



# Citizen science projects in the context of participatory approaches: The case of Izmir

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## Abstract

The term "citizen science" refers to scientific activity done entirely or in part by members of the public, frequently in cooperation with or under the guidance of licensed scientists. To better manage natural resources, monitor endangered species, and maintain protected areas, decision-makers, and non-governmental organizations increasingly turn to citizen science-based programs. A broad field, citizen science, offers numerous strategies for involving volunteers in research in various ways while including a whole range of research methodologies. Thus far, citizen science initiatives have been successful in advancing scientific understanding, and the advancements made by citizen scientists give a significant amount of data globally. The subject of citizen science is spreading rapidly, and its legitimacy is increasing. It also involves enhancing scientific research by utilizing a variety of subjects and data sources. Citizen science has the potential to increase stakeholder engagement, bring in new perspectives, and foster new forms of participation. Also, many initiatives are being developed in cutting-edge scientific fields. These programs now aim to solve an urgent issue or provide an answer to a research question while simultaneously enhancing community participation in science and influencing long-term policy implementation. The study utilizes to examine the citizen science projects in Izmir, Turkey according to the concepts and categorizations in the literature review in a systematic way to understand their participation levels and their potential.

**Keywords:** citizen science, Izmir, levels of participation

## 1. Introduction

The phrase "citizen science" is a catchphrase for the scientific work done by the general population, frequently in cooperation with or under the direction of qualified scientists and scientific institutions. The term "citizen scientist" refers to 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 conduct scientific research, frequently in collaboration with or under the supervision of professional scientists and academic institutions; an amateur scientist (Oxford Dictionary of English, 2014). Basically, citizen science, or in other words civic engagement refers to 'public participation' in scientific research and has a diversified amount of definitions; community-based monitoring, volunteer-based monitoring, participatory monitoring, public engagement, do-it-yourself science, crowd science. Public participation is a phenomenon that affects all facets and levels of society equally and is easily connected to a wide range of issues. In order to get public input and proposals on the governance of human settlements, citizen participation involves educating or working with a number of top-down and bottom-up

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stakeholders (Fredericks et al., 2020). The scientific research of public participation is called 'citizen science'.

There is a great desire to participate in local and global issues and problems. Contrary to this, in essence, what Hindess (1997) refers to as a "democratic deficit" is to blame when liberal democracies encounter difficulties engaging their populace and achieving their goals. It is widely known that for governments to effectively administer metropolitan areas, citizen participation is essential. In order to create inclusive and sustainable cities, stakeholders must take into account the participation of citizens. Collaboration is essential if the government is to have access to the collective knowledge, suggestions, and skills of the population.

Citizen science projects involving citizen scientists that collect vast amounts of information regarding species occurrence and distribution around the globe have a significant impact on scientific understanding and advancement. Most citizen science initiatives help people to understand the living things they are watching, be the part of the solution. Furthermore, because the results of citizen science initiatives are scientific and informative, creating and implementing public data collecting of these programs requires substantial work (Bonney et al., 2009). At various levels, many citizens would engage in science, to contribute of knowledge. A field with expanding validity, citizen science is quickly expanding. By involving a variety of themes and data sources, it includes advanced scientific research. Stakeholder participation can be increased by citizen science, which can also bring in new perspectives and forms of collaboration. Innovation in scientific fields are the subject of several projects. At this point, they take on the role of providing an urgent solution to a problem or providing an answer to a research issue, while also enhancing community capacity for involvement in science and long-term policy implementation and decision-making. These public policy programs have an impact on every aspect of environmental protection to health and education, to research and innovation in the modern world. Moreover, citizen science has a long history that spans several disciplines, including astronomy, biology, geology, archaeology, biodiversity, monitoring, public health, urban planning and design, architecture, and etc. Collaboration between various scientific, medical, engineering, and social science fields are resulted from these efforts (Hecker et al., 2018).

The aim of the study is to take the portrait of Izmir city in the context of citizen science projects for to understand its potentials and benefits for being resilient. In this study, in order to examine the citizen science phenomenon in Izmir, first of all, we made a literature review and drew a conceptual framework was drawn about the theoretical development, definition and types of the concept of participation approaches and citizen science. Citizen science studies in Izmir were compiled by keyword scanning. The website documents of the studies were defined by examining the conceptual framework drawn on the research purpose and the method. The current situation is discussed by evaluating the examples of citizen science projects in Izmir with the conceptual framework.

## 2. Participation Approaches

Everyone, who has a connection to the city, is impacted by every intervention, particularly the residents. Cities are living organisms with memories, histories, and identities just like any other evolved being. Participation is a phenomenon that affects all facets and levels of society equally and is easily connected to a wide range of issues. In order to get public input and proposals on the governance of human settlements, citizen involvement involves educating or working with a number of top-down and bottom-up stakeholders (Fredericks et al., 2020).

