Identifying and Prioritising Citizen Participation Indicators in Public Green Spaces: A Policy Arrangement Approach to Urban Agriculture*

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Abstract

Urban agriculture in public green spaces offers an innovative approach toward sustainable urban development. It has considerable potential to improve urban environmental quality and strengthen citizen participation. However, the success of this approach depends heavily on the institutional arrangements that either enable or limit citizen participation. This study aims to identify and prioritise the indicators that influence citizen participation in urban agriculture within public green spaces, using the Policy Arrangement Approach. The research employed a mixed qualitative–quantitative methodology in two phases. In the first phase, a content analysis of 42 reputable national and international sources was conducted. This led to the identification of 47 participation indicators, which were classified into 13 components across four dimensions: resources, actors, rules of the game, and discourse. In the second phase, the Fuzzy Delphi method was used to achieve consensus and refine the indicators. A total of 26 interdisciplinary experts took part, and the reliability of the results was assessed using the non-parametric Friedman test. The findings confirmed 38 indicators and established their order of importance. The results showed that the resources dimension—particularly physical access and spatial allocation—carries the greatest weight in shaping participation. This was followed by the rules of the game dimension, the actors dimension, and finally, participatory discourse. Overall, citizen participation in urban agriculture is an institutional process. It requires the alignment of physical infrastructure, transparent legal frameworks, well-organised actors, and an outcome-oriented participatory discourse. The proposed framework can serve as both an analytical and a policy-oriented guide for planning and for the participatory governance of public green spaces.

Keywords: Citizen Participation, Fuzzy Delphi, Policy Arrangement Approach (PAA), Public Green Space, Urban Agriculture

1 .Introduction

In recent decades, rapid urbanisation, growing pressure on natural resources, worsening environmental challenges, and concerns about food security have drawn the attention of researchers and policymakers to urban agriculture. It is now seen as a key strategy for sustainable urban development, and it has found a particularly important place within the discipline of landscape architecture. Beyond food production, urban agriculture can improve ecosystem services, enhance environmental quality of life, increase urban resilience, and strengthen

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social ties. It is therefore recognised as a vital component of sustainable urban planning (Artmann & Sartison, 2018; Arts & Leroy, 2006; Bagheri et al., 2025; Contesse et al., 2018; Zeunert, 2018).

Public urban green spaces, such as parks, are common assets accessible to all citizens. They hold great capacity for the introduction and development of urban agriculture. By offering a platform for human–nature interaction, these spaces can effectively improve public health, enhance quality of life, and increase social capital (Kabisch et al., 2015; Russo & Cirella, 2018). In most developed countries, pilot projects and research on urban agriculture in public green spaces have already been conducted, and specific regulations have been implemented. In Iran, the Supreme Council of Urban Planning and Architecture communicated the "Guide to Urban Agriculture in Parks and Equipped Urban Spaces" to the relevant authorities in 2021. The guide is structured into three parts: generalities, the relationship between urban agriculture and urban development documents, and a framework for assessing the feasibility of urban agriculture (Supreme Council of Architecture and Urban Planning of Iran, 2021).

Introducing urban agriculture into public green spaces as a nature-based solution offers a high potential for synergy among the ecological, social, and economic functions of urban spaces (Buijs et al., 2014; Van der Jagt et al., 2016). Nevertheless, both international and domestic experience show that the success of urban agriculture in public green spaces depends less on physical design or individual interest and more on the extent and quality of citizen participation throughout the planning, implementation, and management phases. Research has demonstrated that citizen involvement in the management and use of green spaces and urban agriculture projects can increase the sense of belonging, social responsibility, and the long-term functionality of these spaces (Glover, 2004; Kingsley & Townsend, 2006). Participation is not merely a management tool; as a policy-institutional process, it plays a crucial role in urban governance and in achieving sustainable development (Fung, 2015). In this field, citizen participation is a multi-layered concept shaped by the interaction among resources, diverse actors, institutional frameworks, and social discourses (Fors et al., 2021; Mattijssen et al., 2017).

Despite this, a review of the literature reveals that the concept of citizen participation in urban agriculture within public green spaces has often been examined in a fragmented, one-dimensional way. A significant portion of studies has focused on individual and social factors such as attitudes, motivations, and demographic characteristics (Huang et al., 2021), while others have addressed only managerial or policy-related aspects. These reductionist approaches have limited the development of a comprehensive institutional framework for explaining the factors that affect citizen participation in urban agriculture, especially in public green spaces. At the same time, urban agriculture in public green spaces is inherently interdisciplinary. The simultaneous influence of resources, multiple actors, formal and informal rules, and dominant discourses shapes that phenomenon (Fors et al., 2021; Mattijssen et al., 2017) This institutional complexity demands that citizen participation be examined within a multi-dimensional analytical framework. In this regard, new environmental governance approaches, including the Policy Arrangements Approach (PAA), provide an analytical framework for understanding that complexity. By focusing on the dimensions of resources, actors, rules, and discourse, this approach enables a systematic analysis of such complexity in various contexts, including urban agriculture (Arts et al., 2000; Dang et al., 2019). It can bridge the gap between social, managerial, and policy analyses (Arts & Leroy, 2006; Howlett & Ramesh, 1996). However, despite the growing number of studies on urban agriculture, public participation, and public green spaces—especially at the international level—the application of this approach in the field of urban agriculture, particularly in public green spaces, has received limited attention in previous research.

In addition to the conceptual gap, methodological limitations are also evident in existing studies. Although qualitative or mixed methods are common in urban participation research, a significant research gap remains concerning the systematic identification, screening, and consensus-building around the indicators and components that affect citizen participation in urban agriculture situated in public green spaces, particularly in the context of Iranian cities. This has led to long, heterogeneous lists of indicators, which reduces their practical value for urban policy-making (Queirós et al., 2017; Tahriri et al., 2014).

