provide inspiration for more cooperative kinds of interaction. Some models have developed entirely outside of the formal epistemic and ethical frameworks of science, with a limited prior discussion of important issues like peer review, the dangers of magnifying dubious claims, the lack of consent forms about risks and rewards, etc. Current citizen science models indicate new opportunities where accepting uncertainty and risk may result in new benefits while also transferring perceived risk from the admittedly rigid structures of traditional research to the person. People with access to their own data streams can develop a unique familiarity that can support interpretive fluency. Developing relationships with engaged individuals can create new opportunities for rich cross-sectional data streams, both informing their own choices and allowing larger groups to emerge from individual streams. Human cognitive processing is uniquely suited to and in some cases provides superior performance in such tasks as image analysis, graph interpretation, and puzzle solving. Many members of the public presently demonstrate a strong interest in and willingness to contribute to meaningful scientific research [59]. Like any emerging field, citizen science faces many challenges. One of the biggest issues of citizen science is ensuring data quality when professional scientists rely on data from individuals with questionable qualifications [60].

One of the biggest obstacles for citizen science programs might be communication. Although the importance of outreach is growing among scientists, many scientists still receive little or no formal training in effective communication. People in charge of planning citizen science programs are often taken aback by how much time and work it takes to effectively connect with participants and other stakeholders [61].

The supporting infrastructure for citizen science is still being developed. The fact that citizen science is still a relatively new, developing profession and community of practice contributes significantly to these strategic challenges [55].

There are differing opinions on the benefits of citizen science among academics and participants. The assumption that the general people may contribute to research in a constructive way is still contested by some experts. The dependability and trustworthiness of citizen-generated data, one of the major methodological issues of citizen science programs, helps to partially explain these worries. On the opposite side of the trust divide, communities may be easily discouraged from participating in citizen science initiatives if community priorities and research agendas are not in alignment [29].

Managing a project that incorporates amateur researchers can result in a variety of difficult ethical problems. Citizen science has the potential to unintentionally exploit volunteers, and misuse public data, and the public. It could ultimately accidentally make it harder for citizen research to break through the boundaries between laypeople and experts [62].

Three key elements need to be present for a citizen science initiative to succeed. Access to professionals is the first. Additionally, material resources are required. If there are no connections to prominent stakeholders or resources a project needs to succeed. The open-access publication is the final element required. This might be the most crucial resource for educating the public about current issues. An informed public will result in motivation for change. The usage and acceptance of citizen science will take some time, but it is already off to a good start [63].

2.5 Citizen Science in Turkey

Although citizen science is a very new research area in Turkey, various studies in this field have been carried out under different terminologies. The concept of citizen science has just recently been introduced to Turkey. With regard to policymaking, The Scientific and Technological Research Council of Turkey (TUBITAK) has been funding the Horizon 2020 program of the European Union Framework Programme for Research and Innovation, which includes calls for citizen science projects. As a result, citizen science has been indirectly supported through international partnerships. The new open science policy of TUBITAK, which is based on publishing TUBITAK research in an open-access manner and may have an impact on public participation in science, is another policy development in Turkey that links to citizen science [27]. The earliest works on citizen science in Turkey conducted a comprehensive literature questionnaire and provided some initial examples. An amateur meteorology forum, a policy-making event encouraging citizen involvement in water research, and a few state enterprises supported by citizen-generated data have been mentioned. However, as the authors have stated, many of these works do not directly correspond to citizen science as they are not open-access or volunteer-based projects [64].

Various citizen science projects and platforms exist in Turkey, according to the present research. These notable projects include "The Map of Threats to Water Resources in Turkey" by the TEMA Foundation [65], "The National Jellyfish and Gelatinous Organisms Watch Programme" by the Turkish Marine Research Foundation [66], and "The Turkish Breeding Bird Atlas," which is a part of The Second European Breeding Bird Atlas [27].

The citizen science project held within the scope of Bioblitz Peninsula Citizen Science Practice in 2018 was held with the headline “botany science” in Urla/Izmir. Citizens were asked to find and identify as many species as possible in a specific area [67]. Another citizen science project in Izmir; the ‘Bioatlas’ project aims to determine the plant diversity living in Izmir, determining the location of the plant, photographing the plant, to collect and archive the basic data in a digital base to be created by the project partners. It is also aimed to verify the data obtained with the contribution of expert

academics, to match local, national, and Latin names, and to share the information publicly over the internet [68].

In addition to those large-scale environmental projects in which citizen scientists are mainly in data collection, PSLifestyle is a citizen science project that aims to help close the action gap between climate awareness and individual action and to increase citizen participation in sustainability topics. This project has received funding from the European Union's Horizon 2020 research and innovation program. PSLifestyle promotes data-driven momentum for sustainable behavior change in Estonia, Finland, Germany, Greece, Italy, Portugal, Slovenia, and Izmir/Turkey. The co-creative Citizen Science Lab methodology used by the initiative is intended to encourage citizens' active participation in localized sustainability issues in order to co-develop and commit to real-world climate change solutions [69].

Lastly, our case studies in the fourth chapter are relevant to apply citizen science methods in urban design in Izmir, Turkey.

2.6 Concluding Remarks

Citizen science is defined and presented in the literature, and the ideas about public engagement are expressed by scientists. Citizen science represents a new type of open movement welcoming contributions to scientific research from a diverse population of volunteers. Initiatives in citizen science are producing data that supports policy-making at the local, national, regional, and international levels. In order to develop important scientific research, citizen science serves as a bridge between many facets of society. Being a citizen scientist is open to everyone, which is revolutionary. The ten principles of citizen science emphasize the importance of the scientific outputs of citizen science, such as research papers or advancements in the policy.

As the government serves the interests of the people, the data collected by citizen scientists may influence policy choices. Although formalizing citizen science is still under development, it is gaining more and more acceptance. Every year, more studies and projects use citizen science to their advantage. Scientists are realizing the value and advantages that citizen scientists provide. The information that citizen scientists gather only improves the work that scientists are doing. Citizens also get more power

to effect larger change the more educated they are. Finally acknowledged, the beneficial link between science and society has been demonstrated through a number of fruitful scientific endeavors, data, and investigations [63].

It is possible to regard citizen science as the subsequent development in the participatory shift, one that has the potential to improve upon the drawbacks of the democratic regime by including the public in the scientific process itself. In other words, citizen science seeks to "democratize" research by promising to create new knowledge, inform the public, and transform science from a closed to an open activity [45]. Citizen science is an important vehicle for democratizing science and promoting the goal of universal and equitable access to scientific data and information.

Therefore, participation in citizen science is a complicated and varied subject that requires consideration, investigation, and theorizing. Understanding citizen science involvement also helps people better understand how open science should function, the value of open-access publications that have been emphasized as part of the ten principles of citizen science [70] for helping people learn new things, and the necessity of assisting people on their scientific journeys [46].

Consequently, citizen science is being viewed more and more as a scientific discipline. The number of publications from citizen science initiatives that have been published has significantly increased since about 2010. The primary areas of study are biology, ecology, conservation, ornithology, astronomy, meteorology, and microbiology producing the most scientific research [55] in the world as well as in Turkey. The citizen science projects held in Izmir reveal the potential of the city in this sense. Besides, a gap is found regarding applying citizen science techniques to the fields of architecture and urban design.

Chapter 3

Participatory Urban Planning and Design

According to United Nations [2], social cohesiveness, and environmental protection in keeping with the goal of sustainable development, urban planning and design must engage in a process of transformative change. New forms of participation are becoming more common in urban governance in the quest for trust. Popular approaches for fostering direct citizen participation in policymaking include democratic innovations, co-production of services, and participatory urban planning and design [71].

3.1 Participation Approaches

"Citizen Participation is Citizen Power. [72]*"*

Every intervention in the city affects everyone who has a relationship with that city, especially the local people. Cities are living organisms and, like every developed organism, they have memories, histories, and identities. What is happening in that city, which forms the identity of a city, is the events that have been lived and left a trace. The phenomenon of participation is an issue that concerns every segment and layer of society without discrimination and can be easily related to many problems. Citizen participation is the process of informing or collaborating with a variety of top-down and bottom-up stakeholders, with the objective of obtaining public feedback and

suggestions on the governance of human settlements [73]. Democratic urban planning and design require the active participation of citizens to help shape cities.

It is generally acknowledged that citizen participation is crucial for governments to deal with urban management. The demands, interests, and expertise of many stakeholders must be taken into account by urban planners in order to design inclusive and sustainable cities. This calls for the deliberative design and decision-making procedures where the government collaborates with citizens to solve societal issues and develop new regulations. To give the government access to the population's aggregate knowledge, ideas, and expertise, collaboration is crucial.

Why is there such an interest in participation? In essence, when liberal democracies struggle to connect with citizens and fulfill their ambitions, this is due to what Hindess [74] terms a "democratic deficit". Since there is less confidence in government institutions, social movements are growing, the public sector is changing, and people have higher expectations for the quality of services, elected officials are more concerned with legitimacy. Participation turns into a desirable tactic for bringing dissatisfied individuals back into the political mainstream as well as for improving policies. Anthony Giddens [75], [76] believes that local communities and nonprofit organizations should be allowed to participate in the policy-making process, which he refers to as "experiments with democracy."

There are many definitions of citizen participation in the literature. Participation is the expectation of citizens to have a say in the political process; citizens distrust intermediary institutions in the political decisions that concern them and expect to have a direct say in the decisions [77]. According to Nabatchi and Leighninger [78]; citizen participation is an umbrella term that describes activities in which the needs, interests, values, and expectations of citizens are incorporated into decisions and actions on public issues and issues. Citizen participation is also defined as “in ways that citizens prefer an instrumental activity in which they seek to influence the government to act” by Verba and Nie [79]. According to Creighton [80]; participation is a process in which citizens' concerns, needs, and values are incorporated into the state's institutional decision-making. It is a two-way communication and interaction process between the citizen and the government for better decisions [81].

Participation is a term that applies to every theme and is essentially what society expects from a democracy. Applications of participation, whether done consciously or accidentally, eliminate any injustices done and include an equal component. The study's definition of "participation" is those actors actively engaged in the processes of urban planning and design that are influenced by those processes. Greater citizen participation in decision-making, urban planning, and design is needed to increase knowledge about complex problems, better mediate divergent interests and promote improved quality of life for everyone [82]–[84]. Citizen participation may also contribute to the creation of policies that are more popular with the general public and increase faith in the government [85].

Urban planning's accomplishment is significantly dependent on the actions of a variety of actors across many practically independent policy sectors due to the vast, diversified, and complicated nature of its aims. Urban settlement and community development are a process that calls for in-depth investigation and analysis, strategic planning, expertise in urban planning, public input, policy suggestions, implementation, and management [86].

Urban challenges can be identified or actively addressed by citizens, who frequently new versions of insights and solutions. Citizens have the opportunity to notify the government of the level of well-being in their community and even develop proposals for well-being improvement according to their specific requirements. Mueller et al. [87] translate the phrases above to urban design by changing "the user" to "the citizen" or by defining the terminology. Citizens are the users of urban design. Citizen-centered planning includes urban planning procedures that primarily focus on optimizing the public space for citizens but do not necessarily include citizen involvement approaches. Participatory planning includes urban planning processes that involve citizen engagement.

Participatory urban planning directly engages neighborhood residents in the process of land use planning. Citizens offer information and knowledge specific to their area to complement the technical expertise of professionals and the government. To address community needs, solutions are created cooperatively. Utilizing a range of techniques and instruments for participation and public engagement, participatory urban planning changes communities and cities via an inclusive process [88]. The social component

of urban design in urban design theory and practice ideally involves both users and inhabitants of a region in the urban design process. Community design, participatory design, or community engagement for urban design refers to the participation of several players, ranging from common residents who will be impacted by urban development to professional specialists [89].

According to Lane [90], the nature of the planning enterprise being undertaken, the definition of the planning problem, the types of knowledge used in planning practice, the conceptualization of the planning, and the decision-making process all play a significant role in determining the role of citizen participation in urban planning. In line with this assertion, urban planning strategies are investigated in relation to societal, political, and citizen engagement contexts.

The participation of all relevant stakeholders in decision-making processes that may directly or indirectly affect their lives is the essence of the participatory method in urban planning. Since decisions in both domains influence a large public and numerous stakeholder, planning and urban design are the two sectors where the adoption of a participatory approach is most appropriate. The actual spatial interventions themselves are seen to be the most effective means of involving inhabitants and users in participation. Many different groups utilize public spaces, some of which may not be familiar to one another. Participation increases stakeholders' involvement in the space they design [91].

If the goal of participation is conceived in terms of what has to be achieved when there is a recognized need to involve community members, participation can be effectively handled. Simple inquiries like "who," "what," "where," "how,"and "when" are needed to conceptualize the problem as [92]

- Who are the parties to be involved in participation?
- What should be performed by the citizen participation program?
- Where should the participation road lead?
- How should people be involved?
- When is participation desired in the planning process?

In order to get to an agreement on a program and its modalities, a series of activities known as participatory urban planning allows various groups and wants to engage with one another [93]. Participatory urban planning is based on the principles [94]:

- The society is multiplied.
- There are legitimate confrontations between people's interests in the community.
- Strengths of an individual or a group should not force their opinions on others.
- The parties concerned must communicate with one another to exchange information, attempt to comprehend one another's viewpoints, and reduce the controversy.
- No individual or group should be disregarded throughout the negotiation process, and planning should be done in a participative manner based on simple actions.
- New training is needed for development assistance personnel in participatory planning.
- Developing a participatory approach
- Garantie of approval of the government's participative strategy
- Identifying active agents in different tasks, their roles, and the degree of their participation in these activities
- Choosing the appropriate level of active and passive participation
- Group Decision-making methodology
- Creating local knowledge
- The adoption of relevant norms that have been created in the community and changed throughout its rule.

Besides, Sanoff [95] listed the following guidelines for participation in community action planning:

- There is no ideal response to a design issue. There are several remedies for each issue. Traditionally, these are based on two sets of criteria; facts: in terms of material strengths, economics, building codes and etc., the data derived from experiment and observation, and attitudes in terms of the way of explanation of the facts, conventional and customary approaches, and assessment of value. Hence, design and planning decisions are by nature biased and depend on the values of the decision maker.

- Planners who are active in the participation process have the responsibility of identifying potential alternatives, and discussing the effects of those options, but not deciding amongst them.

- It could be possible to make a planning or design activity transparent. Alternatives that professionals are considering are frameworks in their minds and may be brought up for discussion by users. Since the product is more responsive to the needs of the users, it has a higher chance of success.

- The perspectives of all citizens and interest groups might be shared in an open forum. Crucial talks could take place, and decisions that are fully acceptable to all participants could be made.

- The participation process is ongoing and constantly evolving. The process's end result is not the product. In order to adapt to the participants' changing needs, tasks, and expectations, it must be evaluated and reevaluated.

Sustainability reveals the concept of ‘participation’ along with urban development, planning, and design approaches. Especially in the second half of the 21st century according to the changing world conditions, the unlimited communication tools developed in parallel with the advancement of technology and the awareness rate rising with these tools have also caused the concept of democracy to change, and participatory democracy has begun to come to the fore in the issues where the understanding of representative democracy is insufficient. This process took place in this way in the interventions to the physical space of the city, and soon after it was

realized that the feasibility of the plans and projects prepared for the city, which does not consist of physical space. Participatory approaches were carefully considered in urban planning and design processes in many parts of the world [96].

After World War II, a number of paradigm changes were experienced in the world. Tekeli [97] summarizes those changes through four differen discourses:

- The industrial society and the information society,
- Fordist production with flexible production mechanisms,
- Nation states and a globalizing world phenomenon,
- Replacing modernism with postmodernism.

Those changes have also been reflected in traditional planning and design approaches, and planning studies, whose boundaries were drawn with a deterministic approach, have begun to give way to non-coercive strategic plans that include flexible processes and decisions. In 1912, urban planner Patrick Geddes carried out with local government and designers [95]. In urban arrangements, the issue of where the people take place has opened up for discussion. Geddes put forward the idea that local governments could create a public forum so that the public could be represented in the design process. Citizen participation in modern urban planning practice did not begin in the United States until the 1950s, when citizens' opposition to the demolition of inner-city neighborhoods began to rise, despite the fact that citizen participation has long been a pillar of the country's democratic traditions. The methodical, systemic approaches of the 1960s chose to self-identify the means for solving problems. Since then, one of the difficult themes in modern urban planning theory has been the direct participation of citizens in planning practices. The fact that this path started to create contradictions within the participatory democracies started to make itself known as a result of various oppositions [96]. Planning democratic involvement was urged by social movements of the 1960s and 1970s to reduce inequality. Thus, the socially, politically, and economically weakened sections of society stood up to the inequalities they encountered in their daily lives by demanding rights in every field [90]. Before the advent of modern urban planning regulations, American urban planners worked directly with the public to put their plans into action. Early zoning regulations were

written with the intention of including the public in an open and transparent process. By the 1960s, due to the loss of confidence in modern social, political, and economic institutions, the understanding of democracy, which is at the root of modern society, has also evolved. Beyond the protection of freedom and rights of the modern individual, democracy has begun to be seen as a means of self-realization. Democracy has gone beyond being based on discriminatory, aggressive, competitive, analytical reason, and objective values formed by the masculine and institutional, and has undergone a meaning change that includes the unifying, nurturing, intuitive, and experiential belonging to the subaltern excluded by these values. Transactive and advocacy planning strategies were created along the same lines. Paul Davidoff's [98] advocacy planning model opposed conventional planning methods, promoted the rights of low-income residents, and created participatory planning techniques in America in 1965. According to Davidoff [98], the planning process must be conducted in a way that includes rather than excludes residents from involvement if it is to promote democratic urban government. The individual interest gained greater attendance due to the pluralistic approach on the agenda within all the parts of disciplines such as policy and planning. In order to make planning for everyone, community design centers were established in the United States and England, and design centers for the community provided design and planning services for the poor and disadvantaged citizens. In response to the shortcomings of transverse planning models, Friedman [99] created a transactive planning technique in the 1970s. In stark contrast to synoptic models, this method stresses the value of interpersonal discourse and person-centered, face-to-face contact in the planning process. In this sense, reciprocal learning is the core idea of the transactive planning method, and Friedman [99] assumes that communication between a planner and client is founded on mutual learning as well. According to him, a planner should have been more concerned with helping marginalized socioeconomic groups become self-sufficient than advocating for their needs to the government. The planner acts as a conduit for information and feedback between clients (the general public) and professionals. In a manner, the transactive planning approach asserts that public engagement and empowerment are the outcomes to be attained rather than the strategies to be employed. Since the late 1980s, Jürgen Habermas' [100] communicative rationality has unquestionably dominated the theoretical discourse in planning and has begun to discredit a number

of interpretations, including Healey's [101] "collaborative planning" in the UK literature and Forester's [102] "deliberative planning" in the US literature. In short, a new era for citizen participation in urban planning has begun with the communicative shift [103].

The participatory approach and participation tools, which were previously implemented with local initiatives in the late 2000s, started to be discussed in the urban planning agenda. Efforts such as strategic planning approaches, participatory protection policies, multi-actor decision-making processes, and civic empowerment have become widespread [104].

Traditional planning has lost its instrumentality in understanding the movements in the urban space and solving the problems, and at this point, as a new approach, strategic planning can realize these features together with the interaction network between the stakeholders. It also adopts active participation processes in spatial intervention processes while this new planning agenda accepts the distribution of urban value instead of public benefit. One of the reasons for the emergence of the participatory urban planning and design process is the need for a new approach that is not deterministic and can be sustained in parallel with the changes in society. For this reason, participation is actually one of the tools that are chosen or spontaneously on the agenda for the realization of these goals. Participation introduces a new relationship structure [104].

The results of studies on citizen participation, particularly urban planning that includes participation are often a good thing. Citizens' roles are strengthened by participation, which helps citizens lead democratic decision-making processes. Another result is that participation in design initiatives or other collective local interest groups may help to build their sense and be considered a component of community development.

Since the 1950s, urban design projects have been the subject of more in-depth analysis and sometimes contentious arguments due to growing critiques over the effects of big growth on neighborhoods, the environment, and the historic character of the city. Incentives and subsidies for private development, the gentrification of downtown, and the resultant eviction of disadvantaged communities have all raised further public concerns and sparked conflict among various interest groups in recent years.

Participation has occasionally helped in the creation of better designs or laws that take different demands and interests into account. Other times, poorly designed or managed public procedures have led to discontent and demonstrations, legal challenges, project delays, and higher costs for governments and developers [105]. By bringing together citizens with various information, expertise, skills, and ideas, citizen participation in urban planning may enhance outcomes. It can also promote reciprocal learning, promote a sense of ownership and commitment, and increase support for implementation.

Public participation in government can radically improve our quality of life. Moreover, it can create more active citizens, help manage complex issues in public service design and delivery, create new relationships and exchanges of power and resources required by 21st-century governance, and develop individuals' skills, conviction, willingness, and vision. Thus, public participation in government has become an essential part of the public policy decision-making process and delivery. The growing expectations from citizens to participate in decision-making, such as infrastructure decisions and planning, particularly at local and regional levels, have posed a challenge to democracies in recent years [106].

3.2 Levels of Participation

One of the reasons for the emergence of the participatory urban planning and design process is the need for a new approach that is not deterministic and can be sustained in parallel with the changes in society. It is one of the tools chosen or spontaneously brought to the agenda for its realization. Participation introduces a new relationship structure. There are several definitions of participation at various levels by many professionals in the literature that might alter over time owing to distinct circumstances and differing points of view, both in theory and in practice.

One of the first and most well-known models of citizen participation is Shelley Arnstein's [51] ladder of participation. In it, she compares citizen participation levels to ladder rungs. The importance of citizen participation in societies was becoming more and more apparent in the late 1960s. Arnstein outlined and clarified the idea of participation in a piece that was initially published in 1969. Later, other academics frequently used this article as the foundation for their ideas of participation. Arnstein

utilized the metaphor of the participation ladder to show how citizen involvement relates to citizenship power as mentioned in the the previous chapter [107] (see Figure 3.1).

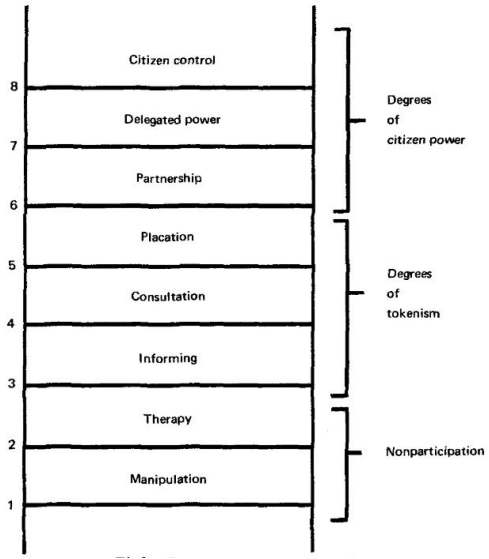


Figure 3.1: Arnstein's eight rungs on a ladder of citizen participation [51]

Participatory decision-making could include any realm of human activities, including economics, politics, management, and cultural activities. One of the earliest attempts to define citizen participation and its relationship with social imperatives was Arnstein's [51] ladder of participation. According to Arnstein; all participation opportunities are not equal. They can be classified into different types corresponding to various degrees of citizens' involvement as well as the power to determine or change the final outcome. She divided the eight stages into three groups: nonparticipation, degrees of tokenism, and degrees of citizen power. The top rung depicts residents playing an active and engaged role in a partnership with public administration, while the bottom rung represents citizens having no engagement at all. Participatory methods, in her opinion, are useless as long as there is an unequal distribution of power [108]. The first two steps are manipulation and therapy, expressed as non-participation; they are methods that aim to educate or improve the participants by the power holders rather than ensuring the participation of citizens in planning. It is

generally applied to prove participation in user-oriented projects, but the participants or the committees formed to ensure participation has no legal enforcement power. In other words, the absence of engagement in two categories that he refers to as manipulation and therapy are evident at the bottom of Arnstein's ladder, where there is no power for the citizens. According to Arnstein, this manipulation suggests that certain government organizations have presented a fictitious number of involvements while their true objective is to inform the public on how to accept the work that has already been defined. The following stage involves the introduction of therapy, another type of non-participation. Such a lack of participation is dishonest and self-serving. Here, the objective is to discover a means to disavow the opinions and actions that the relevant organization does not share, but can not express clearly, so it disavows under the guise of a citizen questionnaire. Informing and consulting are additional rungs on the ladder. This phase entails educating the populace on the facts of the government's goals, as well as their rights, responsibilities, and potential solutions. If the information is accurate and the information flow is not biased, informing, consulting, and citizen questionnaires may be helpful [109]. The placation level is characterized as a greater degree of tokenism since those who lack the means still have no voice in decision-making because those in positions of power retain their rights. The final three rungs of the ladder, partnership, delegated power, and citizen control, collectively represent various levels of citizen power. A partnership is a type of organization in which ordinary people are permitted to bargain and make trade-offs with powerful figures. The majority of the decision-making process is controlled by citizens who lack resources on the levels of delegated power and citizen control. The difference between the stage defined as the power of the citizen from the others is the reorganization of the decision-making power. Participants may be in various partnerships and may even become dominant in decision-making processes in later stages. At the partnerships level, participants must have strong leadership and the economic resources to pay for their time and effort, as well as the power to hire their own techniques and methods organizers. It is very important in terms of power holders and their ability to impose real sanctions on the plan. At the this level, it can be stated that the organization and institutionalization of participation have a significant impact [51]. Additionally, citizen control, the highest level on Arnstein's ladder, was condemned for encouraging

secession and dividing public services. This criticism is described as follows by Arnstein in her article [110]:

> "*It is costlier and less efficient, it enables minority group "hustlers" to be just as opportunistic and disdainful of the have-nots as their white predecessors; it is incompatible with merit systems and professionalism; and ironically enough, it can turn out to be a new Mickey Mouse game for the have-nots by allowing them to gain control but not allowing them sufficient dollar resources to succeed* [51]*."*

Genuine and pseudo-participation are the two categories offered by Deschler and Sock's participation model. Domestication is a new term for the first three rungs of Arnstein's ladder, which are manipulation, therapy, and information. The following two stages (consultation and placation) are now categorized as "assistencialism". Together, these two levels make up "pseudo-participation." Together, partnership and delegation of authority form "cooperation," with public control remaining at the highest level. "Genuine participation" is composed of these two stages. Genuine involvement, on the other hand, is a degree to which the community has the ability to influence the commission [111] (see Figure 3.2).

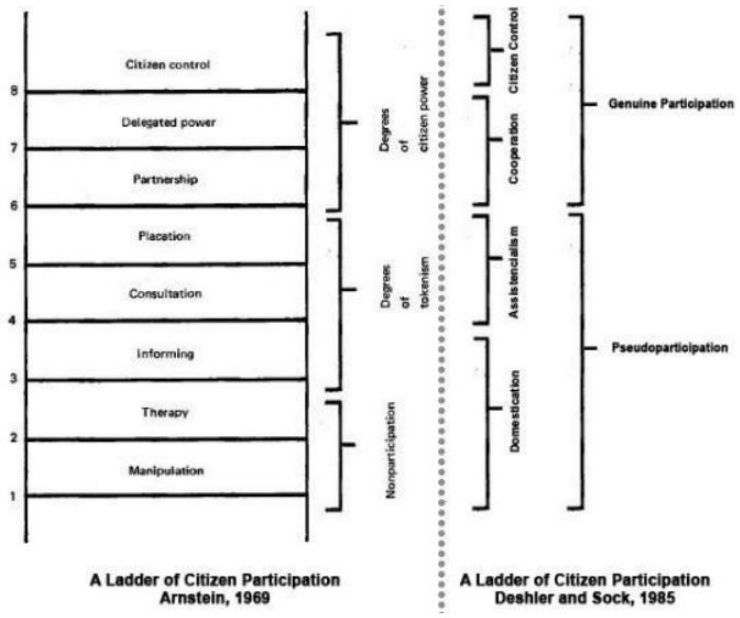


Figure 3.2: "Comparison of the ladders of Arnstein [51] and Deshler and Sock [112], [110]

Midgley [113] categorizes participation into four groups; 'anti-participatory mode, manipulated mode of participation, incremental mode of participation, genuine mode of participation' based on how governments have responded to it. Anti-participatory mode's proponents support restricting mass participation. Governments forbid public participation in policymaking and meddling that would go against their overall economic and social objectives. In the manipulated mode of participation, the government encourages public participation with hidden agendas. In this strategy, local public participation is employed to regulate social politics with the understanding that participation makes the plan easier to implement. Governments aim to use this mode to implement development projects, control local movements and communities, and gain political-social legitimacy. The government takes a two-way approach to deal with participation, meaning that it endorses it in official capacities but does not actively endeavor to put participatory proposals into action in the incremental mode of participation. In the genuine mode of participation, the government actively promotes social involvement and strives to develop the necessary frameworks for local communities to effectively participate in all spheres of life. In this mode of participation, in addition to creating real local institutions, the government is committed to participation through community building and training, the distribution

of supplies and other forms of assistance, and the coordination of decision-making at the national, regional, and local levels [98].

Burns [111] divides participatory design methodologies into four parts, each of which helps citizens to come to an agreement on their own environment [110]. He claims that the process begins with the awareness step, in which the citizens investigate the facts of their surroundings. Due to their shared experiences on the area that has to be improved, the awareness process improves the relationships between citizens. The second stage is perception, which marks a change from being aware of their physical, social, cultural, and economic environment to understand it. Citizens now communicate their environmental goals and expectations, which serve as planning and design inputs. In the third step, decision-making, citizens make actual physical designs that professionals can utilize as inputs to combine alternative and final ideas. The final step is implementation, during which the community takes action to put the idea into practice. Even though inspiring action is one of the primary goals of participation, this process is sometimes disregarded in participatory projects. If the process is over without any action being taken, citizens' accountability also expires. As a result, citizens should participate in the process and take initiative to improve their neighborhood. The proposed participative design is as; awareness, perception, decision-making, and implementation [111].

Jules Pretty [114] put up another well-known typology of participation in 1995. Pretty divided participation into seven categories, from "the bad form: manipulative participation" to the better form: participation through consultation, and the best form: self-mobilization," as shown in Table 3.1. This classification is based on the participation process as a whole, in contrast to Arnstein's typology which based on the perspective of those on the receiving end [115] (see Table 3.1).

Table 3.1: Citizen Participation Typology by Jules Pretty [115]

Type	Characteristics of each type
Manipulative participation	Participation is simply a pretence, with 'people's' representatives on official boards, but who are un-elected and have no power.
Passive participation	People participate by being told what has been decided or has already happened. It involves unilateral announcements by an administration or project management without any listening to people's responses. The information being shared belongs only to external professionals.
Participation by consultation	People participate by being consulted or by answering questions. External agents define problems and information-gathering processes, and so control analysis. Such a consultative process does not concede any share in decision-making, and professionals are under no obligation to take on board people's views.
Participation for material incentives	People participate by contributing resources, for example, labour, in return for food, cash or other material incentives. Farmers may provide the fields and labour, but are involved in neither experimentation nor the process of learning. It is very common to see this 'called' participation, yet people have no stake in prolonging technologies or practices when the incentives end.
Functional participation	Participation seen by external agencies as a means to achieve project goals, especially reduced costs. People may participate by forming groups to meet predetermined objectives related to the project. Such involvement may be interactive and involve shared decision-making, but tends to arise only after major decisions have already been made by external agents. At worst, local people may still only be co-opted to serve external goals.
Interactive participation	People participate in joint analysis, development of action plans and formation or strengthening of local institutions. Participation is seen as a right, not just the means to achieve project goals. The process involves interdisciplinary methodologies that seek multiple perspectives and make use of systemic and structured learning processes. As groups take control over local decisions and determine how available resources are used, so they have a stake in maintaining structures or practices.
Self-mobilization	People participate by taking initiatives independently of external institutions to change systems. They develop contacts with external institutions for resources and technical advice they need, but retain control over how resources are used. Self-mobilization can spread if government and NGOs provide an enabling framework of support. Such self-initiated mobilization may or may not challenge existing distributions of wealth and power.

According to Pretty's typology, "functional participation," which is probably the most prevalent form of citizen participation in development, conceptualizes the kind of participation that aims to achieve project goals effectively despite the fact that the key decisions have already been made and controlled by external agents. Both Arnstein's and Pretty's typologies on citizen participation have been seen as a kind of spectrum in which its levels have been distinctly specified by a shift from experts' or specialists' control to citizens' or communities' control [115]. This is true even though their endpoints clearly differ. The focus of these two spectrums, however, differs; although the former's starting point is "power," the latter focuses mostly on the reasons underlying participatory processes [103] (see Figure 3.3).

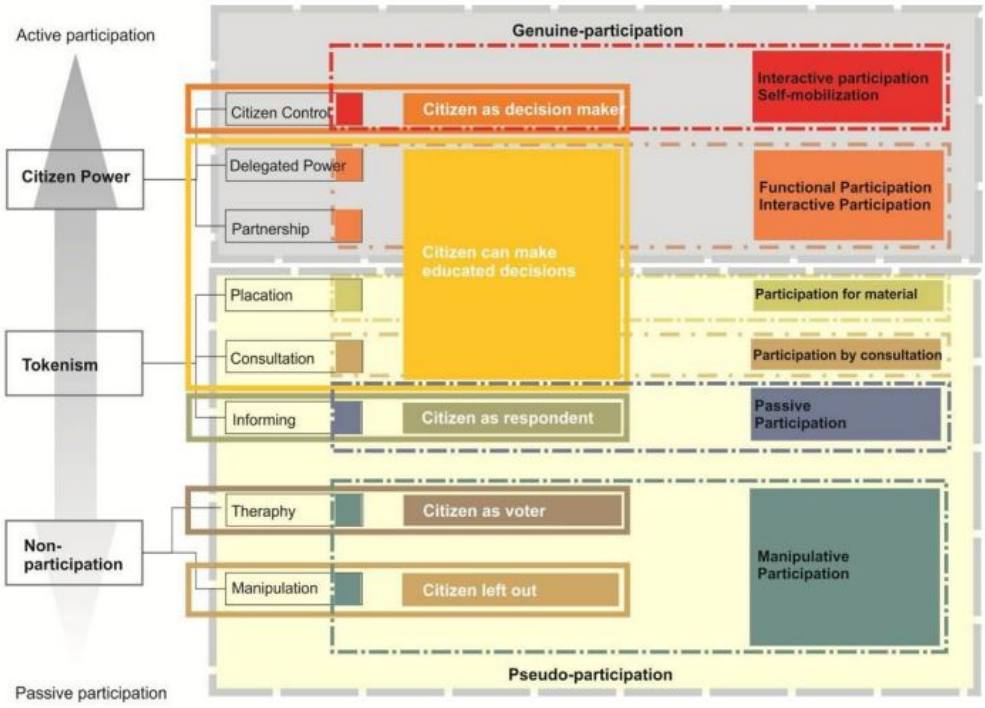


Figure 3.3: Arnstein's ladder of participation, citizen participation typology of Deshler and Sock, Pretty's participation typology [103]

As Wulz [116] stated in his study, there are 7 different forms of participation that line up between two opposite poles defined as expert and user autonomy. Those forms are representation, questionary, regionalism, dialogue, alternative, co-decision, and self-decision. He also emphasized that participation can be active or passive. Representation is the most passive level of participation, where the designer develops ideas by putting himself in the shoes of those who will be affected by the decisions. Questionary refers to the level at which research is conducted to get the opinions of the public. Regionalism refers to understand the expectations and behavioral movements of the local population living in a particular region from physical design. It defines a level that targets the users but does not affect the decisions. At the level of dialogue, participation takes place in a two-way flow of information between the designer and the local community, mostly through informal conversations, but the final decision-maker is the designer. The level of alternative offering is the level of participation achieved by local people choosing one of several alternatives offered to them. The designer is in dialogue with the users during preparing alternatives at this level. While there is passive participation of the public at the previous levels, a balance

is established between the designer and the participants at the joint decision-making level. The co-decision level, which is a level where the public is included from the beginning of the design process, is a phase where decisions are made with the active participation of the public. At the self-decision level; the user decides and starts to make and implement decisions with the do-it-yourself method.

Scott Davidson [109] created the wheel of participation in 1998 to encourage citizen participation. It offers a range of participation levels without promoting any in particular. Decisions are based on ongoing interactions between the government and citizens under this approach. Although Davidson essentially utilizes the wheel rather than the ladder and does not take priority or precedence for the levels involved in the participation, the wheel still contains four degrees of participation, which include inform, consult, participate, and empower (see Figure 3.4).

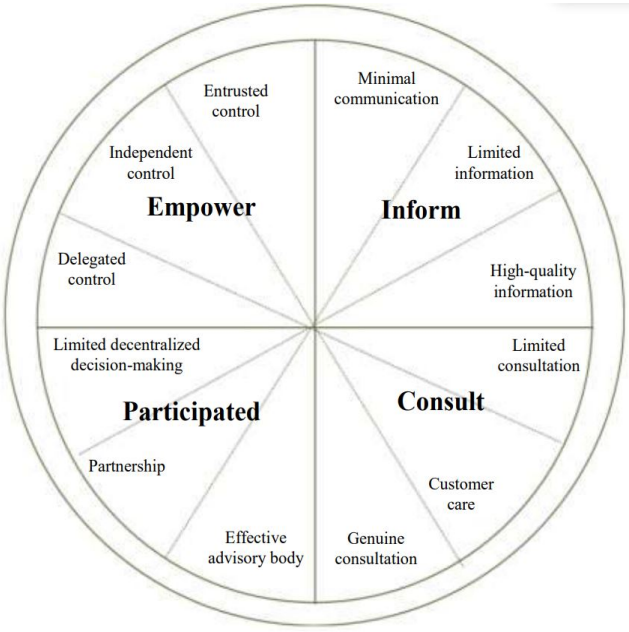
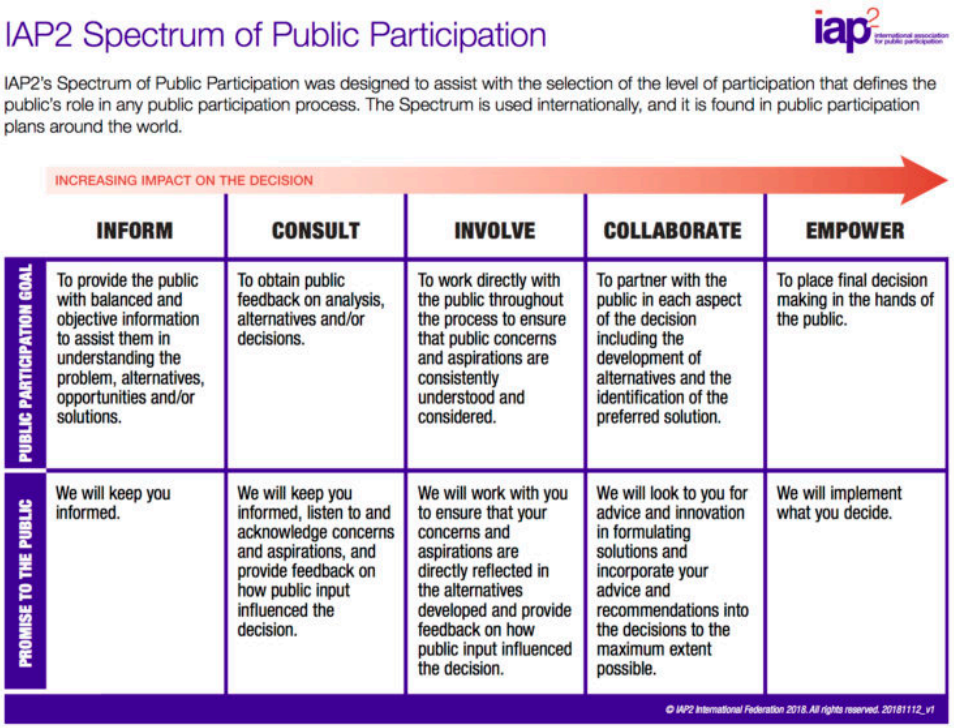


Figure 3.4: Davidson's wheel of participation [94]

IAP2 (International Association for Public Participation) is an international association of members who seek to promote and improve the practice of public participation and public engagement in relation to individuals, government, institutions, and other entities that affect the public interest in nations throughout the world. This association

defines levels of participation in five stages; inform, consult, involve, collaborate, and empower. It was first proposed in the early 2000s [117] (see Figure 3.5).



IAP2 Spectrum of Public Participation

IAP2's Spectrum of Public Participation was designed to assist with the selection of the level of participation that defines the public's role in any public participation process. The Spectrum is used internationally, and it is found in public participation plans around the world.

INCREASING IMPACT ON THE DECISION

	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
PUBLIC PARTICIPATION GOAL	To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision making in the hands of the public.
PROMISE TO THE PUBLIC	We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and aspirations, and provide feedback on how public input influenced the decision.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will look to you for advice and innovation in formulating solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.