In the literature, citizen participation is defined in a variety of ways. Citizens distrust intermediary institutions in the political decisions that affect them and expect to have a direct voice in the decisions, which is what participation in the political process means to them (Bishop & Davis, 2002). Nabatchi and Leighninger (2015) define citizen engagement as any activity in which the needs, interests, values, and expectations of citizens are taken into account when making decisions and taking action on matters of public concern. Verba and Nie (1987, p. 133) add the definition "in

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ways that citizens desire an instrumental action in which they strive to persuade the government to act" to their definition of "citizen engagement". Creighton (2005) defines participation as the process through which the institutional decision-making of the state incorporates the ideals, needs, and concerns of the population. Government and citizens connect and communicate in both directions to make better decisions (B Seçkiner, 2021).

In principle, participation is what society expects from democracy and is a term that can be used to describe any topic. Implementations of participation, whether made intentionally or unintentionally, eradicate any injustices and contain an equal component. The term "participation" in the study refers to those participants, who actively engage in citizen science projects and are influenced by those activities. To better mediate conflicting interests, advance improved quality of life for all, and raise awareness about complicated issues, there needs to be greater citizen involvement in decision-making about local and global problems (Adams, 2004). The development of policies that are more favored by the populace and boost trust in the government may also benefit from citizen participation (Sousa & Klyza, 2007).

Participation can be effectively managed if the goal is envisioned in terms of what needs to be accomplished when there is a recognized need to involve community members. To understand the issue simple questions like "who," "what," "where," "how", and "when" are required (Sanoff, 2011): (a) Who are the parties to be involved in participation, (b) What should be performed by the citizen participation program, (c) Where should the participation road lead, (d) How should people be involved, (e) When is participation desired in the planning process.

Urban development strategies and the idea of "participation" are revealed via sustainability. The concept of democracy has changed, particularly in the second half of the twenty-first century as a result of the shifting global conditions, the unlimited communication tools created concurrently with technological advancement, and the rising awareness rate with these tools. Participatory democracy has started to take center stage in areas where understanding of representative democracy is insufficient. In many places of the world, participatory methods were carefully explored (P Sertbaş, 2013).

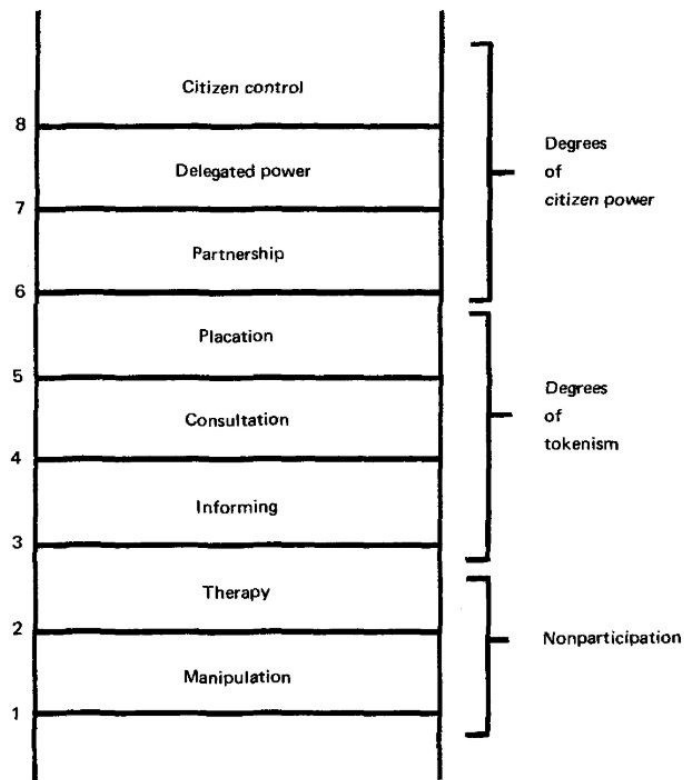
The standard of living can be significantly enhanced by citizen participation in governance. Additionally, it helps foster the development of citizens' abilities, convictions, willingness, and vision. It can also help handle complicated difficulties in public service design and delivery. Democracies have faced challenges in recent years due to the rise in citizen expectations for participation in decision-making, particularly at municipal and regional levels (Khan et al., 2014).

### *2.1. Levels of Participation*

In the literature, there are different definitions of involvement at various levels by many professions, which may change over time as a result of unique situations and contrasting points of view, both in theory and practice.

Shelley Arnstein's (1969) ladder of participation is one of the first and best-known model of public participation. She makes a comparison between citizen participation levels and ladder rungs in it. In the late 1960s, it became increasingly clear how important citizen participation is to societies. In an essay that was first printed in 1969, Arnstein explained and further refined the concept of participation as seen in Figure 1. Thereafter, other scholars frequently based their theories about participation on this article.