Accordingly, the main research problem of this study is: what are the indicators that affect citizen participation in urban agriculture located in public green spaces, based on a content analysis of authoritative sources, and how can these indicators be identified, screened, and prioritised within a coherent institutional framework? This study employs the Policy Arrangements Approach and a mixed-methodology (content analysis and fuzzy Delphi) to answer this question and to provide a practical framework for policy-making, planning, and the participatory management of productive public urban green spaces.

2 .Research Theoretical Foundations

The rapid urbanisation of recent decades has turned cities into the primary arena where environmental, social, and economic challenges emerge and intersect. Urban population growth, shifting consumption patterns, and

increasing pressure on natural resources have confronted urban planning and management systems with complex problems. Rising social inequalities and threats to food security add further to this complexity (Breuste et al., 2015; Un-Habitat, 2020). In this context, traditional urban planning approaches—based on land-use segregation and top-down, centralised management—have lost their capacity to respond. Consequently, the need to transition towards integrated, participatory, and sustainability-oriented models has been increasingly stressed (Campbell, 1996).

Urban agriculture, as one of the innovative approaches that rethinks the relationship between the city, nature, and production, has gained a growing place in the literature on urban planning, environmental governance, and sustainable development. The concept extends beyond food production within city boundaries. It encompasses a spectrum of activities, including the production, processing, distribution, and consumption of agricultural products. These activities take shape in direct interaction with the social, economic, spatial, and institutional systems of the city (Opitz et al., 2016; Orsini et al., 2017). Research indicates that urban agriculture differs from rural agriculture. Rural agriculture is primarily defined by economic production and a market-oriented logic. Urban agriculture, by contrast, can simultaneously fulfil environmental, social, educational, and economic functions (Artmann & Sartison, 2018; Barthel et al., 2015; Lovell, 2010). This leads to improved ecosystem services, enhanced urban resilience, and a better quality of life for citizens. From a social perspective, these activities create spaces for collective learning, social interaction, and collective action. As a result, they can strengthen social capital, increase place attachment, and improve citizens' quality of life (Glover, 2004; Kingsley & Townsend, 2006; Pourais et al., 2015).

One of the key settings for the establishment of urban agriculture is public urban green spaces. This category includes parks, community gardens, and public open spaces. Recognised as common urban assets, they play an essential role in citizens' physical and mental health, social cohesion, and the quality of the urban environment (Kabisch et al., 2015; Wolch et al., 2014). Integrating urban agriculture into public green spaces can move these spaces beyond purely recreational and aesthetic functions. In this way, they become multifunctional spaces with productive, educational, and social value (Dennis & James, 2016; Russo & Cirella, 2018; Zeunert, 2018). However, empirical evidence suggests that the success of urban agriculture in public green spaces does not depend solely on providing physical infrastructure. Rather, it hinges on the extent of active, meaningful, and sustained participation by citizens and other stakeholders (Arjen E Buijs et al., 2016; Mattijssen et al., 2017). Citizen participation in the design, implementation, and management of these spaces can increase the legitimacy of decisions, reduce institutional conflicts, strengthen place attachment, and ensure the long-term sustainability of projects (Kingsley et al., 2019; Reed et al., 2018).

The concept of citizen participation has long been a central pillar of urban planning theories and democratic governance. Arnstein's (1969) classic ladder of participation, with its emphasis on the link between genuine participation and the distribution of power, provided a basis for the critical analysis of participatory processes. However, contemporary approaches view participation not as a static state but as a dynamic, interactive process grounded in social learning. In these approaches, diverse actors engage in knowledge production and decision-making through dialogue, negotiation, and collaboration (Fung, 2015; Healey, 2020; Innes & Booher, 2004). Within the framework of modern urban governance, citizen participation is considered an inseparable part of the governance process. It can lead to more effective policies, stronger social capital, and greater spatial justice. Nevertheless, critical studies indicate that participation is always subject to challenges. These include power imbalances, conflicts of interest, institutional constraints, and dominant discourses—factors that can lead to tokenistic or unsustainable participation (Cooke & Kothari, 2001; Newig et al., 2018).

In response to these complexities, studies in environmental and urban governance have turned to the development of institutional analytical frameworks. One prominent framework in this field is the Policy Arrangements Approach (PAA). First introduced by Arts and colleagues for analysing the dynamics of environmental policy-making (Arts & Leroy, 2006; Arts et al., 2000), this approach views policies and participatory processes as institutional and dynamic arrangements. These arrangements are shaped by the interaction of four main dimensions: resources, actors, rules of the game, and discourse. In this framework, the resources dimension refers to the distribution of and access to material, financial, human, and knowledge resources. The actors' dimension encompasses the actors involved, their roles, and the power relations among them. The rules of the game dimension covers the formal laws, regulations, and informal norms that govern action. The discourse dimension refers to the systems of meaning, values, and narratives that define problems and solutions (Dang et al., 2019; Kütting & Lipschutz, 2012). The interaction of these dimensions determines the structure and trajectory of participation, creating the basis either for the sustainability or the fragility of

participatory initiatives. This framework has been widely applied in studies of climate change, natural resource management, and urban governance.

Applying the Policy Arrangements Approach to analyse citizen participation in urban agriculture within public green spaces makes it possible to examine participation not as a single variable but as the outcome of a multi-dimensional institutional structure comprising resources, actors, institutional rules, and dominant discourses. Recent research indicates that the misalignment among these four dimensions is one of the main reasons for the failure or instability of participatory projects in public green spaces (Arjen E Buijs et al., 2016). Thus, the Policy Arrangements Approach provides a coherent and robust theoretical basis for identifying, analysing, and prioritising the indicators of citizen participation in urban agriculture in public green spaces. It also establishes a clear link between the theory, method, and findings of the present study.