Figure 3.5: International Association for Public Participation (IAP2) – Spectrum of Public Participation [117]

The one-way, two-way, and deliberative communication modes that are associated with each type of public participation are included in Tina Nabatchi's [118] modified version of the Public Participation Spectrum. The graphic demonstrates how increased participant involvement, collaboration, and empowerment improve the possibilities for deliberative communication (see Figure 3.6)

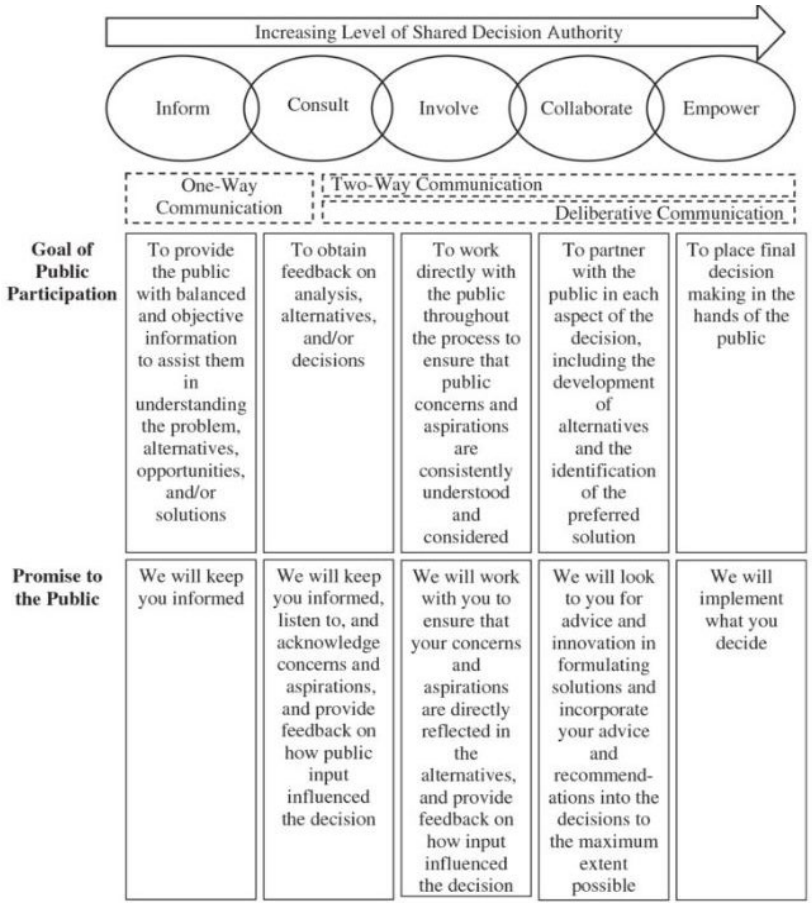


Figure 3.6: Modified version of the Public Participation Spectrum [117]

The first mode of public participation "inform" is to help the public comprehend the issue, potential solutions, alternatives, and/or opportunities, and aims to deliver fair and impartial information. The "consulting process" seeks input from the general public on analyses, choices, and/or decisions. Participants in a consultation process provide their points of view, ideas, or preferences, and leaders utilize this knowledge to guide their decisions. Working closely with the public to ensure that their concerns and ambitions are continually recognized and taken into account is the aim of the "involving process". Participants actively participate in a decision-making process that is facilitated by leaders like school administrators and public officials. The "collaborative process" aims to involve the public in all aspects of the decision-making process, including the creation of alternatives and the determination of the preferable course of action. In the collaborative approach, leaders like school administrators and government representatives collaborate with the general population to identify issues and provide solutions. The "empowering process" seeks to give the citizens the final

say in decision-making. In an empowering process, decision-making authority may be partially or fully transferred from leaders like school administrators and public officials to participants from the public, or the public may mobilize to create a decision-making process in place of institutional leadership or action on a crucial issue. At its best and most advantageous, an empowerment process gives the public the capacity to make decisions, which increases public trust and makes the required resources available [117].

The OECD (The Organisation for Economic Co-operation and Development) aiming at the development of economic and social welfare in the world, defines three terms that will strengthen the relationship between government and citizens as; information, consultation and active participation [119] (see Figure 3.7).

Figure 3.7: Information, consultation and active participation by OECD [119]

Governments either proactively share knowledge on policymaking, or individuals actively seek it out. In both situations, the government and the public have a one-way connection where information mostly goes in one direction in terms of "information". Public records access, official publications, and government websites are a few examples [119]. The government solicits and accepts citizen input on the formulation of policies at the "consultation" level. Government establishes whose opinions are sought on what subject during policy-making in order to gather feedback. In order to receive input from the citizens, the government must enlighten them. Thus, consultation establishes a slender two-way dialogue between the government and the citizens on proposed legislation and at large [119]. Citizens actively participate in making decisions and forming policies in terms of "active participation". Active

participation refers to the involvement of citizens in the policy-making process, such as when they provide policy ideas. At the same time, the government is in charge of formulating policies and making the ultimate decision. A sophisticated two-way relationship between government and citizens is founded on the partnership principle and involves including citizens in policymaking. Open working groups, layman's panels, and dialogue processes are a few examples [119].

İlhan Tekeli [97] defines five different forms of participation; the adaption of the plan by the public, informing the planner through participation, the participation of the public in the planning decisions, participation as a tool for the realization of critical rationality, and participating in the excitement of creation, not sharing. The first approach, the adoption of the plan by the public, is depicted for sale in terms of marketing. In this approach, the planner produces plan decisions with all his knowledge in order to ensure the public interest and has these decisions accepted by the public. However, in this approach, the fact that information flow is one way and there is no real participation. The approach of informing the planner through participation is to get information by establishing a relationship with the public only if the planner is insufficient to reflect the problems of the people. At this stage, the planner decides for the public interest, and the public does not participate in the decision-making processes. The participation of the public in the planning decisions is a stage that requires the politicization of the planning approach and the role of the planner in the first two approaches he defined. Planning is no longer a technical process; participation is perceived as a requirement of democracy. The approach, which sees participation as a means of realizing critical rationality, says that the first level is that a compromise between different wishes and interests is not sufficient. Social good will only be determined by creating a collective discourse with the participation of the public and its rationality will be evaluated within this discourse. The difference at this stage is the change in the direction of participation. The excluded and invited citizens are public while in other approaches, the planner's participation in an existing participation process is expected. The last approach is that participation is not limited to aiming at resource allocation, but that the society can also mobilize its own resources. It refers to a participation process that aims to create together and not divide. A participatory approach that goes beyond the distribution of limited public resources and includes individual resources in the process can become a solution to

the resource problem by changing the balance of collective consumption and private consumption. Clarity of the participation process is basically aimed at realizing the concept of participation at different levels and involving the public in the participation process [120].

A new network-based paradigm for public participation in communicative planning had been developed by Innes and Booher [121] in 2000 as seen in Figure 3.8. There is no central authority in this network that directs all decision-making toward the objectives of the dominant group. Furthermore, there is no hierarchy in the process that would obscure the ideas of the weak or non-interested parties and lead to inequality. Power was distributed among the several players evenly. The government is no longer a black box that only offers terse explanations or unresponsive answers to citizens' inquiries. According to Innes and Booher, a successful collaborative dialogue results in the network when certain debates are finished, other dialogues occur, and power is built on all of the participants. Since not all of the participants involved in the decision-making process are connected, different sorts of knowledge (whether professional or local) will constantly circulate between them. Such a network can also be thought of as a shared-power network, which corresponds to Arnstein's demand for citizen involvement in the respect of accessible citizen power [121].

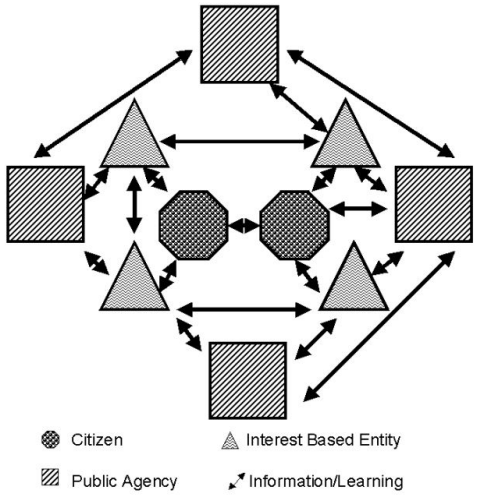


Figure 3.8: Collaborative network paradigm for citizen participation [121]

Participation is closely related to how effective the decisions taken by the citizens, the opinions expressed or the suggestions made are in the decision-making process, and also how the power distribution is made in the participation process [51] [111]. To conclude, participation can signify many different things, from fake involvement to actual participation. Planners and designers continue to utilize Arnstein's article to understand involvement levels as they build new models and techniques.

3.3 Methods and Tools in Participatory Urban Planning and Design Projects

The instrument and method of participation become important when it is viewed as a pedagogical process and linked to the production of knowledge to be included in design and planning [110]. Participation is a multi-actor process that searches for certain methods and approaches to bring all the actors and work together toward a common goal. A variety of efficient methods should be used to guide participation procedures. Various strategies and techniques for participation in the process of deciding how to manage and shape their environment are described in the literature. All methods and techniques must have sufficient planning time as well-defined objectives, strategies, and action plans. They are also criticized for taking a lot of time, being ineffective, and not being particularly productive, and as a result, they have changed over time in response to these complaints [122]. Every participatory project has its own unique dynamics and traits. Methods and strategies for participation differ based on the area's scale, location, and goals: the position and attitudes of the actors; the manners of the citizens; the backgrounds of the experts; technology breakthroughs; and so forth. The participatory approaches can be tailored in numerous ways to meet the unique needs of the neighborhood. A wide variety of methods and techniques can be chosen or combined in different ways depending on distinct needs and qualities [123]. Professionals recommended a variety of strategies, tactics, and formats in accordance with the goals of participation. The complexity of the problem, the number of participants, and the nature of the groups engaged, as well as the sort of information to be gathered, all play a role in defining methodologies and strategies. Adaptations have been made to all methodologies and procedures to account for new environments, technology developments, and community profiles. Alternative techniques could be

appropriate for various target audiences [123], [124]. For example, both digital and analog methods can be used for citizen participation projects.

Sanoff [122] classifies approaches for participation processes into three primary categories: "awareness methods, group interaction methods, and indirect methods." Surveys and questionnaires are examples of indirect methods of involvement that are used to gather data and ascertain the attitudes and opinions of a sample of the user community. Results from surveys and questionnaires can be quickly and easily quantified. Surveys and questionnaires have the drawback of reflecting the viewpoint of those who created them rather than those who answer them. However, one-on-one interviews can deliver more thorough information. Even when they do not fit a scientific sample, interviews still provide detailed, qualitative information that cannot be obtained in any other way [124].

A variety of strategies for encouraging creative collaboration between experts and laypeople are essential to the success of community design. Many of these techniques are already commonplace in participative procedures. Without the interactive group decision-making that typically takes place in workshops, participation is uncommon, whereas interviewing and mapping enable substantial participation. Sanoff's [124] methods are divided into five main groups: *awareness techniques, group interaction techniques, game techniques, indirect techniques, and open-ended strategies.*

Awareness methods

Newspaper inserts and articles are useful tools for informing people about the procedure and ensuring that they are kept fully informed. Newsletters are also good at maintaining interested readers over the course of a protracted decision-making process. A news release is another technique to pique the media's interest, particularly in larger communities where it might be difficult to catch their attention. Planning a walking tour across the research region is another method to help users become more conscious of environmental circumstances, mainly where people have acclimated to unpleasant conditions. During this stroll, participants might re-discover a familiar setting or get to know a brand-new one. This approach may contain a map or plan, a list of particular activities, and designated stops for recording impressions. The participative process can effectively be introduced via this method [124].

Indirect methods

A sample of the user population's information, attitudes, and opinions is gathered through surveys and questionnaires. This method produces quick, easily quantifiable outcomes. This method has the drawback of reflecting the opinions of those who create the surveys rather than those who answer them. However, one-on-one interviews might provide much more information. Interviewing does not produce a scientific sample, but it does produce precise, qualitative information that can only be gathered through interviews [124].

Group interaction methods

All group approaches involve direct communication, sometimes known as a workshop. Nevertheless, there are many other ways to interact. Focus groups typically have six to ten carefully chosen participants, along with a moderator who steers the conversation toward pertinent topics. A method for abstracting a problem's key components without the usual restrictions is gaming. This procedure brings together interest groups for a series of lively sessions with the goal of resolving specific issues. This is a practical technique where professionals and citizens collaborate to investigate alternatives using blueprints, pictures, and/or models [122].

Open ended methods

A community meeting, also known as a public hearing or a public forum, can be used to inform a broad audience about proposals, spark interest, or win approval. Community representatives can present project information at any stage of the process by holding public meetings. But these sessions' condensed agendas don't provide much time for discussion. Even though it's referred to as community participation, only the most assertive individuals frequently participate and take the lead in the conversation. During open meetings, votes are frequently taken by a show of hands. For example; planning a ballot was designed as a tool to increase active citizen engagement by giving those who are unable to attend or speak at public meetings a platform to do so [122].

Brainstorming methods

Brainstorming is the most popular technique for accomplishing this. With three principles to follow, traditional brainstorming is a verbal problem-solving technique employed in small groups of three to nine people:

- Come up with as many options as you can.
- Unusual concepts are welcomed.
- No criticism is permitted; final judgment is withheld.

For groups greater than twelve people, there are various brainstorming techniques, frequently referred to as brainwriting. A group of people who are unable to congregate in one location at the same time may also use these techniques. Besides, it is possible to combine verbal and written brainstorming approaches to benefit from each method's strongest points. Gallery, pin card, nominal group technique, cranford slip writing, ringii process, delphi methods can also be used by a group of people who cannot meet in the same place at the same time [122].

Each participant receives an easel and a sizable pad, along with enough time to record all of his or her thoughts on the issue in gallery method. A timeout is ordered. Following a tour of the easels, participants go back to their own to add to and modify them. There is an idea of hitchhiking. A different crew receives the notes and evaluates them. People who feel uneasy speaking in front of a group will find this technique to be especially helpful.

In the pin card method, people jot down thoughts on note cards while seated around a large table. The participants can then add their suggestions and modifications to the original concept after the cards have been passed around. After then, cards are gathered for a different team to evaluate.

In the nominal group technique; participants have five minutes to write down their thoughts in silence after hearing about the issue. The collected ideas are then debated, ranked in order of preference, and voted on. The idea generation and idea evaluation processes are combined into a single session with this method [125].

When big groups of people wish to be part of the process, cranford slip writing is utilized to gather thoughts. Each participant is instructed to list 20 ideas on separate slips of paper after the problem definition has been delivered. These are gathered and given to an additional team for organization and evaluation of the created ideas.

Ringii process is a Japanese process where an idea is circulated in written form. Participants jot down ideas and send them on. The original author receives it back, considers the advice, and revises the concept. There can be multiple rounds of this process. If predicted, it prevents interpersonal confrontations [122].

The Delphi method is a process that starts with written brainstorming and keeps going until the greatest ideas have been agreed upon. Participants can remain anonymous in this situation because there is no direct connection because the ideas are gathered through a questionnaire or online computer. It gathers concepts. These are then listed, and each participant is given the opportunity to evaluate and rank the list. Up until a decision is made, this procedure is ongoing [125].

Interactive brainstorming methods

Interactive brainstorming is a technique that can be used by groups of up to 20 people and includes periods of concept writing and verbal idea sharing. Idea trigger and panel format are referred to as interactive brainstorming methods.

Idea trigger is a process in which each member takes turns reading their list after a brief period of silence during which they all scribble down ideas on notepads with two columns. Other participants tick off any fresh or hitchhiking thoughts they have in the second column as individuals read from their lists. The process is repeated traveling counterclockwise around the group after going around it once clockwise. The concepts are gathered for later examination after the second cycle is finished [122].

A panel of 5–10 participants can be created in a bigger group, such as 20–30 people, who then verbally brainstorm in front of the rest of the group in a panel format. While listening to the panel, the entire group will jot down any new or hitchhiking ideas they may have. Following the process, the opinions of the panel and the audience are compiled for later evaluation [122].

Group process

According to Sanoff [122]; a collaborative, positive group method enables participants to exchange ideas and enhance the caliber of one another's work. A positive group should consist of eight people, each of whom makes a suggestion and receives responses from the others. The rules of the process are:

- Just a referee/timekeeper, no leader (who also presents).
- Everyone has between 5 and 10 minutes to present an idea or proposal. Each respondent has between one and two minutes.
- Each participant solely offers positive feedback in the form of, "If I were you, I would... (presenter's name) ..." (Responses that sound similar to others shouldn't be suppressed; repetition helps the presenter.)
- The presenter does not respond, but instead fully and in writing captures each affirmative response. The useful outcome is this list of responses.
- After everyone has replied, the presenter responds to each affirmation collectively before attempting to include all or the majority of them in the upcoming iteration of their design [122].

Participation games

Other forms of participation, such as designing and planning games for setting up group decision-making, can be used to encourage participation. According to Jerome Bruner [126]; participation is one of the most important elements in the learning process, particularly when using games that integrate the formal characteristics of the phenomenon the game is an analog of. A game is a representation of reality that enables participants to participate in social interactions and act out scenarios. Games are educational because they aim to foster a learning environment and function as a catalyst for action. Gaming is a collaborative approach to the problem that involves a real-world scenario that has been reduced in time, allowing the key elements of the issue to be examined. In a dynamic setting where decisions must be made on a regular basis, this strategy enables learning about the process of change. In essence, a complicated issue is found, its essence is abstracted, and the outcome is a simulation

process. Games are made up of participants who are placed in a predetermined environment, with rules and procedural guidelines acting as the environment's limitations. Design games engage players in both their play and the outcomes of their design and planning. There are many causes for this, but the following three are crucial:

- Participants adopt a persona and approach the issue from that stance.
- Games create an overall model out of intricate details. The gamer is able to understand nuances that they might otherwise miss.
- Games compel players to make trial decisions, and this commitment hones their decision-making skills.

Workshops

There are many different participation techniques used in workshops. When a citizen participates in a workshop, they get the chance to learn about interpersonal relationships. Learning is most effective when it emerges from personally meaningful experiences that need reflecting, developing, and testing new ideas and problem-solving techniques. These procedures become obvious when participants may settle their disagreements while pursuing a common objective. Workshops achieve a high level of interaction between participants who have the same purpose. In a workshop, participants explore problems and gain knowledge from one another. Building group cohesion is a crucial step in the development of a workshop. There should be opportunities for groups to become so entwined that they start to view one another as individuals and develop an interest in one another. Experience is meant to aid learning that could otherwise be haphazard and dispersed. It is vital to structure the experience so that the group process has a focus in order to achieve this. Additionally, it ought to make it more likely that the participants will learn particular things.

Study circles

Study circles, rooted in the historical town meeting tradition, are used to achieve a community-wide conversation on public concerns, in contrast to the usual public meetings and workshops. They are made up of small groups of 5 to 15 individuals who consent to meet often to discuss a problem facing the neighborhood. Study groups are

completely optional and very participative. Each member gets an equal chance to engage, allowing the group to absorb the collective wisdom of its members. People are encouraged to exchange ideas and gain knowledge from one another. Since reaching a consensus is not the main goal of the debates, they might explore new concepts as they go along [124].

Virtual reality (VR)

It is believed that virtual reality (VR) will make it easier to create tools that will let laypeople actively participate as designers in the initial stages of the urban design process. It does not take the place of any established techniques. VR, also referred to as a "powerful empathy machine," is an ideal technology to create a tool for use in participatory urban design. There are countless opportunities for content development in virtual reality [127]. It can be applied to the creation of tools for both inactive observation and active participation. Participation in participatory urban planning processes varies, and the medium can be utilized to create various tools for various purposes. VR should be viewed as a creative way to supplement the current toolkit rather than as a replacement for participatory instruments. Participation in the early stages of project development is made feasible by the use of VR-based tools in urban design [128].

The design or planning charrette is another approach that was mostly created by architects and planners based on their own expertise in the creative method. According to this theory, creative solutions to design problems result from intense, frequently teamwork-driven focus. Step-by-step or regular methods cannot help you develop creativity. In this concept, experts will bring together a large group of residents or other interested groups to examine a location or a site, envision possible possibilities for it, and design ways to realize those futures [121].

Toker [129] offers various approaches for each level of his five-stage process, which consists of preliminary investigation, goal-setting, strategy identification, action planning, and connecting decisions to planning and design outputs. For the initial research stage, activities like awareness walks or awareness camera activities can be carried out. He proposes likes and dislikes analysis, desire poems, PARK analysis, interviews, and other methods for developing goals. He also offers design games,

lifelike visuals, and a way of choosing among possibilities for physical planning and design decision-making (see Figure 3.9).

Figure 3.9: Participants voting on Terms of Reference [130]

The effectiveness of the participatory design process is significantly influenced by the participatory approaches. There are many approaches described in the literature [110], however, occasionally these methods may not be appropriate for getting user input. The designer's creativity is now more significant. A good urban designer will observe the neighborhood and operate in line with its demographics.

Along with more traditional participation methods, traditional participatory methods can be created for specific project plans, such as audio-video installations around the city. A participatory project can also plan a variety of participation-related events [131].

Digital methods have been developed to facilitate stakeholder participation in participatory urban design and planning. Singapore’s non-governmental organization (NGO); Participate in Design [132] suggests involving residents in enhancing and beautifying their neighborhoods. Various strategies are used in the community workshops; one opportunity is to co-create streets and communities by involving the community in the design phase. In the Netherlands, Blok74 [133] is engaged in similar projects. In their citizen participation seminars, the designers employ game ideas to help participants comprehend and improve the built environment. In addition to acting

as a community initiative, London's Coin Street [134] also provides a framework for co-designing public spaces. Block by block organization [135] encourages citizens to use the video game Minecraft to share their visions for their neighborhoods. In order to ascertain the desires of residents for design change, this collaborative and competitive design technique has been tested in a number of cities [43].

Placemaking is the process of creating places with people in mind. Jane Jacobs and William W. Whyte [136] are credited with the concept. The emphasis on designing cities for people and including citizens in the decision-making process when designing public areas are two fundamental tenets of placemaking. Even while we are not directly designing physical places when we design public services, those services still have their own habitats within the urban environment and are utilized by their citizens. Exchanges and interactions among people can alter how people perceive the value of public services since people are social beings and they are shared experiences.

The spatial and social benefits or constraints of the citizen's participation in the planning, design, and implementation stages are valuable in the production of urban space. Contemporary urban movements, which bring a new perspective to the production of urban space, aim at spatial and social change by enabling the participation of the citizens. The definition of 'active participant' is that the citizen is in a direct decision-making and designer position. Urban movements in which the citizen contributes to the production of urban space as an active participant and in a decision-making position do it-yourself urbanism, temporary urbanism, pop-up urbanism, tactical urbanism, guerilla urbanism, urban hacking, urban parkour, urban squatting, urban acupuncture, and digital urbanism [137].

Traditional participation methods are implemented with a top-down organization model as Arnstein’s [51] and Sanoff’s [122]. The urban movements, which include active participation practices as above, have several decisive common points. It is based on the urban initiative as an organizational model. Some of the urban movements mentioned are purely bottom-up organizations when considered within the framework of the above-mentioned top-down and bottom-up organization models. Some of them can be implemented with both bottom-up and top-down organizations. Firstly, the citizens take decisions directly. Secondly, these urban movements focus on the open spaces of the city. The open spaces of the city are the places where the citizens can

interact with each other in daily life. Thirdly, the participants decide how to use those spaces.

Urban practices, in which we can shape micro-areas in many cities around the world, are increasing day by day [137]. Traditional methods and urban strategies that offer long-term solutions cannot achieve the desired efficiency. Urban practices that include active participation contribute to the production of urban space according to the needs of the user. Fundamental to this is the ability to understand people and their needs, as ultimately those new experiences are used by citizens.

According to Kaliski [138]; there is an increase in "citizen experts" who have access to information and an understanding of planning and design. These citizen specialists are becoming more involved in shaping how the city develops and is built. There are more resources accessible for citizens to participate in comprehending and assessing issues and suggestions related to urban planning, even though the precise function of citizen experts is still to be defined.

3.4 Citizen Design Science

Cities around the world are facing tremendous challenges such as mass transport, inadequate urban infrastructure, or other environmental side effects due to the fast growth of urban areas and the demand for flexible and adaptive strategies for urban planning. According to European Union [139]; in a "smart city," existing networks and services are enhanced with digital technologies for the benefit of locals and businesses. The smart city concept refers to this movement to improve the city. The idea of "smart cities" describes the city's efficiency and efficacy as well as problem areas including energy use, government, traffic, etc. Also, a "resilient city" which is under the smart city concept refers to having the ability to absorb, recover and prepare for future shocks (economic, environmental, social & institutional). Resilient cities promote sustainable development, well-being, and inclusive growth. The strategy from the previous decades was to take use of cutting-edge technologies and learn through data mining techniques. The issue with this approach is that it ignores human factors like how we perceive space. The active design feedback from citizens is identified as a yet missing but essential way towards a responsive city. The city does not only makeup of great infrastructure and sustainable energy supply but also citizen profit and feedback as

well as their awareness. Urban planning needs to consider the judgment of the public in order to decide the choice of society as well [140]. Understanding the needs, concerns, and perceptions of citizens is essential to human-centered urban design and development. Therefore, current strategies concentrate on human-centered technology and attempt to engage citizens in some parts of planning. Since then, the advancement of democratic governance and several related domains can be attributed to citizen participation. These contributions are believed to enhance responsive and accountable states, cultivate a feeling of citizenship and elevate positive sentiments. These include things like the quality of life, often known as liveability or a citizen's sense of identity. There are many solutions to make this vision practical. Johannes Mueller, Hangxin Lu, Artem Chirkin, Bernhard Klein, and Gerhard Schmitt developed a new strategy that combines active co-designing with crowdsourcing methods as participatory design approaches in urban planning at Future Cities Laboratory, ETH Zurich [9]. This new strategy is called, “citizen design science “. Citizen design science (hereafter CDS) represents new forms of citizen participation in the urban planning process. CDS is about the understanding of transferring information from citizens to make it knowledge and even wisdom.

3.4.1 Concept of Citizen Design Science

One of the earliest CDS techniques can be viewed as Kevin Lynch's [141] mental mapping technique. The use of mental maps in behavioral geography has gained popularity thanks to Lynch's research, which was published in "The Image of the City". Participants in his study were instructed to create basic sketches of interactive city maps. Lynch identified five characteristics of a city that, in his opinion, stand out the most landmarks, nodes, paths, districts, and edges. This method can be used in participatory planning to learn significant structures and landmarks as well as how locals view their surroundings [141].

> “*Nothing is experienced by itself, but always in relation to its surroundings, the sequences of events leading up to it, the memory of past experiences.* [141]”

The process of becoming aware of actual physical objects, phenomena, etc. through senses is referred to as perception. The images, experiences, and meanings that individuals associate with the built environment are thus included in the perceptual dimension of urban design. The perceptual dimension of urban design examines how individuals view their surroundings and interact with their surroundings. More than just observing the environment is involved in perception. Perception is socially and culturally learned while sensation may be stimuli to everyone [142].

Elisabeth Sanders, a social scientist, and designer from the United States write on how citizens might participate as co-designers. Sanders [143] asserts that citizens communicate their experiences by talking, thinking, acting, utilizing, knowing, feeling, and dreaming. The last four actions are more subliminal and latent while the first four are explicit and visible. She suggested using "making tools" to gain access to these levels of experience. People can express themselves in a variety of ways thanks to tools. For instance, cognitive toolkits that assist users in building maps and 3D models can reveal how they view and comprehend a location because they compel users to think and communicate in unique ways. Mueller and his colleagues expand on Sanders' idea and employ technologies they create for citizen participation in urban design. They refer to this fusion of citizen science, urban design, and design science as "CDS" [144] (see Figure 3.10).

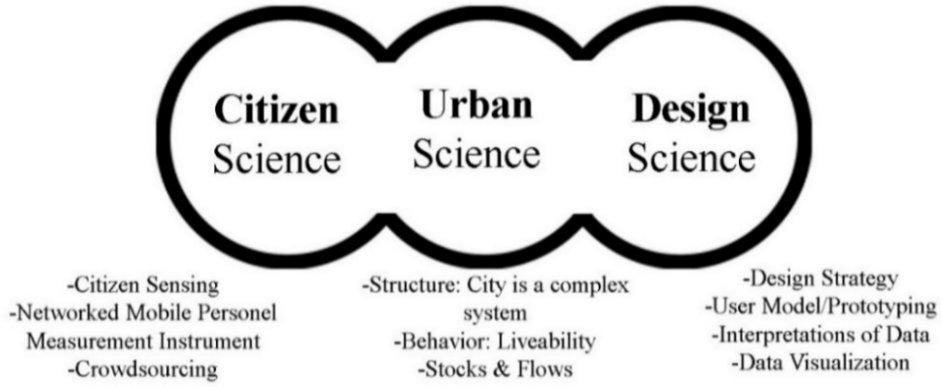


Figure 3.10: Citizen Design Science: A concept [144]

CDS is a concept that adds the strength of thousands of citizens in terms of observation, human cognition, experience, and local knowledge in a scientific framework [144]. Using urban design tools, CDS is a new approach to including citizens in the urban design and planning process. The three foundations give rise to the phrase CDS. It is also referred to as a) citizen science, which refers to the participation elements and the type of data collecting; b) citizen design, which denotes active design by citizens; and c) design science, which is crucial for converting citizen design suggestions into the designs of urban designers [43] (see Figure 3.11).

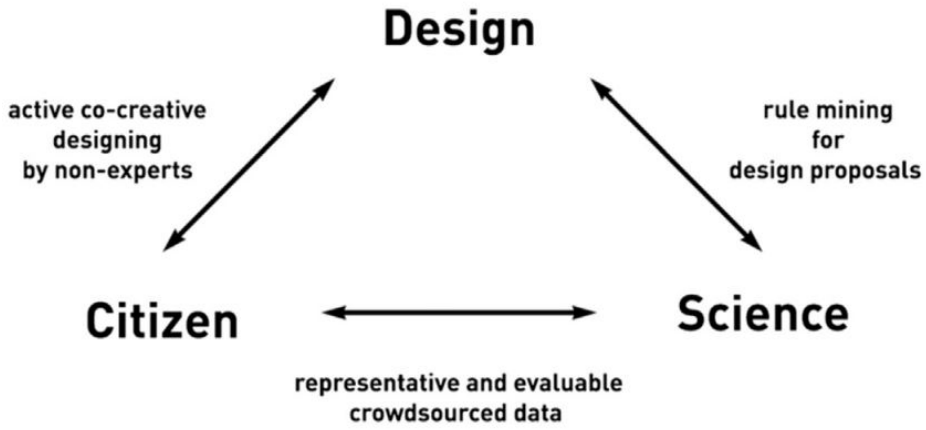


Figure 3.11: The three terms of Citizen Design Science: Citizen Science, Citizen Design and Design Science [9]

Applying citizen science techniques to the field of architecture and urban planning contributes representative and evaluable crowdsourced data from citizens into the process. CDS is seen as participatory research that involves society informing voluntarily. Citizen science stands for scientifically relevant to apply its methods in urban planning in this strategy. By conducting mass-participatory design for the setting of urban design, it can be put into practice. The scientific perspective emphasizes how important it is to consider these techniques for better cities in the future. The amount of collaborative active design will remain low if there is no citizen science. Since many people live in one neighborhood of a high-density urban area, it is now important to consult more than thousands of people even for design issues on a neighborhood size. [9].

Citizen design is not frequently used in the literature. Mueller and his colleagues [9] used this term to describe a specific kind of participatory design. It is the active designing of the urban habitat by non-expert citizens. It is as Sander [143] described to gain hidden information from the citizens. CDS without citizen design would merely involve citizens in the planning process without the creative design component. Younger people's curiosity about new technology and the gaming element of Citizen Design add to its attractiveness. People can express their ideas in unexpected ways because there is no right or wrong in the process, which may increase their motivation to engage [9].

The goal of *design science* as a component of citizen design science is to organize experimentation protocols, quantify, and establish citizen design patterns.

Mueller and his colleagues locate citizen design science in the realm of design research and take Sanders' [145] topography of research areas in the design. The horizontal dimension of the map, which has two dimensions, shows the degree of user participation in the design process. User-centered design methodologies make the assumption that designers have more expertise in creating the thing and should make the key choices. The user is engaged in the process through participatory design. The user can participate in the process by providing simple concept input and also by making decisions. The vertical dimension explains where the design strategy came from. Sanders makes a distinction between approaches derived from theory against those that originated from practice (design-led) (research-led). Even though CDS just described the setting of urban design on the map, it is important to position this technique in the participatory mentality since it relates to general design research. An important component of our strategy is the participation and empowerment of citizens. However, a comprehensive bottom-up design approach is not suggested. [9] (see Figure 3.12).

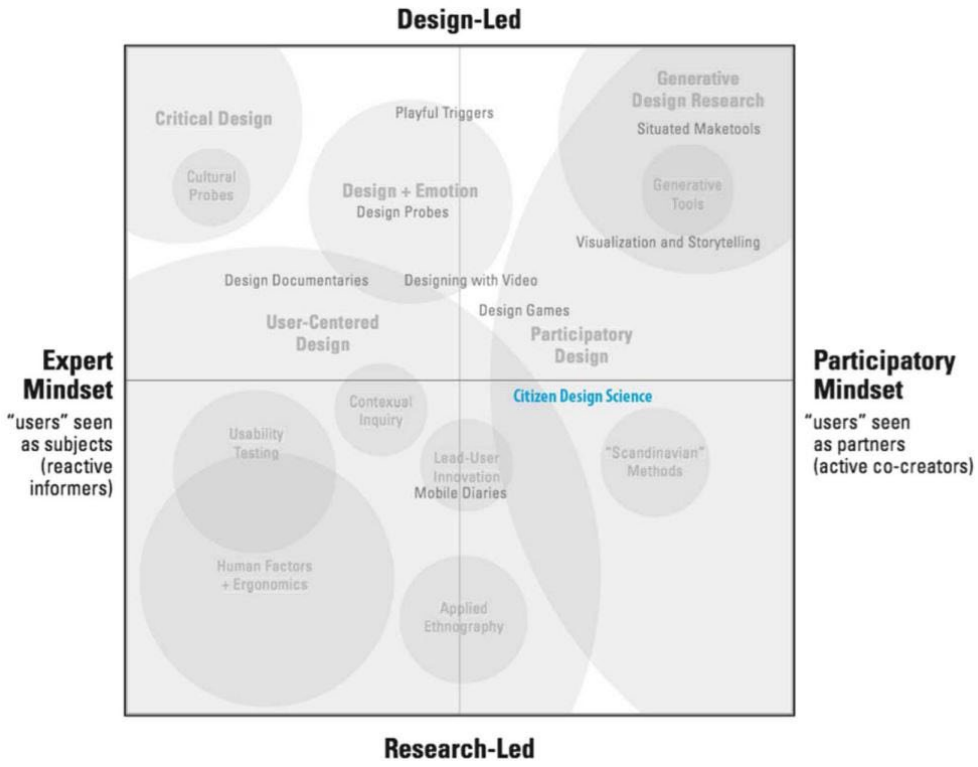


Figure 3.12: Citizen Design Science addition to Sander's map of new tools and methods in Design Research [9], [145]

In order to characterize creation and co-creation in public organizations and classify their design methods, Junginger [146] provides a framework (Figure 3.12). It displays the options for designing for, designing with, or designing by citizens and organizations in a matrix. With designing for, with, or by organizations on one side and designing for, with, or by citizens on the other, the 3x3 grid framework gives a general overview of prevalent design methods in public organizations. Similar to IAP2, various circumstances, organizational setups, and attitudes result in a preference for one option over others. This matrix can be used to compare an as-is and a to-be state and provides for the location and categorization of current public-sector activities around the world [147]. The CDS concept stands for designing with citizens and design experts design with citizens as seen in Figure 3.13.

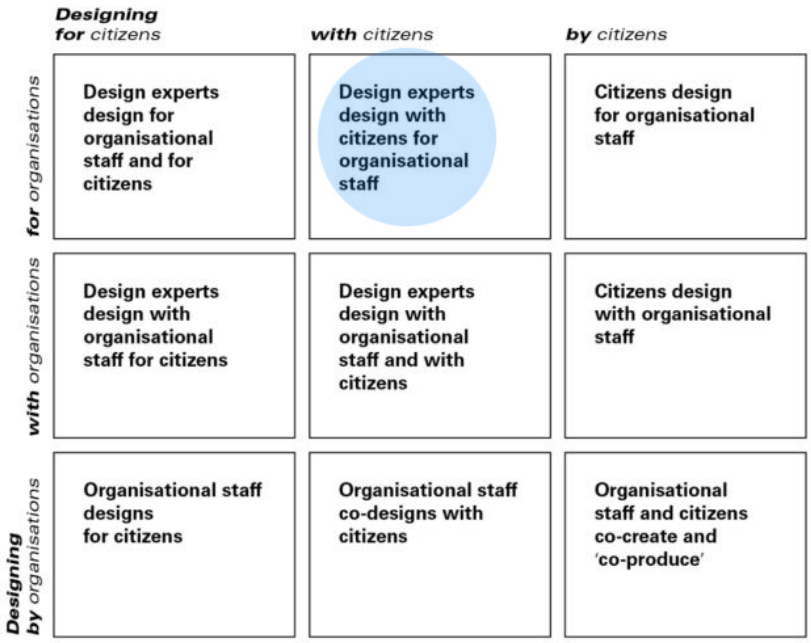


Figure 3.13: CDS, Common design practises in public organisations [147], modified

The CDS concept basically consists of four-step processes; collecting the data based on citizens' knowledge, expressing and sharing knowledge into scientific data, and its impacts. It is handled under the concept of a resilient city regarding how the citizens respond to the design of the city according to their needs and wishes. Each step is shown in Figure 3.14.

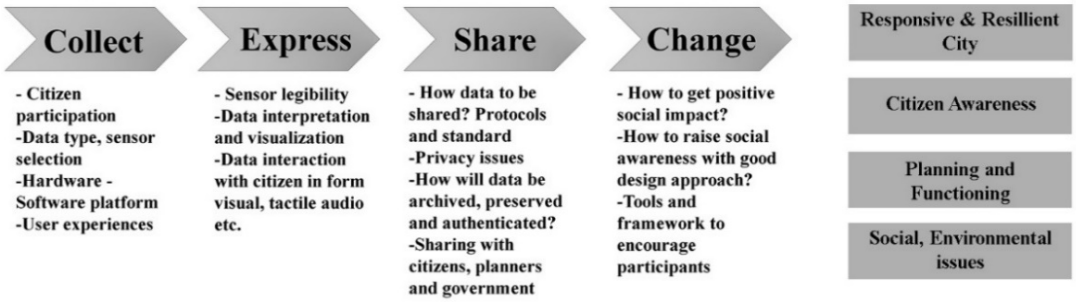


Figure 3.14: Citizen Design Science: A challenge [144]

CDS is an interdisciplinary process that mainly occurs in four components as design, information, architecture/urban, and technology as shown in Figure 3.15. Interaction and creative design, information visualization are the components of the design part. The urban study, GIS (Geographical Information Systems), and spatial planning are the components of the Architecture/Urban planning part. Data fusion, sensing technology, sensor network, the internet of the thing, web technology, and crowdsourcing are the components of technology. Urban computing, machine learning, and data mining are the components of the information part.

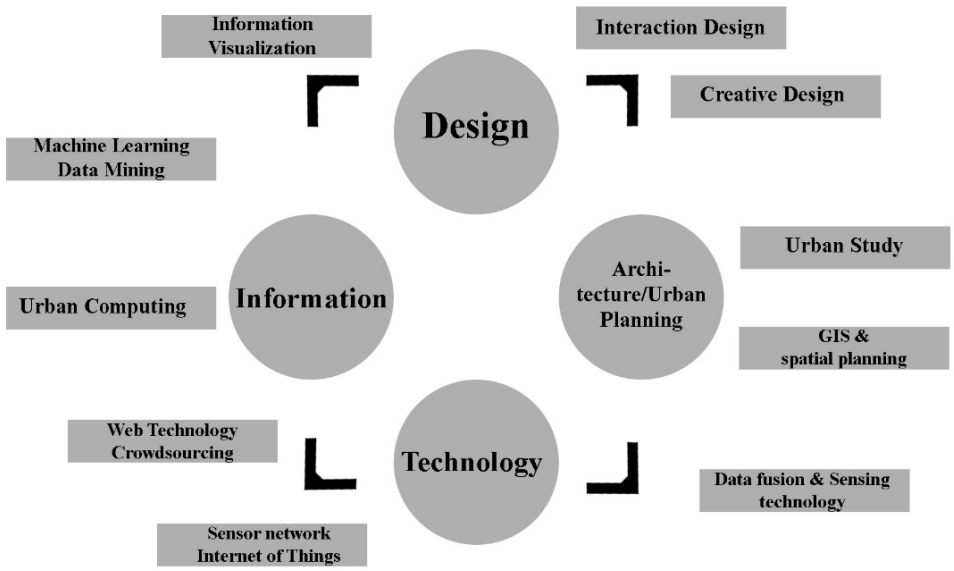


Figure 3.15: Citizen Design Science: Interdisciplinary [144]

CDS projects in practice also occur in three main fragments as shown in Figure 3.16. Urban computing and participatory design generate state of art. This collaboration includes actors from many different disciplines.