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**Figure 1** Arnstein's eight rungs on a ladder of citizen participation (Arnstein, 1969)

Economic, political, managerial, and cultural activities are all examples of areas where participatory decision-making may be used. Arnstein contends that not all possibilities for involvement are created equal. Depending on the level of public participation and the ability to influence or affect the outcome, they can be divided into numerous types. She categorized the eight stages into three categories: lack of engagement, varying levels of tokenism, and varying levels of citizen power. The top rung shows citizens participating fully and actively in a relationship with government entities, whereas the bottom rung shows no citizens participation (Arnstein, 1969). She believes that participatory approaches are pointless as long as power is distributed unfairly (Callahan, 2007). The first two steps are manipulation and therapy, which are both forms of non-participation; they are strategies used by those in positions of authority to inform or better participants rather than to ensure that citizens participate. It is typically used to demonstrate participation in user-centered projects, but neither the participants nor the committees established to guarantee participation happens. In other words, at the bottom of Arnstein's ladder, where there is no power for the citizens, it is obvious that there is no participation in the two categories she refers to as manipulation and therapy. According to Arnstein, this deception shows that certain government organizations have offered a fake amount of participation while their real goal is to educate the public on how to accept the task that has already been established. The next phase entails the introduction of therapy, which is another form of non-participation. Such indifference is dishonest and self-serving. The goal, in this case, is to find a way to indicate how the relevant organization disagrees with the views and activities that it does not share but cannot articulate clearly, therefore, it does so by disavowing them through the use of a citizen survey. The ladder has additional rungs for informing and advising. This stage comprises informing the citizens about the reality of governmental objectives as well as their rights, obligations, and alternative remedies. Informing, consulting, and citizen questionnaires may be useful if the information is factual and the information flow is not skewed (Bice, 2018). Because citizens in positions of power continue to have their rights, the level of placation is described as having a higher degree of tokenism because those without the means still have no participation in how decisions are made. Collectively, the last three rungs of the ladder —partnership, delegated authority, and citizen control— represent different tiers of citizen power. A partnership is a sort of business where regular individuals are allowed to

haggle and make deals with influential persons. On the levels of delegated power and citizen control, citizens who lack resources control the majority of the decision-making process. The restructuring of the decision-making power distinguishes the stage characterized as the power of the citizen from the others. Participants may be involved in a variety of collaborations and later on, may even gain control over the decision-making process. Participants at the partnerships level must possess strong leadership, the financial means to cover their time and labor, and the authority to hire their own technique and method organizers. It is crucial for those in positions of authority and their capacity to inflict meaningful sanctions on the plan. At this level, it is possible to assert that the institutionalization of participation and its organization have a substantial impact. Arnstein's highest level, citizen control, was also criticized for splitting public services and fostering secession. It is more expensive and less effective, it allows minority groups "hustlers" to be just as opportunistic and contemptuous of the have-nots as their white predecessors, it is incompatible with merit systems and professionalism, and ironically, it can end up being a new Mickey Mouse game for the have-nots by allowing them to gain control but not providing them with enough financial resources to succeed. These are the criticisms made by Arnstein in her article (Arnstein, 1969).

As we approach the present, another important spectrum of participation was developed by IAPP2 (International Association for Public Participation). IAP2 is a global organization whose members work to advance and develop the practices of public engagement and participation in interactions with individuals, institutions, and other groups that have an impact on the public interest around the world. The five phases of levels of participation are: inform, consult, involve, collaborate, and empower, in accordance with the association. In the early 2000s, it was first schema as seen in Figure 2.

### 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.

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Figure 1 International Association for Public Participation (IAP2) – Spectrum of Public Participation (IAP2, n.d.-a)

According to IAP2's Spectrum of Public Participation (IAP2, n.d.-a);

An "informing process" aims to educate the public about an issue, its alternatives, opportunities, and/or remedies by giving them accurate, objective information. While communicating with the



public, it is best to be as impartial, truthful, and fact-based as possible. Moreover, the public should be kept informed of the reasons behind the decisions being made by decision-makers including elected officials, public servants and school administrators. Yet, when leaders are not completely open and conceal crucial or relevant facts, or when they disclose skewed information in an effort to misrepresent a situation and influence the public's opinion, an informing process can become problematic.

A "consulting process" seeks input from the general public on analyses, choices, and/or decisions. Participants in a consultation process offer their points of view, ideas, or preferences, and leaders use this information to guide their decisions. By providing public authorities with a more precise grasp of the views, needs, worries, or priorities of those who will be touched by their decisions, consulting enhances the results of a decision-making process at its most effective and advantageous level. Yet, when decision-makers gather public input without considering it or exclude significant constituencies or stakeholder groups from the process.

Working closely with the public throughout the process to ensure that public concerns and goals are continually addressed and taken into consideration is the aim of an "involving process". An engaging process, however, might become problematic if leaders and organizers do not give the training, information, inspiration, or other types of assistance that participants may need to participate fully or competently, or if the chances for public involvement offered are unreliable.

A "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. Genuine collaborative processes and partnerships place leaders and participants on an equal footing, and those in positions of power share control, management, or decision-making with participants to the greatest extent possible. Yet, when leaders take the advantage of their partners' weaknesses or undermine their authority, a collaborative process can become problematic or dangerous.

An "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 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. However, an empowering process can turn problematic or harmful when organizations or individuals are given the responsibility to manage a process that they might not have the resources or expertise to manage effectively, or when institutional leaders, professionals, and experts withdraw themselves from a decision-making or problem-solving process that needs institutional leadership, specialized expertise, or professional skills to reach a successful conclusion or resolution (IAP2, n.d.-a).