3 .Conceptual Linking of Theoretical Foundations with Research Dimensions and Indicators

The conceptual linking of the theoretical foundations with the dimensions and indicators of citizen participation, within the Policy Arrangements Approach (PAA) framework, rests on a fundamental premise: participation is not merely a behavioural phenomenon. Rather, it is the outcome of a dynamic interaction among institutional structures, resources, actors, rules, and dominant discourses within the context of urban governance. In this approach, policies and participatory actions are understood as institutional arrangements that are shaped and transformed through the interaction of these four dimensions (Arts & Leroy, 2006; Arts et al., 2000; Kütting & Lipschutz, 2012). Accordingly, the research indicators are analysed not as independent variables but as elements of an intertwined institutional arrangement. This arrangement determines the quality, scope, and sustainability of citizen participation in urban agriculture situated in public green spaces.

In the resources dimension, the focus on indicators such as space allocation, easy physical access, spatial quality, security, and privacy demonstrates that citizen participation first requires adequate physical and spatial contexts, regardless of individual motivations or social capital. Within the PAA framework, resources are not merely physical tools for action; they are also carriers of institutional power. The distribution of these resources can create the possibility, or the limitation, of participation (Arts & Leroy, 2006). This finding aligns with the urban agriculture literature, which considers access to land, water, and safe infrastructure as preconditions for the sustainability of participatory initiatives in productive green spaces (Dennis & James, 2016; Lovell, 2010; Russo & Cirella, 2018). Furthermore, indicators related to knowledge and educational resources—such as educational materials, expert knowledge, educational spaces, and empowerment programmes—emphasise the role of social learning and institutional capacity-building in shaping meaningful participation. This has been widely highlighted in studies on participatory environmental governance and natural resource management. However, participation in productive green spaces, such as community gardens, requires more intensive management than green spaces with tree cover, even fruit-bearing trees (Innes & Booher, 2004; Reed et al., 2018). The economic indicators of this dimension, such as production costs and Time to harvest, also express the link between citizens' economic rationality and institutional support structures. These indicators show that participation is sustained when actors perceive it as having functional and economic justification (Opitz et al., 2016; Siegner et al., 2018).

In the actors' dimension, indicators such as demographic effects, physical and skill capacity, willingness and interest, values and beliefs, and attachment and belonging indicate that participation in urban agriculture is shaped by the human, social, and cultural capital of actors (Glover, 2004; Kingsley & Townsend, 2006). At the same time, indicators such as management style, perception of impact, and community support highlight the role of formal and local institutions in directing and legitimising participation. These findings are consistent with studies that stress the importance of institutional leadership, facilitation, and trust-building in participatory processes (Arjen E Buijs et al., 2016; Mattijssen et al., 2017). In addition, indicators related to integration, interactivity, internal and external cooperation, structuring, and network formation explain participation as a networked, multi-level process. Such participation achieves sustainability only through synergy among citizens, civil organisations, and government institutions (Abrantes et al., 2025; Buizer et al., 2015; Muller, 2010).

In the rules dimension, indicators such as formal laws, policy-making, cultural norms, deviation from the law, programme timing, and programme levels represent the institutional frameworks that govern participation. The PAA emphasises that formal and informal rules simultaneously shape participatory action; a lack of coherence between these rules can lead to tokenistic or unsustainable participation (Arts et al., 2000; Dang et al., 2019). The presence of indicators related to formal laws and policy-making aligns with studies in urban governance that view clear legal frameworks and explicit policies as necessary conditions for increasing trust, reducing ambiguity, and ensuring the continuity of citizen participation (Arnstein, 1969; Mattijssen et al., 2017).

The discourse dimension, as the semantic and normative layer of policy arrangements, is explained through indicators such as the nature of participation, clear participation objectives, the social aspect of participation, participation level, mix of participation tools, and the participation process. These indicators show that participation is not merely an implementation mechanism but a reflection of the dominant narratives, values, and perceptions of the role of citizens in urban governance (Healey, 2020). Indicators related to project- and programme-based continuity, as well as mixed approaches, stress the necessity of institutionalising participation within policy discourse. They suggest that sustainable participation is achieved when it moves beyond ad-hoc projects and becomes part of the logic of urban governance (Fors et al., 2021; Mattijssen, 2018). Furthermore, indicators of discourse quality—including diversity, depth, and impact of discussions—highlight the link between discourse and decision-making. They show that meaningful participation occurs when participatory discourses lead to shared learning and effective executive decisions (Fung, 2015; Innes & Booher, 2004).

In sum, the conceptual linking of theoretical foundations with the research dimensions and indicators demonstrates that the Policy Arrangements Approach provides a coherent and analytical framework for understanding citizen participation in urban agriculture. This framework is capable of simultaneously addressing material and knowledge resources, actors and institutional networks, formal and informal rules, and dominant discourses. This theoretical linkage explains participation as an institutional, multi-dimensional, and dynamic process in the policy-making and management of public urban green spaces. Moreover, it offers a valid basis for empirical analysis and the formulation of policy recommendations (Dang et al., 2019).

4 .Research Methodology

A review of previous research on citizen participation in green spaces and urban agriculture indicates that a large portion of studies have used qualitative methods or mixed qualitative–quantitative approaches. The mixed-method approach, by combining the strengths of both, allows researchers to analyse the complexity of socio-spatial phenomena more comprehensively and to compensate for the limitations of each method (Creswell & Clark, 2017; Queirós et al., 2017). Given the multi-dimensional, interdisciplinary, and institutional nature of citizen participation in urban agriculture, the present study is applied in nature and uses a mixed-method (qualitative–quantitative) approach, carried out in two consecutive phases.