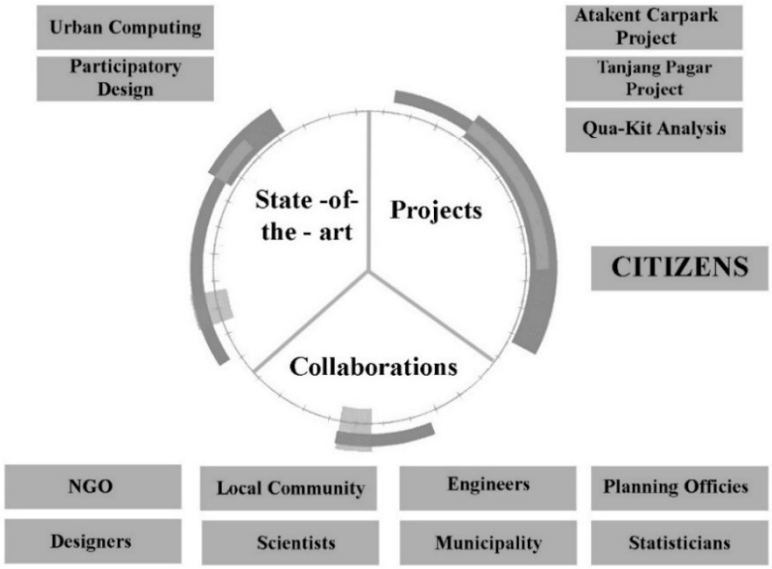


Figure 3.16: CDS in practices [144] – modified

Four features of the CDS strategy could be viewed critically [9]:

1. *Citizens just create what they already know.*

Based on Sanders' [145] theory of implicit and latent user experience and Carteau's [148] theory, citizens would not only experiment with creating the urban environment in the way they know it, but also enhance it with their own wishes, dreams, and needs (see Figure 3.17). For example, the walking person is the person making the choice [148].

Figure 3.17: The walking person is the person making the choice: design/user experience (Velibeyoğlu's archieve)

2. *Citizens do not have the entire view of a city; they are just focused on optimising their neighbourhood.*

Residents depend on solid infrastructure, for example, yet a motorway in the backyard is typically not better for the neighborhood. There is an opportunity to compromise with CDS. Municipalities can incorporate their needs (such as the minimum number of buildings in a new region that is undergoing development or the urban components needed to change a public space) into the design tool, and citizens control the design process in accordance with these demands. Another approach is to use this method as a starting point for bottom-up responses and apply the viewpoint of neighborhood residents to the top-down viewpoint by challenging the overall course of policies, which frequently favors economic over residential concerns.

3. *CDS experiments give more input than complicated oral and written consultations of citizens.*

A different kind of feedback by the citizens with the help of CDS. Although access to the citizens' knowledge may be more challenging, the value of the hidden experience may outweigh any verbal or written commentary.

4. *The direct dialogue between citizens and design makers is essential and not replaceable by computer technologies.*

Mueller and his colleagues [9] are aware that direct public debates with decision-makers or community workshops are not exchangeable by any high-tech computer tools. They do not want to set CDS in competition with other participatory design strategies. Additionally, they present CDS as a powerful opportunity for urban planning as a human-centered process.

There are several projects in this field. If it is used on a representative sample of residents, the Block-by-block project is an illustration of CDS. The focal focus of this project is citizen design, and design science methodologies. The outcomes of the Minecraft ideas are straightforward to assess. Utilizing the video game Minecraft encourages locals to share their visions for their neighborhoods. To uncover the desired design improvements of citizens, they tested this collaborative and competitive

design technique in many cities as seen in its global impact (see Figure 3.18 and Figure 3.19).

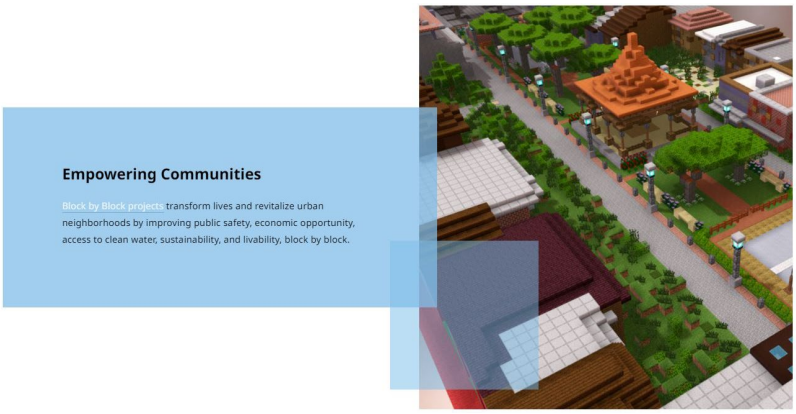


Figure 3.18: Block-by-Block [149]

Figure 3.19: Block-by-Block's global impact [149]

Jannack, Münster and Noennig [150] suggest a blueprint for a collaborative creative platform in their work. A project information model is created by translating numerous bits of information about the project space. Then, modified models are created and presented to the appropriate users. The final presentation of the public feedback to co-designers and decision-makers uses semantic analysis.

Another sample is a free application called Unlimited Cities DIY will be made available by UFO (Urban Fabric Organisation) in association with the creators of the collaborative planning tool "Unlimited Cities Pro" [151] (see Figure 3.20).

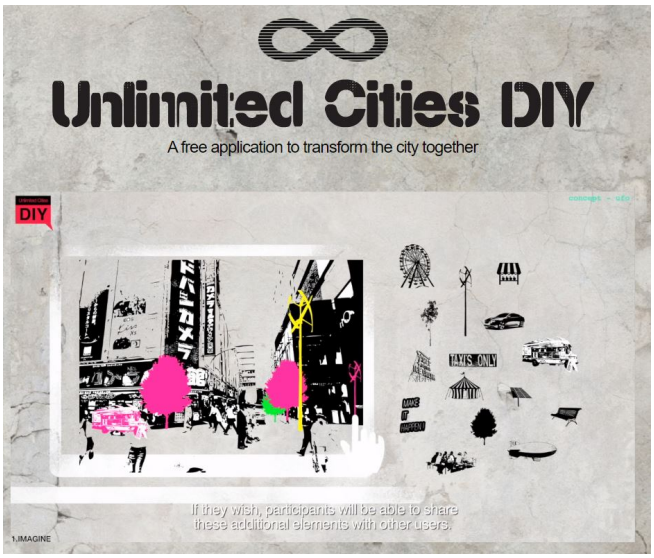


Figure 3.20: Unlimited Cities DIY's introduction page [151]

3.4.2 The Quick Urban Analysis Kit (Qua-Kit)

Quick Urban Analysis Kit (qua-kit) was developed by Artem Chirkin at the Chair of Information Architecture at ETH Zurich [152]. The program was first employed for a massive open online course (MOOC) at ETH Zurich, where students utilized it to finish their coursework.

The tool can be used in bottom-up interactions, where users develop their preferred design concepts and optionally discuss potential variants (see Figure 3.20). Mueller and his colleagues [10] provide a version that links the top-down and bottom-up decision-making processes. Although citizens are considered to be a significant source of local knowledge, the expertise of professionals is not ignored. Figure 3.21 demonstrates how citizens can be integrated as stakeholders in the urban planning process using online design tools. Designers as urban planners, authorities, etc. create the tool under predetermined limits, such as height restrictions or a necessary density.

Designers and other stakeholders provide appropriate design tasks for citizens to complete and implement rules in the design tool. After receiving feedback from the public, designers assess it and draw out valuable design criteria that have an impact on their master planning [9]. Thus, citizens contribute to this task by submitting their design ideas through the online tool. The results will be evaluated and formulated as design criteria and thus are useful for the work of designers.

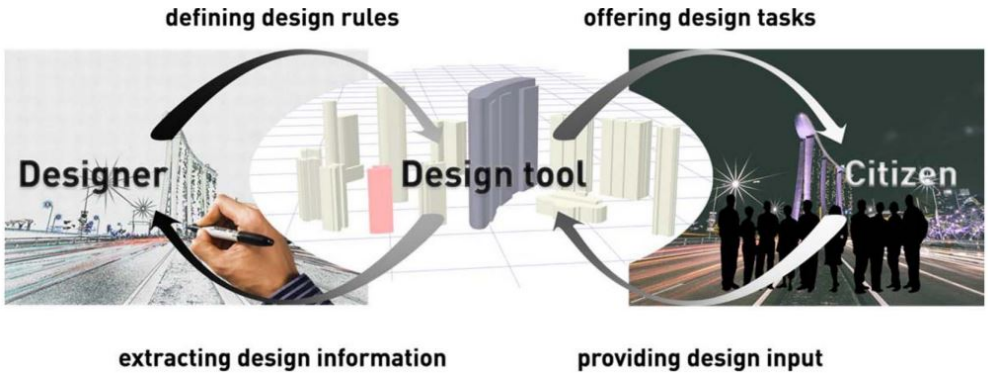


Figure 3.21: Mingling bottom-up and top-down processes [9]

For the Qua-Kit activities, a plugin called the Design Dashboard was created to visualize planning indications. An online design and participation tool called Qua-kit enables the creation and modification of 3D geometry in a 3D environment. The components of the system are shown in Figure 3.21 [43]. A part refers 3D Map-based design view showing an urban design layout. B part refers to the info view that provides textual descriptions and images of the design idea. The c part refers to the design components view that lists the elements available for the design. D part refers to control components that provide design controls, access to design analysis, and sharing functions. The part refers to the urban design dashboard plugin that supports analyzing the urban design and visualizing indicators including function distributions, planning, and energy indicators. F part refers to review components that enable users to comment on urban design proposals and vote on predefined criteria (see Figure 3.22). Besides, the single design view has five major components, including map components, tools components, design components, information components, and review components [43].

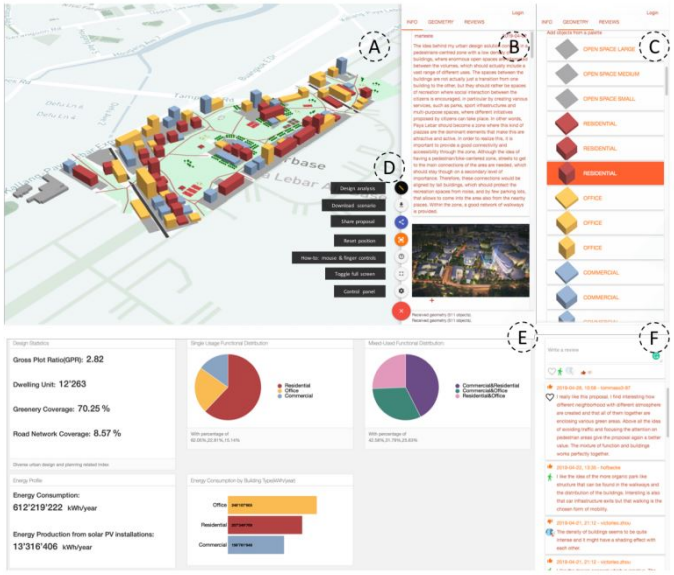


Figure 3.22: Quick urban analysis kit system with Design Dashboard plugin [43]

The tool's visual user interface can be seen online at http://qua-kit.ethz.ch/viewer (see Figure 3.23). This viewer can display 3D objects that are both static and moving. The qua-primary kit's purpose is to give the user the ability to adjust an object's position and, if necessary, rotate it. Because the items themselves cannot be modified, the qua-kit is less complicated for the user and has broader applicability.

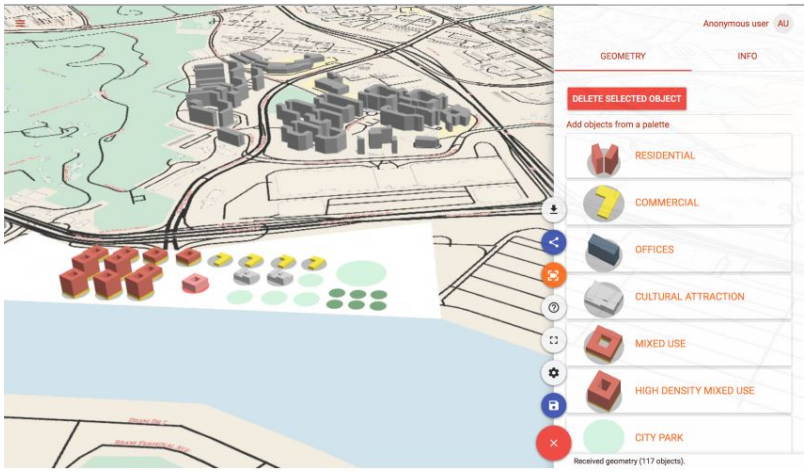


Figure 3.23: The interface of Qua-Kit tool [153]

Additionally, blocks cannot be stacked, which keeps the kit from being too similar to a Lego brick editor. The user makes changes with the left mouse button while changing the position of the view with a right click. The user can zoom in and out by using the scroll wheel. With the help of this straightforward web tool, even novice designers can customize pre-made geometry layouts to suit their unique preferences. Not the construction of infrastructure or the development of new objects, but rather the configuration of geometries is the main focus. The finished layout may be saved and submitted with optional comments on the user's design goals or further justifications [9].

Different applications of the tool are shown in Figure 3.24. Building-like items can be moved and rotated in the upper half of the graphic based on the user's choices. A community workshop that focused on improving the open area between the construction blocks was held using the simulation in the lower left. The trees, benches, and other facilities that are useful for designing parks and open spaces are the items of interest in this micro-scale scenario. The image on the lower right depicts a macro-scale area that is undergoing redevelopment. The citizens are asked to organize regions with various uses such as residential, business, park, etc., which are denoted by various colors. The suggested design concepts would provide access to citizen data that would not have been available through direct questionnaire questions [9]. Distinct design tasks require different urban components.

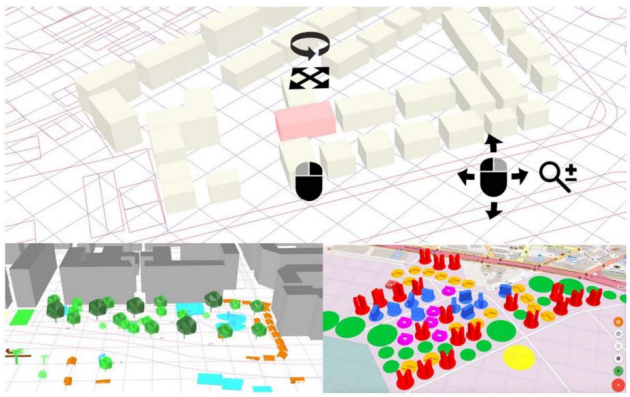


Figure 3.24: Screenshots of the qua-kit viewer [9]

Depending on the practice, the 3D elements can be customized. Users can select them, place them in a particular location, and rotate them. It is not possible to change or resize the 3D elements. The application logs user-submitted spatial configurations, together with camera zooms, movements, and the frequency of items utilized.

Easy access is important for citizen science research. Qua-kit gives users the option to build without following any design guidelines. It is possible to structure design tasks so that participants can complete them in a short period of time. Users may consider their own thoughts and preferences by voting on and commenting on proposals in galleries that display other participants' design submissions. The high caliber of the data gathered with this technology is a further crucial feature. The contributions are not actual 3D models or photographs, but rather geo data that makes it simple to use geographic assessment techniques without first going through the image recognition stage [10]. This participation is regarded at a high level.

Besides, each participant is required to complete and submit a proposal before being asked to provide information about the specifications and details of his design as well as some general data, including his gender, educational background, and age range [153]. The ability to edit basic city models combined with this tool's accessibility through a browser made it useful. In the meantime, some tools such as Maptionnaire and ESRI ArcGIS Urban have comparable characteristics and can be used in a format similar.

A gallery of buildings and other urban design aspects can be found in the design components. For instance, a residential housing design exercise consists of many forms of residential buildings. A neighborhood design exercise includes structures with residential, commercial, and office uses. Street networks and urban furnishings are offered as design elements in some design exercises. The master plan zoning map [154] from Singapore's Urban Redevelopment Authority is used in order to list the various building types. Menz's [155] work on Singapore's public space led to the creation of other urban design areas. Table 3.2 gives examples of design elements that were used in the exercises [43].

Table 3.2: The design components of Qua-Kit [43]

Types	Examples
Buildings	Residential, office, commercial, cultural, and mixed use
Space	Open space, greenery, and water element
Street Network	Walkway, street
Urban Furniture	Park, playground, outdoor cinema, bazaar, sport court, and theme park

The review components show the comments of other participants and domain experts. Other users are able to vote on a design using established criteria like accessibility, likeability, density, and practicality in addition to leaving written comments on the design. Besides, another feature of Qua-Kit is that it allows users to view numerous designs at once. A description and the results of the votes, this view offers a summary of the urban design with a screenshot. Figure 3.25 depicts the many design views. Additionally, users can browse based on the design exercise's name, submission date, and results [43].

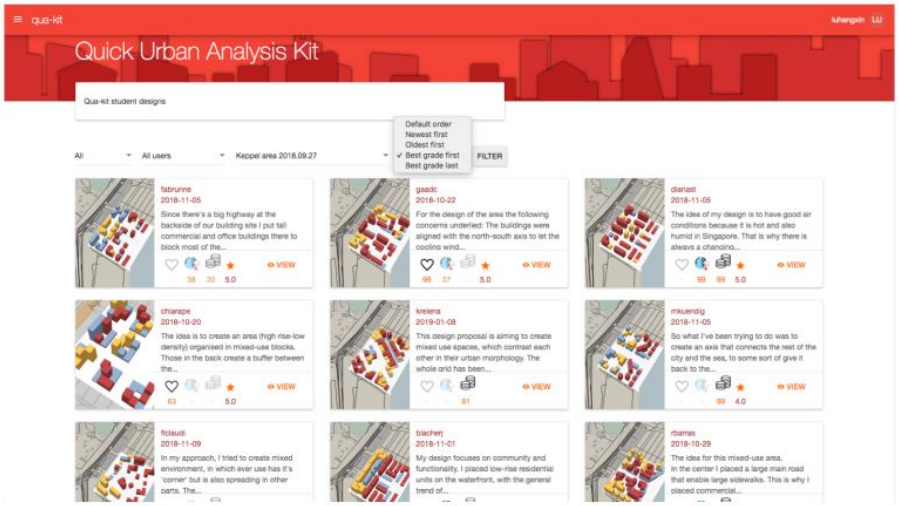


Figure 3.25: Multiple design view on Qua-Kit [43]

The Qua-Kit has two different sorts of users as citizens and professional designers. Urban design concepts can be proposed and discussed by the citizens, and professionals can create the design exercise and evaluate the submitted designs. Figure 3.26 outlines the urban design procedure.

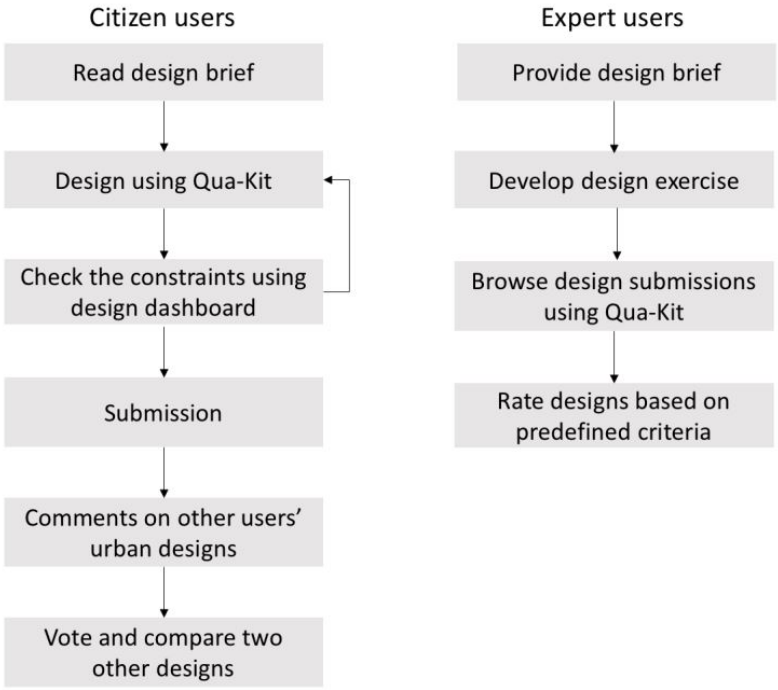


Figure 3.26: Design process using Qua-kit [43]

Also, the questionnaire is designed to collect three aspects of information including user profiles, feedback on crowdsourcing participatory design digital system, and qualitative information on designs at the end of the exercise [156].

Non-expert designers can easily alter provided geometry layouts to fit their unique preferences thanks to this straightforward web application. Instead of focusing on the infrastructure or developing new products, the focus is on configuring geometries. The finished layout can be submitted and saved along with optional comments on the user's design goals or further justifications. Along with voting and commenting on other participants' offers, participants can also consider their own thoughts and preferences [10].

Qua-kit provides the option for design without the need for designer guidance. It is possible to structure design tasks so that participants can complete them quickly. It is a tool for gamifying design problem-solving. The capability to edit items directly is a limitation of the program. This limits participant creativity while ensuring that they only pay attention to how the objects are arranged [10].

3.4.3 Citizen Design Science in Practice

The Qua-Kit was utilized by students in two case studies to design urban spaces in Singapore. The two case studies were carried out in 2018 and 2019 for an ETH Zurich course on information architecture and responsive cities [43]. Case studies were conducted in order to determine whether users might use the design feature, design dashboard feature, and discussion feature to enhance the caliber of their design work.

In the first qua-kit exercise a student is asked to work on a predefined design scenario. The first case is Waterfront Tanjong Pagar design study. Singapore is home to the Greater Southern Waterfront. From Pasir Panjang to Marina East, it reaches. A major new entrance and place for urban life along Singapore's southern shore will be built there from its existing use as a container terminal [157]. At least 70,000 residential units, including public housing, and at least 500,000 square meters of commercial space are the general planning objectives for the entire great south waterfront area. The south waterfront serves as the backdrop for the design activity the students will complete. The planning area is 20 hectares in size and is situated on the spectacular south shore. The Qua-Kit website allows students to look at each criterion's specifics. Students are given a list of 27 urban design elements with a range of functions, heights, and surface areas to plan the new neighborhood along the great south waterfront. The individual design exercise takes place during the first two weeks of the design study, and the review tasks are implemented by the students during the final two weeks. Over the course of the four weeks, 67 design submissions were received (see Figure 3.27).

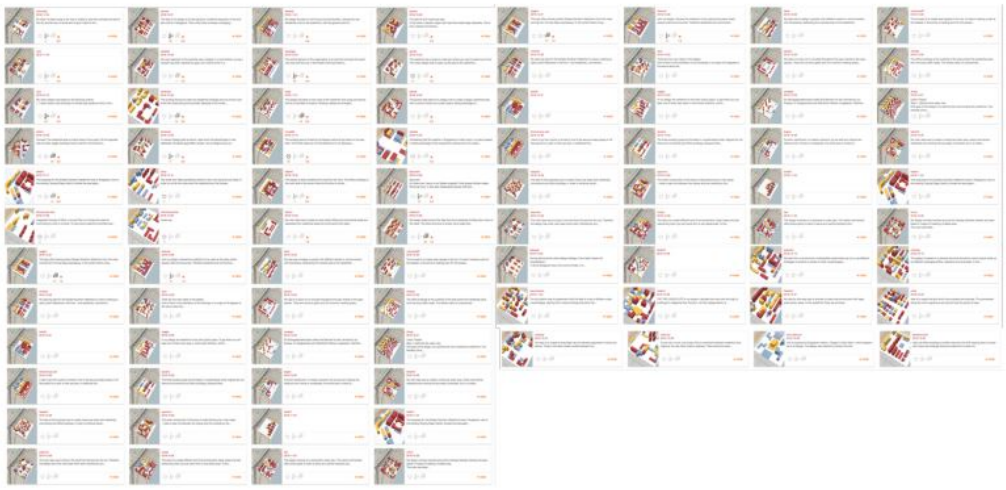


Figure 3.27: Design submissions for the Tanjong Pagar design study [43]

The urban design is analyzed to examine the distribution of features and extract the design patterns of the submissions. To summarize the design submissions, the distribution of building types was mapped. Also, k-means clustering analysis is used to understand the differences in the design submissions and to identify the design patterns (see Figure 3.28) [43].

Figure 3.28: Interface of the tool on the device as used in the study [158]

The second case is Paya Lebar Air Base design study. Singapore's former Paya Lebar airbase will be moved, and the neighborhood will be developed into a new town. Paya Lebar Air Base into a livable mixed-use neighborhood while maintaining its historical site identity. The urban transformation of the Paya Lebar airbase serves as the backdrop for the design process. The 100-hectare design site is surrounded by a historical air force facility, greenery, and the airport road. The runway for the airport is also included, its width is about 50 meters. The student's task was to create a livable mixed-use urban environment while maintaining the identity of current urban structures. The design elements were given to the students as; building types, space types, road networks, and urban furniture types. In six weeks, the design research is completed. Students present their design ideas during the course of the first four weeks, and during the final two weeks, they complete peer review assignments. There were 24 students' submissions of valid designs (see Figure 3.29). It was observed that although the design proposals come in a variety of shapes, the residential building is by far the most common [43].

Figure 3.29: Design submissions of the Paya Lebar urban design exercise [43]

A participatory design study was conducted with local residents in Beijing. The Dashilar, a business district with traditional residences close to Beijing's Qianmen neighborhood, is where the participatory design study is being done. It has a more than

500-year history, and it features old stores, lanes, and courtyards. With urban improvements like the Beijing Fun project and the redevelopment of various streets, including Yangmeizhuxie street, the Dashilar area is undergoing urban rejuvenation. Dashilar platform is one of the significant urban redevelopment projects. It is an open forum for involving several stakeholders, including the Beijing Municipality, urban developers, planners, architects, private firms, and locals, in exploring fresh approaches to transform the historic Dashilar core. Beginning in 2011, the Dashilar project hosts yearly design exhibitions during Beijing Design Week. Dashilar hosted participatory design research as part of the "Design your perfect Dashilar: you place it!" project during Beijing Design Week. The project's goal was to investigate computational and interactive techniques for including citizens in the expression of their ideas and viewpoints for the future urban planning of the Dashilar area. Visitors to the exhibitions, including both locals and tourists, were engaged in the participatory design study. A semi-structured questionnaire was then conducted after participants were asked to redesign the Dashilar region using the interactive tool. The objective was to gather data on personal preferences, design behavior, descriptive verbal behavior, and environmental measurements (see Table 3.3). Participants were asked to conduct their designs in sequential order (see Figure 3.30). During the design phase, the digital tool recorded user behaviors. Geometrical urban layouts, building movement distances, user activities such as rotation and translation, and design time were all collected.

Table 3.3: The building types for the participatory design study in Beijing

Building types	Examples
Residential	Residential mid-rise buildings, Siheyuan (traditional courtyard)
Hotel	commercial hotels, home-stay apartments
Retails	Shopping malls, barbershops, tattoo shops, furniture shops, art galleries
Restaurants	Cafes, western restaurants, local restaurants, tea houses
Public	Libraries, historical sites, public spaces, toilets

Figure 3.30: A participatory design session with a participant [43]

Besides, a semi-structured interview was conducted for this study. The questionnaire was made to gather data on three different levels, including user profiles, input on the design tool, and qualitative design data. The participants have questioned about their preferences for urban areas as well as their demographic information. They were questioned about their opinions of the current system, the desired functionality of such a system, and other open questions during the semi-structured interviews [43].

Another case study area is Empower Shock. The Empower Shack project created models of brand-new shacks that may be expanded to include two-story rooms, making better use of the available space. Even though they didn't use the qua-kit, the neighborhood's people helped reorganize the shacks. The website was created for the MOOC lectures on Smart Cities, and about 500 students used qua-kit to submit their concepts. The findings of the students' work are not the main emphasis of this report because research is still ongoing. Instead, it offers design guidelines and methods to help designers and decision-makers make sense of the vast number of designs. In contrast to images, which require prior image recognition method analysis, this gives a wide range of evaluation possibilities for the data, improving precision. [10].

“My Perfect Public Space” is another exercise. The exercise is based on the Singaporean background but does not represent an existing area. The scale is that of urban design, more especially the designing of a single public space. Varied cultures have different perceptions of public spaces and may react differently to space layouts. The purpose of the exercise is to gather information on local residents' expectations for public space in terms of surface and equipment design. The surfaces and equipment in public spaces are the elements that users may engage with. The list consists of a stage arena, a sports field, a tree, a playground, a pavilion, a covered walkway, tables, and chairs, a water fountain, benches, green pots, a paved open area, and a green field. Each element is represented by a circle that roughly corresponds to its ground occupancy, and stylized 3D models give a general idea of the element of choice (see Figure 3.31) [159].

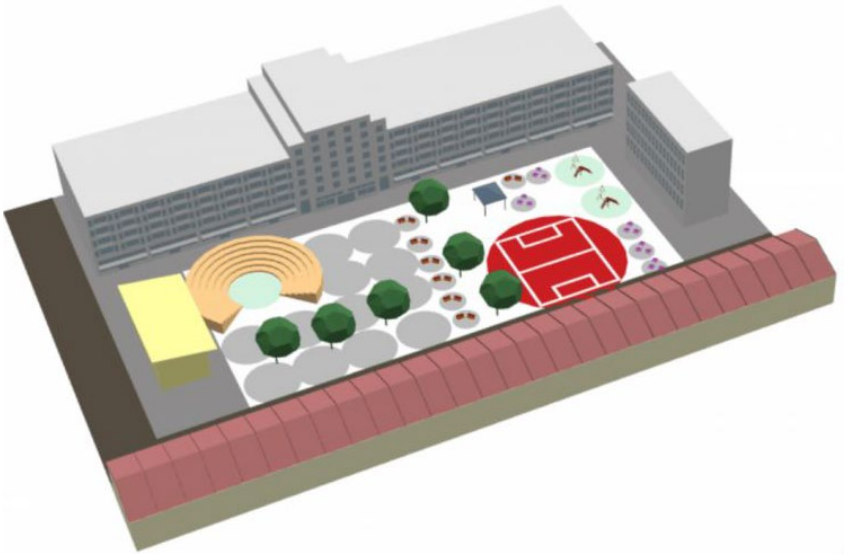


Figure 3.31: An example of the My Perfect Public Place exercise [159]

The exercise's findings are meant to be used in a larger study on data-informed urban planning to assist in assessing and creating public spaces. Informed by people's preferences and use, the goal is to assist designers in creating urban public places that are used and valued.

3.4.4 Evaluation Tools

The evaluation does not take into account an object's 3D structure; instead, it concentrates on how the objects are arranged on the map. The participants can address fundamental design issues at the current level of tool development. The evaluation techniques that have been shown have the potential to be applied to the development of new design challenges with design limitations such as the requirement that the participant constructs a minimum number of residential units. The tool user interface mock-up is offered by Mueller, Asada, and Tomarchio [158].

Geo-referenced data that is saved in the GeoJSON format makes up the bulk of the qua-kit database. In contrast to other architecture programs like Rhino, a 3D object is represented by its faces, which are polygons. All objects have additional data, such as their names and the categories to which they belong. Examples include low, mid, and high-rise buildings, public housing, privately produced housing, mixed-use developments, and sky parks. In addition to these qualitative marks, quantitative marks are also offered, such as the number of units one structure can accommodate. Form-based and perception-based criteria are differentiated by data analysis [156].

3.4.4.1 Form-based Criteria

The layout of buildings and the appearance of objects are measured using form-based criteria. Form-based tools are [10]:

Frequency analysis refer to counting the objects by object type. These analyses are to find out preferences for object types. The more often an object is used by the participant in the proposal means the more it is preferred. Geometric data is disregarded. To structure the evaluations into object groups, it is advised to pre-classify the library's objects. This straightforward analysis primarily supports the comprehension of the basic structure of the participant's design submission. The percentage of particular objects and object groups is instantly visible to both the participant and the planner [10], [160].

Buffer analysis refers to counting the objects in the circuit (buffer) of a particular object type. This analysis takes into account the placement of items, evaluates how they seem

to one another, and demonstrates how they are related to one another. Association rule mining is a perfect fit for this analysis. Association rule mining algorithm results are not all necessarily meaningful, a careful interpretation is necessary to avoid nonsensical results.

Space and streets detection stands for researchers to draw indirect conclusions about the street network and the placement of public and private spaces. This additional layer aids in understanding how the region is structured for researchers. Street and space assignments based on distance require some general interpretation beforehand.

Geometry pattern analysis i is to understand how a study area is organized. In architecture and urban planning, the two form criteria have received much study and are already used in algorithms.

Heat maps aim to show preferred areas for particular objects and also directly reveal the spatial distribution of object types. This method enables the visual merging of ideas from several participants. All other suggested analyses are used with different designs.

Clustering divides the space into smaller communities like blocks at the mesoscale. Through clustering, one can gain access to the preferred number and block sizes. The clustering method enables objective segmentation.

The autocorrelation test shows whether the area's object typologies appear dispersed or concentrated. If they are clustered, the buffer analysis can provide some insight into how the objects are related.

3.4.4.2 Perception-based Criteria

Perception-based criteria formulate conclusions on the participants' perception of the area that can be made by analyzing the geometry. Perception-based tools are [10]:

Creativity analysis does not have guidelines or methods for decision-making. It is an extremely subjective assessment. To account for supervised machine learning, the analysis might be expanded. According to the workers' results, the 2D plot pattern is labeled with the creativity index.

Meta-information analysis is similar to creativity analysis. Its main idea is to identify characteristics in the geometry in order to infer the main purpose of the design. This approach makes it possible to quantify very individualized design aspects.

3.5 Concluding Remarks

In the practice of urban planning and design, citizen participation is seen as essential to just and impartial decision-making. In a movement that promotes democracy, fairness, and sustainability, citizen participation is now essential to global planning and policy improvements. Sustainability and decision-making depend on citizen participation in urban planning and design. With the help of participatory tools in urban planning and design, the awareness of the citizens raises.

The interactive design tools for participatory urban design and planning projects help people to evaluate fairness instead of conventional participation tools such as public hearings, written public comments on proposed projects, and the use of a citizen-based commission. Promoting CDS opportunities to planners and authorities as a new strategy will help researchers create realistic case studies. The evaluation of CDS should concentrate on identifying the design's semantic meaning [145]. It is also a new strategy for Turkey that has never been used in research and projects before regarding to the literature.

The input of activities through CDS can be "translated" into the language of designers and the local knowledge from citizens can be used as a contribution to experts' works in urban planning, which presents an additional challenge for citizen science in urban design. If designers work directly with a community, they can filter the pertinent information from the citizens. Therefore, it is necessary to have a moderated design dialogue in which the designers are upfront about the type of information they are looking for from the citizens.

Originally intended as a research aid, Qua-Kit has evolved into more than just a tool for gathering data. The principles of CDS, a fusion of citizen science, citizen design, and design science, are put into practice via Qua-kit. It encourages the dual processes of professional and academic exchange of urban design knowledge and citizen dissemination of ideas [43]. A contrast between participatory design and user-centered

design is part of the theoretical underpinnings of CDS. Through the use of participatory planning, the new strategy CDS purposes to eliminate the technological bias of current urban planning techniques. Low representation and the expensive procedure of in-person workshops are disadvantages of participatory planning. The lack of a creative option in many participation tools is another issue that CDS solves [9]. This creativity is not enough. Online design tools do not offer enough options for the participants to express their ideas. Instead of giving ready-made objects of Qua-Kit to citizens, open-ended objects can be offered to the citizens. Thus, more data can be obtained from the citizens regarding their problems and expectations of the environment they live in.

Design science methodologies are essential. In simple terms, it is not possible for a designer to analyze tens of thousands of design suggestions and identify connections across all concepts for CDS. Technologies must be utilized to assess the designs in the same way as they give tools for citizen science. CDS promotes a citizen-centric approach. In urban governance, younger people are overrepresented if just using digital design tools [9]. Online design tools can be combined with conventional participation methods or conventional participation methods can be combined with digital evolution methods to promise to be inclusive design for all.

The evaluation of CDS should concentrate on identifying the design's semantic meaning [10]. It is important to figure out the design idea beyond the design proposals of the citizens. The question of how to design exercise output can be used and communicated to other stakeholders, as well as the value of citizen design proposals, are directly related to this problem. In addition, meaningful data can be obtained by a combination of design exercise data with demographic data from the citizens for professional designers and authorities.

Chapter 4

Citizen Design Science in Practices: Case of Izmir

The CDS studies have been carried out in selected public spaces in both Bornova and Karşıyaka in Izmir. The preliminary case study; Re-Shaping Küçük Park urban void in Bornova, Izmir was conducted in 2020 in a master's degree course on the topic of UD 501 Urban Design Project I during the pandemic period. The main case study; Atakent Car park in Karşıyaka, Izmir was conducted in 2022, and collaboration with Karşıyaka Municipality was made in this project (see Figure 4.1). These projects are the first studies of CDS projects in Turkey. Citizens are even given the opportunity to input their ideas for a new physical layout of space in a platform that combines urban design and citizen science and design science in these studies.

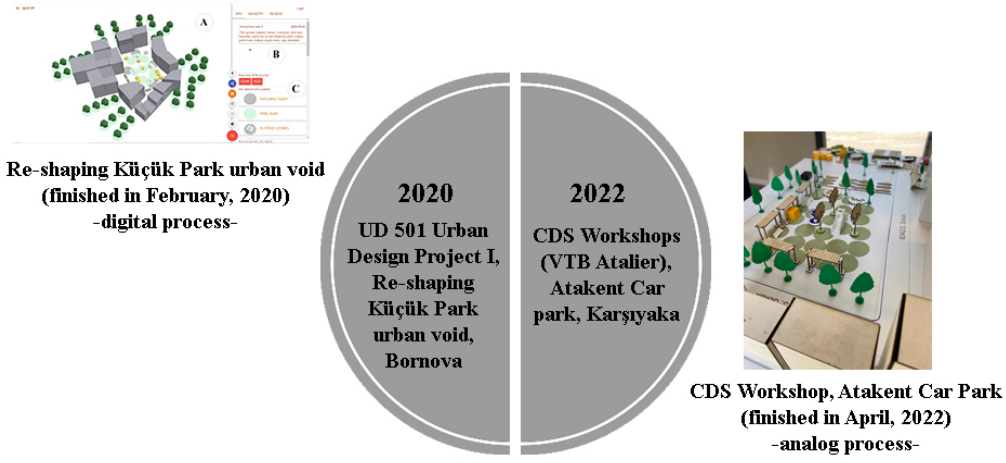


Figure 4.1: Preliminary and main case study

4.1 Preliminary Case Study: Re-Shaping Küçük Park Urban Void

The preliminary case study; Re-Shaping Küçük Park urban void in Bornova, Izmir was conducted in a master's degree course, UD 501 Urban Design Project I at Izmir Institute of Technology (IZTECH). The studio explores to introduce graduate students with principles of citizen design science that would afford to hold sway over a myriad of challenges -ecological, spatial, engineering, and social on micro-scale interventions. Inquiring central part of Bornova, it reflects the conceptualizing citizens' attitudes towards design in a more participatory and digital solution during the pandemic period. Thus, the studio is concerned with the urban void and its place making opportunities by taking account of diverse urban communities. The project examines possibilities of using 'CDS' into urban design. The scale is more specifically design of a single public space as 'My Perfect Public Space' project in the previous section [153]. Studio study's actors are shown in Figure 4.2.

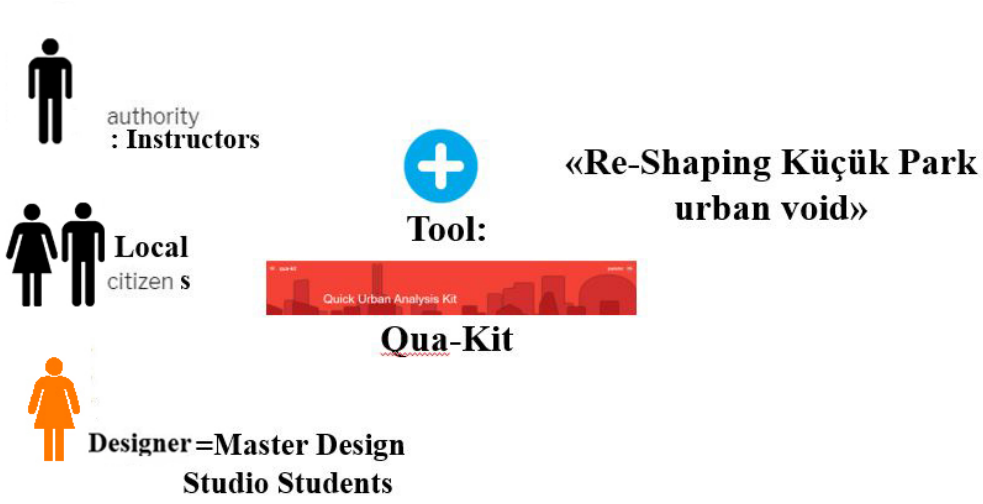


Figure 4.2: Distribution of actors in Re-Shaping Küçük Park urban void case study

Studio study consists of three stages; students' urban design after completing the analysis of the area in the first stage, completing the design proposals on the needs and wishes of the participants on Qua-Kit, and revising the projects based on the incoming

design science data as in Figure 4.3. Design revision method is used in Re-shaping Küçük Park urban void. It means that design science data are not just input but also help to revise the design for the designers.