The effectiveness of the decisions made by the public, the expression of opinions or proposals, and the way power is distributed during the participation process are all intimately tied to the participation strategy. This section of the study comes to a conclusion by stating that the term "participation approach" can mean a variety of things, from genuine participation to phony participation. In essence, IAPP2 Spectrum of Public Participation (IAP2, n.d.-b) which is based on Arnstein's study (1969) is used to understand participation levels as they developed their methodology in this study.

### **3. Citizen Science in the Literature**

The phrase "citizen science" is a vague word that describes scientific work done by the general population, frequently in cooperation with or under the direction of qualified scientists and scientific institutions. A "citizen scientist" is a scientist, whose work is distinguished by a commitment to furthering the interests of society; (b) a member of the public who conducts scientific research, frequently in collaboration with or under the direction of professional scientists and academic institutions; or (c) an amateur scientist (Oxford Dictionary of English, 2014). One of the pioneers in using the term "citizen science" to describe the expertise of laypeople was Alan

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Irwin in 1995 (Irwin et al., 1994). Shortly after, this phrase was modified to refer to a research strategy that gathers or examines scientific data from the general community. Irwin (1995) identified two components of the interaction between the public and science. The first dimension is that science must be sensitive to the interests and concerns of the community. The second component is the potential for citizens to generate trustworthy scientific knowledge.

According to the European Commission Green Paper (Follett & Strezov, 2015), citizen science is defined as the citizens' participation in scientific research activities when citizens actively contribute to science through their intellectual effort, their local expertise, or their tools and resources. The field of citizen science is legitimately growing and spreading quickly. Citizen science frequently increases public interest in science and supports alternate methods of knowledge generation. It is viewed as a collection of initiatives residing under a bigger umbrella of ideas, such as "open science" and "open innovation" (Hecker et al., 2018). The term "citizen science" has many definitions, including do-it-yourself science, crowd science, participatory monitoring, community-based monitoring, and public engagement.

Increased stakeholder participation, new ideas, knowledge, and collaborations are all benefits of citizen science. Several projects are bringing cutting-edge scientific subjects to new audiences, opening up the conversation on the societal ramifications of disciplines. In this regard, citizen science projects are frequently launched to address a current problem or research question while also strengthening the general public's capacity to participate in science and have an impact on the long-term implementation of policies.

Participating in a variety of topics and data sources as part of citizen science contributes to the advancement of scientific research. Citizen science has the potential to increase stakeholder engagement, bring in new perspectives, and foster new collaborations. There are numerous projects being developed in cutting-edge scientific fields. At this phase, they begin to address urgent issues or the research question's solution while also enhancing communities' capacities to engage in science and influence long-term policy decision-making and execution. These public policy programs have an impact on everything from research and innovation to the protection of the environment, health, and education. Moreover, citizen science has a long history that spans a wide range of disciplines, including astronomy, biology, geology, archaeology, biodiversity, monitoring, public health, etc. Collaboration between several fields of research, medicine, engineering, and the social sciences resulted from these undertakings. Projects linked to citizen science and public policy today address a variety of goals, including the protection of the environment, health and education, research, and innovation. In particular, those designed to promote innovation have sparked interdisciplinary collaboration in the social sciences as well as in science, medicine, and engineering. Citizen science also promotes a small amount of interaction between practitioners, important society stakeholders, and public officials (Hecker et al., 2018).

Citizen scientists that contribute a vast amount of data regarding species occurrence and distribution around the world to citizen science projects achieve extraordinary achievement in scientific understanding and progress. The majority of citizen science projects let participants learn about inanimate objects by seeing and understanding the procedures used in scientific studies. Due to the scientific and educational benefits of these projects, creating and implementing public data collection of citizen science programs does really demand substantial effort (Bonney et al., 2009). Several people would engage in science on various levels, each contributing to the scientific knowledge.

The objectives of citizen science initiatives also include funding scientific research conducted by academic institutions, governmental organizations, and non-governmental organizations, adding to the body of scientific knowledge through publications, providing data and analytics to help inform management plans and fostering public awareness of and interest in science (Follett & Strezov, 2015). Citizen science also significantly tackles broader societal issues by engaging citizens in actual research experiences at various stages of the scientific process and using modern communications