In the first phase, qualitative content analysis of sources and previous studies was used to identify and extract the indicators affecting citizen participation in urban agriculture located in public green spaces. Because of the large number of sources, they were identified, reviewed, and filtered in four steps, ultimately being reduced to 42. In the first step, a search was conducted in the Scopus, Web of Science, Google Scholar, and SID (Iranian Scientific Information Database) databases. The search used Persian keywords and their English equivalents, along with related concepts such as “urban agriculture,” “edible landscape,” “productive landscape,” “urban green space,” “urban park,” “urban forest,” and “public or community participation,” “public or community involvement,” “public or community engagement” in the titles of sources. After removing duplicates and items without full text, 976 sources were retrieved. In the second step, from these sources, those that related more specifically to participation in green spaces and participation in urban agriculture—covering any type of public or private green space or urban agriculture—and possessed desirable scientific quality (journal articles, books, and doctoral dissertations) were selected. This reduced the number to 143 sources. In the third step, only those sources that focused on participation in public green spaces and public urban agriculture were chosen, leaving 93 sources. Finally, the remaining sources were reviewed, and only those that in some way fully or partially referred to indicators and factors affecting the success of participation in public green spaces or public urban agriculture were selected, totalling 42 sources. A further 51 sources that addressed other topics in this field were removed from the selection list. Ultimately, the final 42 remaining sources—reputable scientific articles, books, and doctoral dissertations, as listed in Table 1—were analysed in detail. The content analysis of these sources led to the identification of 47 indicators related to citizen participation. Due to the diversity of approaches and the lack of theoretical consensus in the literature, these indicators showed some dispersion. They were categorised into 13 components across four institutional dimensions—resources, actors, rules of the game, and participation discourse—consistent with the framework of the Policy Arrangements Approach (PAA).

Table 1. Final Sources used for extracting the research indicators.

Row	Sources	Row	Sources
1	(Beckley et al., 2006)	22	(Bucklin-Sporer & Pringle, 2010)
2	(Bendt et al., 2013)	23	(Tóth & Supuka, 2013)

3	(Delshammar, 2005)	24	(Sheppard et al., 2017)
4	(Chung et al., 2005)	25	(Dang et al., 2019)
5	(Mazereeuw, 2005)	26	(Leroy & Van Tatenhove, 2000)
6	(Mendes et al., 2008)	27	(Young, 2011)
7	(Buijs et al., 2016)	28	(Shan, 2012)
8	(Anuar & Saruwono, 2018)	29	(Buizer et al., 2015)
9	(Bharati, 2016)	30	(Tiraieyari & Krauss, 2018)
10	(Rosol, 2006)	31	(Collins Adjei et al., 2017)
11	(Van der Jagt et al., 2016)	32	(Ambrose-Oji et al., 2011)
12	(Wirtz et al., 2021)	33	(Grunewald et al., 2018)
13	(Wirtz, 2019)	34	(Gamhewage et al., 2015)
14	(Fors et al., 2019)	35	(Huang et al., 2021)
15	(Fors et al., 2021)	36	(Singh, 1992)
16	(McVey et al., 2018)	37	(Philips, 2013)
17	(Mattijssen et al., 2017)	38	(Fors et al., 2015)
18	(Mattijssen, 2018)	39	(Reed et al., 2009)
19	(Sharqi et al., 2016)	40	(Hajer, 1995)
20	(Zeunert, 2018)	41	(Fors et al., 2018)
21	(Dimond, 2011)	42	(Amini & NouroozIanpour, 2014)

In the second phase, the fuzzy Delphi method was used to achieve scientific consensus and to screen the indicators. Fuzzy Delphi, which combines the classical Delphi method with fuzzy set theory, is an effective tool for managing uncertainty, ambiguity, and differences in expert judgement on complex, multi-dimensional issues (Jailani & Loy, 2023; Tahriri et al., 2014). Relying on principles such as expert anonymity, iteration with controlled feedback, statistical aggregation of opinions, and the use of triangular fuzzy numbers, this method makes it possible to obtain a reliable group opinion (Chang et al., 2011; Murray et al., 1985). The steps include forming an expert panel, designing a fuzzy questionnaire, conducting the survey, converting the linguistic scale into fuzzy values, calculating the fuzzy mean, determining a threshold value, calculating the percentage of agreement through quantitative computations, and, if necessary, repeating the survey, evaluating and identifying inconsistent items, and analysing the results. In this study, the experts' views were collected using linguistic scales and then converted into triangular fuzzy numbers using fuzzy logic. In subsequent steps, these numbers were mathematically analysed and defuzzified to enable ranking, consensus measurement, and precise decision-making under conditions of uncertainty (Tahriri et al., 2014). Using this method increases the scientific validity and analytical precision of the indicator selection process (Chang et al., 2011). Moreover, because both types of data (qualitative and quantitative) are involved in the analysis, the fuzzy Delphi method is used in this research as a mixed tool, which aligns with the interdisciplinary nature of the topic.

In this study, expert panel selection was based on the recommendations of Hsu & Sandford, Hasson et al., and Rubio et al., using purposive sampling and criteria that included relevant expertise, academic background, and practical experience. Selection was carried out in two groups: faculty members and practising professional experts (Hasson et al., 2000; Hsu & Sandford, 2007; Rubio et al., 2003). Owing to the interdisciplinary character of urban agriculture, various disciplines—including landscape architecture, architecture, urban design, environmental design, urban green space, agriculture, environment, and geography—are involved in research and practice in this field (Bagheri et al., 2025; Zeunert, 2018). Therefore, in this study, the expert panel consisted of two groups holding a master's degree or doctorate: practising professional experts working in executive bodies and consulting engineering firms, most with over 20 years of work experience in the urban green space sector and in the fields of green space, environmental design, landscape architecture, horticulture, and agricultural extension and education; and faculty members and academics from the aforementioned disciplines who have publications or experience supervising theses on urban agriculture. Initially, 56 individuals were identified; they were contacted by phone or email, and a link to an online questionnaire was sent to them. Twenty-six of them responded to the questionnaire; their specifications and disciplinary distribution are presented in Figure 1. Moreover, the Delphi

method used is of the fuzzy type, whose advantages over the traditional Delphi method include the possibility of using a single round or iteration, especially in research such as this that faces time and budget constraints.