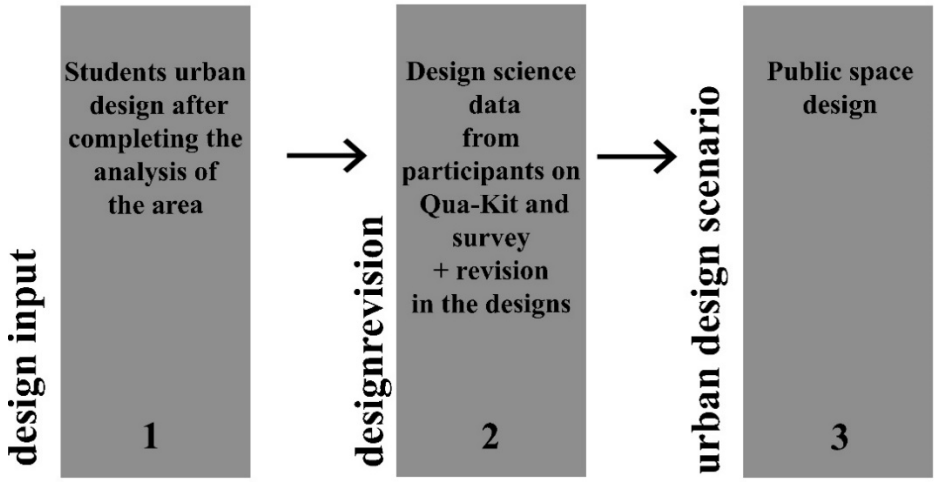


Figure 4.3: Three stages of UD 501 Urban Design Project studio

The reason for using this tool for the study was its accessibility via the browser in combination with the feature to manipulate simple public space models during the severe epidemic. This case study is a pilot study in that twenty participants finished the Qua-Kit design and questionnaire.

The tasks of the expert users are to provide design briefs and grades for participants. Expert users can browse designs and evaluate them through multiple views and use the review components to examine a specific design. Fig. 4.4 shows the participants' design process using Qua-kit.

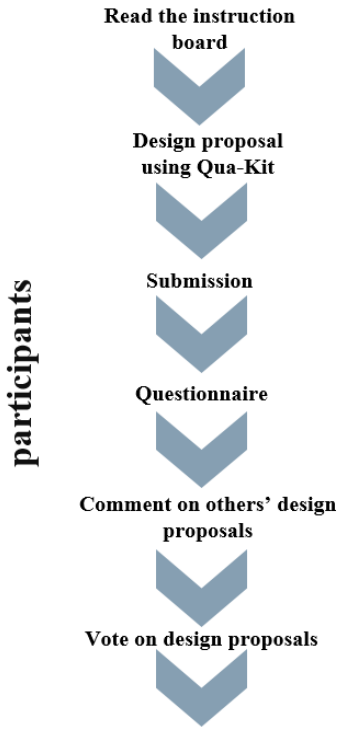


Figure 4.4: Participants' design process using Qua-kit

Expert users (designers) provide design briefs, develop design exercise and use the evolution of design submission using Qua-kit for the professional design.

4.1.1 Study Site

The project site covers the central part of Bornova, a metropolitan district of Izmir with nearly 350.000 inhabitants. Küçük Park is an intensely used urban void that is very close to Bornova Metro Station. It is a socializing and entertainment area. In addition, Suvari Street, where cafes and restaurants are, densely is located in this area (Fig 4.14-15).

Figure 4.5: Küçük Park in Bornova, Izmir via Google maps

Figure 4.6: Küçük Park from own archieve

Figure 4.16 shows the domain axes and routes of Küçük Park. Pedestrian movements within the area were examined under the domain axis analysis. The intensive axis in the project area can be considered as the result of functions on the ground floors and pedestrianized roads.

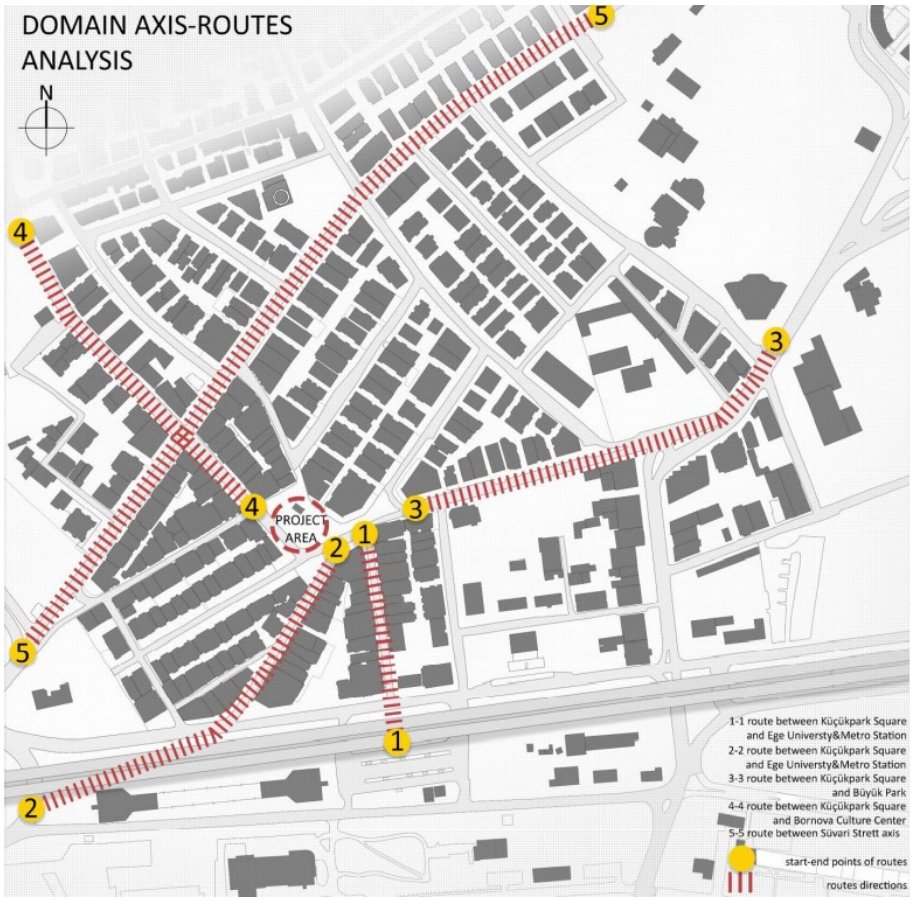


Figure 4.7: Domain axis and routes analysis of Küçük Park

Therefore, the site has the identity of socializing and entertainment district used mainly by the university youth in the surrounding area. Young users, mostly university students of Ege University and Yaşar University usually spend time in cafes around Küçük Park whereas middle-aged and older users spend time in coffeehouses located in the bazaar. Figure 4.17 represents the ground-floor land use of Küçük Park and surrounding.

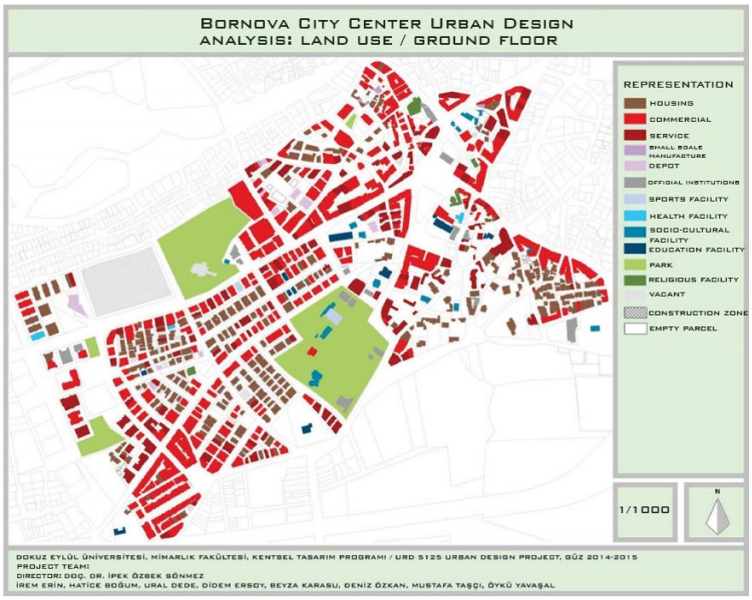


Figure 4.8: Ground Floor Land Use Status of Bornova [161]

Especially in the vicinity of Küçük Park which is close to campus entrances are intensified and those functions are like a part of the university campus. In addition, public transport routes of Bornova Center, transport links, and Bornova metro station are other reasons for the current intensity of use (see Figure 4.18). Küçükpark district is located in the Kazım Dirik Neighborhood, which is mostly fed from Manavkuyu and Mansuroğlu neighborhoods.

Figure 4.9: Küçük Park and its surrounding [161]

We examined Küçük Park's historical development and divided it into four different time phases according to the new development processes that are shown in Figures 4.19 and 4.20.

Figure 4.10: Four phases of Küçük Park

Figure 4.11: Küçük Park in 2000 – 2014 – 2020

Küçük Park was a neighborhood park in a calm residential area in the 1990's (see Figure 4.21).

Figure 4.12: Küçük Park in 1990's [162]

After the opening of Bornova Metro Station and Yaşar University's campus nearby Küçükpark, its surroundings became a commercial district with cafes, bars, and shopping areas. Because of this transition, Küçükpark became an urban void, which is only used for transition purposes (see Figure 4.22).

Figure 4.13: Bornova Metro Station in 2000 (on the left) -Yaşar University Campus, 2007 (on the right)

In the process of saving Küçük Park from its idleness and reintroducing it to the citizens in 2014, Bornova Municipality took the first step in designing a participatory process by emphasizing the cooperation between civil society and the university. The participatory process, which is called #benceküçükpark (#Ithinkküçükpark ...) and

which will involve the citizens with different workshops and activities, was carried out together with UrbanTank, an independent design and thought formation that produces research and intervention projects based on the participation of the citizens. The process of Kümülüs is shown in Figure 4.23.

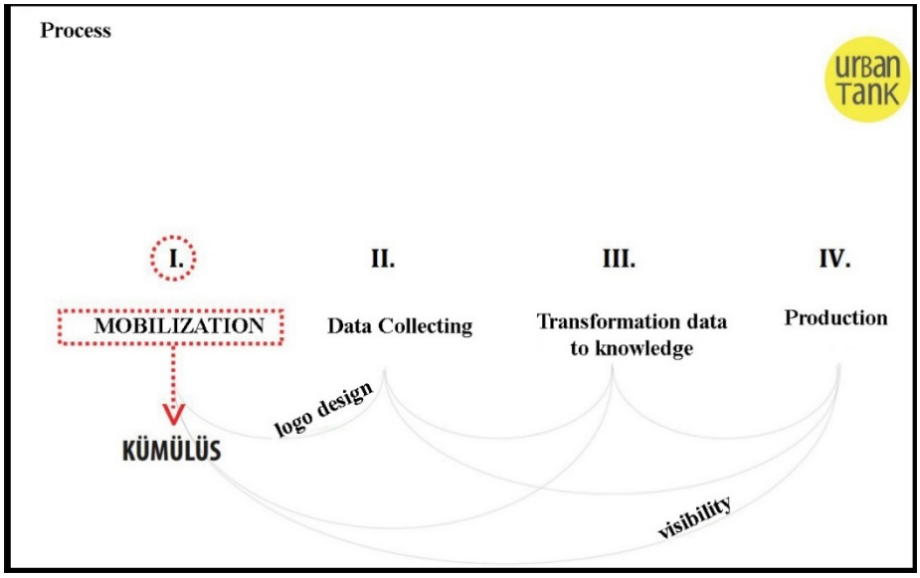


Figure 4.14: Kümülüs' process chart [163]

UrbanTank's first action idea cloud "Kümülüs", which was designed as the beginning of the process, was formed in Küçük Park, where the transformation will take place. Participants who said "I wish..." and "I wish not..." about Küçük Park became a cloud that circulated over the square through papers during the one-day event. Approximately 1,000 participants attended "Kümülüs", an interactive installation work open to the participation of everyone. While the adults attached the papers on which they wrote their ideas to the fishing line, the children contributed to the formation of idea clouds by drawing their ideas [163] (see Figure 4.24). Cumulus aimed to inform about upcoming events with the slogan 'Something is happening in Küçük Park!', and to mobilize people to 'speak up' about the place where they live.

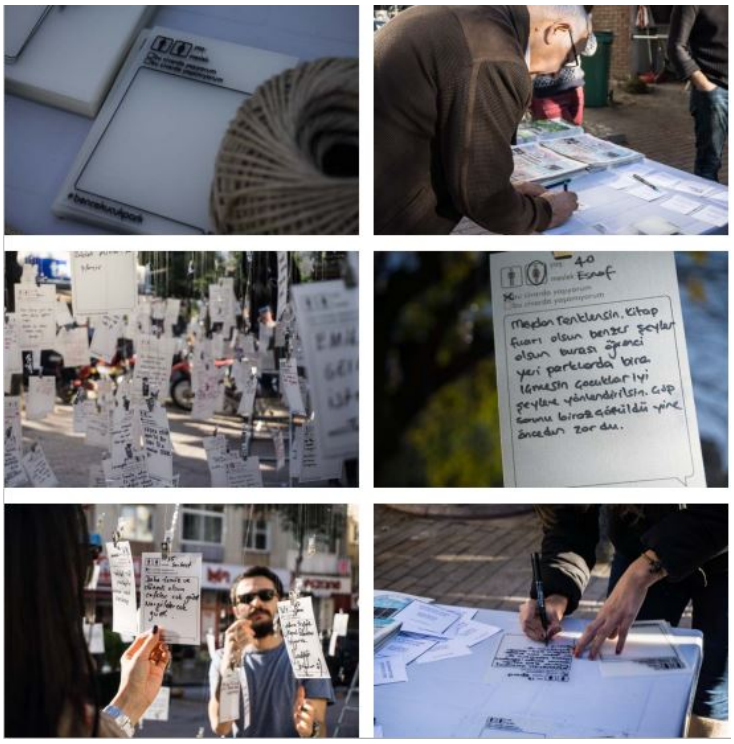


Figure 4.15: Kümülüs at Küçük Park [163]

In 2020, during the Covid-19 pandemic, crowd creative design practice; Re-shaping Küçük Park urban void aims to enable communication and collaboration between local citizens and designers by using the digital design tool Qua kit in Küçük Park. The area is chosen according to these properties:

- Being one of the important gaps/urban voids in Izmir, which has been in the memory of not only those living in Bornova, but also the people of Izmir,
- The need for a multifunctional and qualified public space,
- Previous experience of the 'oral/written' participatory process in the area, therefore to test digital crowd-creative design practice during the Covid-19 pandemic.

4.1.2 Tool Description

CDS implies a new urban design idea(s) beyond the conventional limitations of the site and project themes. Citizen science and its tools have been gaining great

importance in improving the quality of life throughout the years. CDS, then, linked with public participation and citizen science as a new strategy for cities to take citizens' ideas and wishes in the urban planning and design process. This approach is to incorporate the convenience of opinions and thoughts of citizens through present-day information and intelligence technology with active design tools.

This exercise aims to elicit local knowledge from participants. Varied cultures have different perceptions of public spaces and may react differently to space layouts. Public space design is context-specific. The purpose of the exercise is to gather data on local residents' expectations for public space in terms of surface and equipment design.

Qua-Kit provides the option to analyze the geometric data of the objects that participants have placed during the design study. This enables not only a clearer visual presentation of the submitted designs but also a more refined analysis of the individual submissions and a summary of all of them. For the present data set, we apply three different methods to better understand the patterns of the design ideas [164]. We create an exercise for students of the course using the tool, so it serves two purposes as design study with students: on the one hand, it provides an interactive learning environment for students, and, on the other hand, it gives us the necessary feedback data to train the model and test the approach as previous study [43]. The most crucial component of the construction, in which users create a GeoJSON file reflecting the Qua-Kit design scenario, is the geometry of the design exercise. The scenario file uses a GeoJSON extended format. The exercise is available online Qua-Kit is conducted with urban design indicators by the help of Dr. Johannes Müeller (https://qua-kit.ethz.ch/exercise/43/5194#Geometry). Figure 4.5 illustrates the system and its components. Also, we translated and organized the website content into Turkish language.

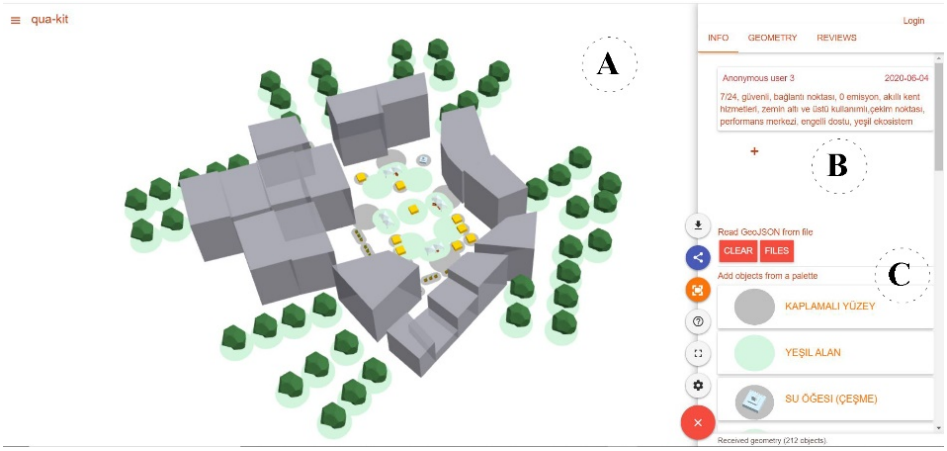


Figure 4.16: Quick urban analysis kit system for Küçük Park urban void. (A). 3D Map-based design view shows urban design layout. (B). Info view provides textual descriptions and image of the design idea. (C). Design components view lists the elements available for the design.

The single design view window has five major components, including map components, tools components, design components, information components, and review components, shown in Fig. 4.5. The map view is composed of the base map with 3D buildings around the site and some other urban components such as urban furniture. Urban components are different in these design tasks. Fig. 4.6 shows examples of urban designs using Qua-Kit.

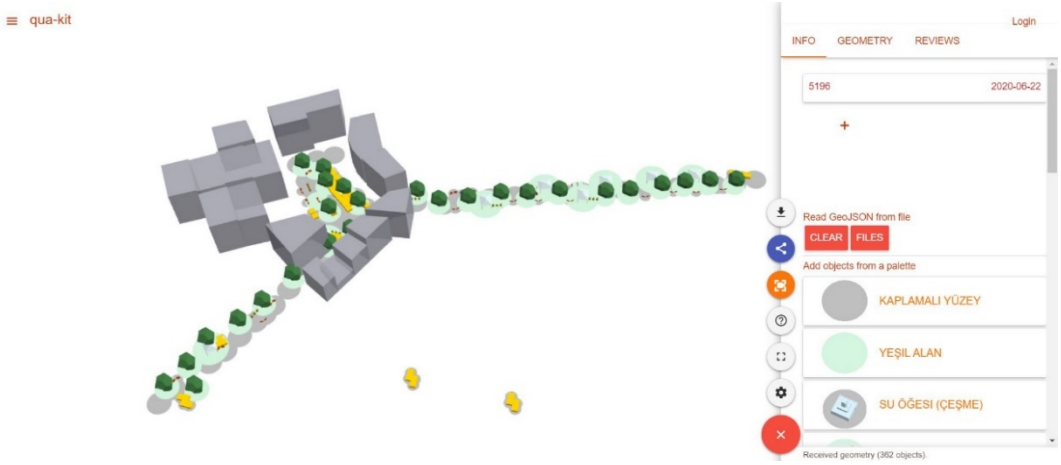


Figure 4.17: An example of the Re-shaping Küçük Park urban void exercise, showing the fixed context and the design elements placed in the white area

The control components provide users with tools to show tutorials, change camera positions, download designs, and share to social media as in previous studies [43]. The tools are grouped and shown next to one another in the control components to give users access to relevant information.

The elements the users could interact with our public space equipment and surfaces. The list includes: stage arena, sports field, tree, playground, pavilion, covered walkway, water fountain, tables and chairs, outdoor exercise, benches, green pots, paved open space, and green field in the previous study 'My Perfect Public Space' [165] (see Figure 4.7). Each element is represented by a circle that roughly corresponds to its ground occupancy, and stylized 3D models provide an overview idea of the element of choice.

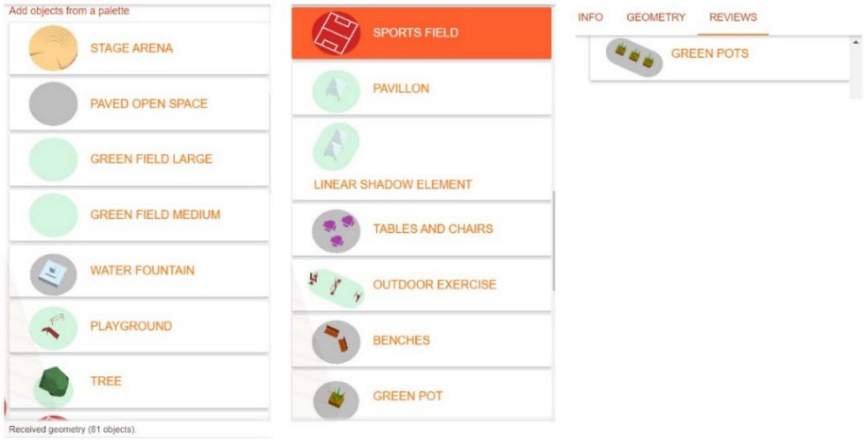


Figure 4.18: Public space equipment and surfaces; 'My Perfect Public Space'

When the user clicks on the link to the workout, a pop-up window with instructions for using the tool opens. Users of the tool can change the position of objects on a 2D surface using a 3D modeler. The right mouse click rotates an item, whereas the left mouse click can be used to select, deselect, and adjust the position of objects. Holding the left and right mouse buttons while clicking will change the view location and perspective angle, respectively, if no item is chosen. Although right-clicking requires two fingers, these features are compatible with touchscreens. Instead of using

conventional venues like town hall meetings, the technology is designed to give residents an interactive, visual activity that enables them to participate in the engagement process as non-experts.

In the Qua-Kit exercise a participant is asked to work on a predefined design scenario. Figure 4.5 presents the Qua-Kit user interface for the exercise. The tool uses 3D geometry in the browser. The participant can move, delete, or create from individual objects and yellow object-open object. After the design proposal is finished, the participant submits the design with an optional textual explanation of their ideas. Then, the pop-up window appears and directs the participant to the digital questionnaire page (see Figure 4.8-9). At any moment, the participant can come back to the site and update their design proposal submission.

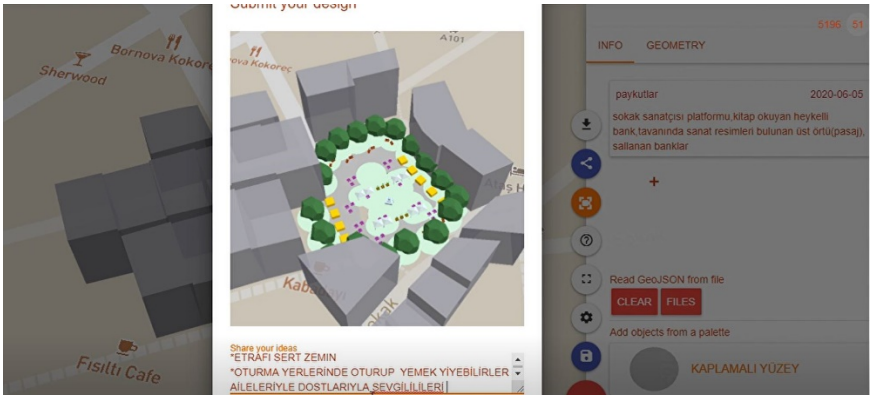


Figure 4.19: Participants can submit their ideas about their design proposal and yellow object- open object's explanation

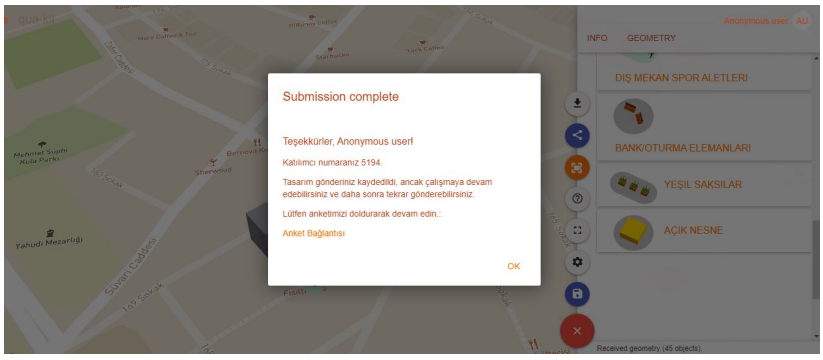


Figure 4.20: Digital questionnaire page (embedded link on Qua-Kit)

The public space equipment and surfaces could be reproduced. Among the urban elements to be proposed for the study area, we decided to add the 'yellow object' –open object' to the set, which is for functions that the participants could not find within the scope of ready-made equipment and surfaces for urban design study (see Table 4.1, Figure 4.10).

Table 4.1: Design elements and surfaces for Re-shaping Küçük Park urban void

Urban design elements and surfaces for Küçük Park study case
paved surface
green field
water fountain
playground
tree
sports field
pavilion
linear shadow element
tables and chairs
outdoor exercise
benches
green pots
(new item): yellow object - open object

Figure 4.21: Design elements view on Qua-Kit for Re-shaping Küçük Park urban void [166]

Thus, the participants would be able to propose this yellow object for the new functions and for changes in the atmosphere of the area. Also, they would write the information about the yellow object that they named in the B section in Figure 4.4. In this way, design freedom and originality were aimed at the participant design, instead of the public space equipment and surfaces determined by the designer and the authority, through the yellow object - the open object (see Figure 4.11). With the help of yellow object-open object; we may also collect qualitative data on the field from the participants.

Figure 4.22: Yellow object- *open object*

The opportunity to browse other participants' designs with Qua-Kit's multiple-design view is another key feature. With a screenshot, a description, and the results of the votes, this view offers a summary of the urban design. The numerous design view is shown in Fig. 4.12. Additionally, users can browse based on the design exercise's name, submission date, and results (see Figure 4.11).

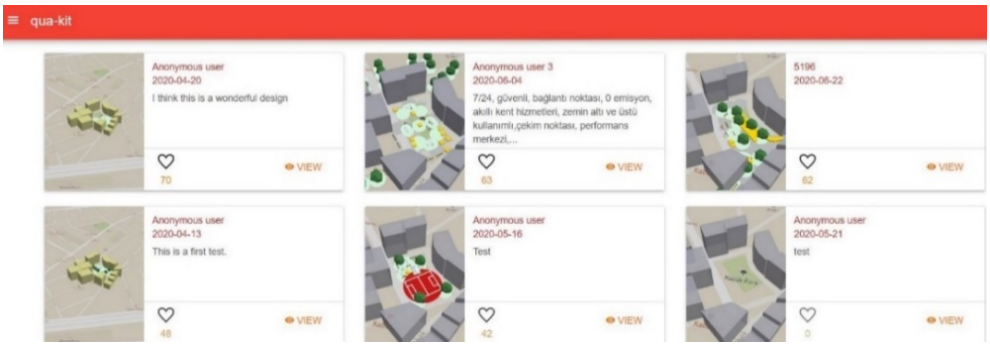


Figure 4.23: Multiple design view on Qua-Kit

To propose and discuss urban design ideas; the citizen users read the design brief, which includes the design constraints such as urban design elements and surfaces. Before participants start to design on Qua-Kit, instruction for Re-Sahping Küçük Park urban void exercise appears in the pop-up window in Figure 4.13. Basically, this guide helps participants to understand how they move on Qua-Kit. This method is user-friendly that also respects personal data.

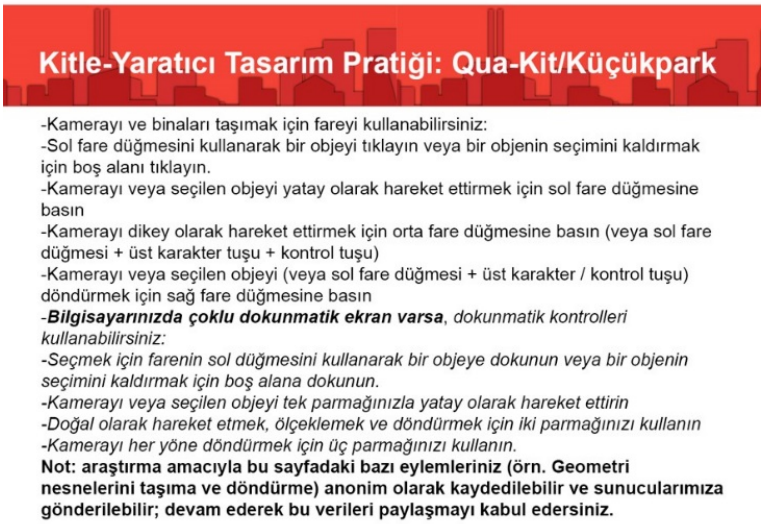


Figure 4.24: Instruction board of Re-Shaping Küçük Park urban void

After users complete the design on Qua-Kit, the second phase of the study appears on the screen that redirects to the questionnaire. The questionnaire was designed to collect three aspects of information including user profiles, demographic data, feedback on crowdsourcing participatory design, and qualitative information on design as in the previous works [156]. We also add other questions to understand user behaviors and yellow object – open object's data. For user profiles, we have asked the participants about their age, whether have a kid(s), gender, whether they are local residents, whether they have negative thoughts about the current version of Küçük Park, and whether they use yellow object-open object (detailed information is included in appendix A). For feedback on the system, questions were asked regarding the feedback of the current system and wished functionality of such system with multiple choices and open questions and yellow object – open object on design. Also, with the help of

the digital process, we also record the time they spend on the exercise and their behaviors on Qua-Kit.

4.1.3 Findings & Results

First, the students started physical and social analysis as; land use, historical, transportation, climate, demographic, and 24-hour usage analysis were made to understand the project area's potentials, problems, and possible solutions. With the help of analysis problems of irregular pedestrian roads, lack of sitting furniture, impermeable surfaces, and lack of greenery were detected. In this exercise, participants were asked to design a 'multi-functional' public space with the given design elements and open object. After completing the design layout, they were asked to answer the questionnaire questions. The study is composed of two phases that are shown in the tool description part and below. The evaluation has three steps:Urban design proposals analysis

- Yellow object- open object analysis
- The questionnaire analysis.

For the first phase, 5 master design studio students are asked to work on a predefined design scenario of Küçük Park. Then, they started to design the 'public space' in the first phase. In the second phase, the participants submit their urban design proposals on the e-participation tool Qua-Kit. After analyzing the urban design proposal submissions and the questionnaire, the master design studio students revise their urban design projects according to the study's findings and results.

Urban design proposals that users and participants could develop through an interactive user interface were collected using a map-based e-participation tool; Qua-Kit was conducted in the case study. To design the new multi-functional public space, students are given 12 urban design components of various functions, surfaces, and open object; paved surface, green field, water fountain, playground, tree, sports field, pavilion, linear shadow element, tables and chairs, outdoor exercise, benches, green pots, and yellow object.

For the second phase, the study is shared with local groups potentially interested in participatory urban design. Before the exercise, each participant is given a number as a nickname (starting from 5194 to 6013) to be respectful of their personal data. 20 design layouts from the controlled group were submitted as a result of our study's use of the previously mentioned web-based participatory design tool, which was promoted online through Google Meet. In addition, we employed the tool in an empirical context to ensure the accuracy of the data given. To demonstrate our analysis techniques in this study, we examine the contributions from this controlled group (pilot case study, n=20). We cooperated with Dr. Johannes Mueller for Qua-kit setup and spatial analysis.

There were 20 urban design submissions from visitors of the case study (mostly students), residents, and shop owners through Qua-Kit. Figure 4.25 shows the results of the design submission from participants. We analyze the urban design submissions to examine the distribution of features and extract the design patterns of the submissions and qualitative data on the area based on the experience questionnaire.

Figure 4.25: Design submissions for Küçük Park design study

We present the analysis results of the engagement data and design data from the case studies. The study aims to use interventions through creative suggestions, we also offer yellow object-open object to the users and participants, despite the creativity, which is restricted by the tool's limited library of objects. In addition, we made the 'yellow

object-open object' analysis over the categories of the proposed urban design elements as; public, commercial, and artistic functions.

First, we calculated the frequency of the particular objects to reveal their popularity. In the second analysis, we represent the 3-dimensional objects as a plot and overlap them to get insights into the object constellations. These heatmaps are produced for each submission, but also as composite analysis over all submissions for each object type. As a third analysis method, we calculate the dispersion index of each object constellation for each submission.

The dispersion index is a self-creation of the researchers to indicate whether two object types tend to be arranged together, apart or in a rather random constellation. The idea of the index is based on the analysis of the k-nearest neighbours, which is a standard analysis for point patterns. All objects that a participant placed in the viewer are first reduced in their complexity to their centroids. If n is the number of objects placed by a participant, each object has n-1 nearest neighbours. We first create n-1 lists for each object, in which the 1, 2, ..., n-1 nearest neighbours are indicated. From these lists we create n-1 matrices, whereby each matrix consists of all object types as rows and columns. The values from the lists are then aggregated over the object types. The rows contain the object type of the centroids; the columns represent the object type of their k nearest neighbours. Instead of considering the k nearest neighbours in the k-th matrix, we cumulate the neighbours up to the k-th nearest neighbour. Since the frequency of the objects varies, we eventually normalise all n-1 matrices by the total number of object types in the submission. The results are matrices containing relative frequencies of objects by object type. The matrices can be shown in diagrams as in Fig. 1. Each subplot corresponds to a specific object type. The graphs are the object types of the k nearest neighbours. The x-axis indicates the k nearest neighbour and the y-axis the corresponding values from the kth matrix. The diagrams provide a first insight into the spatial dispersion of the object types and their relationship to each other. If the diagram is close to a line with a slope of 1, this means that the relative number of k nearest neighbours is fairly evenly distributed. This would mean that there are some objects that are placed near the object type indicated in the sub-graph, but also some that are placed rather far away from it. However, if the graph is initially close to 0 and increases only for higher k nearest neighbours, this means that objects

of these object types are placed farther away from the object type specified in the subplot. If, on the other hand, the graph increases at the beginning, it shows that the object of this object type is placed near objects of the corresponding object type. In the example shown in Fig. 26, for example, we could show that the objects of the type "playground" are placed near the objects of "outdoor exercises", while "tables and chairs" are placed far from them (See Figure 4.26, subplot "outdoor exercises").

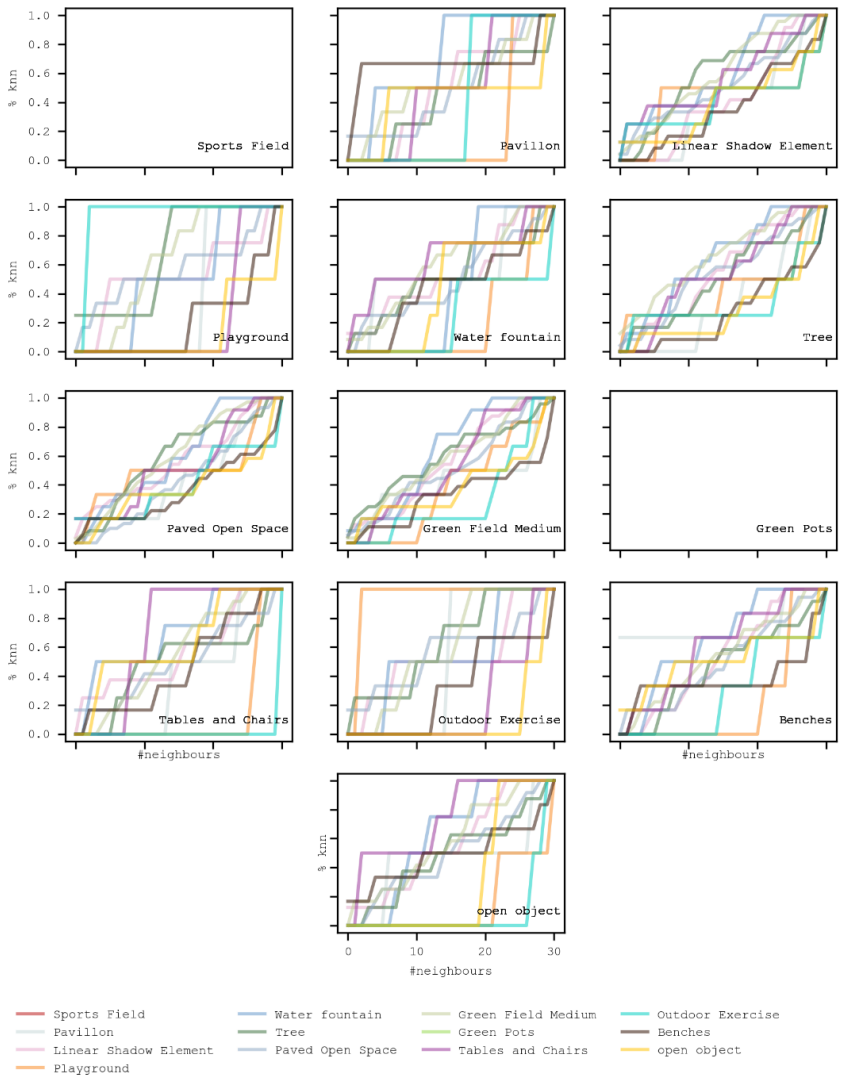


Figure 4.26: Example of k nearest neighbours grouped by each object type

Though these graphs contain all relevant information, they are not easy to compare and do not reveal all patterns at the first sight. Therefore, we created a spatial

dispersion index which yields by taking the area below the graph normalized by n-1 – similar to the Gini-Coefficient. A random distribution corresponds to values around 0.5, values between 0.5 and 1 indicate that the object of the compared two object types are placed close to each other and values between 0 and 0.5 that they are placed apart from each other. Another advantage of this index is that allows a composite analysis by averaging the matrix of indices overall submission. These average indices are discussed later on in the results.

The frequency of objects that participants placed in their design proposal is to a certain degree an indicator of the popularity and necessity of the object types. But it is also important to consider that object types are used in different ways. If an object type is used to build the basis of parts of the design (such as the green field or the paved surface, they are placed more frequently than object types that are not meant to overlap with others (such as playgrounds). Therefore, the frequency is the only tendency, but not a certain indicator for the popularity of an object type.

Some participants also presented their ideas for parts of the area that lie outside the space surrounded by the grey buildings. Therefore, for comparison, we will only include objects placed inside the convex hull of the plots of the buildings surrounding the park. On average, the participants placed 28.5 (median 27) objects in their designs, ranging from a minimum of 15 to a maximum of 61 objects.

Trees were by far the most frequently placed objects (9.25 objects/submission), followed by the open object (3.85 objects/submission). Benches (3.6 objects/submission) and linear shadow elements (3.1 objects/submission) were similarly popular. Green pots (2.5 objects/submission), water fountains (2.05 objects/submission), and tables and chairs (1.9 objects/submission) were also favored by the participants whereas all other objects were placed less than once in each submission.

The overlay for each object type provides an intuitive way to perform a composite analysis across all submissions. The more submissions are made, the less helpful this analysis method is for an urban designer. With the 20 urban design submissions of our study, it is still possible to visually discover patterns (see Figure 4.27-28).