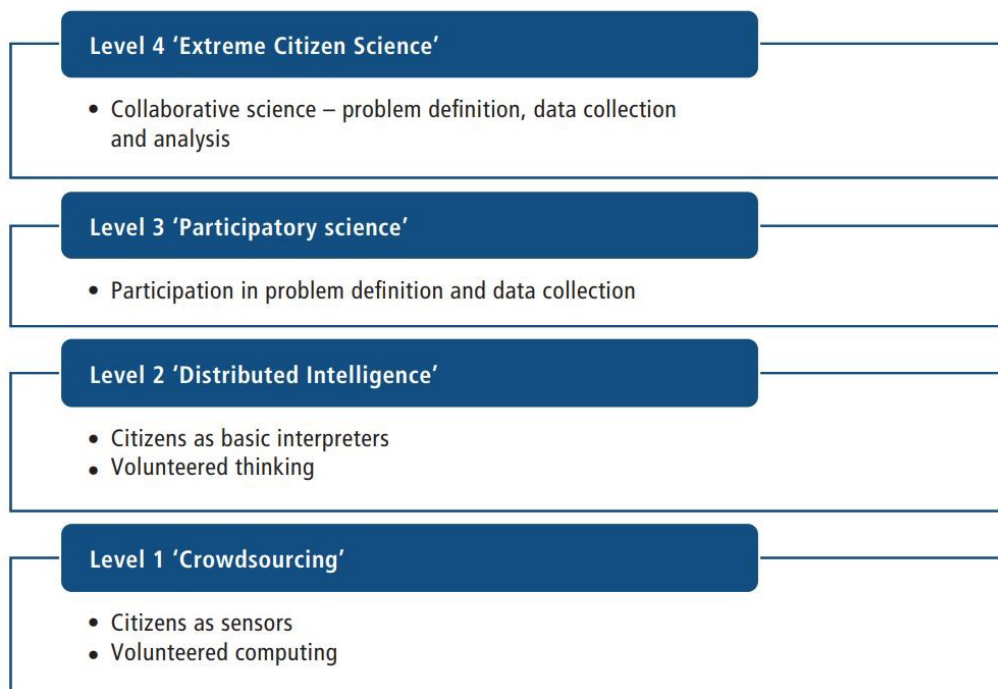
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techniques to draw in and keep participants. A number of new advancements in information science over the past 20 years, particularly in data informatics, graphical user interfaces, and geographic information system-based web applications that can now be ported to smartphones and other hand-held devices as well, have greatly aided the emergence of citizen science. Problems with sustainability and prioritization in citizen science projects bring up the question of how government funding and partnerships may assist sustain public interest in research for society (Dickinson et al., 2012).

### 3.1. Levels of Citizen Science

Due to the wide range of fields in which citizen science can be used as well as the diverse organizational and cultural settings of such practices, there are numerous terms that come under the more general category of citizen science. Some examples include community science, collaborative mapping, community remote sensing, locally-based monitoring, and community-based monitoring (Fraisl et al., 2022).

Although it has been challenged throughout the years, Arnstein's ladder served as an inspiration for typologies. Haklay (2018), an expert in citizen science, is in charge of what looks to be a ladder of the citizen scientific engagement as seen in Figure 3.



**Figure 3** Levels of participation in citizen science (Haklay, 2018)

This classification parallels the ladder of participation described by Arnstein (1969). Eight steps make up the ladder of citizen participation, each indicating a distinct level of involvement. The steps describe the level of citizen participation and the level of influence required for the process and outcomes to be decided from the bottom to the top. For defining the programs and policies that emphasize participation, the ladder makes sense. Although Arnstein used the phrase "the powerful and citizens" in her script, she underlined that neither the term refers to a single entity nor both groups include individuals who have varying degrees of influence. Powerful actors employ various sorts of non-participation at the bottom of the ladder to push their objectives. When participants learn about interventions and express their opinions about them, power holders are said to have received "input." Participation does not result in change, however, because the participant's voice will not have any impact on the intervention. The highest rung on the participation ladder gives citizens more authority to consult with and influence status. The voices of the participants are recognized and addressed. The steps and obstacles needed to get from one level to the next are not shown on the ladder. In real-world circumstances, however, there may be many more levels,



and participants may climb and descend the ladder over time while still participating in the same intervention.

Haklay's (Weber et al., 2019) system classifies citizen science activities in accordance with a four-level structure of participation based on the depth of their interaction with volunteers. In level 4, or so-called extreme citizen science, participants take an active role in the project's development and work to meet their own goals. Extreme citizen science refers to projects where professional scientists have no part at all, and the study is directed entirely by the public. Science with participation is Level 3. Participants are involved in directing the research's course from topic development to data collecting. Level 2 includes distributed intelligence, which provides some essential information before requesting people to collect and analyze data. Crowdsourcing is Level 1 within the process. These are the least inclusive programs and rely solely on volunteers to supply the processing power or collect data from dispersed sensors (Science Europe, 2018).

According to Haklay (2018); there are six different sorts of citizen science programs. They include passive sensing, volunteer computing, volunteer thinking, environmental and ecological observations, participatory sensing, and community science. Participants in the initiative must contribute a resource they already own in order for passive sensing to work. The data was being gathered by using the sensors. Scientists use the data later for analysis. Volunteer computing is the practice of users contributing their unused computing resources on a personal computer, tablet, or smartphone. When the device is not in operation, scientists are permitted to run sophisticated computer simulations. Volunteer thinking refers to the cognitive abilities of persons, who do not engage in passive leisure activities like watching TV.