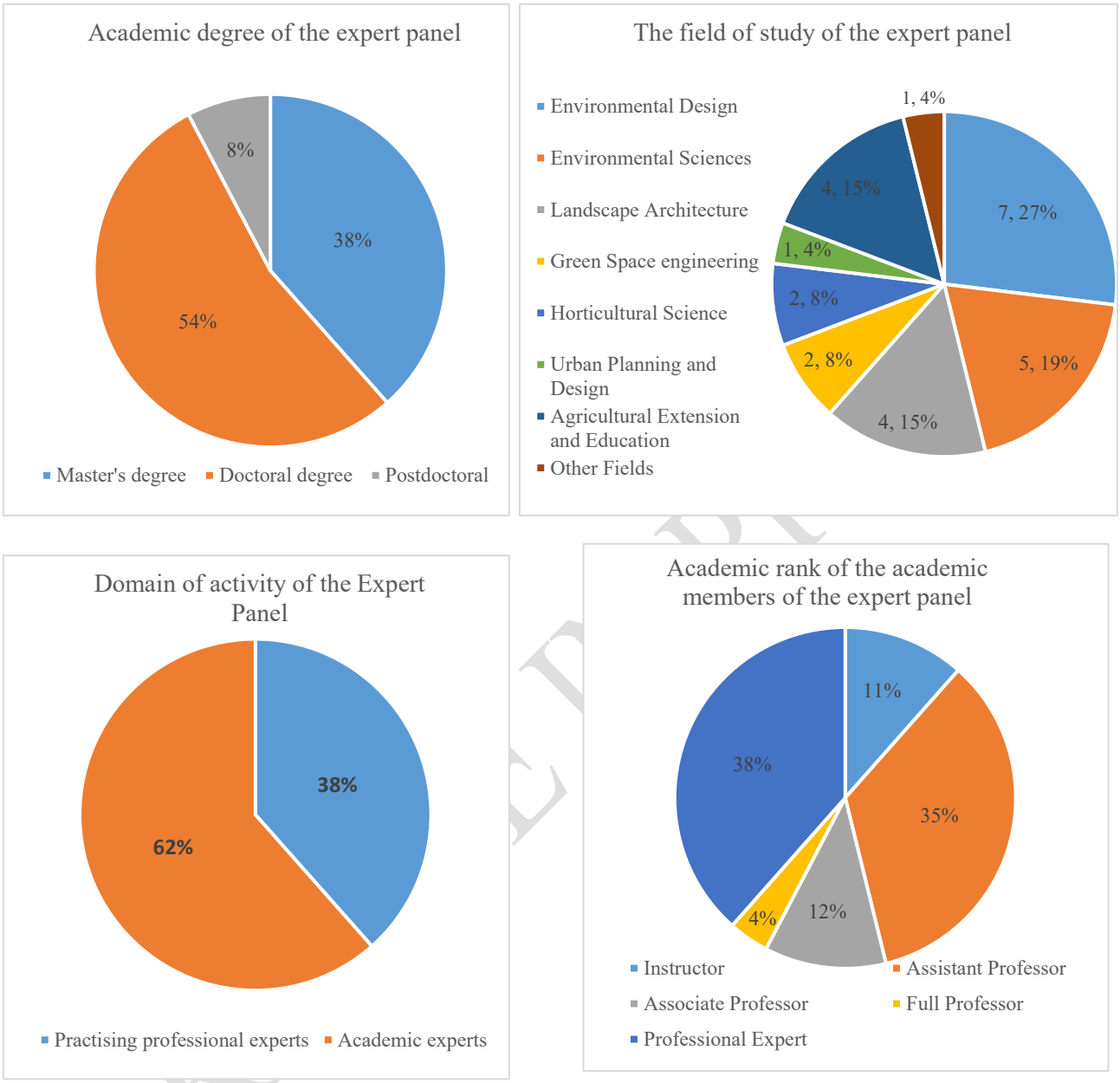

Fig. 1: Characteristics of the Research Expert Panel (The field of study, Academic Degree, Academic Rank, and Domain of activity) (Source: The authors)

For the fuzzy analysis calculations, the online questionnaire was completed by the research expert panel using Google Forms. The data were transferred to Excel software via the "view in worksheet" option and stored there. These data were calculated and analysed using fuzzy techniques in Excel by entering the relevant formulas. The calculations included converting the Likert scale into triangular fuzzy numbers; calculating the lower bound mean, upper bound mean, and most probable values based on the formula $F_{AVE} = \frac{\sum l}{n}, \frac{\sum m}{n}, \frac{\sum u}{n}$; performing defuzzification using the centre-of-gravity method and based on the formula $if\ \mathrm{F} = (\mathrm{L}, \mathrm{M}, \mathrm{U})\ Then\ \mathrm{F} = \frac{L+M+U}{3}$ to obtain the crisp value (the common consensus of experts); and determining the threshold value for screening. Experts' opinions were collected using a five-point linguistic scale and converted into triangular fuzzy numbers (as per Table 2) using fuzzy logic. The values used in such tables for converting verbal expressions into fuzzy numbers are a common and conventional method in this approach. In subsequent steps, these data were mathematically analysed and defuzzified (i.e., the common consensus of experts was obtained) to enable ranking and consensus

measurement of indicators. By comparing the common consensus with the threshold value, an indicator was confirmed if its crisp value exceeded the threshold; otherwise, it was not confirmed. The determination of the threshold value in the fuzzy Delphi method varies across studies and according to the researcher's judgement. There is no simple or statutory rule for this (Firoozabadi & Baghiri, 2014; Habibi et al., 2015). It can be set based on the type of fuzzy scale used in the questionnaire. For example, if a five-point fuzzy scale is used, the threshold value can be between 0.5 and 0.7. In this study, due to the interdisciplinary nature of the topic and the fact that the experts were divided into two groups (academics and practising professionals)—making diversity of perspectives natural—and in accordance with some previous studies (Zargar, 2024), the midpoint between these two numbers [0.5 and 0.7], namely 0.6, was selected. With the acceptance threshold set at 0.6, ultimately, 38 indicators were confirmed, and 9 were not confirmed.