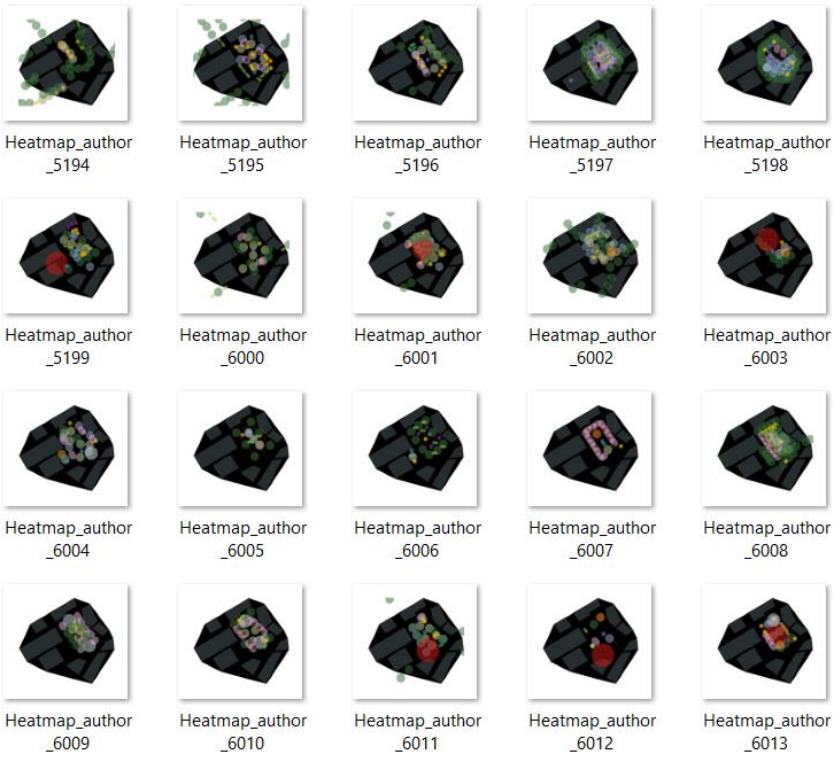


Figure 4. 27: Heatmap analysis of each participant's design layout (n=20)

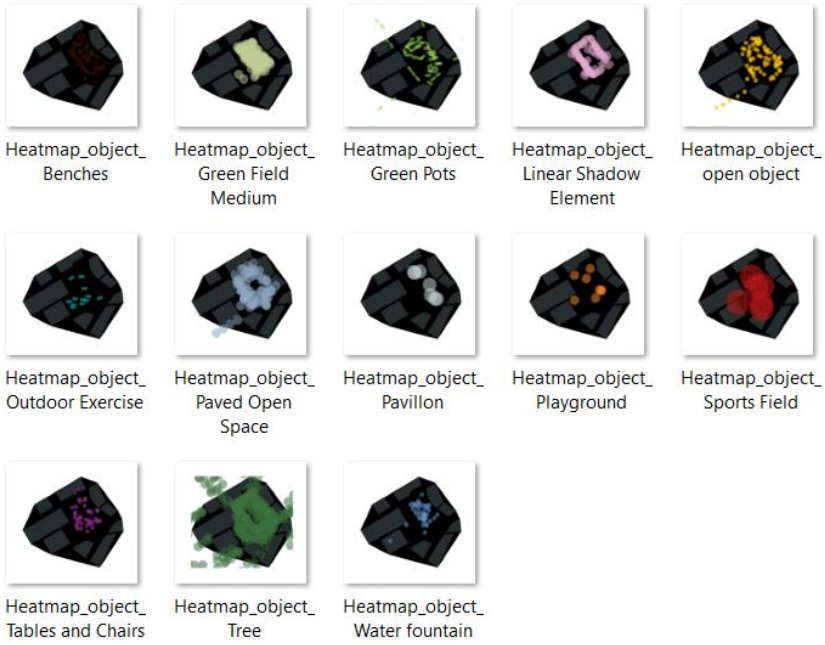


Figure 4.28: Heatmap (overlay) analysis of each urban design and surface object

We could identify that benches, green pots, linear shadow elements, and trees were predominantly placed along the street which surrounds the park. The outdoor exercise elements were mostly placed close to the buildings whereas water fountains were preferably put in the middle of the parking area (see Figure 4.29).

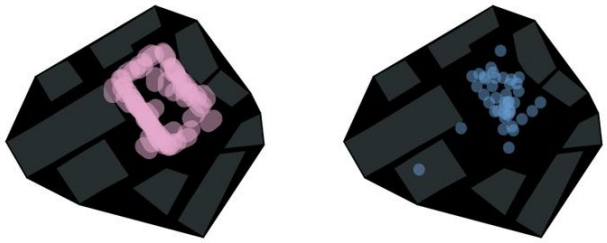


Figure 4.29: Overlay of objects from all submissions for object type ‘linear shadow element’ (left) and ‘water fountain’ (right)

The analysis of the spatial dispersion index reveals information about the preference of the participants placing particular object types next to each other. We obtain relatively high values for this index for the constellation of tables and chairs with themselves and outdoor exercises with themselves. This means that these two object types were often placed in a clustered formation and not spread around the area. Also, water fountains were tendentially located next to benches, outdoor exercises were often found next to sports fields and pavilions often come together with paved surface. Trees, on the other side, are elements that do not show this typical pattern of being placed near a certain type of object, but instead have each type of object equally likely as a neighbour. An interesting observation is that pavilions are usually placed as a singular element and not grouped with other ones.

Besides, the challenges and problems of the urban site turn into problem statements for designers on Qua-Kit. For instance; the nonexpert uses shadow elements to show that the heat island problem is felt on the site.

The frequency table, heatmap (overlay), and spatial dispersion index matrix of urban elements and surfaces are detailed in Appendix A. These results are shared with the master design studio’s students.

Open object – yellow object is also categorized and analyzed regarding the type of object as artistic, commercial, or public item (see Table 4.2).

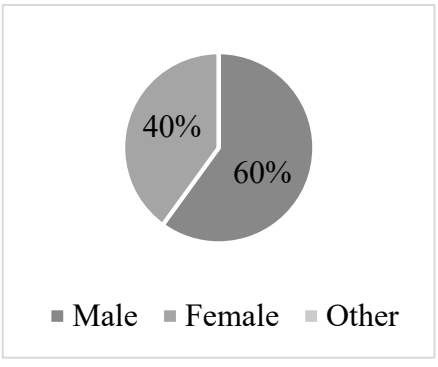
Table 4.2: Open object analysis of each participant's design layout

ID	Non-Designer	Designer	Open Object Type
5194	X		artistic items
5195	X		artistic+commercial+ public items
5196	X		artistic+commercial+ public items
5197	X		public items
5198	X		artistic+commercial items
5199	X	X	artistic items
6000	X		public items
6001	X		public items
6002	X		public items
6003	X		public items
6004	X		public items
6005	X		public items
6006	X		public items
6007	X		commercial+public items
6008	X		artistic+commercial items
6009	X		commercial items
6010	X		artistic+commercial items
6011		X	artistic+commercial items
6012	X		commercial items
6013	X		artistic+commercial items

Open Objects type:	Artistic items
	Commercial items
	Public items

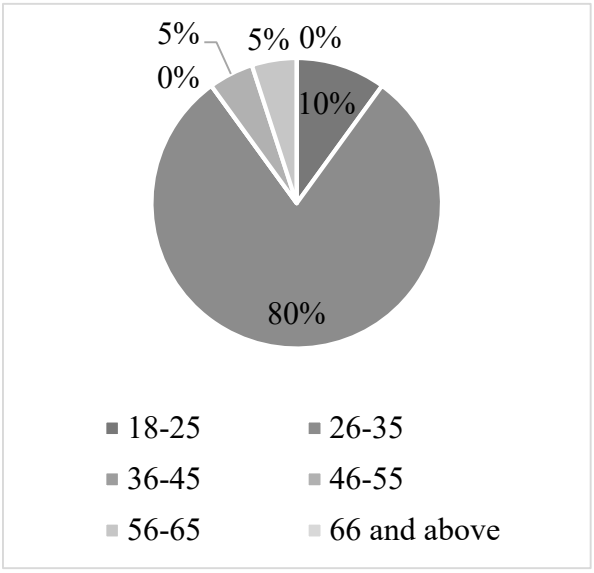
Among the 20 participants who finished the Qua-Kit design also completed the questionnaire. Table 4.3 shows the gender distribution of participants. Forty percent of the participants are women.

Table 4.3: Gender distribution of participants



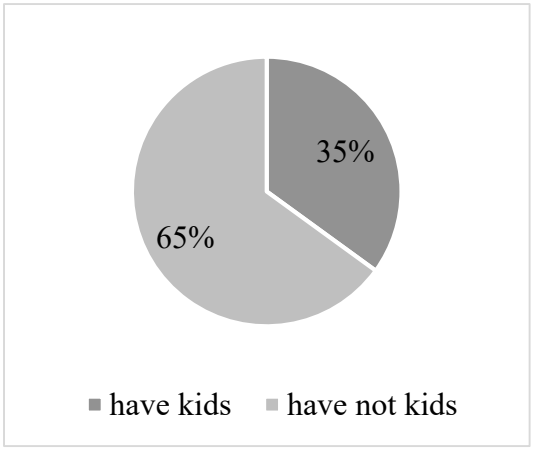
The proportion of participants aged 65 and over is five percent. The highest participation rate of 80% belongs to the participants between the ages of 26-35 (see Table 4.4).

Table 4.4: Age distribution of participants



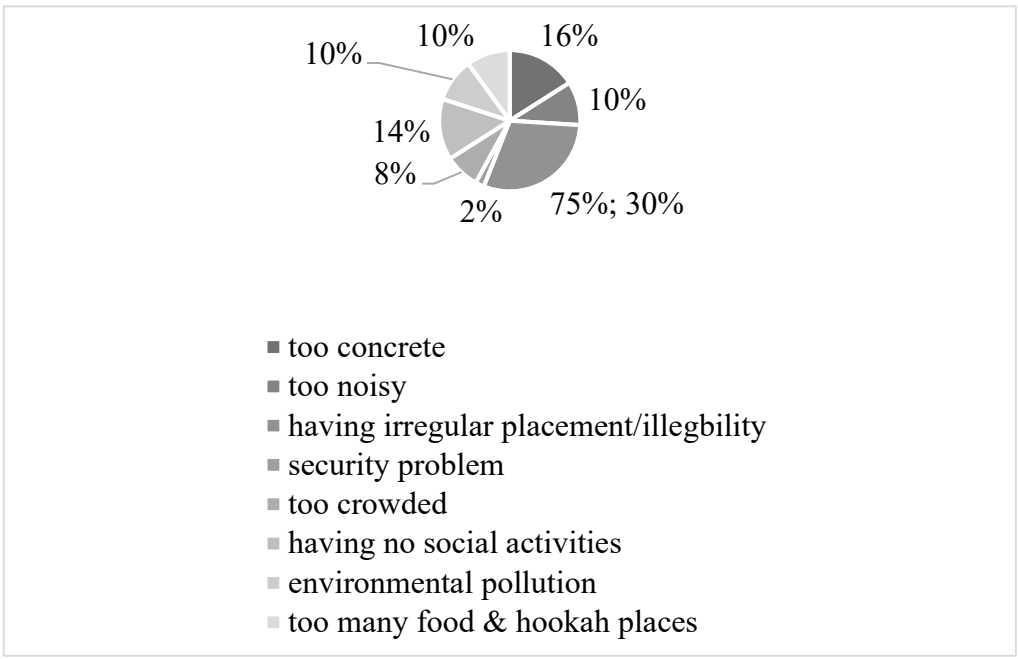
While 35% of the participants have children, 65% do not in the study (see Table 4.5).

Table 4.5: Whether participants have children



The 20 participants were asked about their negative thoughts about the current version of Küçük Park. 75 percent of participants thought that Küçük Park has irregular placement, and forty percent thought it and its surroundings occur too much concrete. These negative thoughts are in hierarchical order; having no social activities, environmental pollution, too much noise, too many food and hookah places, being too crowded and security problem follows (see Table 4.6).

Table 4.6: Distribution of negative thoughts about current version of Küçük Park



For the purpose of this overview, the frequency of an element is not based on elements count but on the number of users who decided to prefer to use the urban design element (how many people decided to use the shade element, not how many shade elements people used in total). The less used element is the playground (30% of users), while the most used is the water fountain water element (90% of users) (See Table 4. 7). Water elements in public places aid in reducing climate change, provide aesthetic value, and also serve as cultural references; playgrounds encourage activities that are specific to public spaces. Participants in Küçük Park tend to prefer green elements that also provide shade and recover from climatic events (heat island effect). Shade elements are the second most used element (75%). This data gives the clue about the

heat island effect of the area. The performance stage has been used by 40% of the participants. Also, sales units (coffee, food, handmade crafts, etc.) are the most preferred open object by the participants (%35). All data set is shared with the students to revise their first predefined design scenario of Küçük Park urban void. In particular, we suggested that the urban elements preferred at 30% or more should be used in the design.

Table 4.7: Distribution of most prefered urban elements for Küçük Park

Participants' demand for Küçük Park	Number of Participants (n=20)	Percantage
Performance stage	8	40%
Green field	13	65%
Sports area	6	30%
Sales units – open object	7	35%
Public toilet - open object	6	30%
Playground	6	30%
Linear shadow element	15	75%
Water element	18	90%

4.1.4 Design Results

There were five urban design submissions from the students. In addition, students determined design principles for the field related to the data received in the questionnaire study. Thus, both design science data and questionnaire data were used in the study. Regarding the questionnaire study, Student B and Student C proposed design principles as shown in Figure 30–31.

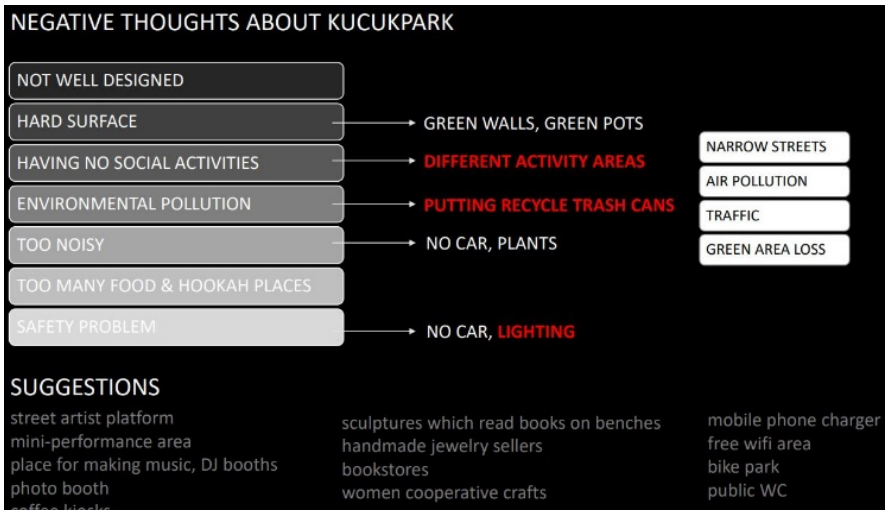
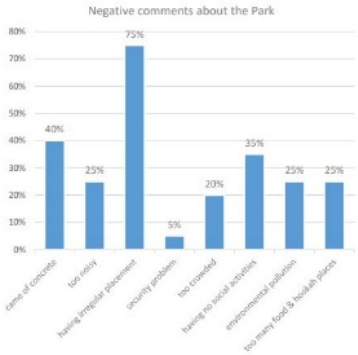


Figure 4.30: Student B's design principles based on questionnaire results



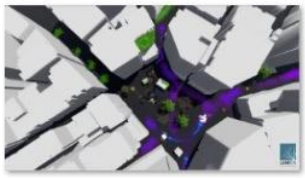
–VE Comment	Design Intervention
Too much concrete	▪ Provide more green areas ▪ Diversification of material use & permeable surfaces
Too noisy	▪ Use of water fountains and water Jets ▪ Controlled access for vehicles & motorbikes
Insecurity / Safety	▪ Adequate lighting ▪ Increased social activities to attract people ▪ Controlled traffic movements for reduced conflicts
Too crowded	▪ Encouraging time specific activities ▪ Provision of more sitting places and movable seats for flexibility & Convenience
Lack of social activities	▪ Introduction of more flexible space use – e.g. Playing, Performances, Gatherings, Open air theatre, Eating etc. ▪ Providing opportunities for family and group activities
Environmental pollution	▪ Increased provision of potted plants and trees ▪ Reduced/Controlled vehicular movement
Having irregular placement / Illegibility	▪ Enhance legibility through signages and material use ▪ Modular design to break the space into smaller sub uses.

Figure 4.31: Student C's design principles on questionnaire results

We analyze the urban design proposals to examine the distribution of features and extract the design patterns of the submissions (see Figure 4.32-33). We observed that the design submissions had various multi-functional forms and similar design patterns.

Student A_site plan

Student B_site plan



Student C_site plan

Student D_site plan

Student E_site plan

Figure 4.32: Students' urban design submissions, site plan

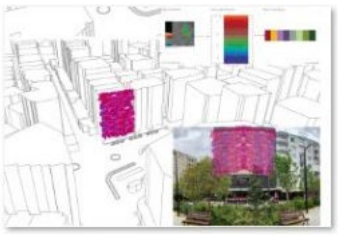


Figure 4.33: Students' urban design submissions, views

When concept designs of Küçük Park are completed, students submit them along with an optional textual explanation of their ideas. The student has a chance for changing the submission at any time by coming back to the website. Project coordinators also can comment on the final version of the designs.

4.2 Main Case Study: Atakent Car park

Karsiyaka Municipality aims to regenerate the areas selected by the Urban Vision Development Office affiliated with the Urban Design Directorate based on the inventory of selected parks, green areas, and idle areas in Karşıyaka district into qualified public spaces for the wishes and needs of local citizens within the scope of "participatory co-design process".

This regeneration will be implemented with the analog model of the 'CDS' method, which is the new participatory design strategy. For this purpose, it was decided to organize a series of CDS workshops for selected fields. Atakent Car Park, which is the main case of the study, is one and first of these selected areas.

The project examines the possibilities of using ‘CDS’ into urban design. The scale is a more specific design of a single public space as the ‘My Perfect Public Space’ project in the previous section and Küçük Park [165]. The studio study’s actors are shown in Figure 4.34. The participatory co-design process is based on the cooperation of our organization as scientists, local citizens, visitors, and the authority of Karşıyaka Municipality.

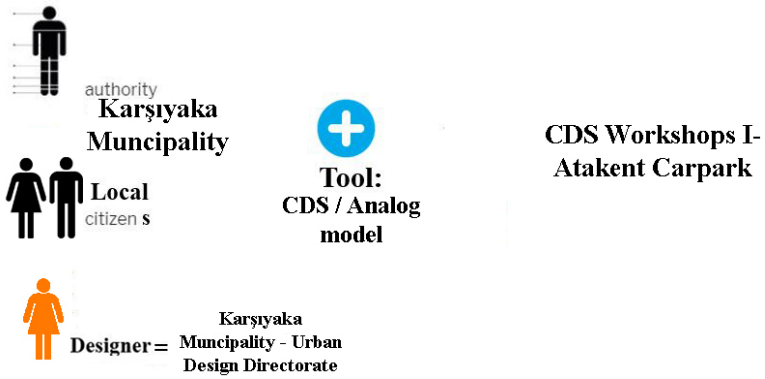


Figure 4.34: Distribution of actors, Atakent Car park case study

The communication process between the actors is based on the local citizens establish the data about the problems of the area through the active design tool with the expert designer, present individual design proposals with the implementation as an expert designer and that the design science data is evaluated by the expert designer and the authority as a result of the workshop (see Figure 4.35).

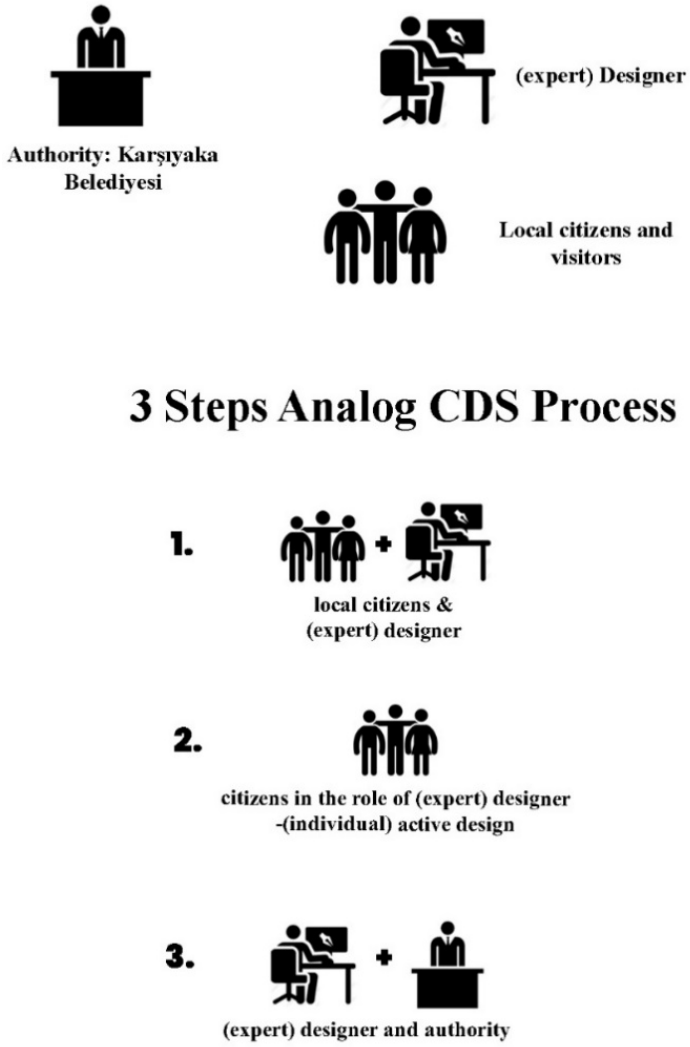


Figure 4.35: CDS Workshops' actors and communication process -modified [9]

CDS workshops which cover the co-design process and produce design science data aim to provide solution proposals covering the experience, needs, and wishes of the

participant local citizens about their surrounding through active design tools in Karşıyaka district. Workshops covering the sharing of design science and questionnaire data with citizens aim at the transparent and democratic method of data-based decision-making of local government.

4.2.1 Study Site

With the construction of the railway in the 19th century, Karşıyaka, located in the north of İzmir city center and İzmir Bay, quickly turned into a residential area. In the 20th century, it grew rapidly and turned into a district. Due to its strategic location and the presence of various public transportation centers such as railway, bus, ferry, and tram, Karşıyaka is one of the most accessible districts of İzmir. The population of Karşıyaka district is 347,023 people according to TUİK's data taken in 2020. It has a surface area of 102.4 km2 covering 27 neighborhoods (see Figure 4.36).

Figure 4.36: Karşıyaka, Izmir, Turkey

Karşıyaka Municipality-Urban Vision Development Office detected approximately 300 leftover spaces during field studies. The study site; Atakent Car park is one of the lands of that study's leftover spaces (see Figure 4.37). The area has been selected from the list of leftover spaces in accordance with the criteria of high usage diversity, close proximity to social basic equipment areas, and high pedestrian accessibility.

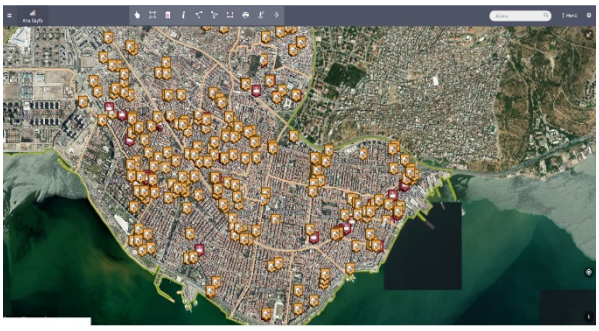


Figure 4.37: Inventory of Karşıyaka's leftover spaces land by Urban Vision Develeopment Office

Atakent Car park continues to function as an irregular open car park with a size of 4,400 m^2 located in 6342/3 in Karşıyaka, which is a regional multi-storey car park area in the zoning plan, within the borders of Atakent and Yalı Mahallesi (see Figure 4.38).

Figure 4.38: Atakent Car park, Karşıyaka

Atakent Car park; sports complex, hospital, high school, primary school, a library for the visually impaired citizens, and the old stream bed water trace are located in its immediate vicinity. In the northeast of the area, which currently has an irregular parking lot function and where passive green meets old trees, there is a street part with

a higher amount of green compared to other streets. The parking area is also used as a disaster assembly area (see Figure 4.39-40).

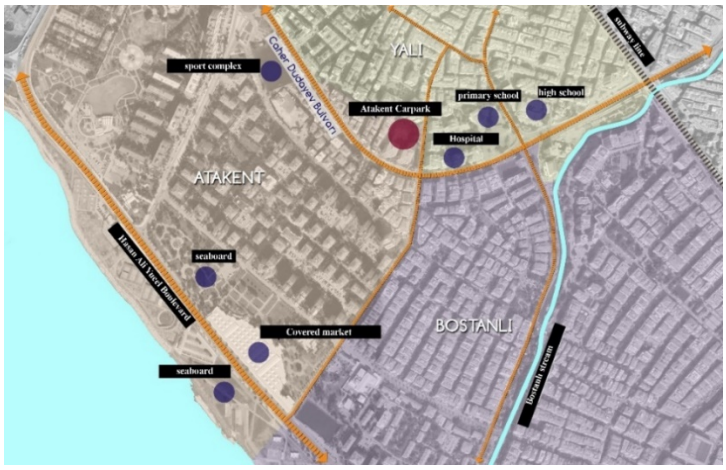


Figure 4.39: Urban context of Atakent Car park

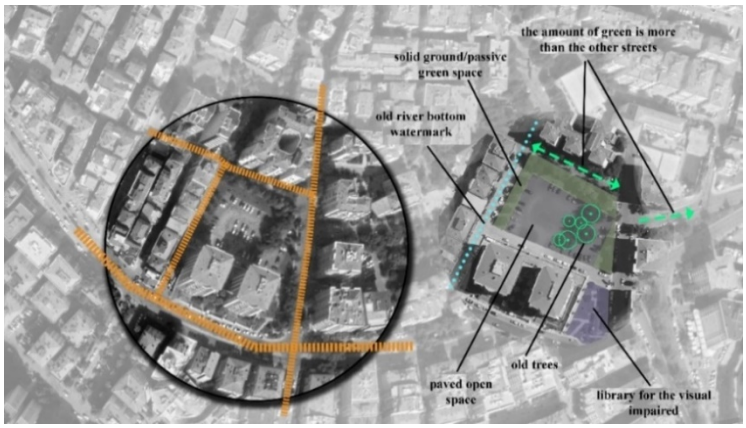


Figure 4.40: Context of Atakent Car park

4.2.2 Tool Description

Contrary to traditional participation practices, thanks to the design data generated by local citizens about their environment through active design tools, dialogue is essential. This dialogue formed by the design science data produced by local citizens about the environment they live or visit through active design tools is essential and

citizen-oriented [9]. Due to reaching more local participants and close dialogue with citizens, the method was handled and re-adapted through analog design tools; models.

In the workshop, the new workshop instruction (analog) design tool and additional processes suitable for the field and the actors are discussed. In this sense, the series of 'CDS Workshops' can be described as an urban experiment.

The method consists of a four-stage process as in Figure 4.34. The questionnaire study (Appendix B) includes interviews with the authority on the needs program and rules, active design practice, and demographic and field experiences within the scope of the participatory process. It aims to document the spatial organization proposals of the citizens who have experienced or visited the area. The questionnaire, active design application, and voting results are shared with authority and professional designers an in 'round table meetings.' Then (alternative) concept design scheme/s are obtained. We also add a co-product process as a continuation of the process for being an inclusive participation process (see Figure 4.41).

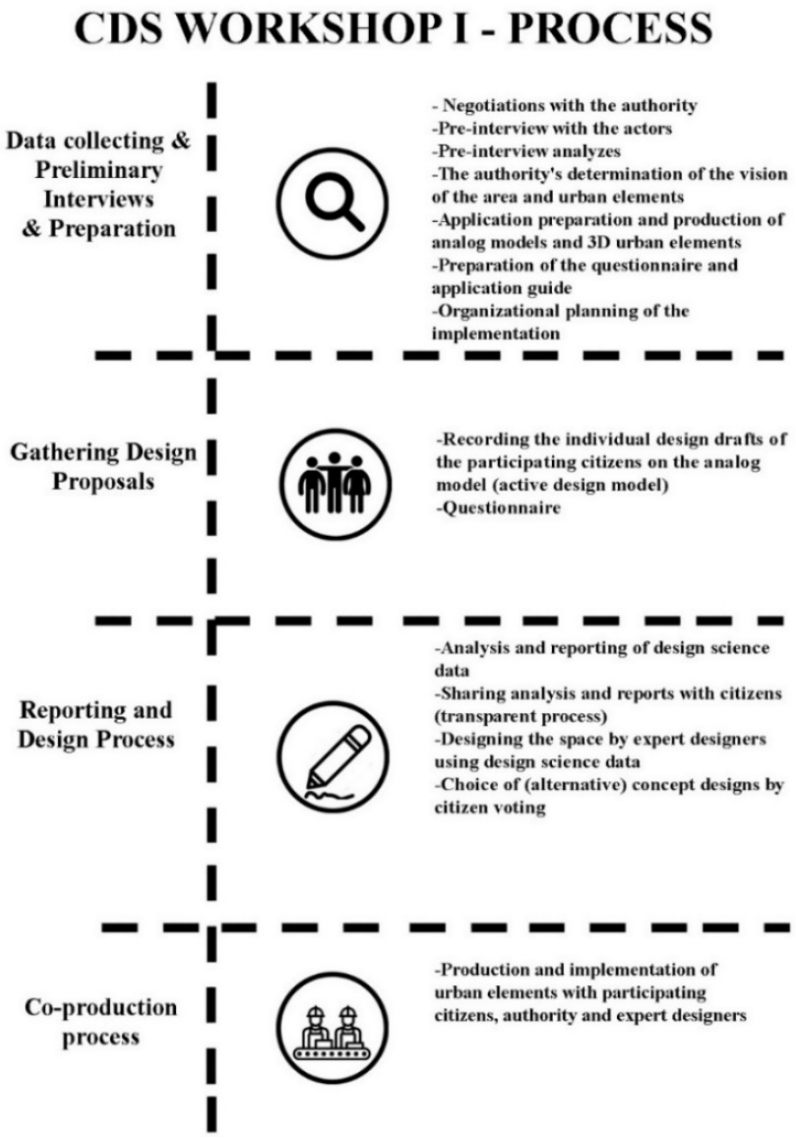
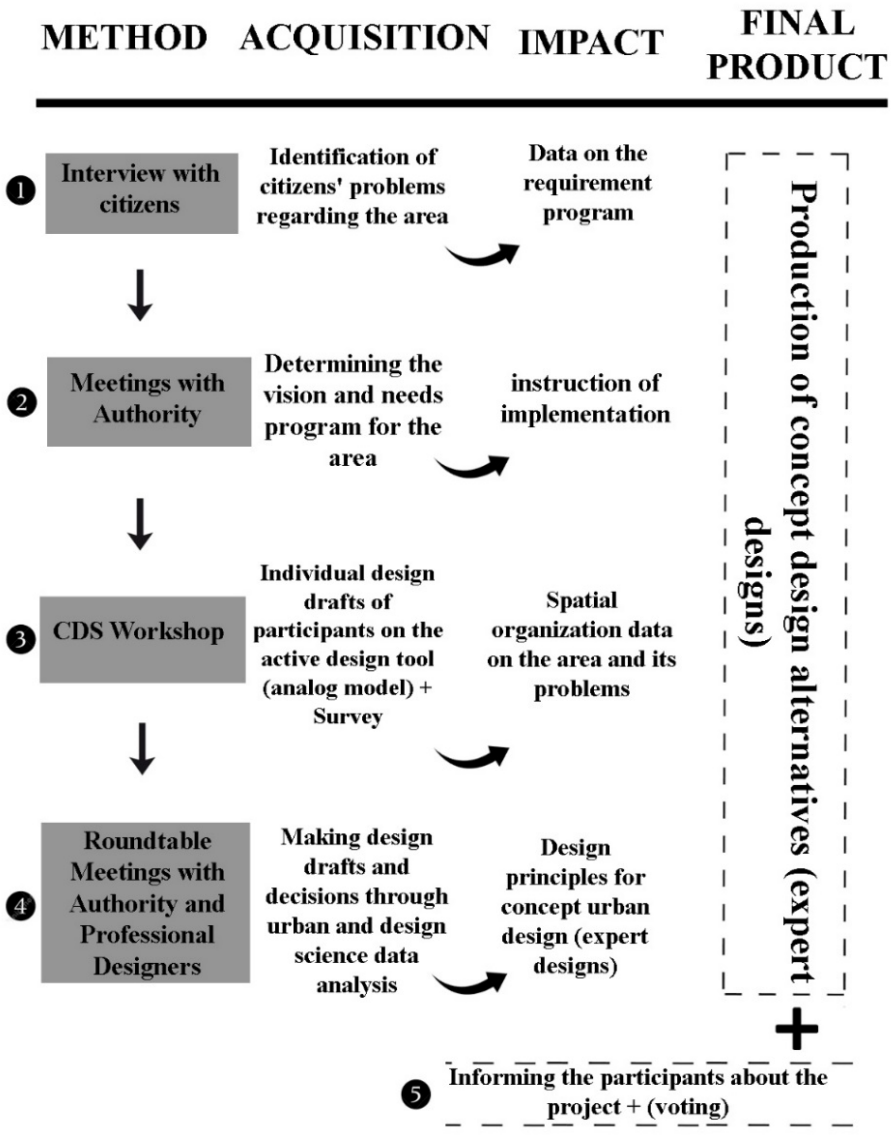


Figure 4.41: Implementation process of Atakent Car park project

Preliminary interview studies focus on local citizens' problem determinations about the area, how they want to see the area in the future, and contribute to the vision and need program decisions to be taken by the authority in the first process. In the study report prepared after the meeting; these problems, suggestions, and evaluations are shared with the 'authority'. Then, in the meetings held with the 'authority', the vision of the field is evaluated through this report, and the needs program, production process, and application directive are planned for the active design stage within the scope of the workshop. Within the scope of the workshop, individual design drafts of the participants on the analog model are recorded. After the implementation is completed,

the participants are directed to the questionnaire, which includes questions about demographic data, experience, and problems in the field. The design science data was obtained as a result of the analyzes prepared after the implementation and questionnaire. In the round table meetings, design decisions are made regarding the spatial organization by negotiating with the 'authority' and 'expert designers'. With reference to the design decisions taken; concept design alternatives are produced and all design science data and design alternatives are submitted to the voting of the participating citizens (see Table 4.8).

Table 4.8: CDS Workshop I: Method-Acquisition-Impact-Final Product Chart



For the participant target, a stratification sampling method with 96 participants in over-age groups was chosen (Table 4.9).

Table 4.9: Distribution stratified sampling based on age range

Age Range	Number of target group
15-24	11
24-34	15
35-44	20
45-54	17
55-64	15
65 +	18
Total:	**96**

4.2.3 Findings & Results

In the preliminary study carried out in order to determine the problems regarding the current situation of the area; the actors as neighborhood residents, shopkeepers, and library users of the visually impaired were interviewed. As a result of the preliminary study, the problems of the users regarding the area were determined regarding the preliminary interviews *(first step: interview with citizens)*:

1. **Neighborhood residents:**

- It is not desired that the area currently used as a car park becomes a closed car park. A group of neighborhood residents appealed by applying to the Municipality with a petition for the area not to become a closed car park.

- They stated that they did not feel safe in the area. There was not enough lighting in the area and this brought security problems.

- They stated that the average age of the people living around and using the area is over 50 years old.

- They stated that they wanted the area, which has been functioning as an irregular car park for more than 10 years, to be arranged in the new project, to

maintain its parking function, to increase the amount of open green space and to arrange a parking lot.

- Visitors also use the area as a car park.
- They stated that they only used the area for transit, as there are no seating units in the area.
- Parking occupancy rate in the area reaches its maximum level after 18:00 p.m.
- During the interview, the residents of the neighborhood who did not want to use the parking lot also expressed their opinions.
- Some of the residents living nearby of the area stated that they brought their pets to this area and that they are willing to create a more qualified area for animals.
- It has been stated that there are vehicles in the area almost every hour on days when there is a market set up in the immediate vicinity of the area.

2. Shopkeepers:

- They stated that middle and upper-income groups lived in the surrounding area.
- They stated that the occupancy in the area was high during weekdays and evening hours.
- They stated that the area is used as a parking lot by the residents of the neighborhood and the customers coming to their businesses.
- They stated that they were not against the regeneration of the area into a multifunctional area, including a parking lot.

3. Users of the library:

- The library, which has been operating since 2014, is used for study and book-sounding purposes for visually impaired citizens.

- Along with the arrangement of a multifunctional public space including the car park, it has been stated that this area is currently a challenging public space f for visually impaired citizens to spend time.

- It has been stated that the number of volunteers in the library is more than the number of students.
- It has been stated that interventions that include the disabled, such as placing an informative sound button in the park, can be positive in terms of use.

Preliminary Interview Evaluation with the Authority *(second step: meetings with authority)*:

After the preliminary interview, an evaluation was made in order to evaluate these views with the authority and to take decisions regarding the urban elements within the vision, design constraints, and needs program of the area.

Based on the opinions of the neighborhood residents, the shopkeepers, and the library users of the visually impaired:

- The use of the area as a car park at a maximum of 50% and the arrangement of a multifunctional, qualified public space in the rest of the area,

- Among the urban elements to be proposed for the area, the decision of presenting the 'yellow object', which the participants could not find within the scope of the study and which is the wildcard object for the functions,

- To protect the existing trees in the area,

- In order for the participants to perceive the space and scale more easily, the pole star's element that they can navigate on the analog model should be a transformer instead of the container, which is the workshop space,

- The opinions about the accumulation of water due to the old stream bed water trace in the immediate context of the area are important in terms of regulation,

- Emphasizing the importance of the participation of visually impaired citizens in this participatory workshop, based on the concept of "design for all!"of the "CDS" method,

- In the context of urban governance, the establishment of an innovative 'Citizen Involvement Office' within the Municipality organization in order to ensure coordination before and during the workshop implementation (see Figure 4.42),

Figure 4.42: Link to citizen participation: Citizen Involvement Office, Karşıyaka Municipality

- Decisions were taken regarding a method (co-production) that should be followed not only in the project design process, but also in the implementation process in order to complete the smart city-smart citizen cycle.

For workshop application; the coordinator person responsible for the general operation of the Karşıyaka Urban Vision Development Office and the Citizen Involvement Office, the person responsible for welcoming and directing the participants, the person responsible for the analog model and implementation guide, the person responsible for registration-documentation and theperson responsible for the questionnaire and nickname have been assigned (see Figure 4.43).

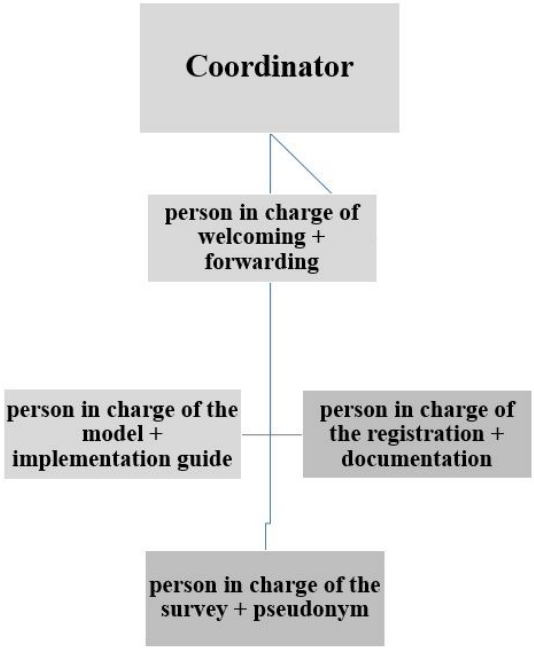


Figure 4.43: Workshop organization diagram

The urban elements determined for the spatial regeneration in the area for the demands and needs of citizens are green area, paved surface, tree, car park, bike park, bicycle path, walking path, linear shadow element, sitting element, water element, dog park, cat house, playground, hobby garden, skateboarding area, basketball court, volleyball court + the yellow object-open object. All the objects and their images are shown in the implementation guide (see Figure 4.44).

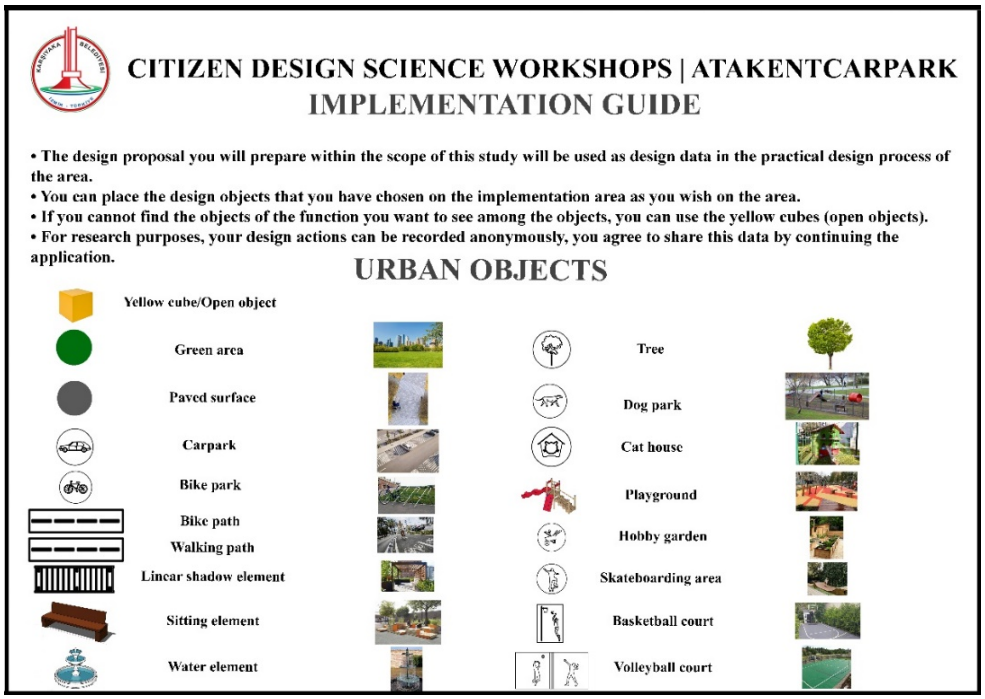


Figure 4.44: Implementation guide, Atakent Car park

Within the scope of Atakent Car park's participatory urban design process, it is aimed to prepare a user-friendly analog design tool and implementation guide, which includes the model base and the simplest representations of urban objects belonging to urban elements with its proper scale (see Figure 4.45-46). Thus, the participants can easily express their spatial suggestions regarding the area.