At the bottom of the ladder, powerful actors use a variety of non-participation tactics. Participants are considered to have provided feedback when they learn about interventions and share their opinions about them. Yet, as participation does not result in change, the participant's opinion will not have any bearing on the intervention. Citizens have more power to consult with and affect status at the top of the scale. Participants' voices are acknowledged and addressed. In these kinds of programs, the participants pledge their capacity to see patterns or analyze data that will later be employed in scientific research. The participants in the environmental and ecological observations type concentrate on observing flora and wildlife or monitoring environmental contamination through the activities. Participatory sensing is the practice of giving individuals more roles and authority. While many environmental and ecological observations adhere to the data collection standards, the process is more assigned and emphasizes the active engagement of the participants in setting what will be collected and examined. Bottom-up science is the ultimate concept in community/civic science; it is suggested and directed by a group of participants who identify an issue that is important to them and address it using scientific methods and tools. In these types of activities, the problem, data collecting, and analysis are frequently carried out by members of the community or in conjunction with scientists or established laboratories (Sui et al., 2013).

The user's dual role as participant and researcher within the environment creates new opportunities for cross-disciplinary, cross-sectoral, and trans-generational environments where communities can collaborate to solve problems, develop group hypotheses, and test existing theories with the aim of comprehending reciprocal systems and modeling potential futures for citizens.

It is not shown how to ascend the ladder from one level to the next or what challenges must be overcome. Yet, there might be a lot more levels in real-world situations, and participants might climb and descend the ladder over time while still participating in the same intervention (Arnstein, 2019).

#### **4. Citizen Science Projects in Izmir, Turkey**

Although though citizen science is a relatively young subject of study in Turkey, numerous studies in this area have been conducted using various terminologies. Turkish researchers have just

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recently been exposed to the idea of citizen science. In terms of policymaking, the European Union Framework Plan for Research and Innovation's Horizon 2020 initiative, which includes calls for citizen science projects, has been funded by The Scientific and Technological Research Council of Turkey (TUBITAK). As a result, multinational collaborations have indirectly helped citizen science. Another policy change in Turkey related to citizen science is the new open science policy of TUBITAK, which is based on disseminating TUBITAK research in an open-access way and may have an impact on public participation in scientific research (Us, 2020). The first studies on citizen science in Turkey compiled a thorough literature survey and included some first examples. A few governmental enterprises backed by citizen-generated data, an amateur meteorology forum, a policy-making occasion encouraging citizen participation in water research, and more have been described. However, many of these programs do not directly relate to citizen science because they are not open-access or volunteer-based, as the authors have noted (Anbaroğlu et al., 2017). Various citizen science projects and platforms exist in Turkey, according to the present research.

In parallel with these developments, citizen science projects belonging to different disciplines were carried out in the city of Izmir, located in the west of Turkey.

#### *Biyogatlas (2009)*

Izmir Biyogatlas Project (Url-1), which is open to the participation of citizens with the support of academicians, who are experts in their fields in order to reveal the herbal diversity of the city under the coordination of the Izmir Metropolitan Municipality Mediterranean Academy, the natural richness and flora of the city will be determined through and this richness will be embraced with the awareness that is created. Determining the plant diversity living in Izmir, determining the location of the plant, photographing the plant, collecting and archiving the basic data in a digital base to be created by the project partners are 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 on the internet through the Project of Creating and Sharing the Biodiversity Atlas of the Province of Izmir. During this citizen science project; plant diversity, photographs and location information are clearly determined for the participation of the citizens, and these data will be collected over the web and shared with the existing plant inventory (Figure 4).

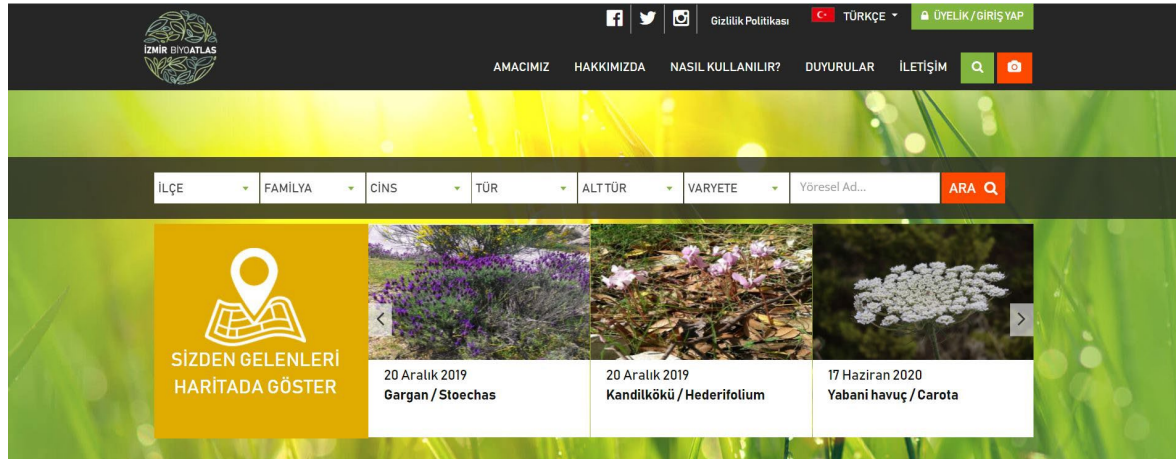


Figure 2 Izmir Biyogatlas Project (Url-1)

#### *Bioblitz Peninsula Citizen Science Practice (2018)*

Counting species activity, also known as bioblitz (combination of the words "bio" meaning life and "blitz" meaning raid), has been around in many countries, including the United States and the United Kingdom, as a community science activity to pique interest in nature among the general public. The living things seen in nature are identified by professionals in this exercise, which is open to participants of various backgrounds (Url-2).