Table 2. Triangular fuzzy numbers of five-point Likert scale (Kumar et al., 2023)

Linguistic values	No importance (No)	Very Low importance (VL)	Low importance (L)	High importance (H)	Very High importance (VH)
Fuzzy numbers	(0, 0, 0.25)	(0, 0.25, 0.5)	(0.25, 0.5, 0.75)	(0.5, 0.75, 1)	(0.75, 1, 1)

To assess the reliability of the results and to compare the ranking of indicators, the non-parametric Friedman test was used as a parallel method. The results of this test showed a high degree of overlap with the fuzzy Delphi output, indicating the stability and validity of the findings.

5 .**Findings**

The content analysis of 42 reputable domestic and international sources revealed that citizen participation in urban agriculture within public green spaces is influenced by multiple factors. Based on this analysis, a total of 47 indicators affecting citizen participation (as shown in Table 3) were identified, which were then categorised into 13 components and four main dimensions. This four-dimensional structure corresponds to the institutional framework of the Policy Arrangements Approach (PAA), which identifies the dimensions of resources, actors, rules, and discourse as the key elements shaping policies and participatory actions.

The process of identifying dimensions and components involved a systematic review of the selected sources, the extraction of factors affecting participation, and the subsequent classification of these factors into main and sub-categories. In this process, the main categories were defined as the four institutional dimensions, and the sub-categories as the components of each dimension. Accordingly, the resources dimension comprises three components: land and water resources, knowledge and skill resources, and products. The actors dimension encompasses four components: participants, participation authorities, other park users, and organisation and leadership. The rules of the game dimension includes three components: formal laws and guidelines, informal rules, and programmes and agreements. Finally, the participation discourse dimension consists of the components of participation conditions, durability and continuity of participation, and discourse quality. Each component contains several indicators (Table 3). According to the content analysis results, the distribution of indicators across the dimensions shows that the actors dimension, with 18 indicators, accounts for the largest share, while the rules of the game dimension, with 6 indicators, has the smallest number.

Table 3. Dimensions, components, and indicators affecting citizen participation in productive urban green spaces prior to screening.

Dimensions	Components	Indicators	Reference(s)	Dimensions	Components	Indicators	Reference(s)
Resources	Land and water resources	Physical access	Beckley et al., 2006; Bendt et al., 2013; Delshammar, 2005; Chung et al, 2005; Mazereeuw, 2005	Actors	Participatory authorities	Integration	Mendes et al., 2008
						Interactivity	Buijs et al., 2016; Beckley et al., 2006; Anuar & Saruwono, 2018
		Spatial allocation	Mazereeuw, 2005; Sharqi et al, 2016			Internal cooperation	Buijs et al., 2016

					Other park users	Awareness raising	Delshammar, 2005
		Spatial quality	Bharati,2016; Rosol, 2006				
		Privacy	Amini & Nouroozianpour, 2016				
		Security	Fors, 2018				
	Knowledge and skill resources	Educational materials	Van der Jagt et al., 2016; Wirtz, 2019; Fors et al., 2021; McVey et al, 2018			External cooperation	de Magalhães & Carmona, 2009
					Organisation and leadership	Structuring	Zouwen, & Arts, 2019
						Network formation	Leroy & Van Tatenhove, 2000; Young, 2011
		Expert knowledge	Van der Jagt et al., 2016, Mattijssen et al., 2017; Wirtz, 2019	Rules of the game	Formal laws and guidelines	Formal laws	Shan,2012; Buizer et al., 2015; Sheppard et al., 2017; Mattijssen ,2018
		Educational spaces	Van der Jagt et al., 2016; Wirtz, 2019; Dimond, 2011; Bucklin-Sporer & Pringle, 2010; Tóth & Supuka, 2013			Policy-making	Mattijssen ,2018; Wirtz, 2012
					Informal rules	Cultural norms	Tiraieyari & Krauss, 2018
						Deviation from the law	Beckley et al., 2006; Buijs et al., 2016
		Empowerment programme	Van der Jagt et al., 2016; Wirtz, 2019; Sheppard et al., 2017		Programmes and agreements	Programme timing	Collins Adjei et al., 2017; Ambrose-Oji et al., 2011;
	Products	Time to harvest	Fors et al., 2019, X Wang, 2016;			Programme levels	Collins Adjei et al., 2017; Ambrose-Oji et al., 2011
		Production costs	Fors et al., 2019; X Wang, 2016	Participation discourse	Participation conditions	Nature of participation	Fors et al., 2021
						Clear participation objectives	Grunewald, 2018
Ators	Participants	Demographic effects	Beckley et al., 2006; Ambrose-Oji et al., 2011; Gamhewage, M. I et al, 2015			Social aspect of participation	Rosol, 2012; Collins Adjei et al, 2017
						Participation level	Ambrose-Oji et al., 2011; Collins Adjei et al., 2017
		Group presence	Fors et al., 2021				

		Physical capacity	Delshammar, 2005			Mix of participation tools	Sheppard et al., 2017; Beckley et al., 2006; Buijs et al., 2016
		Skill capacity	Van der Jagt et al., 2016				
		Adaptability	Van der Jagt et al., 2016; Mattijssen et al., 2017			Participation process	Fors et al., 2021; Ambrose-Oji et al., 2011
		Willingness and interest	Shan,2012; Huang et al., 2021		Durability and continuity of participation	Project-based continuity	Fors et al., 2021
		Values and beliefs	Singh, 1992			Programme-based continuity	Mattijssen ,2018
		Attachment and belonging	Philips, 2013			Mixed approaches	Fors et al., 2021
	Participatory authorities	Management style	Fors et al., 2021		Discourse quality	Diversity of discussions	Hajer, 1995; Zeunert, 2018
		Perception of impact	Buizer, et al., 2015, Fors et al., 2015			Depth of discussions	Beckley et al., 2006
		Community support	Mattijssen et al., 2017; Fors et al., 2015			Impact of discussions	Van der Jagt et al., 2016; Reed et al., 2009; Beckley et al., 2006

Given the relatively high number of extracted indicators and in order to achieve scientific consensus and enhance the applicability of the results, the fuzzy Delphi method was used in the next stage for screening and prioritisation. In this stage, the opinions of 26 experts were collected. Using fuzzy Delphi made it possible to manage the uncertainty and ambiguity in expert judgements and to evaluate indicators based on fuzzy mathematical logic.