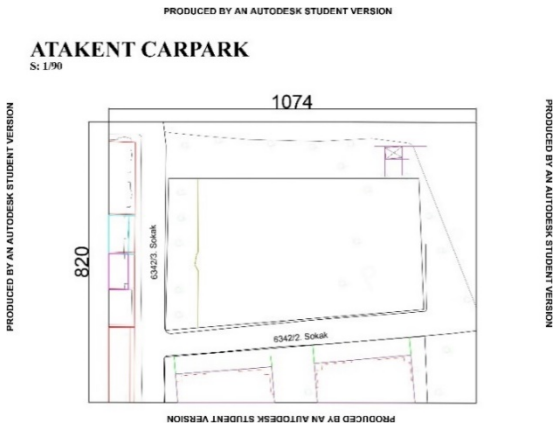


Figure 4.45: Atakent Car park

Figure 4.46: 3D and embossed models of urban elements

In addition, for the participatory process in which the concept of 'design for everyone!' is adopted. The urban objects belonging to the urban elements were produced in 3D and embossed form in order for the visually impaired participants to participate in the process (see Figure 4.47). 3D and embossed objects of structures and urban elements on the model base have been produced in 3D printers and laser cutters in cooperation with İzmir Metropolitan Municipality, FikrimİZ Office-FabLab Izmir.

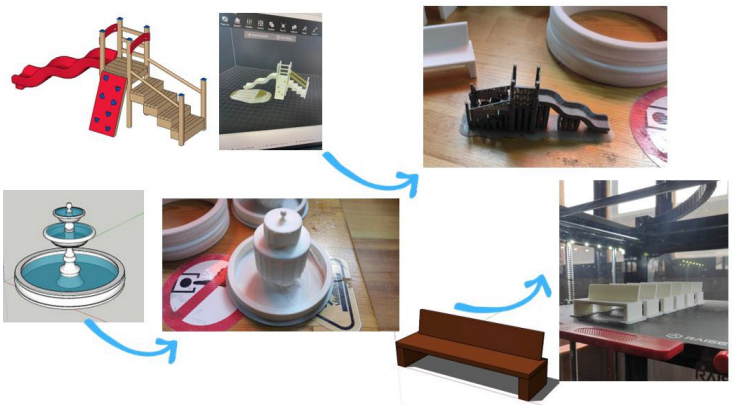


Figure 4.47: Examples of 3D urban objects

Before the workshop implementation, the Citizen Involvement Office conducted fieldwork. They informed the participants with the brochures and invited them to the CDS workshop (see Figure 4.48).

Figure 4.48: CDS Workshop-Atakent Car park, brochure

The ‘mind map’ process was added to the implementation guide for these participants [141]. Library users of visual impaired were guided on the area. They were informed by the workshop coordinator about the important elements on the field as a transformer, trees, pole star object etc., and directed to the implementation (see Figure 4.49).

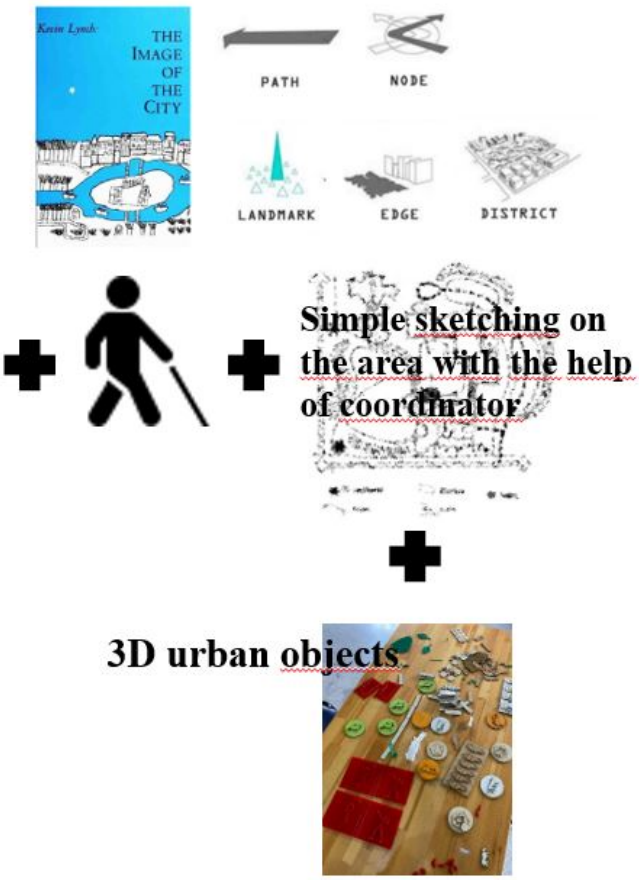


Figure 4.49: Visually impaired citizens' guide based on 'The image of the city' [141]

The second step of the workshop, 'questionnaire study' is a consisting of 25 questions sensitive to the protection of personal data in order to measure demographic data, understanding of the demands and needs of the area, measure the experience of implementation, interest in the production process (co-production process) and trust in the local government for implementation of the project (see Appendix B).

The container, which was the workshop space before the implementation, was placed at a point that dominates the area, close to the guiding pole star's element (determined as the transformer) (see Figure 4.50). The element is chosen for participants to find direction and understand the model scale.

Figure 4.50: Atakent Car park Implementation -Container Point and 'Pole Star': transformer

It is aimed to record the top view of the design drafts of each participant by placing a tripod and camera on the model base inside the container. Just next to the container, an open space arrangement was made for the questionnaire study. In the front part of the questionnaire study area, a tea and coffee catering section was created for the waiting process and motivation of the participants (see Figure 4.51).

Figure 4.51: Container and open space arrangement for questionnaire study

Citizen Design Science Workshop I- Atakent Car park was conducted between April 15 and April 26, 2022, with the participation of 190 citizens (Step 3: CDS Workshops). In the first step of the workshop, spatial design proposals for the Atakent Car park area were documented, and in the second stage of the study, the process of collecting design proposals for the area was completed with a questionnaire consisting of 25 questions (see Figures 4.52-53).

Figure 4.52: Example of participant's design layout, implementation process

Figure 4.53: on the left: implementation guide, in the middle and on the right: examples of questionnaire study

During the workshop, free sampling was used based on the participation density, despite the fact that the target group was detected as stratified sampling distribution based on age range.

Before the implementation, the reference point was determined on the parcel on ArcGIS (see Figure 4.54).

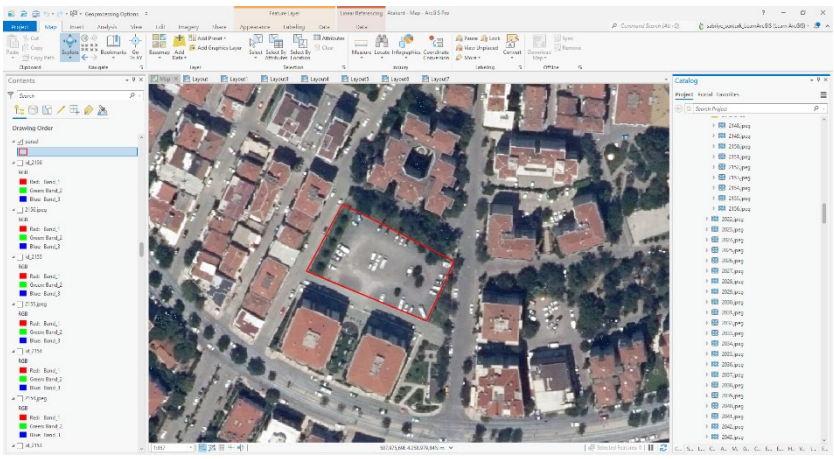


Figure 4.54: Determining the reference point on Arcgis

The model photo is coordinated with georeferencing and added control points (see Figure 4.55).

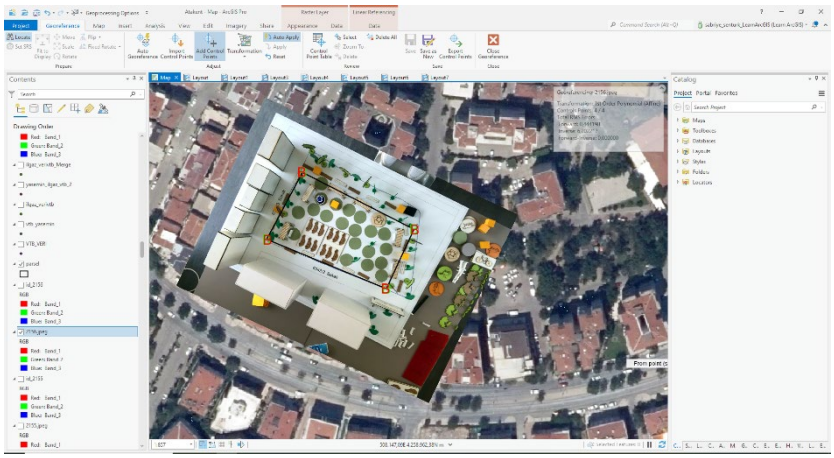


Figure 4.55: Coordinating the photo of the model

Urban objects are processed as points on coordinated photographs. Attributes such as object code, object name, and yellow object name are created in the table (see Figure 4.56).

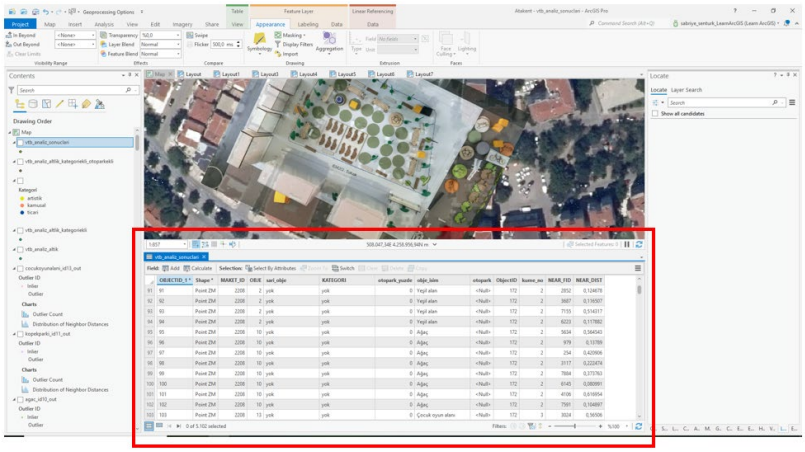


Figure 4.56: Processing urban objects as points on coordinated photographs

After adding the model photographs regarding design drafts of all participants, the clustering analysis of the objects was made (see Figure 4.57).

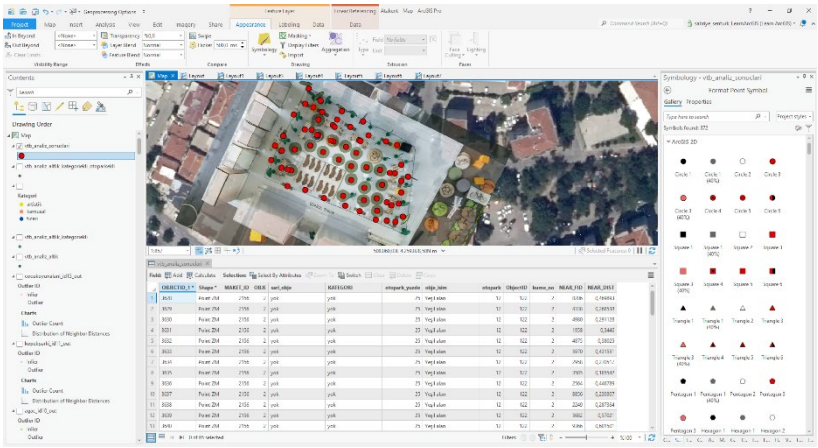


Figure 4.57: Processing urban objects as points on coordinated photographs

In order to perform hierarchical cluster analysis with SPSS, a pivot table was prepared after the analysis results and the entered data were translated with the Microsoft Excel program (see Figure 4.58).

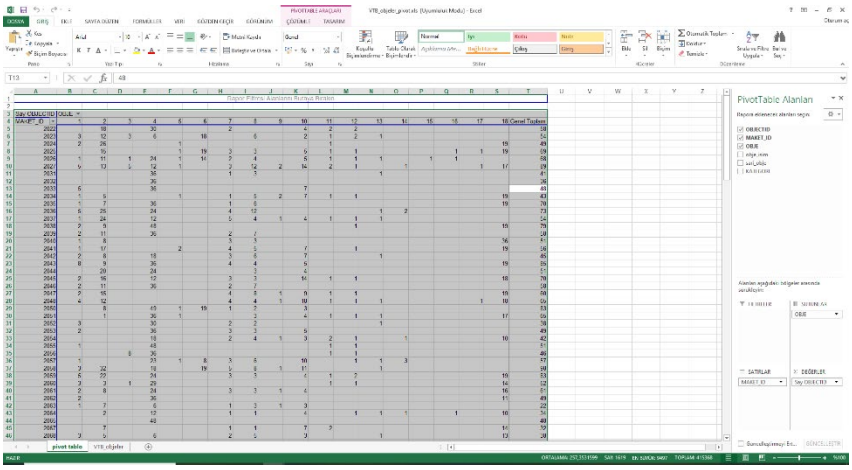


Figure 4.58: Pivot table

Analysis results for hierarchical cluster analysis with SPSS; were classified according to both users and urban elements (see Figure 4.59).

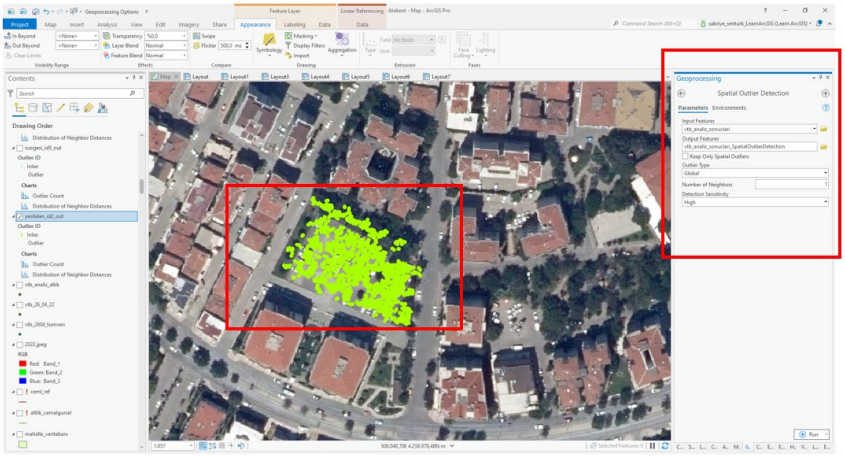


Figure 4.59: Clustering analysis of urban objects

In order to perform hierarchical cluster analysis through SPSS, the data were organized to classify according to user type with the preparation of the analysis results. Afterward, the data were organized to classify according to the urban object type. In addition, dendrogram graphs related to user groups and urban objects were produced via SPSS.

In the CDS Workshop I-Atakent Car park, in whom the spatial design proposals of 190 participants regarding the Atakent Car park were documented; the design principles to be adopted in the concept design (s) were determined through the analyzes prepared in line with the relations of the spatial suggestions with each other (see Figure 4.60).

Figure 4.60: Design submissions of CDS Workshop I, Atakent Car park

Spatial suggestions of current and potential users of the area were included in the study. The analyzes, which include the experiences and design suggestions of 190 participating citizens in the workshop, are examined under 3 main headings:

- Questionnaire analysis
- Spatial Data Analysis (Design Science Data)
- Open Object analysis.

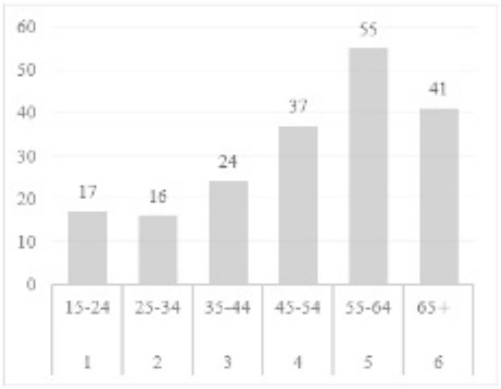
Evaluations based on the analysis results are;

- Infrastructure – technical needs
- Spatial organization of urban elements and design principles
- Open object decisions.

1. **Questionnaire Data:**

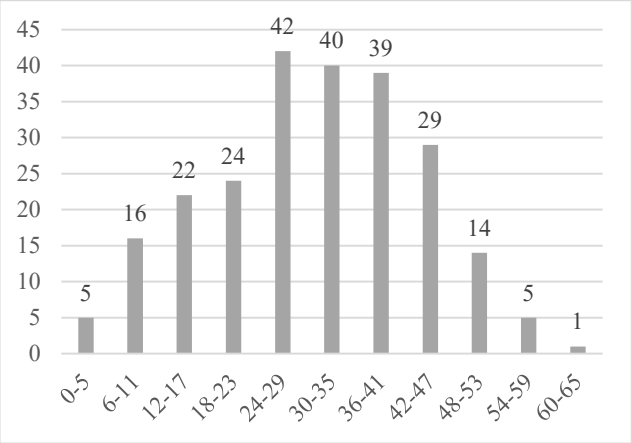
Within the scope of the workshop, the study was completed with 190 citizens consisting of 92 women and 98 men; 48% of the participants are female and 52% are male. The highest participation rate is between the ages of 55-64 with 29%. This rate is followed by the 65 and over the age group with a rate of 22% (see Table 4.10).

Table 4.10: Age distribution of participants



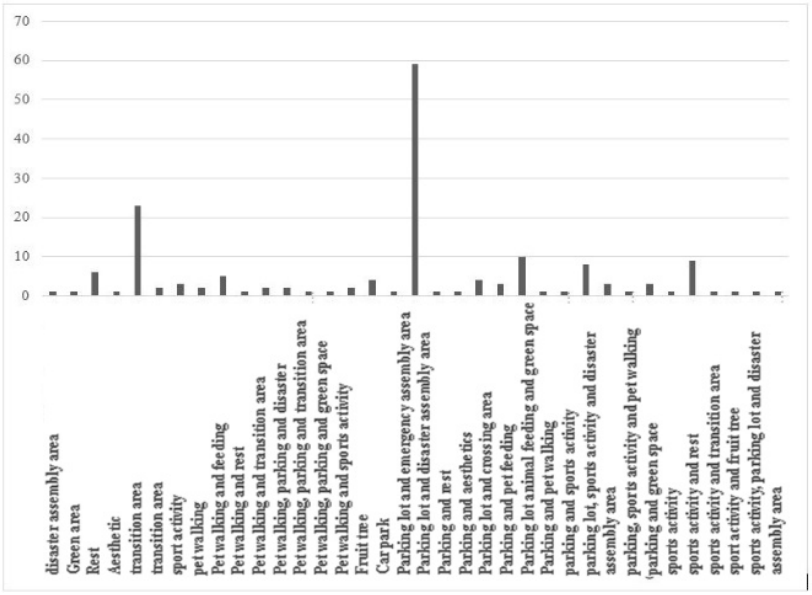
72% of the participants have children. In the age graph of the children of the participants, the rate of participants with children aged 0-5 is 5%, while the rate of participants with children aged 6-11 is 16% (see Table 4.11).

Table 4.11: Age distribution of the children of the participants



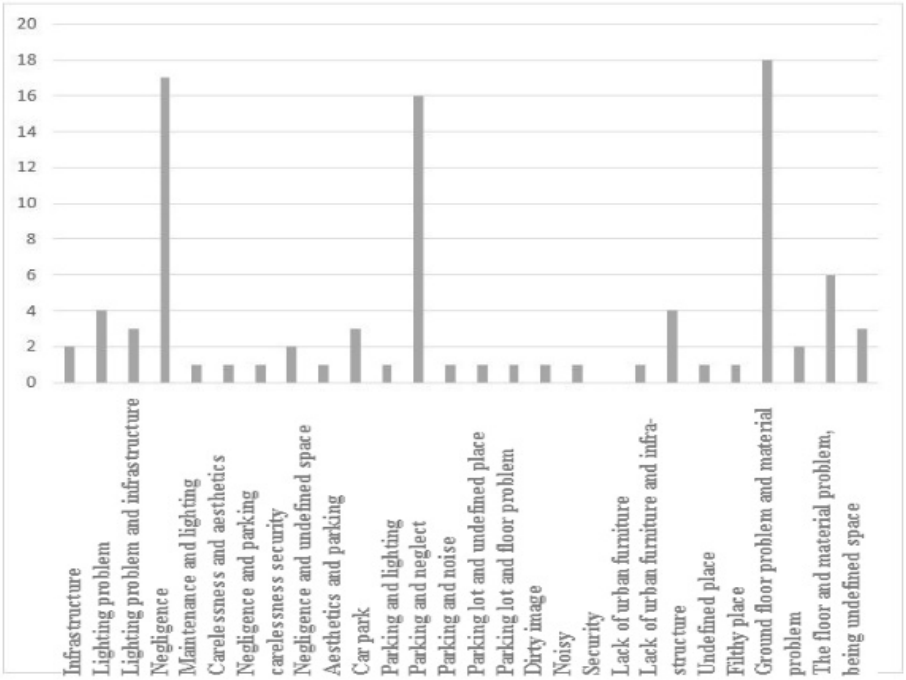
While 164 of the 190 participants were using the area, the participants who stated that they used the area were asked for what purposes they used the area. According to Table 4.12; the area is mostly used as a car park with a rate of 35% (59 people). However, the area is used as a "transition area" with a secondary ratio of 14% (23 people). These data emphasize the transit space's feature of the area instead of the spend of spaces (see Table 4.12).

Table 4.12: Participants' purpose of use of the space



Questions of negative thoughts about the area are answered by 93 participants. 18 participants stated that the area is undefined, 17 participants stated that the area was neglected, and 16 participants claimed about the area to use as a car park (see Table 4.13).

Table 4.13: Negative thoughts of participants about the area

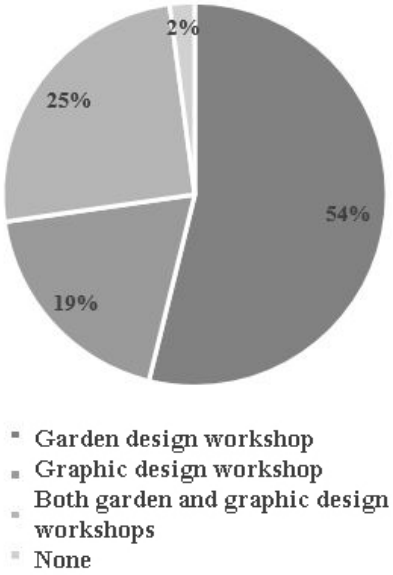


The co-production process, which is the method that citizen participation should be followed not only in the project design process but also in the implementation process to complete the cycle of creating a smart city-smart community, is a continuation of the method. While 75% of the participants said yes to the question of their willingness to participate in co-production, 25% did not want to participate. It is noteworthy that the participants are interested in the 'co-production process', which is the continuation of the co-design process.

In the continuation of the question in which the desire for the co-production process is measured, the participants were asked which of the potential co-production workshops could be opened for implementation in Karşıyaka Municipality. Out of 142 people

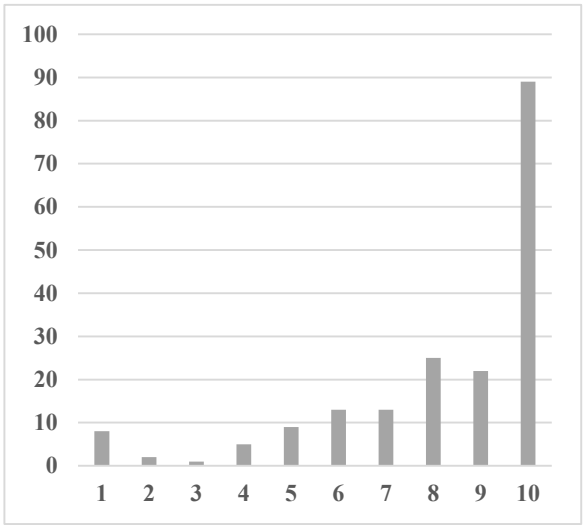
who wanted to participate in the workshops, 77 participants wanted to attend the garden design workshop and 27 participants wanted to attend the graphic design workshop. 36 participants want to attend both workshops. 3 participants want to participate in the workshops but do not choose the workshop (see Table 4.14).

Table 4.14: Distribution of workshops that the participants want to participate in the co-production process



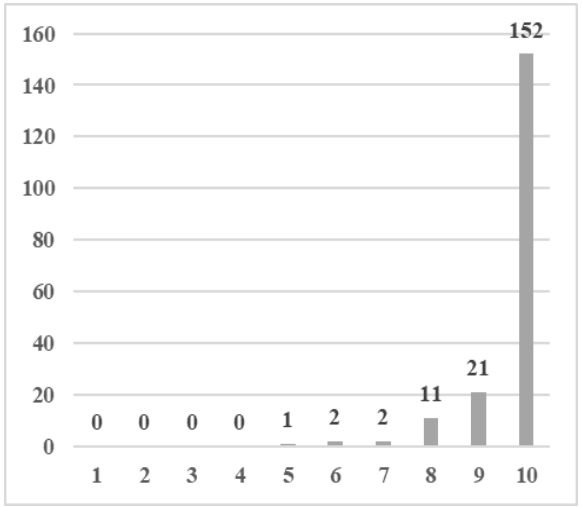
187 participants answered the question asked to measure their belief that the spatial design drafts produced by the participants during the participatory process would be taken into account by the project implementer Karşıyaka Municipality (authority). To this question, which was asked on a 10-point Likert scale, 89 participants gave the answer representing the "highest" belief. 47 participants marked the option as representing "high" belief. The number of participants who have no faith is 8. All 3 participants stated that they had a low belief that their design would be taken into account (see Table 4.15).

Table 4.15: Distribution of participants' belief in local government in the context of implementation (1 to 10)



80% of the participants (152 people) stated that they enjoyed designing in the study and gave 10 full points, which is the highest score. The number of people who gave 8 and 9 points representing the high score is 23 people with a rate of 12%. No participant stated that they did not enjoy the study (see Table 4.16).

Table 4.16: Distribution of participants' enjoyment during design (1 to 10)



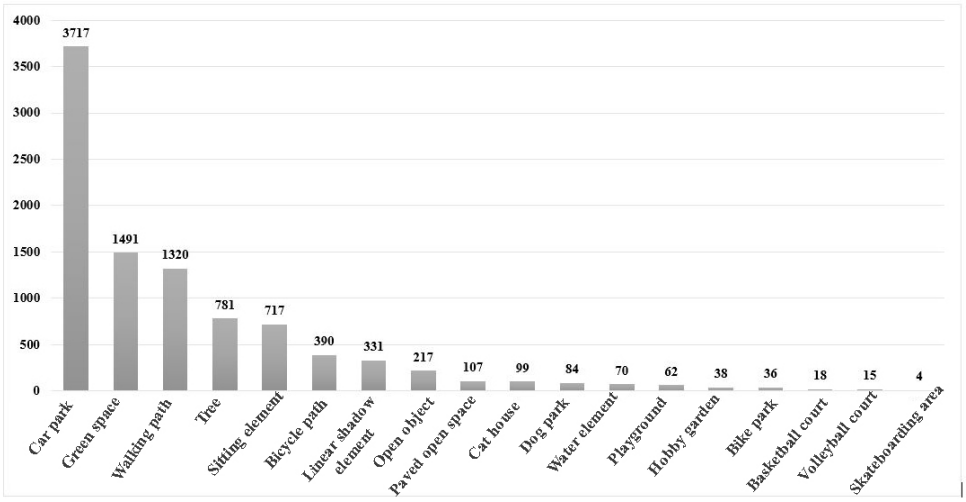
2. Spatial Data

In the participatory urban design process, each participant has a spatial design draft for the experience, needs, and wishes regarding the area; documented with photographs and coordinated on geographic information systems tools, and evaluated with 'hierarchical cluster analysis'. The table in the database by processing participant profile and ID information, object type definition for each urban element, and design trends for the physical organization of the space were also determined by classifying the data according to their similarities.

In the spatial data analysis of the implementation with a democratic and transparent understanding; anomaly detection was applied (outlier detection) by isolating rare urban elements that differed significantly from the majority of the data. Thus, design principles were evaluated in the production of public space for the shared wisdom proposals of the current and potential users of the area.

9.497 urban objects were used in the study, in which 190 participants took part in the co-design process. The most used parking object shown in Table 4.17 is the clue of the participant groups who came across the car park during the implementation, over the density of the parking function in the area (see Table 4.17).

Table 4.17: Distribution of urban objects used in design layouts



According to Table 4.18; there are 140 sitting element objects, 137 green space objects, 123 tree objects, and 83 pedestrian ways objects uses. This emphasizes the needs and wishes of the area currently highlighted as the transit area in the questionnaire results.

The graph showing the average number of objects per user is followed by the car park, green area, pedestrian path, tree, seating elements, bike path, linear shadow element, and paved surface objects, which are expected to be arranged in relation to the current situation, respectively (see Figure 4.61-Table 4.18).

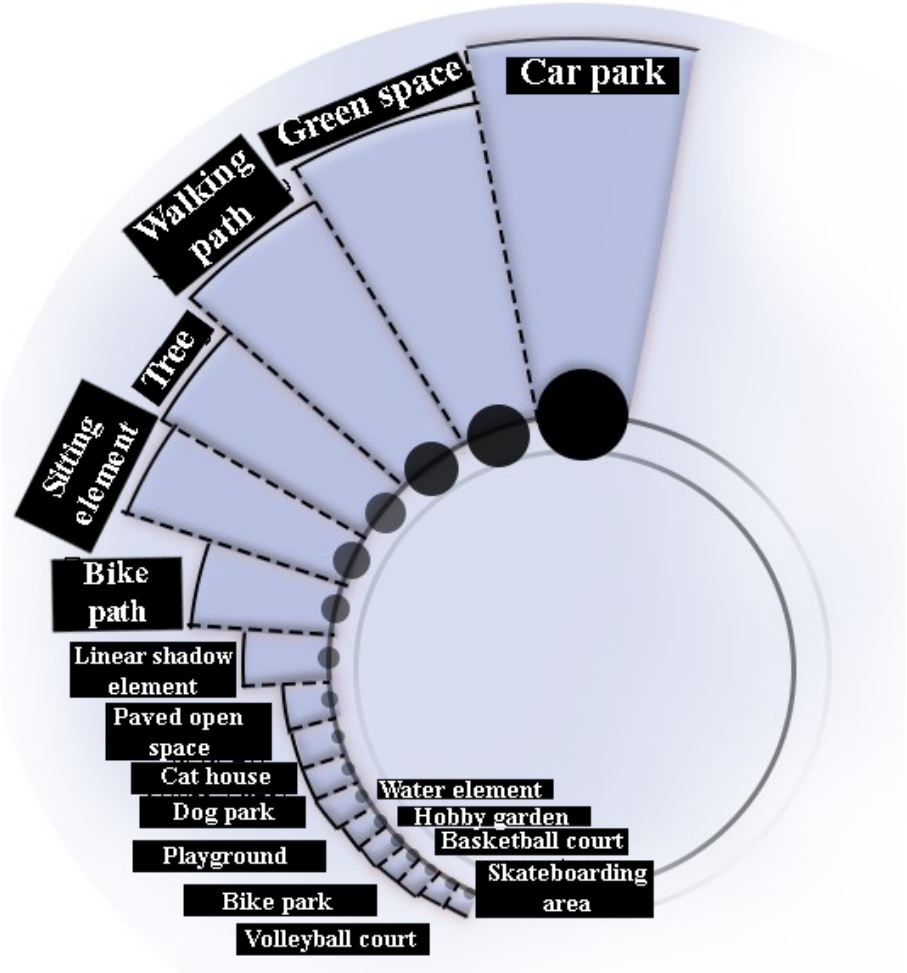
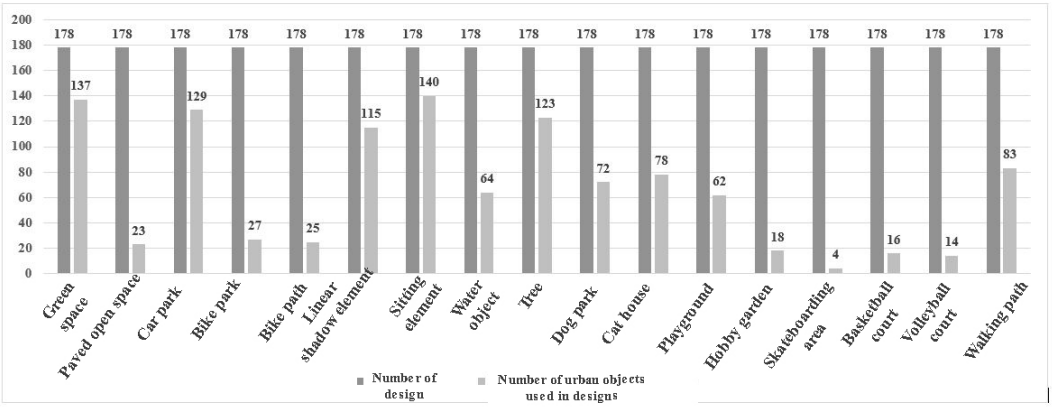


Figure 4.61: Average number of objects per participant (hierarchical display)

Table 4.18: Number of urban objects used in design layouts



Hierarchical cluster analysis was conducted for each object of urban elements through the bases produced using geographic information systems tools.

1. *Green Space:*

The second most preferred item among the number of uses of the objects preferred by the participants in the study is the green area item. In the current situation, the green area extending along the perimeter of the area is intensely homogeneously spread over the entire area in the spatial data analysis of the design drafts (see Figure 4.62).

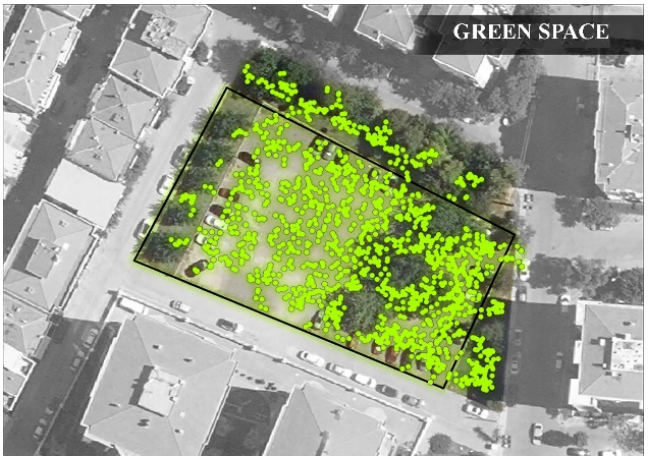


Figure 4.62: Hierarchical cluster graphic of green space

2. *Paved surface:*

With 23 repetitions of use, the paved surface is one of the lowest-intensity urban objects. In addition, the accumulation of rainwater in the area close to the old creek bed track is matched by the low density of hard floor surface coating by the users. The current and potential users of the area suggest a greener space set up for the area (see Table 4.63).

Figure 4.63: Hierarchical cluster graphic of paved surface

3. *Tree:*

In today's world where global warming and ecological issues are on the agenda, green tissue, and trees, whose value is more appreciated with the effect of the pandemic in the past years, provide multidimensional benefits to the city and citizens. In parallel with the green area selection of the participants; 123 frequently the tree element was the third most preferred urban element. The spatial distribution is parallel with the green area urban object and is homogeneous on the graph. In addition, trees due to shadow creation also act as a top cover and alleviate the heat island effect. Therefore, a tree hierarchical clustering graph was taken into consideration while evaluating the linear shadow element (see Figure 4.64).

Figure 4.64: Hierarchical cluster graphic of tree

4. Car park:

Car park urban object with a maximum density of fifty percent of the area was presented to the participants based on the authority's pre-interview evaluation decisions. According to the questionnaire analysis and preliminary interview results, some of the current and potential users of the area do not want the entire area to be used as a car park, and some of them think that there may be a regular car park in the area with multi public functions. The hierarchical clustering graph shows the distribution of parking lot items in the area with a current capacity of approximately 120 vehicles; there is a parking function proposal with a density of approximately 50%, concentrated in the northeast of the area on the graph (see Table 4.65).

Figure 4.65: Hierarchical cluster graphic of car park

The proposed parking space rate in the design drafts is 30% with a capacity of 0-20 vehicles, and 30% with a capacity of 60-80 vehicles. In addition, within the scope of the workshop, which does not allow participants to use more than 50% of car park objects, the yellow cube object-open object was used as a car park object by 11% of the participants, who envisaged the use of the area as a 100% car park function. The workshop was hacked (see Figure 4.66). ***(design hack)***

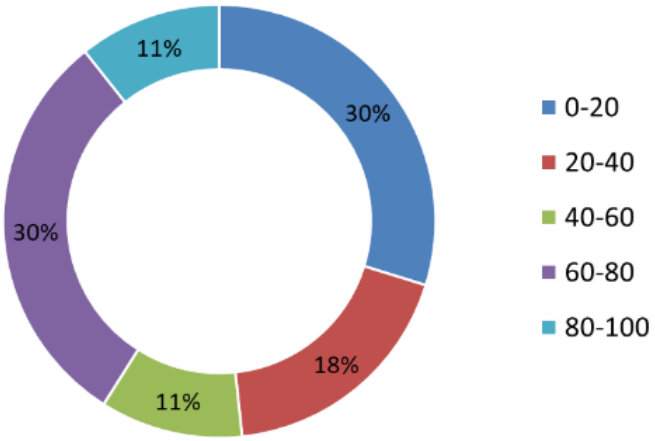


Figure 4.66: Distribution of demanded car park area

5. *Bike park:*

One of the basic needs of the transportation approach, which aims to strengthen the bicycle network in the city, is bicycle parks. When the hierarchical clustering graph of the bicycle park urban element is examined, it is seen that the suggestions are concentrated in the north and southeast of the area. It is seen that the bicycle park object preferred by 27 participants is significantly dense (see Table 4.67).

Figure 4.67: Hierarchical cluster graphic of bike park

6. *Bike path:*

It is seen that the suggestions of the bicycle path element, which is evaluated together with the bicycle park element, are concentrated in a way that surrounds the area. 27 participants used 390 bicycle path objects in their spatial design proposal (see Table 4.68).

Figure 4.68: Hierarchical cluster graphic of bike path

7. *Walking path:*

In addition to the area's 'car park' function for its current situation, participants proposed a walking path to surround the area. Besides the perimeter, it can be said that the walking area is leaking compared to the center of the area. 83 participants used 1390 walking path objects in their spatial design suggestions (see Figure 4.69).

Figure 4.69: Hierarchical cluster graphic of walking path

8. *Linear shadow element:*

According to cluster analysis; it is seen that the user demands the linear shadow element, which is a shade element, to be concentrated on the existing green area and on the periphery of the area. It was used 331 times in the design proposal of 115 participants. Since the linear shadow element is a shade element when it is considered with the tree object, which is an important and natural shade element for public open spaces in an ecological context, it is seen that the demand for top cover in the area is intense in relation to the heat island effect in the area. It is seen that the demand for top cover in the area is intense in relation to the heat island effect in the area (see Figure 4.70).

Figure 4.70: Hierarchical cluster graphic of linear shadow element

9. Sitting element:

Examining the cluster analysis graph of the seating element, it can be said that it is homogeneously distributed throughout the area. This situation, which can be considered as an exception, is interpreted in relation to the need of current and potential users for a seating area focused on 'stopping and spending time' and 'the need to breathe' in this area. 717 sitting element objects included in the spatial proposal of 140 participants were used. It is seen that the need for sitting element, which also contributes to socialization, is a significant need in the area (see Figure 4.71).

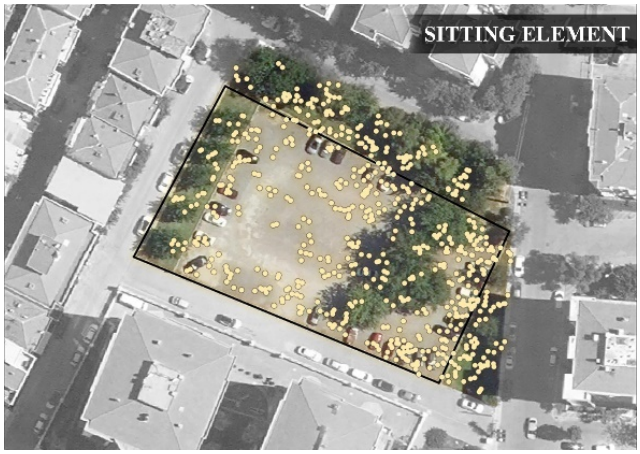


Figure 4.71: Hierarchical cluster graphic of linear sitting element

10. Water element:

The water element, which is one of the elements that can show ecological harmony in urban spaces; create healthy environments for individuals biologically, physically, and psychologically. Water element is a design element; in addition to its visual and psychological effects on people, it brings vitality to the space and unifies the elements of space [167]. Considering that sound and touch are the most important elements for disabled citizens; the place of the water element in the inclusive design approach is important.

Looking at the hierarchical clustering graph of the water element, it can be said that it is suggested in the central focus of the area (see Figure 4.72). In the spatial proposal of 64 participants, 70 water elements were used.