Botany science was the theme of the 2018 Bioblitz Peninsula Citizen Science Practice citizen science workshop that took place in Urla, Izmir. In a particular location, citizens were instructed to locate and identify as many species as they could (Url-3). A further citizen science project in Izmir, the 'Biyoatlas' project intends to identify the variety of plant life in Izmir, pinpoint the location of the plant, take a photo' of the plant, and compile and archive the fundamental data in a digital base that will be developed by the project partners. Additionally, it aims to match Latin, local, and national names and to openly publish the information online. These goals were achieved with the assistance of experienced academics.

First, the presentation was given on the goal and reached citizen science practice at the conference held at Bademler Natural Life Village with the involvement of Zeytince Association. Afterward, the fundamentals of botany, how to approach the problem, and the floristic diversity of Turkey and Izmir were given to the participants. In addition, basic details on how to carry out research in citizen science practice are and instructions on how to utilize the smartphone application and responded to queries from the audience were provided in the session. An applicable field trip was included in the meeting with the participants (Figure 5).



Figure 3 Bioblitz Peninsula Citizen Science Practice (Url-3)

### *PSLifestyle Living Labs (2017)*

PSLifestyle is a citizen science project that aims to close the action gap between individual action and climate awareness and to increase citizen participation in sustainability topics. In addition to the large-scale environmental projects mentioned above where citizen scientists are primarily involved in data collection. The Horizon 2020 research and innovation program of the European Union has financed PSLifestyle. In Estonia, Finland, Germany, Greece, Italy, Portugal, Slovenia, and Izmir/Turkey, PSLifestyle foster data-driven momentum for lasting habit change. The initiative's co-creative Citizen Science Lab methodology aims to promote citizens' engaged involvement in localized sustainability challenges in order to develop and commit to practical climate change solutions. The project partner Sistra, who created Lifestyle Test' carbon footprint calculator built the web based tool in 2017. An enhanced version of the application is developed and contextualized as part of the PS Lifestyle project to better reflect the local reality of the target populations. In order to understand the local skills, possibilities, and motivations of the citizens in engaging in more sustainable lifestyles, this was accomplished by co-creating a localized version of the application using citizen science laboratories. In order to develop solutions based on citizen data, the PS Lifestyle project also collaborates with other societal catalysts, such as legislators, corporations, civil-society organizations, and academics (Url-4) (Figure 6-7).



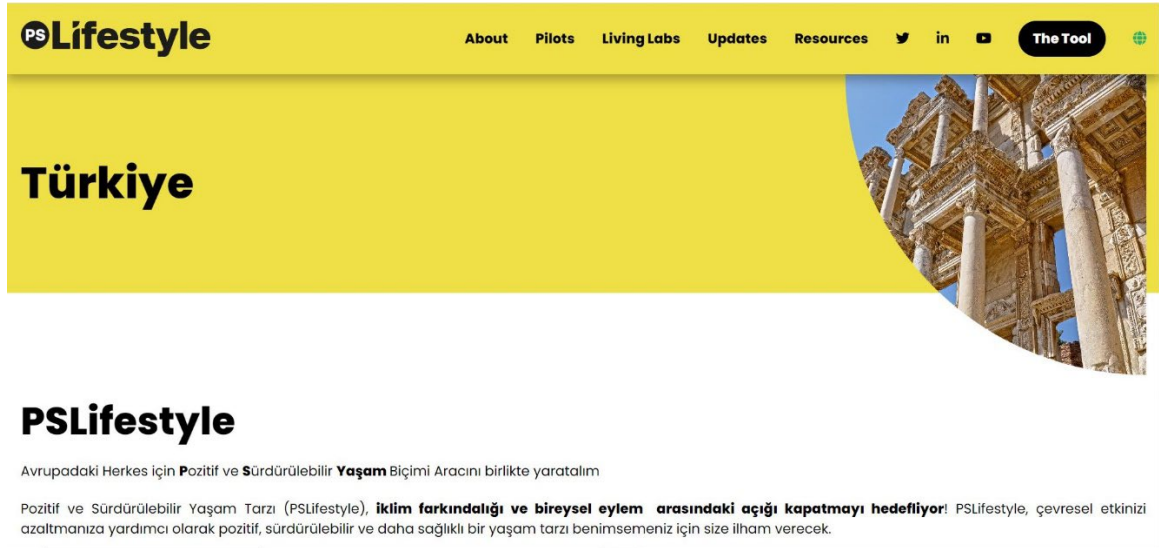


Figure 4 PSLifestyle (web-based tool) (Url-4)



Figure 5 PSLifestyle Living Lab (Url-4)

#### *Citizen Design Science Workshops, Izmir (VTB Atölyeleri) (2022)*

Human-centered urban design and development require an understanding of inhabitants' needs, concerns, and perceptions. Modern initiatives emphasize human-centered technology and make an effort to involve citizens in some planning processes. Since then, increased citizen participation has contributed to the development of democratic governance and several related fields. These contributions are seen to strengthen accountable and responsive states, foster a sense of citizenship, and increase good feelings. They consist of elements such as the standard of living, often known as livability or a person's sense of identity. The term 'citizen design science' refers to this innovative approach. New types of citizen participation in urban planning are represented by citizen design science in the context of citizen science concept. Understanding how to impart

knowledge and even wisdom to citizens through the use of citizen design science is central to the program. Many of citizens' strengths in terms of observation, human cognition, experience, and local knowledge are added by the notion of citizen design science in a scientific framework. Citizen design science is a novel method for including residents in the process of urban design and planning (Mueller et al., 2018).