The results of the fuzzy Delphi calculations indicated that out of the 47 initial indicators, 38 were confirmed and 9 were not confirmed. According to Appendix Table 1, the unconfirmed indicators included: privacy (resources dimension); demographic effects, group presence, physical capacity, skill capacity, and values and beliefs (actors dimension); deviation from the law (rules of the game dimension); and depth of discussions and impact of discussions (participation discourse dimension).

The calculation of the crisp means of dimensions and components (according to Appendix Table 2 and Table 5) showed that the resources dimension had the highest priority, followed in order by the rules of the game, actors, and participation discourse dimensions. Furthermore, based on expert consensus, the priority of components within each dimension is as follows: In the resources dimension: land and water resources, products, and knowledge and skill resources; in the actors dimension: organisation and leadership, participants, participatory authorities, and other park users; in the rules of the game dimension: formal laws and guidelines, programmes and agreements, and informal rules; and in the participation discourse dimension: participation conditions, durability and continuity of participation, and discourse quality. According to the overall prioritisation of all indicators (Appendix Table 1), the top ten indicators—physical access, space allocation, programme continuity, security, policy-making, attachment and belonging, clear participation objectives, participation level, willingness and interest, and spatial quality—received the highest scores, respectively. It should be noted that the prioritisation of

research indicators is based on fuzzy values and mathematical ranking; in some cases, the values are very close to one another, so a lower ranking does not imply perceptible unimportance.

Finally, to assess the reliability of the fuzzy Delphi results, the non-parametric Friedman test was employed. The results of this test (Table 4) showed a significance value of less than 0.05; therefore, at the 95% confidence level, the null hypothesis—that the ranks of the indicators are equal—is rejected, and there is a significant difference between at least two groups of indicators. A comparison of the fuzzy Delphi results and the non-parametric Friedman test indicates approximately 90% overlap in the unconfirmed indicators and the ten highest-priority indicators, demonstrating acceptable reliability and validity of the research findings.

Table 4. Analysis of variance using the Non-Parametric Friedman test

N	Kendall's W	df	Chi-Square(χ^2)	Asymp. Sig. (p-value)
26	0.116	46	139.106	0.000
.a. The significance level is .050				
Result: (Rejection of the null hypothesis) There is a significant difference between the responses to the indicators, and the ranking of the indicators by the experts is not identical.				

6 .Discussion

The findings of this research indicate that citizen participation in urban agriculture within public green spaces is influenced by multiple factors. It is not a one-dimensional phenomenon based solely on individual or social motivations. Instead, it is an institutional, networked, multi-level process that takes shape through the simultaneous interaction of resources, actors, rules of the game, and discourse. This result aligns with contemporary perspectives in urban governance and green space management, which view participation not merely as an implementation tool but as an integral part of urban governance structures (Arjen E Buijs et al., 2016; Buizer et al., 2015; Mattijssen, 2018; Van der Jagt et al., 2016).

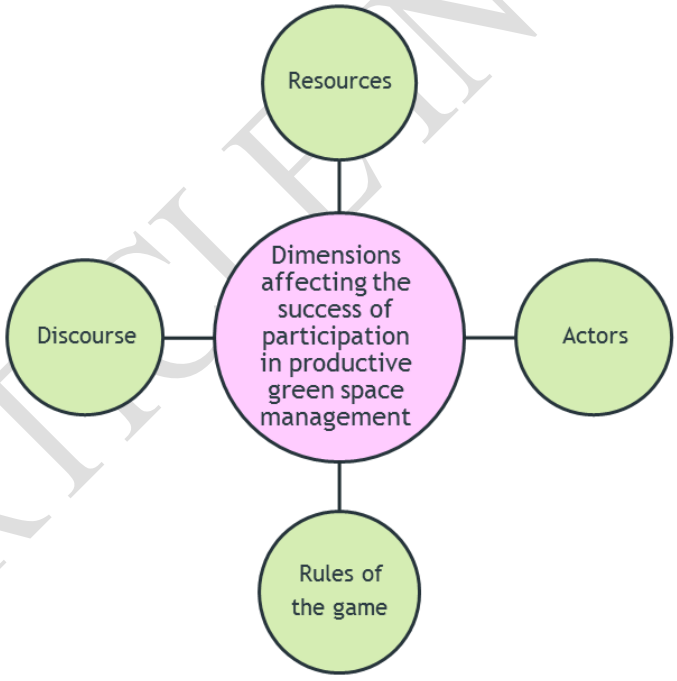

Figure 2: Four effective dimensions on public participation in the management of productive public green spaces

According to the findings, citizen participation in urban agriculture within public green spaces is influenced by 13 components and 38 confirmed indicators, all situated within the four institutional dimensions of resources, actors, rules of the game, and participation discourse (Figure 2 and Table 5). Among these, the resources dimension is mainly physical-spatial and educational in nature, whereas the other dimensions lie mostly in the realm of the social, institutional, and discursive environment. This distinction suggests that successful participation requires the simultaneous presence of physical infrastructures and institutional-social mechanisms.

The actors dimension had the highest number of indicators, while the rules of the game dimension had the lowest. This distribution reflects the extensive emphasis in the research literature on the role of actors and

institutional relationships in shaping participation. At the same time, it may indicate a lack of theoretical consensus regarding the legal and institutional frameworks for participation in urban agriculture within public urban green spaces—an issue also highlighted in comparative studies (Arjen E Buijs et al., 2016; Mattijssen et al., 2017). Figure 3 illustrates the dimensions and components affecting citizen participation in urban agriculture within public green spaces.