Figure 4.72: Hierarchical cluster graphic of water element

11. Dog Park:

Based on the questionnaire data, it is seen that the demand for the dog park object, which reflects the sensitivity of the pet owner users, is concentrated in the north of the area on the graph (see Figure 4.73). In the spatial design proposal of 72 participants, 84 dog park objects were used at a low-density level.

Figure 4.73: Hierarchical cluster graphic of dog park

12. Cat house:

Animals that are users of urban spaces with humans in the urban ecosystem. Area users who are observed to be sensitive in this context; voluntarily care for cats at the northern end of the existing area.

When the hierarchical clustering graph of the cat house object is examined in spatial design suggestions, it is seen that the demands for cat houses are intensified at the southeast end of the area in addition to the northwest end in parallel with the current situation (see Figure 4.74). 99 cat house objects used in the design of 78 participants are an indication of the needs of the users.

Figure 4.74: Hierarchical cluster graphic of cat house

13. Playground:

The quality and quantity of playgrounds, which are indicators of quality of life, are important for urban life. Based on the questionnaire results; the proportion of participants who have children in the play age group is low. When the hierarchical clustering graph of the playground object is examined, it is seen that the suggestions are concentrated at the southeastern end of the area. In the spatial design proposal of 62 participants, 62 playground objects were proposed (see Figure 4.75). In addition, the existence of qualified playgrounds was determined in the field study carried out by the Urban Vision Development Office for the parks located in the immediate vicinity of the area (see Table 4.19).

Figure 4.75: Hierarchical cluster graphic of playground

Table 4.19: Parks and their equipment in the context of Atakent Car park

PARKS	EQUIPMENT
Kardelen Park	sports equipment, basketball/volleyball court (qualified), bench/rest elements
Ekrem Bulgan Park	playground, benches/resting elements, disaster assembly area, cafe
Uğur Demirkan Park	basketball/volleyball court (not qualified), bench/rest elements
Kazım Sönmez Park	playground, benches/resting elements
Ali Levent Tığrak Park	playground, bench/rest elements, disaster assembly area, basketball/volleyball court (qualified)

14. Skateboarding area:

No significant clustering was found in the hierarchical clustering graph prepared for the skateboard area design object, one of the recreational outdoor uses. 4 participants proposed a skateboard area object in their spatial design proposal (see Figure 4.76).

Figure 4.76: Hierarchical cluster graphic of skateboarding area

15. Hobby garden:

In the hierarchical cluster graph prepared for the hobby garden urban element, which is chosen for the purpose of satisfying the citizens' longing for nature, which is not a professional purpose, it is seen that there is no obvious concentration, although there is demand at different points on the periphery of the area. 38 hobby garden objects were used in the spatial design proposals of 18 participants (see Figure 4.77).

Figure 4.77: Hierarchical cluster graphic of hobby garden

16. Basketball court:

No significant clustering was found in the hierarchical clustering graph prepared for the basketball court design object, one of the recreational outdoor uses. 18 basketball court design objects used in the spatial proposal of 16 participants are seen in the area in a very low-density and scattered form (see Figure 4.78).

Figure 4.78: Hierarchical cluster graphic of basketball court

17. Volleyball court:

No significant clustering was found in the hierarchical clustering graph prepared for the volleyball court object, one of the recreational outdoor uses. In the spatial design proposal of 14 participants, it is seen that 15 objects are scattered at the northwest end of the field with low density (see Figure 4.79).

Figure 4.79: Hierarchical cluster graphic of volleyball court

3. Open Object Data

In co-design work; the open object urban element is defined for the needs and desires that are not among the urban element options given to the participants for the design proposals and were used 217 times by the participants.

While analyzing open object data, 97 objects consisting of technical needs and wishes were excluded from the cluster. (lighting element, trash can, rubber floor, etc.) The remaining 120 open objects are analyzed in three different groups (see Table 4.20):

- Public function
- Commercial function
- Artistic function.

Table 4.20: Distribution of open objects

Open Object Type	Number of object
Commercial function	14
Public function	81
Artistic function	8
Commercial and public functions	11
Commercial, public and artistic functions	2
Public and artistic functions	4
Total	**120**

While the open object urban element was mostly characterized by the public function by the participants, the lowest preference was the object proposals with a commercial function. Open object definitions with public functions are hierarchical; concentrated on the picnic table, table tennis, and sports equipment. The elements of the public function are located in the space without clustering in the hierarchical clustering graph of the open object. (see Figure 4.80).

Figure 4.80: Hierarchical cluster graphic of open objects

Within the scope of the study, spatial data were associated with each other within the scope of questionnaire data containing drafts and participant profiles evaluated for:

1. Infrastructure – technical needs

2. Spatial organization of urban elements and design principles

This process was carried out together with the 'authority', 'scientists', and 'professional designers' in a 'round table meeting' setup *(Step 4: roundtable meetings)*.

1. **Infrastructural – technical needs:**

When the questionnaire data and open object analyzes are examined:

- Inadequate lighting elements as of evening hours,
- Inadequate waste bins,
- The neglect of the existing green tissue in the area,

The formation of dense water in the area due to precipitation draws attention to the scale of infrastructure and technical needs.

In the process of transforming the area into a qualified public space, technical solutions such as adequate lighting elements and garbage cans should be considered holistically. Also, permeable concrete surfaces are suggested.

2. **Spatial organization of urban elements and design principles:**

The dominant design scheme and subgroup schemes were evaluated as a result of the user profiles and urban item objects data through the bases produced using geographic information systems tools.

As a result of hierarchical cluster analysis and questionnaire data; the primary element, the car park refers to the arrangement and additional public functions over the existing function of the area. Based on the results of the analysis, the parking arrangement can be considered in the northwest of the area with the rule not to exceed the maximum user capacity of 50%.

The secondary element, the green area, and the tree urban elements, which are evaluated together, clearly reveal the expectation of the regeneration of the area into a greener area.

In the current situation, the walking path urban element in the area that users consider as a transit zone defines a walking route all around the area. Pedestrian road setup, in which visually impaired citizens also reflect their design suggestions for the space should be considered as an embossed surface system that appeals to the sense of touch and provides an orientation to them. Thus, an inclusive design approach can be developed with the concept of "design for all".

In parallel with the questionnaire data, the seating element, which is heavily demanded in hierarchical cluster analysis can be considered as an element that supports activities such as sitting, resting, and watching in the area. It has the potential to increase socialization. Parklet as a seating element that can accommodate more crowded groups outside the bench and the picnic table item recommended as an open object can be matched. This high demand is also an indication of the need for users to use the space without paying.

In line with the goal of using the bike as a means of transportation, the bike park is one of the most important elements for the integration of bike transportation in the city. According to the analysis data; the bike park element clustered in the north and southeast of the area draws attention.

Participants were divided into groups on the basis of their preferred urban elements and design schemes, and the urban element preferences in the immediate neighborhood of these preferences were evaluated together (see Figure 4.81).

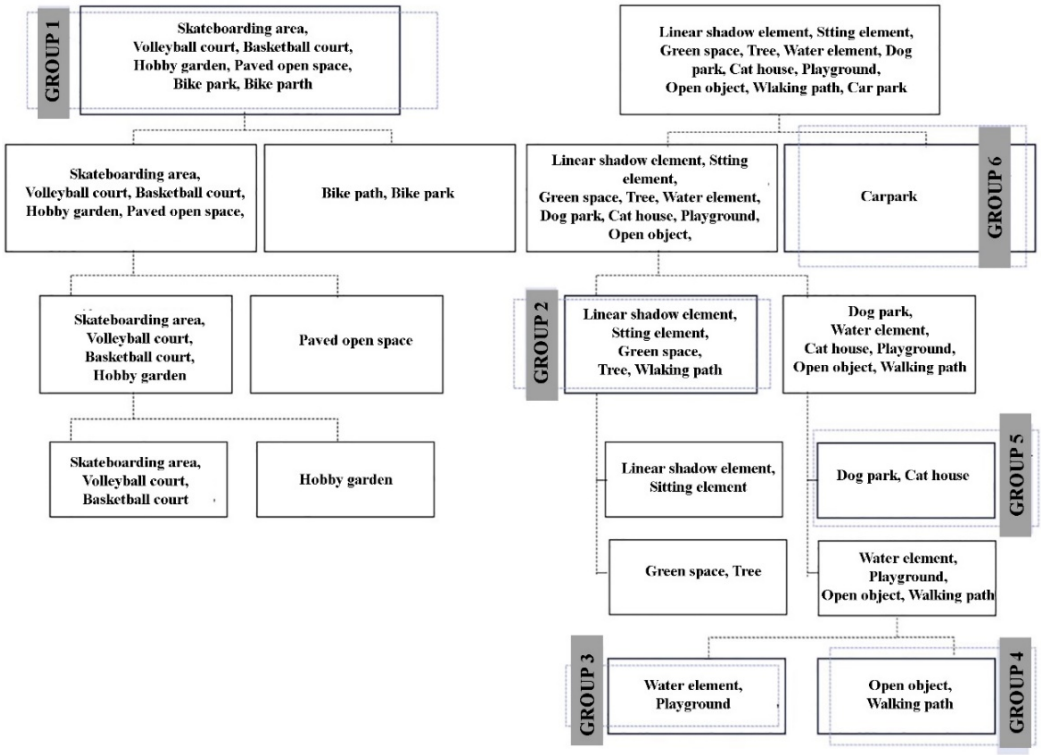


Figure 4.81: Hierarchical trend chart of participant groups according to urban element choices

After the evaluation, it is seen that the participants are divided into 6 tendency groups. The design trend of Group 1, which delivered 11 participants indicates the equal distribution of the urban elements of the cat house, dog park, green area, and car park. In the design trend of Group 2, which delivered 57 participants, car park, recreation elements, green space, cat house and dog park, walking path, water element, and playground are suggested. Group 3, representing 26 participants suggested existing area is largely proposed as a car park. Group 4, representing 64 people, proposed the area mostly as a function of rest, green space and car park, partly recreational outdoor sports activities, cat house, dog park, walking path, playground, and water element were used together. Group 5 representing 15 participants, suggested the area as a green area for resting purposes only; they used water elements and playground elements. This group does not want a car park function in the area. Group 6, which represents 17 participants, suggested hacking the open object element and arranging a new car park throughout the area (Appendix B).

Hierarchical clustering graphs, questionnaire data, and data of group trend graphs are evaluated holistically. The expectations of the participants about the pattern of public life that includes diversity are clearly seen. According to the analysis results; 140 participants offered a recreational area, 134 participants offered green areas, 125 people suggested the parking function, 70 participants offered special areas sensitive to the urban-animal ecosystem, and 65 participants suggested recreational outdoor sports activities.

From the two trends that make up the majority in terms of trend; participants of Group 2 suggested high-density mixed public functions with the partial parking function while Group 4 participants suggested other public functions in addition to the recreational and parking functions of the area. The relationship of spatial design suggestion data with user profiles and trends is examined as;

- It is seen that the car park function is concentrated in the west of the area and the use of public open spaces is concentrated in the east of the area.
- Demand draws attention as it is homogeneously distributed in the hierarchical clustering graph prepared for the green area object.
- Resting areas were proposed to the east of the area with the regeneration of all the peripheries of the area into green areas.
- It is seen that the water element proposal is concentrated in the center of the area.
- The bike and walking path elements are uninterrupted in the entire perimeter of the area, and the bike park element is clustered in the north and southeast of the area.
- Suggestions for cat house, and dog park items were heavily preferred by the participants, and they are concentrated in the north, east and west of the area.

According to questionnaire data and user profiles;

- Participants using the area for sports purposes chose the bike path and bike park objects and did not prefer other recreational outdoor activities.

- The majority of participants (15 participants) who use the area for walking their pets did not suggest hobby garden, bicycle path, basketball, and volleyball court objects.
- All users who suggested the dog park object also suggested the cat house object.
- While the majority of the participants using the area as a car park chose the car park object in their spatial proposal, 50% of the participants did not use the area as a car park object. This assessment is remarkable for the car park urban element.
- A high percentage of the participants (35 participants) who use the area as a transit area, demand green space, top cover, and seating in order to stop, rest and socialize in the area.
- The participant group, who mostly chooses the urban elements for recreational sports activities, varies between the ages of 35-64.
- 50% of the participants (32 participants) prefer the playground and water element.
- 100% of the participants, who found the parking function of the area negative, preferred the urban elements for resting.

4.2.4 Design Results

After the evaluation of design science and questionnaire data in roundtable meetings with the authority (Step 3: roundtable meetings); two alternative concept design projects were decided for the regeneration of public space. These two concept design projects will be submitted to the voting of the participating citizens within the process of CDS.

In the roundtable meeting, the spatial organization chart and the evaluations based on the design decisions were evaluated in three different scales:

• The ownership of the area belongs to Karşıyaka Municipality and its applicability for the implementation process as it appears as a regional multi-story car park in the zoning plan.

• Existence of similar public functions in the immediate context of the field

• Reflection of open object analysis evaluation on two alternative concept designs.

After the evaluation, urban elements and their spatial organization chart and hierarchical clustering graphics were shared with the professional designer for two different alternative concept designs (see Table 4.21).

Table 4.21: Distribution of prefered urban elements for Atakent Car park

Participants' demand for Atakent Car park	**Number of Participants**	**Percantage**
Tree	123	67%
Green space	137	75%
Paved open area	23	14%
Walking path	83	46%
Bike path	25	14%
Bike park	27	15%
Car park	129	70%
Sitting element	140	76%
Linear shadow element	115	64%
Dog park	72	39%
Cat house	78	39%
Skateboarding area	4	2%
Hobby garden	18	10%
Playground	62	33%
Basketball court	16	9%
Volleyball court	14	8%
Water element	64	35%

Urban elements received for *first alternative concept design* as:

- Walking path
- Parklet - shadow element
- Sitting elements-Parklet
- Cat houses
- Dog park
- Playground

- Water element
- Pergola/Top Cover
- Car park (50% capacity) with Artistic works
- Bike park - scooter park
- Picnic table
- Bicycle track area.

Urban elements received for *second alternative concept design* as:

- Sitting elements-Parklet
- Walking Path
- Activity Area
- Water element
- Linear shadow element/Top Cover
- Cat houses
- Dog park
- Bike park -Scooter park
- Table tennis
- Picnic table
- Car park (50% capacity) with artistic works.

In the first alternative concept design project, the 'picnic table' and in the second project, the 'table tennis' element represents the open object.

As seen in the distribution of preferred urban elements for Atakent Car park, the skateboarding area design element, which is preferred by 2% in the public space, was included in the concept design project by the mayor, although the expert designer expressed the data. (Autocracy: the demands of government)

Images of two alternative concept projects designed based on scientific data by Karşıyaka Municipality Urban Design Directorate between 16.05.2022-09.06.2022 are shown in Figures 4.82-4.83.

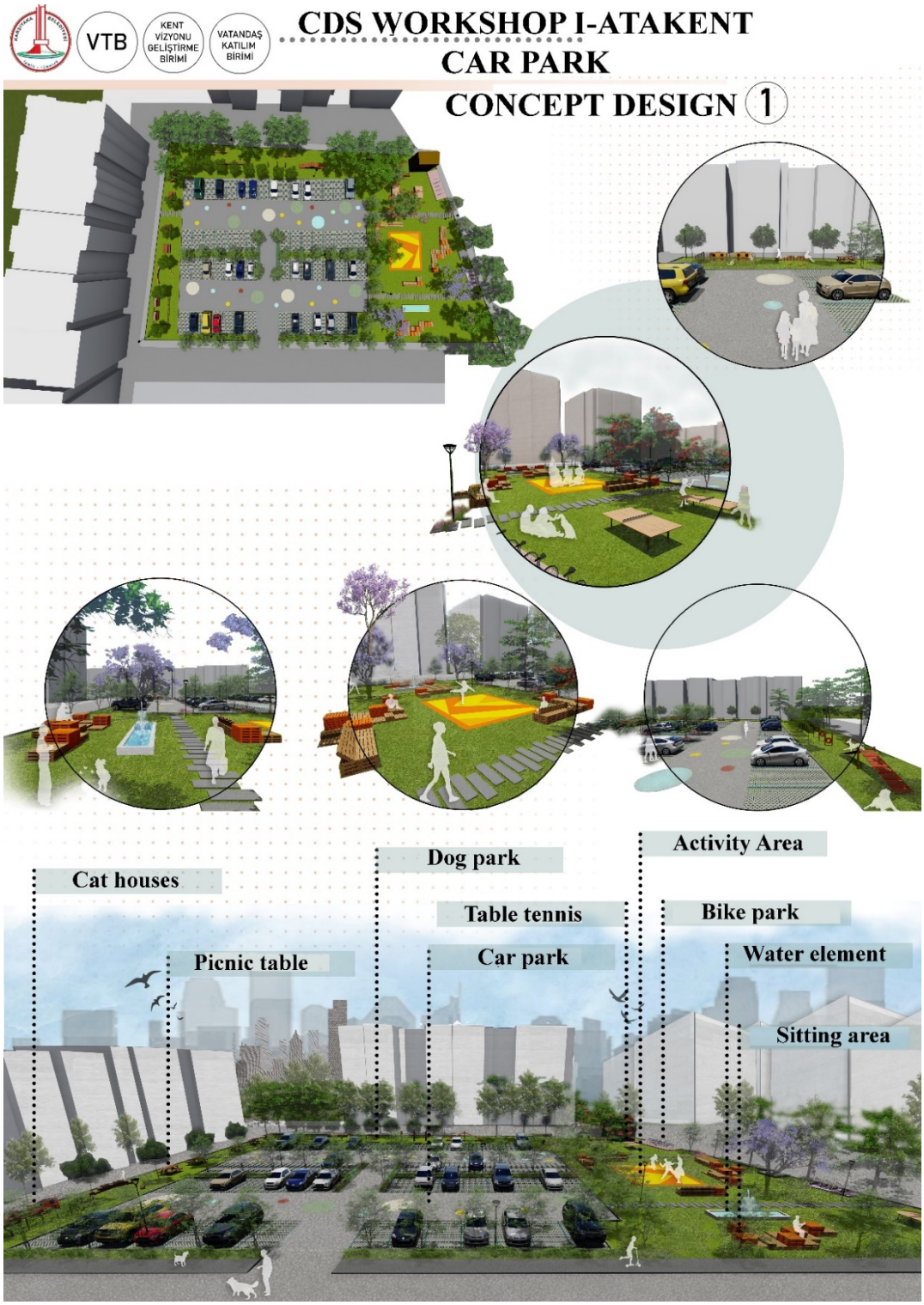


Figure 4.82: First alternative concept design project of Atakent Car Park, Karşıyaka Municipality

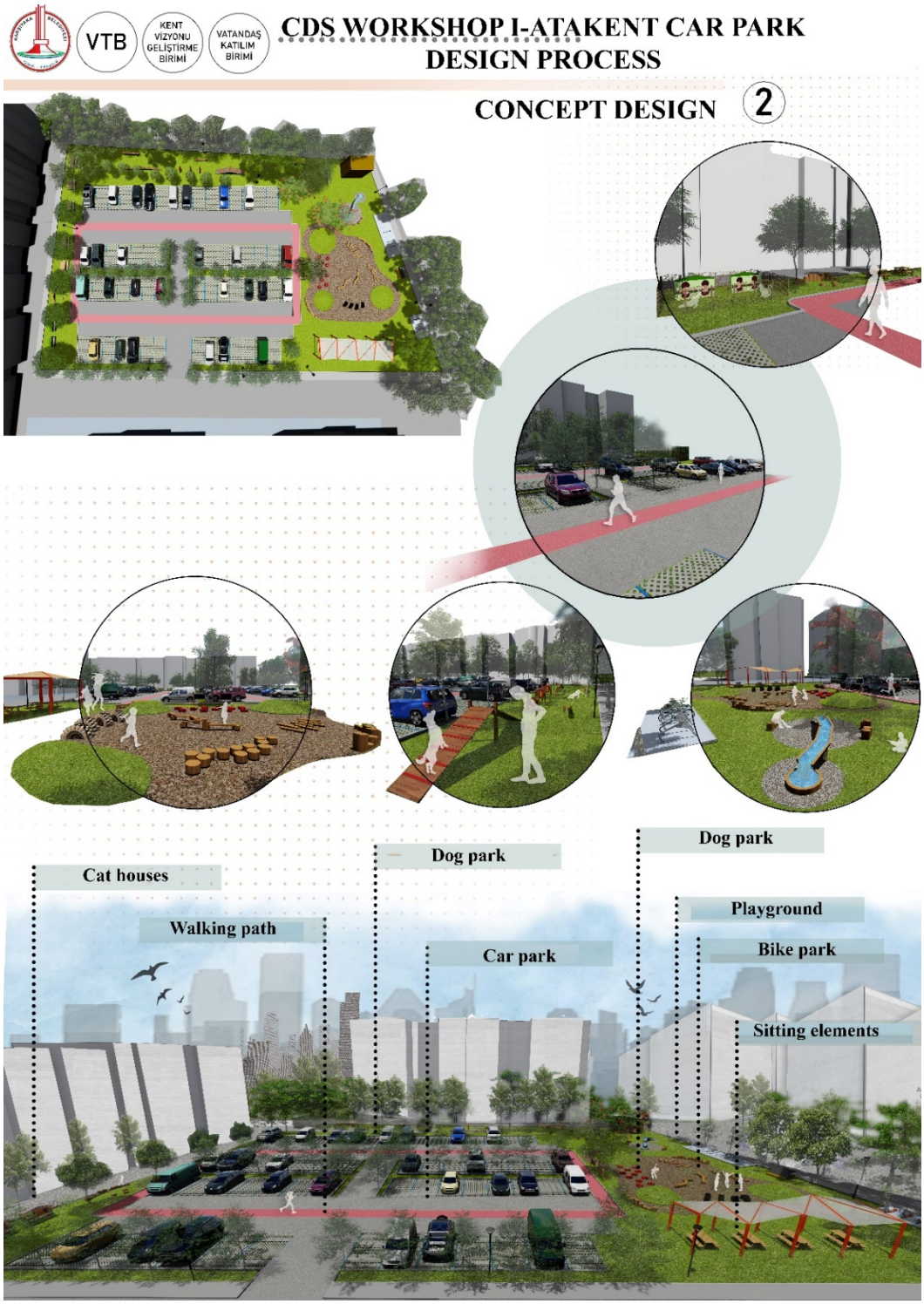


Figure 4.83: Second alternative concept design project of Atakent Car Park, Karşıyaka Municipality

CDS Workshop I -Atakent Car park voting study was conducted between 23.06.2022 and 24.06.2022 to vote on two alternative concept design projects prepared for the regeneration of the area into a qualified public space. The voting process includes the

transparent sharing of design science data, voting on the alternative concept design project by the participants, and questionnaire study (Step 5: informing the participants about the design data & voting process).

One day before the voting process, a short message of invitation to the voting process was sent to the citizens who participated in the design process with the coordination of the Citizens Involvement Office and whose contact information was obtained with their consent. 50 participants took part in the voting process carried out in the area. An online questionnaire form was created for citizens who could not participate in the voting work carried out in the area. This form was sent to the citizens through short messages by Karşıyaka Municipality. In this questionnaire study, which was open to voting between 27.06-29.06.2022; 23 participants took part.

In the voting process, in which all processes and evaluated data were shared with the participants in a transparent manner within the scope of the citizen science method, the projects were introduced to the participants in the area with the coordination of the Urban Vision Development Office and the Citizen Involvement Office. Participants voted on the concept design project they chose in the transparent ballot box (see Figure 4.84).

Figure 4.84: On the left: informing the participants about the data set and concept design proejects, on the right: voting process through the transparent ballot box

Then, questionnaire consisting of 5 questions was added to the voting process setup. Questions included in the voting questionnaire:

- Which urban design project are you voting for?
- Can we learn why you chose the urban design project you voted for?
- Do you have any concerns about the urban design project you voted for?
- If you have concerns, what are the reasons?
- Is there anything else you would like to see within the scope of the urban design project you voted for?

After the voting process, the participants participated in the questionnaire study (see Figure 4.85).

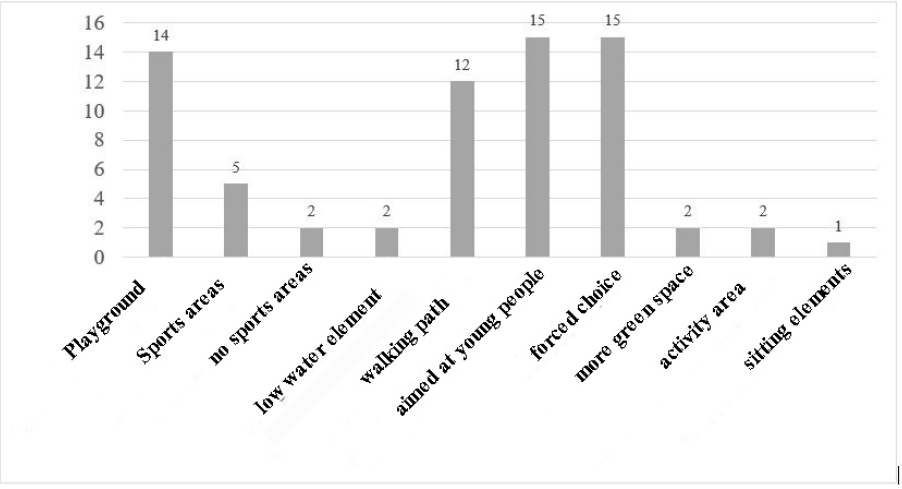
Figure 4.85: On the left: voting process, on the right: voting questionnaire study with participants

Of the 50 participants who voted in the field; 26 participants chose Concept Design-I and 24 participants chose Concept Design-II. Out of 23 people who participated in the online form, 17 people chose Concept Design-I and 6 people chose Concept Design-II. Therefore; 43 participants chose Concept Design-I and 30 participants chose Concept Design-II.

73 participants completed the voting process through analog and digital forms. Considering the reasons for choosing the urban design project that the participants voted for in the questionnaire study included in the voting process; out of 64 respondents who answered the questionnaire; 15 people stated that there was no big

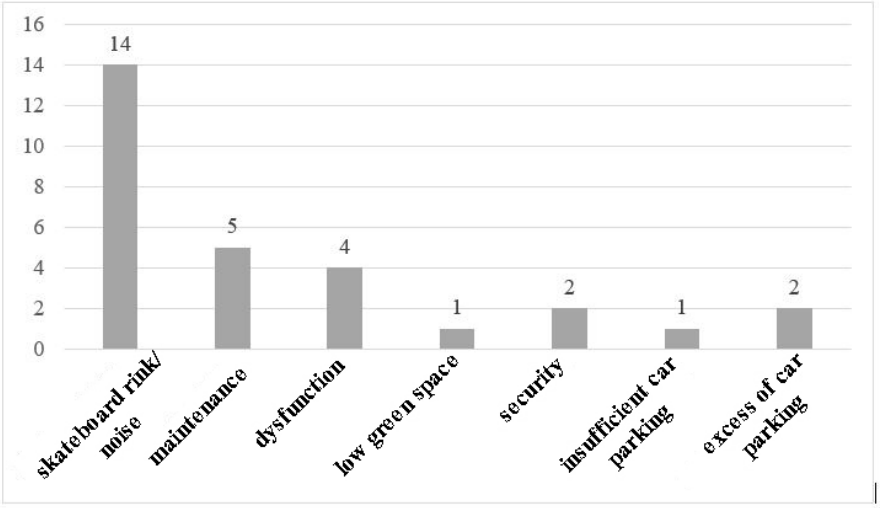
difference between the two designs, and they voted randomly. It is seen that the majority of the participants voted randomly because there was not much difference between the two design projects and they voted for Concept Design I because the election was aimed at young people (see Table 4.22).

Table 4.22: Distribution of the reasons for the urban design project that the participants voted for



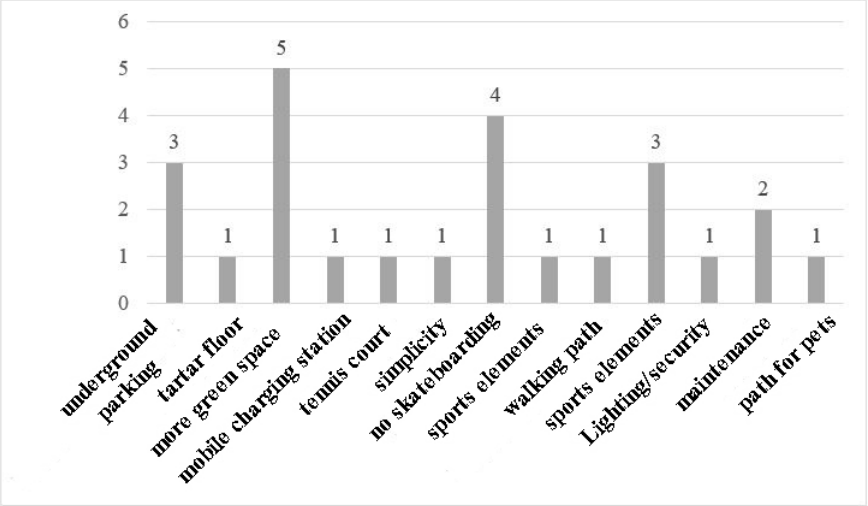
In responding to the question "Do you have any concerns about the urban design project you voted for?", 26 of the 70 participants answered yes 36%, while 42 people stated that they did not have any concerns at the rate of 60%. 3 participants did not want to answer this question. Of the 26 respondents who expressed their concern about the design project they voted for, 14 of them were concerned that the skateboard rink would cause noise, with a rate of 54%. While 5 participants stated their concerns about the regular maintenance and cleaning of the area with 19%, 4 participants expressed their concern that the objects used in the area would become dysfunctional at a rate of 15%. The rate of 2 participants who think that the security problem and the parking area will not be enough is 8% (see Table 4.23).

Table 4.23: Distribution of reasons for concern in the urban design project that the participants voted



In the voting questionnaire, 26 participants answered the question about the elements they would like to see within the scope of the voted urban design project. 5 of the participants stated that they wanted to see more green areas, and 4 people did not want to see the skateboard rink in the area. While 3 participants demanded more parking space and seating area, 2 participants demanded that the area be clean and well-maintained. 1 participant stated that he wanted the area to be safer and brighter, 1 participant wanted the area to be organized, and 1 person wanted to see the area plainer. Participants who request a tartar floor, mobile charging station, tennis court, sports equipment, and dog walking area are 1 person each. Among the answers to the question, the participants demand a high percentage of green spaces (see Table 4.24).

Table 4.24: Distribution of the elements that the participants would like to see in the urban design project they voted for



- Based on the data on the voting process, the voting result of the participants shows that Alternative Concept Design I was elected by a democratic majority. The suggested revision notes on the spatial and functional organization are as follows:
- Current and potential users of the area; young and old groups selected Alternative Concept Design 1. This is indicative of the situation. Therefore, the sitting elements chosen for stopping and resting and functions that will not cause noise are important in the regeneration of the space.
- In the project chosen for the regeneration of the area, the participants' concerns about cleaning, maintenance, and safety after the implementation are remarkable. The physical change of the space should be planned holistically with these elements.
- It is expected that the application of the walking track, which is demanded by the visually impaired participants in this 'design for all' study, should comply with the 'Visually Impaired Walking Path Standards'.
- Parking capacity can be reviewed for the parking function in the area.

The maintenance concern with the dog park is notable. For this reason, instead of the dog park with physical boundaries, the capacity of the free green area in the project

can be increased, with the expectation of more green areas for the other participants, and the maintenance concern of the dog park can be solved.

• It is recommended to complete the revision proposals for the design before the co-production process, which is the continuation of the process.

After the design revision, the concept design has been transformed into an implementation project, and in the current situation, urban elements are produced in Karşıyaka Municipality (see Figure 4.86).

Figure 4.86: Production of urban elements (examples of parklet and skateboard), Atelier of Karşıyaka Municipality

Figure 4.87: Parklet (in the implementation phase), Atakent

A co-production practice is planned in the area with the participants who stated that they would like to participate in the graphic design and garden design workshop for the implementation.

4.3 Results and Discussion

Within the scope of this study, CDS practices were completed by using digital and analog design tools in two selected leftover urban spaces in Izmir. The preliminary case study has been developed in collaboration with Johannes Müller from ETH Zurich. In the preliminary case study, 20 design layouts from the controlled group were submitted on Qua-Kit which was promoted online. The main case study has been developed in collaboration with Karşıyaka Municipality. The main case study was conducted with the participation of 190 citizens. Within the scope of the study, the study reached its goal. Through the CDS method, participants co-produce data for urban design regarding their experience, needs, and wishes and do this on a democratic platform. We both used active digital and analog design tools to implement the CDS

method in two case studies but there are differences in the implementation of the method and its results.

The very inspiring thing about the study is that a citizen who has no knowledge of design uses active design tools to produce a common language or dialogue with a professional designer. As in the previous studies of CDS, citizens were asked what they want to improve by providing them with simplified design tools. Despite useful common language through the tool, it has limitations. For this reason, we have increased the variety by adding a yellow object-open object tool to the common language. An open object is a tool that participants use to identify urban elements that they cannot find for their needs and wishes. Thus, urban elements and functions that the authority or design expert could not think of before the study can be defined. In addition, the participants had the opportunity to express themselves more accurately in both urban design studies. Also, when examining the open object analysis of the two case studies, the open object data in the preliminary case study mainly focused on the proposed various urban functions, while the main case study provides design data on the atmosphere of the area.

This study revealed that the profile of participants with special or different needs can be in the main case study. This situation revealed the necessity of reconsidering the existing citizen design science method in order to be inclusive. For example, it enabled us to produce the 3D and embossed model which is the common design language tool in the main case, and think about the ‘mind map’ process, in a way that the visually impaired citizens can perceive. Therefore, the diversified participant profile became an approach that developed the method experimentally. In this sense, we can say that participants with special or different needs, as in the main case study, have the potential to experience difficulties with the digital design tool.

If we compare the two case studies in terms of the space perception of the participants regarding the area, the place perception of the participants in the main case study, which includes analog design tools, is of higher resolution. This situation coincides with the formation of a better sense of place through the workshop chosen in the immediate vicinity of the area and the scaled model that the participants can touch. In the digital design tool, the space perception of the participants who can rotate and

perceive the primitive 3D model is not as strong as in the analog tool. On average, a user spent 1.054 seconds per design in the preliminary case study, with a maximum of 2.160 seconds, whereas a user spent 600 seconds per design in the main case study with a maximum of 960 seconds. Thus, there is a difference in the perception of the participants for the two case studies.

For the analysis process, it is possible to integrate more interpretation through both hierarchical cluster analysis and overlay of objects from all submissions for the object type. These analyzes are more meaningful to understanding the spatial data on the urban scale.

The CDS method can be used in the urban design process for the co-design process, but there are differences in the context of spending time in terms of digital and analog design tools. For example, if an idea-oriented study is to be carried out in a speculative area, digital design tools should be preferred in order to use time efficiently. However, if there is an intention to implement an urban design in the area, analog design tools with higher-resolution perception should be preferred. Because more time is spent in the working process and organization where analog design tools are preferred for the process. In addition, organizational cooperation is needed for the implementation of both tools to be practical.

As stated above, cooperation is needed for citizen participation in participatory urban design studies in which both design tools are used. However, as in the main case study, it was necessary to establish a new office in the context of organization for citizen participation. In the context of urban governance, the establishment of an innovative 'Citizen Involvement Office' within the municipality’s organization is crucial.

Chapter 5

Conclusion

This study begins with the inadequate or nonexistent citizen participation in urban design projects, despite the growing emphasis placed in the literature on urban planning and design on the adoption of more democratic techniques. The thesis problematized participation in the field of urban design by trying to understand and explain how participation can be integrated into urban design processes. Considering the current place of the concept of participation in urban design theory and practice, it is expected that the study will contribute to fill the gap in creating more transparent, inclusive, and scientifically data-based decision-making for urban design processes. We conducted an empirical study integrating crowdsourcing and participatory urban design, and we used data science to assess the participant responses. In addition, we propose a circular model, which you will see at the end of the conclusion.

This study's key research question is stated as follows: *''How does the co-design process, which includes the spatial experiences, needs, and wishes of the citizens, turn into urban design?''*. In order to respond to the main research question, within the scope of this study, the participation approaches and techniques of urban design are briefly discussed by assessing their relationship and highlighting the fact that urban design is one of the fields in which adopting a participatory approach makes the most sense. A new strategy CDS arises from three components referred to as citizen science which means participatory scientific data collection, citizen design which means active design by citizens, unlike traditional methods of participation and design science which mean citizens' design proposals into urban design projects through scientific data. This existing method is based on the design science data produced through the design drafts created by the citizens for the experience, wishes, and suggestions regarding urban space in the regeneration of public space. In this context, it contributes

to the citizen science method, which is one of CDS's components, on an urban design scale. The method we experienced in the preliminary case study and main case study goes to the system rather than a model. In both case studies, participants, directives, and needs vary according to the urban area. CDS is not an explanatory method, but an applied urban experiment in that local citizens express their experiences, needs, and wishes on the active design tool.

Besides, this study started with an exercise on the active design tool; Qua-Kit. We have experienced the limits of this digital tool. Even though we added yellow object- open object to the tool, we got stuck in user diversity. Thanks to the analog tool, we collected data from the applied field. On the Qua-kit tool, we collected data from the theoretical practice. So, we started to get data from practice rather than theory. Thus, the method turned into praxis. By combining theory and practice, we get the experienced theory.

The method also covers learning by doing the processes in the context of urban experimentation. In the preliminary and the main case study, the intelligent learning process has been brought along. In addition, the model, which is a combination of model theory and practice, is at the intersection of the action research method and praxis. It is an open-ended method beyond the choice of digital or analog design tool that changes according to the need. The urban design process takes place through the tendencies and expectations of the participants.

The method that supports data-driven governance and management is not a populist approach where citizens act as one hundred percent decision-making actors or the majority decision is implemented. On the contrary, in the main case study, we added the roundtable meetings with authority and professional designers step to the method to avoid this approach. In the added step, rational decisions are made regarding the data, current situation, and implementation process. This step supports the avoidance of the citizen in participatory urban design practices, being a stakeholder rather than a decision-maker. Besides, the approach is at the level of partnership in Arnsteins's ladder [51], Davidson's [109] participation wheel, and, at the collaboration level in IAP2's [117] public engagement spectrum.

Answering the second research question, ''Can citizens' design truly reflects what they want and be translated into a common design language in urban design?'' require an

evolution of tools and findings of the applied case studies. CDS is the use of active design tools by a non-designer citizen to create a shared language or dialog with an expert designer. By giving them access to simplified design tools, the citizens were asked what they wanted to be improved. Although the tool helps actors to communicate a shared and fundamental design language, it has limitations. Because of this, we have added a tool plugin as yellow object-open object to this common language to increase the variety of needs and wishes. Participants utilized the "open object" tool to identify urban features that they cannot locate for their requirements and wishes. If we evaluate the open object through case studies, it is very useful in terms of the diversity in common design language. Besides, with the help of open objects; we could also collect qualitative data on the field from the participants. However, it has been seen that it can also be used for urban elements and functions that are not desired by the authority or cannot be implemented as we experienced in the main case study ***(design hack).*** This open object also provides a tactical urban design approach in the context of being a citizen-led approach.

The design hack is an example of how conflicting ideas diverge in the participatory urban design approach. In this sense, the voting step for crowdsourced consensus has been added to the process. The method brings with it reconciliation over the common wisdom.

Answering the third research question, ‘‘How does collecting design ideas from citizens be inclusive for data-driven governance and management in urban design?’’ require reviewing the case studies and previous studies through participant profiles to guide the generation of an inclusive model for participatory urban design. Since the participatory urban design process took place through the active design tool Qua-kit in the past studies and main case study, it was not possible for the profile of participants with special or different needs to participate in previous studies. It enabled us to produce 3D and embossed models which is the common design language tool in the main case and think about the mind map process for these users, in a way that the visually impaired can perceive. Therefore, the diversified participant profile became an approach that developed the method experimentally.

The majority of participants thought the interface's purpose was simpler to understand, yet there are no substantial barriers stopping a user from digitally interacting with 3D

models. Also, considering some difficulties experienced by participants aged 65 and over with accessing smart technologies, the analog model over the participant profile is more inclusive and user-friendly in this sense. But I must say clearly that there is no alternative to the digital design tool for the preliminary case study conducted at the time of the pandemic.

Another evaluation made on the participant profile regarding case studies is that a method is an ethnographic approach. Varied cultures have different perceptions of public spaces and may react differently to space layouts. Studies show that design principles and their results change according to participants' behaviors and habits.

This study facilitates communication between the citizens and expert designers by including participants in the design process using CDS. Our case studies provide us with the possibility to implement the CDS approach combined with participatory urban design through both analog and digital tools.

In the preliminary study, we discovered that CDS can be utilized as a revision tool for urban design that is citizen-centered and directed toward education during a pandemic. As a result, the majority of students believed that the spatial feedback from citizens helped them to better design the exercise. In the main case study, we experienced an urban design implementation through the analog design tool that we produced and developed in the CDS strategy within the scope of cooperation with Karşıyaka Municipality. In the main study, a public innovation took place in the municipality. New offices and units were established for the organization of this new participatory urban design process. In addition to the new bureaucratic expansions created by participation in the governance model, events and formations such as urban design workshops, ideation, and charette have also emerged. The organizational structuring of the municipality was reconsidered and its capacity expanded. In this context, this study can be a guide for urban design studios and municipalities.