Citizen Design Science Workshops-Izmir were conducted by us in 2022, and collaboration with Karşıyaka Municipality was made in those projects. These projects are the first studies of citizen design science projects in Turkey. Karşıyaka Municipality aims to regenerate the selected areas as parks, green areas, and leftover spaces in Karşıyaka district into qualified public spaces by the help of the wishes and needs of local citizens within the scope of 'participatory co-design process'. 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. Citizen Design Science Workshops practices were completed by using digital and analog design tools in four selected leftover urban spaces in Karşıyaka, Izmir. Atakent Car park, Cemal Gürsel Street, Bahar Park and Şehit Ast. Erkan Durukan Primary School were those selected areas that Citizen Design Science Workshops-Izmir implemented (Figure 8).



Figure 6 Citizen Design Science Workshops-Izmir: (1) Atakent Car park, (2) Cemal Gürsel Street, (3) Bahariye-Bahar Park, (4) Şehit Ast. Erkan Durukan Primary School

#### 4.1. Results and Discussion

Bioblitz and Biyoatlas are the citizen science projects that depend on finding and identifying lots of species in a specific area over a period of time. To capture a glimpse of a region's biodiversity, scientists collaborate with citizens. These activities can take place anywhere, in a backyard or a big region, in a rural or suburban setting. The use of smartphone technology and applications will facilitate the collection of photos and biological information about living things. Data is submitted to these programs to create an open-source database that is used by researchers, decision-makers, and communities all across the world. Due to the participants being restricted to resource allocation, these projects are at the most fundamental level of participation. In addition, intellectual participation is at its lowest level. According to Haklay (Sui et al., 2013), the implementation of a comparable level of participation as participatory sensing would urge participants to carry applications and mobile phones as sensors and bring back the digital data to the experiment organizer. Also, they fall under the IAPP2 spectrum's 'involve' level by collecting data.



The PS Lifestyle Living Labs is at the Level 3, participatory science level that citizens help to collect data for the ‘climate problem’, to co-create and shape visions of a good life with the environment in mind as well as design solutions for turning visions reality. Citizens co-define the tool’s content and co-create its features and functionalities. Also, this citizen science project is at the level of ‘collaborate’ in the spectrum.

Citizen Design Science Workshops-Izmir is a citizen (design) science project in that citizens actively design their environment through their knowledge from observations and experiences, and wishes. This design data transforms the conceptual design and the local citizens design into citizens’ environment collaboratively with scientists and expert designers. These workshops are at the Level 3; participatory science that citizens participate in (design) problem and, by using their knowledge and experiences regarding environment, they also bring design data to scientists and expert designers as at the ‘collaborate’ level of spectrum (Table 1).

**Table 1** Levels of Citizen science projects in Izmir

Level of Citizen Science Projects in	Level 1: Crowdsourcing	Level 2: Distributed intelligence	Level 3: Participatory Science	Level 4: Extreme Citizen Science
Inform				
Consult				
Involve		Bioblitz- Biyoatlas		
Collaborate			Citizen Design Science Workshops-Izmir & PSLifestyle Living Labs	
Empower				

## 5. Conclusion

The citizen science studies in Izmir are evaluated within the conceptual framework, Haklay (2018) and IAP2’s Spectrum of Public Participation (IAP2, n.d.-b). Citizen science is a brand-new open movement that welcomes contributions to scientific study from a wide range of individuals. Data generated by citizen science initiatives is helping to inform policy-making at the local, national, regional, and international levels. Citizen science acts as a link between many parts of society in order to create significant scientific research. It is conceivable to think of citizen science as the next step in the participatory shift, one that could address the flaws in the democratic system by involving the general people in the scientific method itself. In other words, citizen science promises to advance knowledge, educate the public, and change science from a closed to an open activity in an effort to "democratize" research.

As a result, understanding citizen science participation also contributes to a better understanding of how open science should operate. Citizen science is becoming increasingly recognized as a legitimate scientific field. Since around 2010, the number of papers resulting from citizen science programs has considerably increased. The main fields of study in Izmir, Turkey, and the rest of the globe provide the scientific research in different disciplines. The citizen science projects in Izmir demonstrate the city's potential as in the previous section. A gap is also discovered when it comes to using citizen science methods at higher levels of the participation spectrum. In addition, Izmir, which has a potential in terms of citizen science projects both in local and global scale, to achieve a resilient society, the participation levels of the projects should be increased and developed in terms of double-sided benefits as citizens’ awareness and right to the city are increased.

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## Resume

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