The method, which is an organizational model in the regeneration of urban space, includes data-based decision-making and urban governance, which improves the capacity of cities in the context of resilience.

In this final section, there are still many limitations in our research, for example, if I had more time, I could think of more steps for the participants with special or different

needs. For example, the involvement of visually impaired users through the digital participation tool is still a problem.

If I had done this study alone rather than in collaboration, I might not have been able to organize the citizens for the study. Otherwise, we couldn't go beyond the local test of CDS. Collaboration in two case studies led to more professional development of the study. Also, the study revealed the necessity of a different organization such as the 'Citizen Involvement Office' in the municipality within the organization beyond cooperation. Thus, we reached more participants in the study. An organizational structure is also needed for the co-production process, which we proposed after the co-design process. The organization's need does not continue organically within the local government. Therefore, special organizations are needed in the continuation of the process. The inclusivity of the model can thus improve, and it allows us to make more recent discoveries.

Taking into account the feedback, further study can be done to improve the model. The developed approach can be applied in other studies as a hybrid model as a combination of analog and digital tools. The level of approval for the use of digital participatory tools among other demographic groups, such as the elderly or the participants with special or different needs, should therefore be the focus of future research.

When viewed from the upper perspective of the city, in addition to the method that aims to create a smart community towards a resilient city, a circular model is suggested (see Figure 5.1).

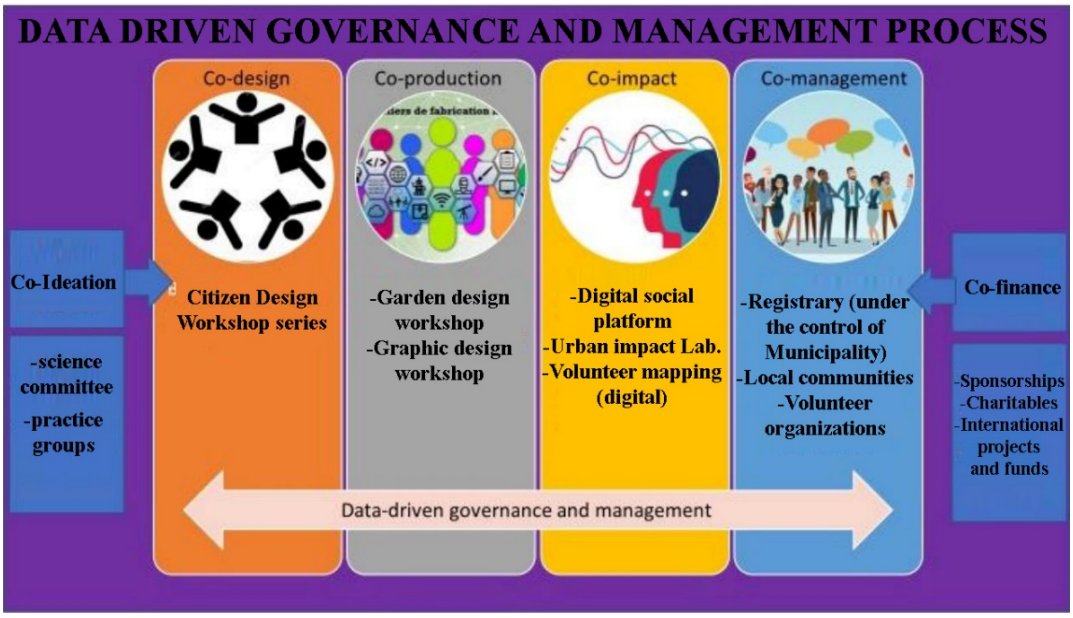


Figure 5.1: Data driven governance and management process design (a circular model), Velibeyoğlu's archieve

First, co-ideation is proposed for the idea-generation process with the science committee. Then co-design process as the Workshop series of CDS, co-production, co-impact, and co-management and co-finance processes are proposed. In the co-production process, production is carried out together with local citizens, depending on the production capacity of the municipality. In the co-impact process, the data produced by the citizens through the citizen (design) science projects to be produced would be collected in digital social platforms and urban impact laboratories. In addition, the citizen juries to be formed will be able to provide supervision. In the co-management process, registration under the control of the municipality, local communities, and volunteer organizations can manage the system. The financial source of the model is proposed as sponsorship, charitable, international projects, and their funds during the co-finance process.

The tool-kit of the proposed model consists of hybrid system (both digital and analog). The mobile-phone application, Birlikte Karşıyaka, which is the digital tool of the whole process, is being developed by Karşıyaka Municipality for this model recently. This circular approach for data-driven governance and management in the city has the potential of being inclusive for being resistant.

This model can not be expected to implement in an area such as an urban transformation model where personal interests conflict. Therefore, no one considers the public interest in terms of conflict of interest. As the scale of the urban area grows, the method, and especially the open object may become ineffective. However, it can be beneficial in terms of influencing the young population for higher policies. Because as seen in the case studies, it is unclear who will rule the organizational limitations, populism issue, designer fantasy, and executive autocracy. The model focuses on the vision determined by the scientific committee during the co-ideation process and implements it toward the needs of the citizens. According to those experiences, design hacks can occur inside of the model, beyond expectation, as in the car park design element.

The circular model, which is the implicit claim of the thesis, also has some limitations. (1) It has validity and operability in urban design, which considers the public interest, instead of urban planning, which is an economic-political income tool in the context of accumulation/regulation. (2) The circular model also has organizational limitations, and the expert designer also loses the role of mediator and translator. It depends on the subjectivity of the designer/planner who will set the priority between the wishes of the citizen (populism), autocracy (demands for the government), and designer fantasy (demands of the designer). In situations of conflict of public interest (parking and skateboarding area design elements, etc.), it is expected to be persuasive, to act as a guide, to know the best public interest, and be an advocate. (3) Policy conflicts based on need (conventional power's planning to understand), demand (expectations of the users), and vision (decision from co-ideation) may occur. The importance of structuring the co-ideation process, which will determine the whole process, quality, and setup, draws attention.

The importance of participation in the co-impact, co-management, and co-finance processes that follow the co-design and co-production processes for the resilient city goal is emphasized. Creating a smart community, an interest group that will ensure sustainability and run it from the bottom up at every step of the circular model, can be achieved by the continuity of the circular model.

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Appendices

Appendix A

Re-Shaping Küçük Park Urban Void Project

Table A.1: Questionnaire questions of Re-shaping Küçük Park urban void project

QUESTIONNAIRE:
Participant number?
Gender?
Age?
Whether have kid(s) ?
Education?
Occupation (whether design related job)?
Whether from Izmir or not?
Whether live in izmir or not?
Whether live in nearby Küçükpark or not?
Preferance towards Küçükpark?
Please indicate whether your negative thoughts about the current version of Küçükpark?
Time spent on design?
Whether have participated in similar participatory projects.
Whether want to find another object(s) in Qua-kit
The quakit task was easy to do? (1 to 10)
The instructions were hard to understand? (1 to 10)
I could not express what i wanted to tell on design.(1 to 10)
I enjoyed doing qua-kit exercise (1 to 10)
I would be motivated to participate in similar participation projects in the future after qua-kit design.
It would be motivated if this exercise would be used to solicit my design feedback.

Table A.2: Frequency table

ID	Water fountain	Paved Open Space	Tree	Linear Shadow Element	Tables and Chairs	Benches	Green Pots	Open object	Playground	Sports Field	Outdoor Exercise	Green Field Medium	Pavilion	**Total**
5194		1.0	51.0		3.0		1.0	9.0	1.0					66.0
5195	2.0	1.0	45.0	4.0		4.0	8.0	10.0						74.0
5196	1.0	1.0	11.0	3.0	3.0	2.0	6.0	6.0			1.0			34.0
5197	2.0		18.0	4.0	10.0	8.0	2.0	10.0				1.0		55.0
5198	10.0	1.0	30.0	2.0	4.0	4.0	4.0	4.0			2.0			61.0
5199	1.0	1.0	6.0		3.0	3.0	4.0	6.0		1.0	2.0			27.0
6000	1.0		12.0	2.0		3.0	9.0	1.0				1.0		29.0
6001	10.0	1.0	14.0	2.0		5.0	2.0	4.0		1.0				39.0
6002			20.0			2.0	5.0	1.0	1.0			1.0		30.0
6003	2.0		7.0		2.0			1.0	1.0	1.0	1.0	1.0		16.0
6004	2.0		4.0	4.0	2.0	3.0		2.0	1.0		1.0	1.0	1.0	21.0
6005	1.0	1.0	6.0	1.0		6.0	2.0	1.0	1.0		1.0			20.0
6006	2.0		9.0		4.0	2.0	6.0	2.0			1.0	1.0		27.0
6007	2.0			15.0		8.0		1.0	1.0			1.0		28.0
6008	1.0		23.0	6.0		8.0	4.0	6.0				1.0	1.0	50.0
6009	1.0		7.0	7.0	2.0	4.0		1.0				1.0	2.0	25.0
6010			4.0	7.0	2.0	7.0	2.0	2.0				1.0	2.0	27.0
6011	1.0		13.0	1.0		2.0	1.0	3.0		1.0	1.0	1.0		24.0
6012	1.0	1.0	1.0	1.0	1.0	1.0	1.0	5.0	1.0	1.0	1.0			15.0
6013	1.0		3.0	3.0	2.0		3.0	5.0	1.0	1.0	1.0	1.0	1.0	22.0
Total	41.0	8.0	284.0	62.0	38.0	72.0	60.0	80.0	8.0	6.0	12.0	12.0	7.0	690.0

Table A.3: Frequency table within the study area

ID	Water fountain	Paved Open Space	Tree	Linear Shadow Element	Tables and Chairs	Benches	Green Pots	Open object	Playground	Sports Field	Outdoor Exercise	Green Field Medium	Pavillon	**Total**
5194		1.0	19.0		3.0		1.0	6.0	1.0					31.0
5195	2.0	1.0	2.0	4.0		4.0	8.0	10.0						31.0
5196	1.0	1.0	10.0	3.0	3.0	2.0	6.0	6.0			1.0			33.0
5197	2.0		18.0	4.0	10.0	8.0	2.0	10.0				1.0		55.0
5198	10.0	1.0	30.0	2.0	4.0	4.0	4.0	4.0			2.0			61.0
5199	1.0	1.0	6.0		3.0	3.0	4.0	6.0		1.0	2.0			27.0
6000	1.0		8.0	2.0		3.0	1.0	1.0				1.0		17.0
6001	10.0	1.0	8.0	2.0		5.0		4.0		1.0				31.0
6002			16.0			2.0	5.0	1.0	1.0			1.0		26.0
6003	2.0		7.0		2.0			1.0	1.0	1.0	1.0	1.0		16.0
6004	2.0		4.0	4.0	2.0	3.0		2.0	1.0		1.0	1.0	1.0	21.0
6005	1.0	1.0	6.0	1.0		6.0	2.0	1.0	1.0		1.0			20.0
6006	2.0		9.0		4.0	2.0	6.0	2.0			1.0	1.0		27.0
6007	2.0			15.0		8.0		1.0	1.0			1.0		28.0
6008	1.0		22.0	6.0		8.0	4.0	6.0				1.0	1.0	49.0
6009	1.0		7.0	7.0	2.0	4.0		1.0				1.0	2.0	25.0
6010			4.0	7.0	2.0	7.0	2.0	2.0				1.0	2.0	27.0
6011	1.0		5.0	1.0		2.0	1.0	3.0		1.0	1.0	1.0		16.0
6012	1.0	1.0	1.0	1.0	1.0	1.0	1.0	5.0	1.0	1.0	1.0			15.0
6013	1.0		3.0	3.0	2.0		3.0	5.0	1.0	1.0	1.0	1.0	1.0	22.0
Total	41.0	8.0	185.0	62.0	38.0	72.0	50.0	77.0	8.0	6.0	12.0	12.0	7.0	578.0

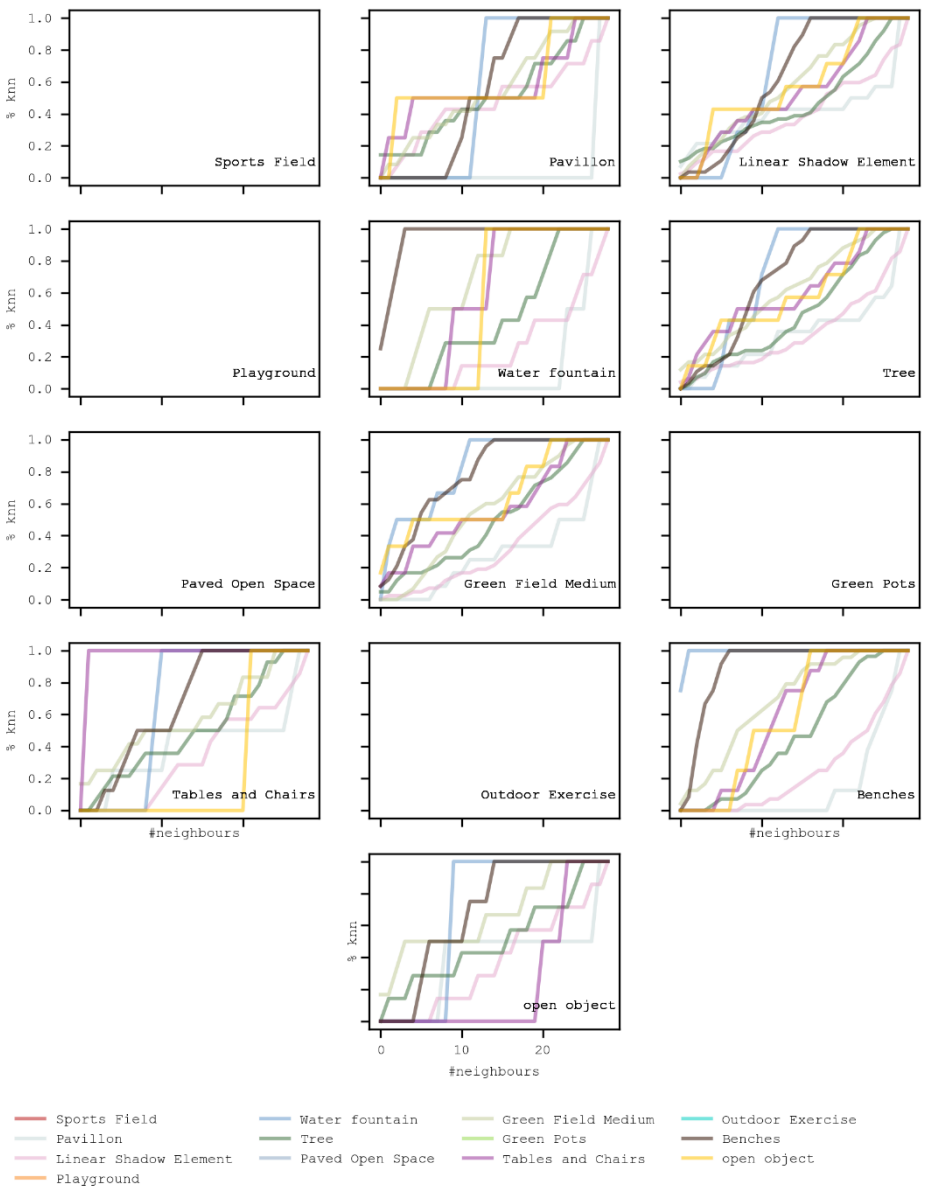

Figure A.1: An example; Graph of k nearest neighbours grouped by each object type (ID:6009)

Appendix B

Atakent Car park

Table B.1: Questionnaire questions of Atakent Car park project

QUESTIONNAIRE:
Participant number?
Gender?
Age?
whether have kid(s) ?
Education?
Occupation (whether design related job)?
Whether from Izmir?
Whether live in Izmir?
Whether live in nearby Atakent Carpark?
Whether use the area?
If you use the area, what is the reason?
Preferance towards Atakent Carpark?
Please indicate whether your negative thoughts about the current version of Atakent Carpark?
Time spent on design?
Whether have participated in similar participatory projects.
Whether want to find another object(s) in design? -yellow cube
Whether want to participate in co-product process?
If you would like to participate in co-product process which atelier you would like to? -graphic design atelier/garden design workshop
The quakit task was easy to do? (1 to 10)
The instructions were hard to understand? (1 to 10)
I could not express what i wanted to tell on design.(1 to 10)
I enjoyed doing design exercise (1 to 10)
I would be motivated to participate in similar participation projects in the future after design.(1 to 10)
I believe that the design you experience in the citizen science workshop will be taken into account by the project practitioners. (1 to 10)

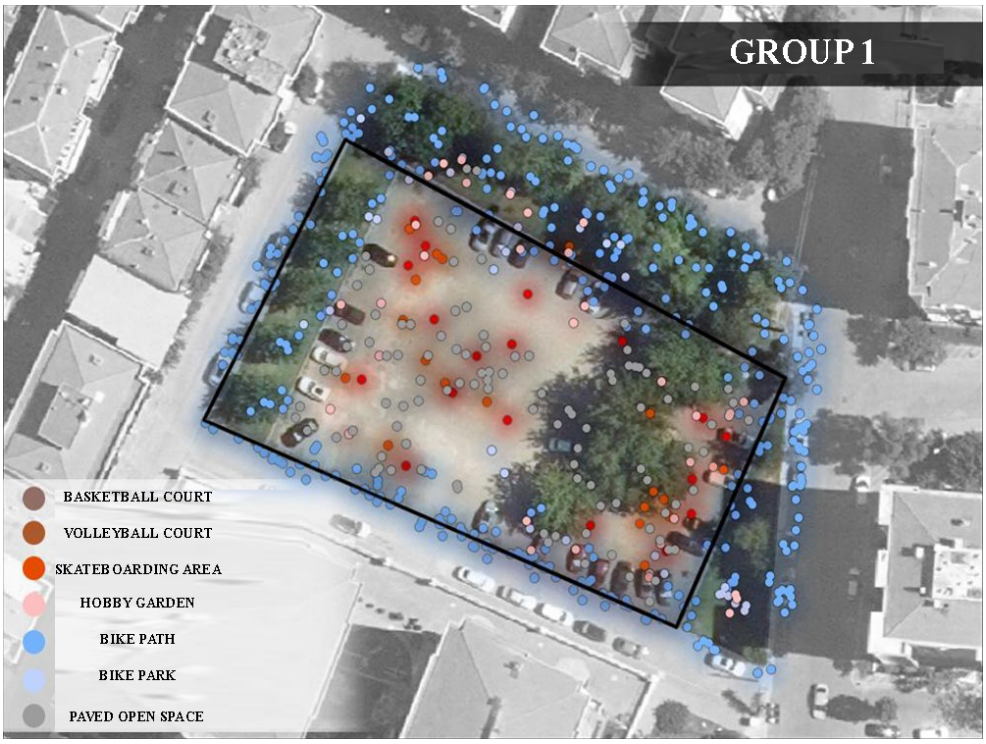

Figure B.1: Hierarchical cluster graphic of Group 1

Figure B.2: Hierarchical cluster graphic of Group 2

Figure B.3: Hierarchical cluster graphic of Group 3

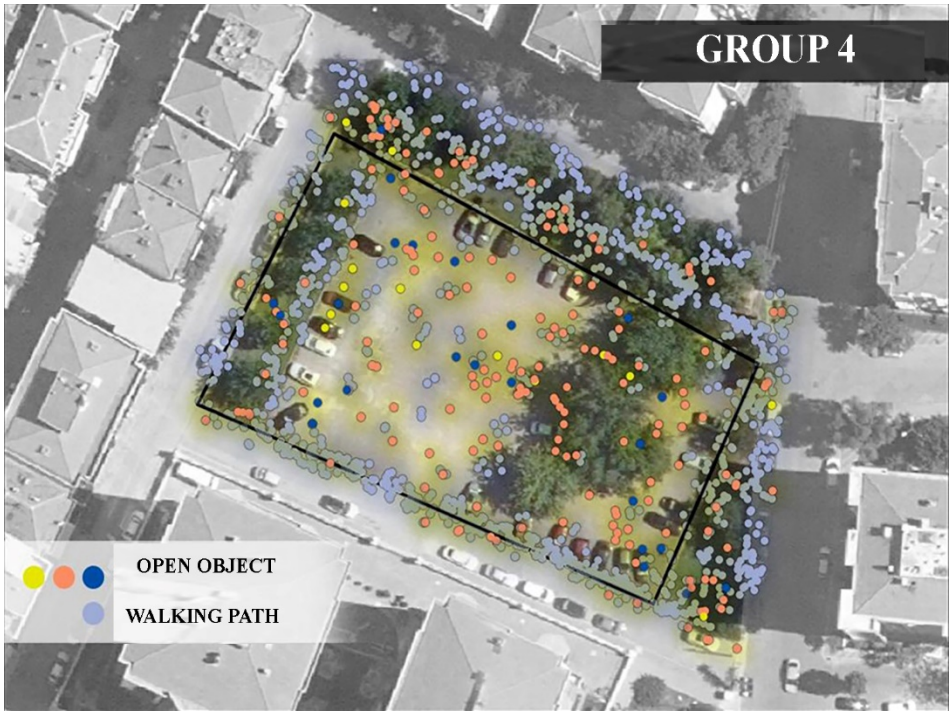

Figure B.4: Hierarchical cluster graphic of Group 4

Figure B.5: Hierarchical cluster graphic of Group 5

Figure B.6: Hierarchical cluster graphic of Group 6

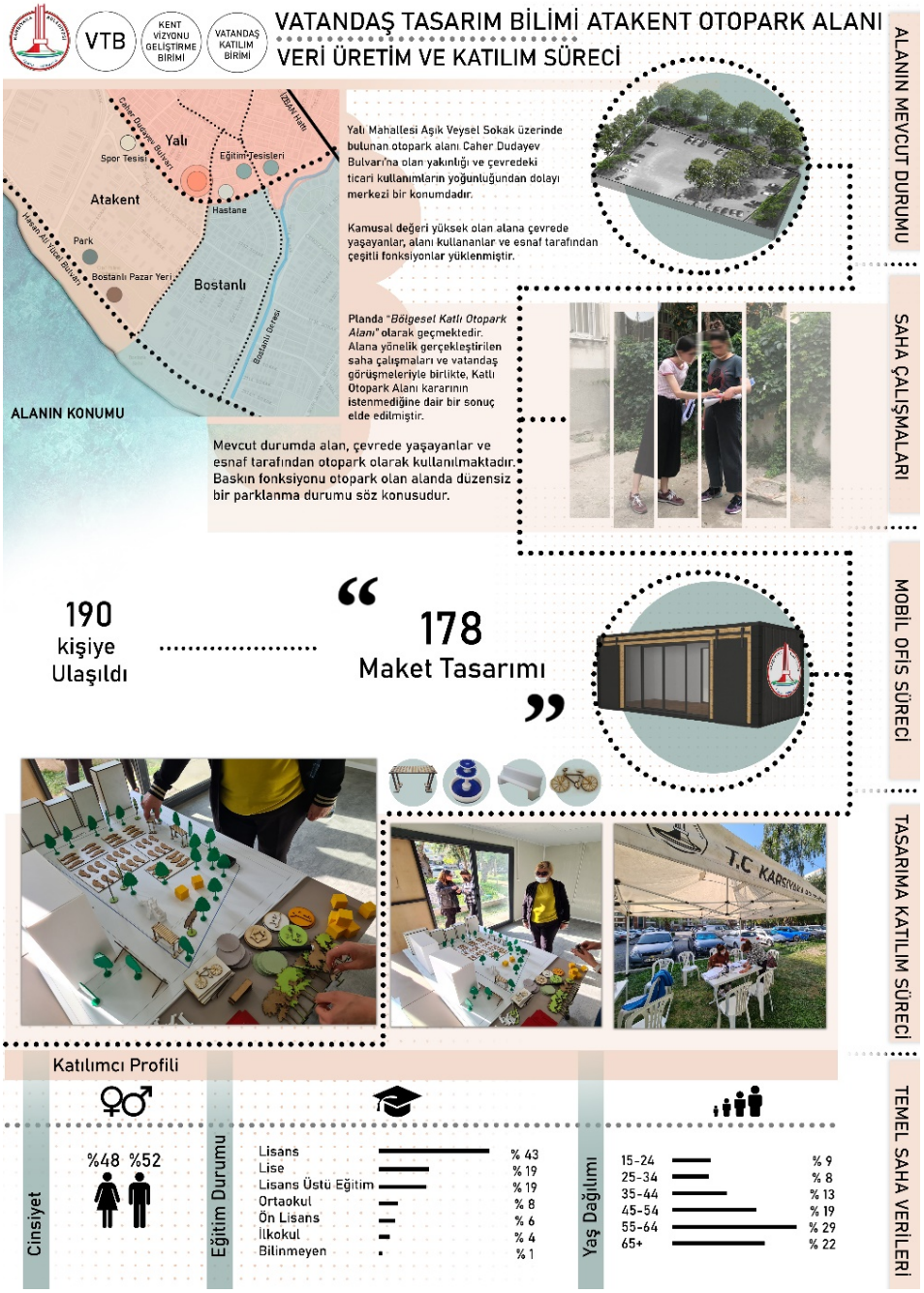

Figure B.7: Layout 1 for Atakent Car park's voting process

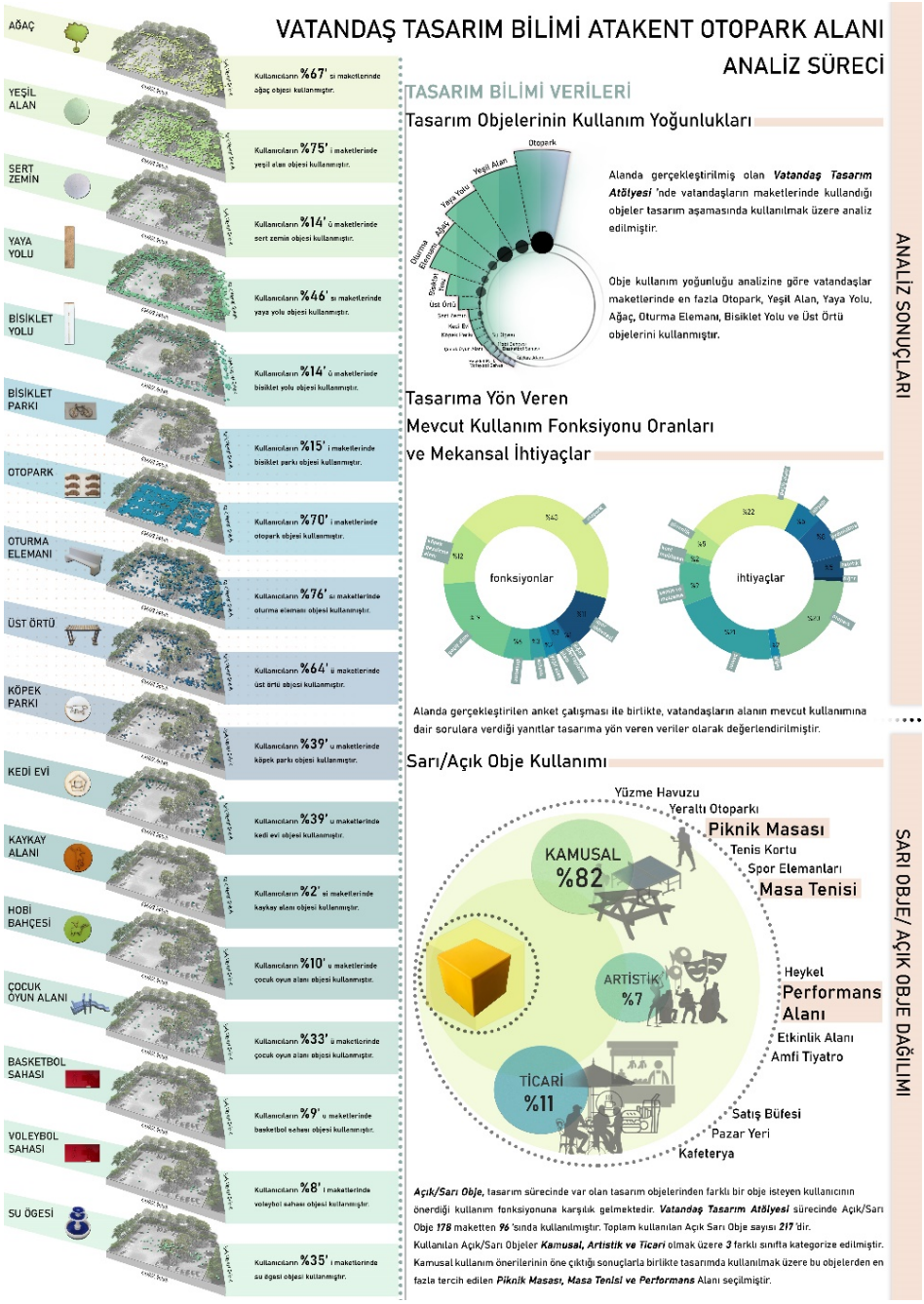

Figure B.8: Layout 2 for Atakent Car park's voting process

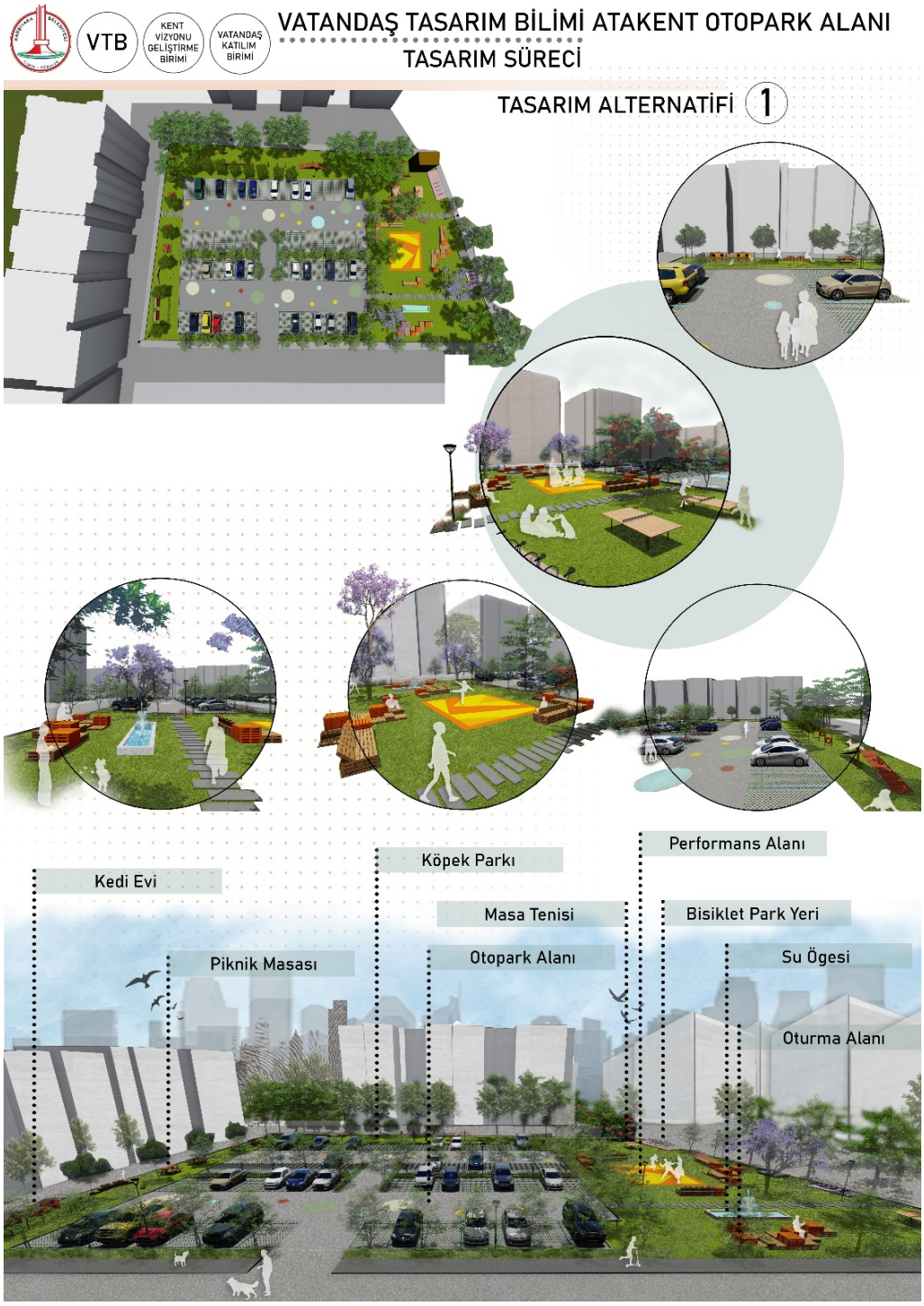

Figure B.9: Layout 3 for Atakent Car park's voting process

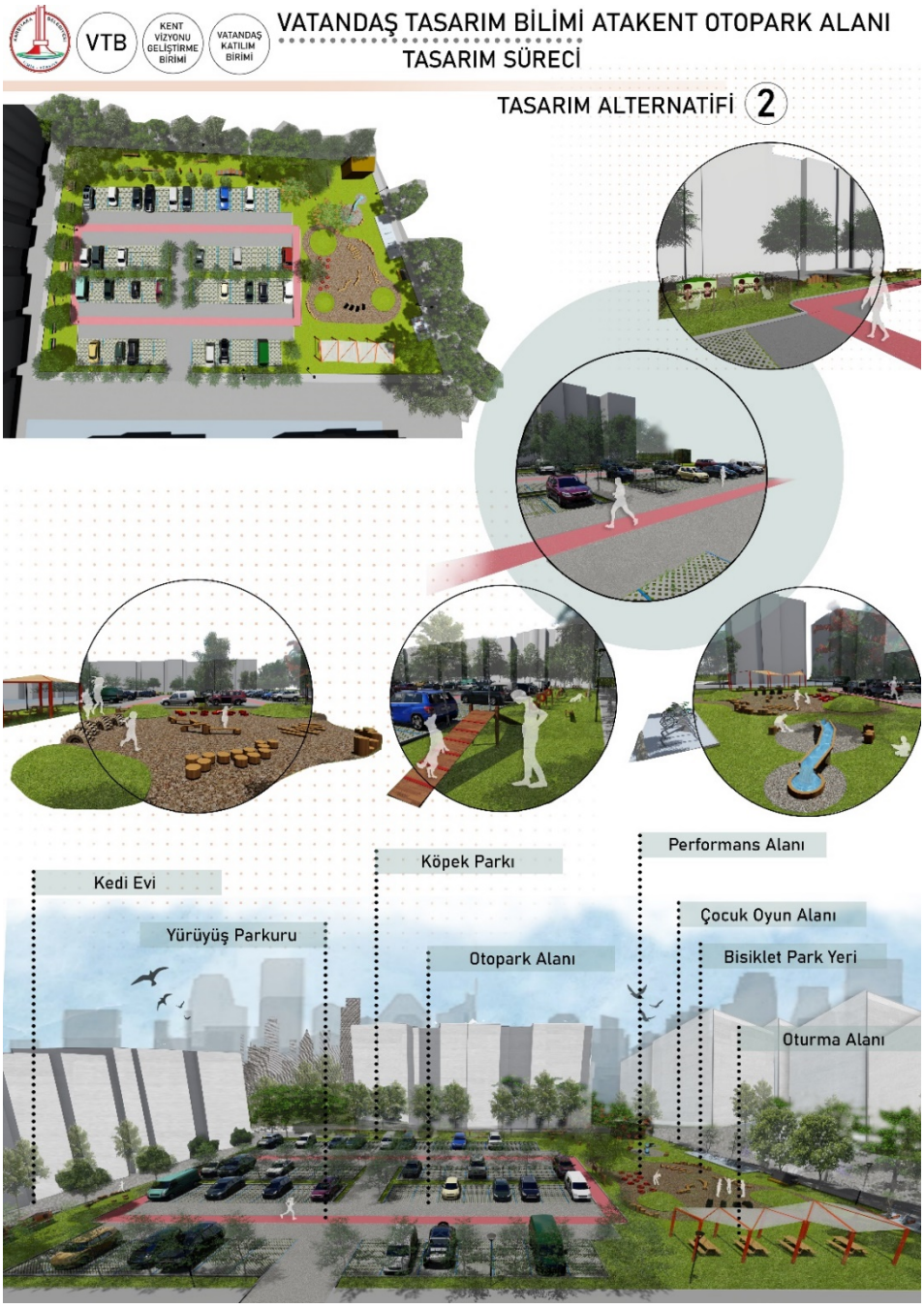

Figure B.10: Layout 4 for Atakent Car park's voting process

Curriculum Vitae

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Education:

2002-2006 Izmir Atatürk High School

2006–2011 Yaşar University, Bachelor's degree in Dept. of Architecture.

2012–2016 Yaşar University, MSc in Architecture (Thesis/English).

2017–2023 Izmir Kâtip Çelebi University, PhD in Dept. of Urban Regeneration.

Work Experience:

2012 – 2016 Res. Assist, Izmir Gediz Üniversitesi- Dept. of Interior Architecture

2018 to present Lecturer, Izmir Kavram Meslek Yüksekokulu- Dept. of Architecture and City Planning /Architectural Restoration Pr.

2021 to present Guest Lecturer, Izmir Democracy University- Dept. of City and Regional Planning

Papers Presented at International Scientific Meetings and Published in Proceedings Books:

1. Aykutlar Pelin, Velibeyoğlu Koray (2019). An Evaluation of Resilient City: Citizen Science Projects Approach. CHANGING CITIES: Spatial, Design, Landscape Socio-economic Dimensions, 117-129. (No:5094464)

Chapters in National/International Books:

1. Human-Computer Interaction and Technology Integration in Modern Society, Section: (An Evaluation of Measuring the Publicness Level of Interiors in Public Building Design: Visual Graph Analysis (VGA) Approach) (2021)., Ozden Pelin, Kutucu Seckin, Can Traunmüller Isın, IGI GLOBAL, Editor: Rahman, Hakikur, Number of editions:1, Number of page: 347, ISBN:9781799858492, No: 7176707

Papers Presented at National Scientific Meetings and Published in Proceedings Books:

1. Ozden Pelin, Velibeyoğlu Koray (2021). Dirençli Şehir Bağlamında Vatandaş Bilimi Projeleri Yaklaşımı. III. Uluslarası Şehir Çevre Sağlık Kongresi, 54-55. (Özet Bildiri/Davetli Konuşmacı) (Yayın No:7176769)
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3. Aykutlar Pelin (2019). Türkiye'de Açılmış Kent Mobilyası Tasarım Yarışmaları ve Değerlendirilme Süreçlerinin Analizi. 8. Türkiye Lisansüstü Çalışmalar Kongresi (Tam Metin Bildiri/Sözlü Sunum) (Yayın No:4753241)
4. Aykutlar Pelin, Kutucu Seckin (2018). Kamusal Bina Tasarımında İç Mekânların Kamusallık Düzeyinin Ölçülmesinde Bir Yöntem: Mekân Dizim Analizi. 2.Ulusal İç Mimari Tasarım Sempozyumu, 33-34. (Özet Bildiri/Sözlü Sunum) (Yayın No:4753104)
5. Aykutlar Pelin, Kutucu Seckin (2014). Yarışma Sonrası Süreçler Yılları Arasında Yerel Yönetimler Tarafından Açılan Mimari ve Kentsel Tasarım Yarışmalarının Uygulanma Performansları. Yarışmalar ve Mimarlık Sempozyumu, 2014, 22-35. (Tam Metin Bildiri/Sözlü Sunum) (Yayın No:1077392)

Invited Talks:

1. Dirençli Şehirler Üzerine Değerlendirme: Vatandaş Bilimi Projeleri Yaklaşımı, *III. Uluslararası Şehir Çevre ve Sağlık Kongresi,* 16-20.04.2021

Certificates:

1. Koç Üniversitesi-Sarat Projesi: Arkeolojik Varlıkların Korunması ve Kurtarılması, Koç Üniversitesi Online Programlar tarafından sunulan ve SARAT Projesi kapsamında hazırlanan 'Arkeolojik Varlıkların Korunması ve Kurtarılması' programı, Koç Üniversitesi Online Programlar, Sertifika, 08.09.2020 - 08.11.2020 (Ulusal).
2. Social Responsibility Project "History Comes to Life in 3D" in the ancient city images of Bergama, Bergama Municipality & Bilkom.

Workshops:

1. International Forum on Urbanism (IFoU) Winter School 2013, Chinese University of Hong Kong, Hong Kong, China (No: 339067).
2. Vatandaş Tasarım Bilimi Atölyeleri I-Atakent Otopark, 2022. Izmir, Turkey.
3. Vatandaş Tasarım Bilimi Atölyeleri II-İklime Uyumlu Sokak-Bostanlı, Cemal Gürsel Caddesi, 2022. Izmir, Turkey.
4. Vatandaş Tasarım Bilimi Atölyeleri III–Şehit Ast. Erkan Durukan İlkokulu Bahçesi, 2022. Izmir, Turkey
5. Vatandaş Tasarım Bilimi Atölyeleri IV-Bahariye Mahallesi Bahar Park, 2022. Izmir, Turkey