Table 5. Ranking of the dimensions affecting the research topic by the expert panel

Dimention	Resources	Rules of the Game	Actors	Discourse
Crisp Score (Defuzzify)	0.74	0.70	0.69	0.68

The predominance of the resources dimension among the four dimensions indicates that citizen participation in urban agriculture, above all, requires the provision of physical, spatial, and knowledge-based infrastructures. Within the PAA framework, resources are considered the enabling foundation for the other dimensions and play a decisive role in the feasibility of participation (Arts & Leroy, 2006; Van der Jagt et al., 2016). The prioritisation of the components "land and water resources" and "products" within the resources dimension (Table 6) also demonstrates that, in the resource dimension, citizen participation hinges primarily on sustainable access to the physical means of production and its tangible output. Furthermore, the findings showed that indicators such as space allocation, easy physical access, spatial quality, and security received the highest priority within the resources dimension. This aligns with recent research showing that sustainable access to land, water, and supportive infrastructure is a precondition for the continuity of urban agriculture activities in public spaces (Lovell, 2010:2511; Opitz et al., 2016; Russo & Cirella, 2018), and that their absence constitutes one of the most important barriers to effective participation (Dubbeling et al., 2009; Pourjavid et al., 2013; Van der Jagt et al., 2016). The high priority of these indicators confirms that, even when social motivations are present, the lack of an appropriate physical context can limit or halt participation. In this regard, the non-confirmation of the "privacy" indicator suggests that participation in public green spaces is primarily understood as a collective, public action rather than an individual-centred activity with an exclusive territory. This is consistent with studies that introduce public green spaces and community gardens as common urban assets—spaces whose functioning is based on shared use, social interaction, and collective learning (Dennis & James, 2016; Ghose & Pettygrove, 2014; Rosol, 2010).

Table 6. Ranking of the components of the four research dimensions by the expert panel

Dimention	Components				
Resources	_	Knowledge and Skill Resources		Products	Land and Water Resources
_	Crisp Score	0.70		0.73	0.78
Rules of Game	_	Informal Rules		Programmes and Agreements	Formal Laws and Guidelines
_	Crisp Score	0.68		0.69	0.74
Actors	_	Other Park Users	Participatory Authorities	Participants	Organisation and Leadership
_	Crisp Score	0.66	0.68	0.70	0.71
Discourse	_	Discourse quality		Durability and Continuity of Participation	Participation conditions
_	Crisp Score	0.64		0.69	0.70

The rules of the game dimension was ranked second, indicating that after the provision of resources, institutional and legal frameworks play a key role in stabilising and legitimising participation. Within this dimension, the higher priority of formal laws and policy-making compared with informal rules demonstrates that sustainable participation requires transparent and legitimate institutional frameworks. This result aligns with recent studies on participatory governance, which emphasise that clear policies, explicit legal frameworks, institutional support, and the alignment of programmes with formal urban management policies play a decisive role in the legitimation and continuity of citizen participation (Mattijssen et al., 2017; Newig et al., 2018). Formal laws act as institutional guarantors of participation and, by reducing ambiguity, strengthen mutual trust between citizens and executive bodies. International literature indicates that participation lacking institutional and legal support often weakens over time or leads to conflicts with formal institutions (Hodgson et al., 2011). The non-

confirmation of the "deviation from the law" indicator also reflects the experts' preference for lawful and institutionalised participation—an issue that carries double importance in the context of Iranian urban governance.

The actors' dimension was ranked third, which may indicate that the role of actors, although essential, is subordinate to access to resources and institutional frameworks. Previous studies that emphasise the role of actors in green space participation are consistent with the present research. For example, Mattijssen (2018) cites support from local authorities—through adopting sustainable policies and agreeing to long-term contracts—as a factor affecting the continuity of participation. Delshammar (2005) considers the acquisition of new competencies and capabilities by the staff of participating organisations necessary for strengthening participation in green spaces. Additionally, Collins Adjei et al. (2017) stressed the role of leadership by authorities in encouraging community-based programme actions to increase participation. The priority of the organisation and leadership component within this dimension underscores the importance of intermediary actors, local leaders, or mediating agents in coordinating interests and expectations and in reducing conflicts among participants, participatory authorities, and other users—an issue widely stressed in the literature on participatory governance and public green spaces (Fors et al., 2015; Rosol, 2010). Although this dimension contains the largest number of indicators, the results indicate that citizens' individual characteristics—such as physical capacity, demographic effects, and even some values and beliefs—are less important than organisational mechanisms, networking, and institutional leadership. This finding emphasises the networked nature of participation and suggests that the role of facilitating institutions, local organisations, and coordination mechanisms among actors is more decisive than individual characteristics in strengthening participation and enhancing social resilience (Dam, 2016; Fors et al., 2018; Soma et al., 2016).

The placement of the participation discourse dimension in fourth place does not mean it is unimportant. Rather, it indicates that, from the experts' perspective, discourse will be effective only when it is built on a foundation of resources, rules, and active actors. The prioritisation of the components "participation conditions" and "durability and continuity of participation" within this dimension (Table 6) shows that the quality of participation discourse depends less on the diversity or depth of discussions and more on its capacity to create long-term commitment and continuity of collective action—a result consistent with critical perspectives on tokenistic and short-term participation in urban governance (Frantzeskaki & Kabisch, 2016; Fung, 2015). Moreover, within this dimension, the priority of indicators such as clear participation objectives, participation level, and project- and programme-based continuity over the depth, diversity, and impact of discussions indicates that effective participation depends more on practical, tangible outcomes than on purely theoretical discourse. This result aligns with contemporary participatory approaches that view participation as a pragmatic, output-oriented process (Fung, 2006). In the context of urban agriculture, studies have shown that projects with clear objectives, a defined participation structure, and executive continuity enjoy more sustainable and effective participation (Kingsley et al., 2019).

The nine unconfirmed indicators—privacy, demographic effects, group presence, physical capacity, skill capacity, values and beliefs, deviation from the law, depth of discussions, and impact of discussions—across the

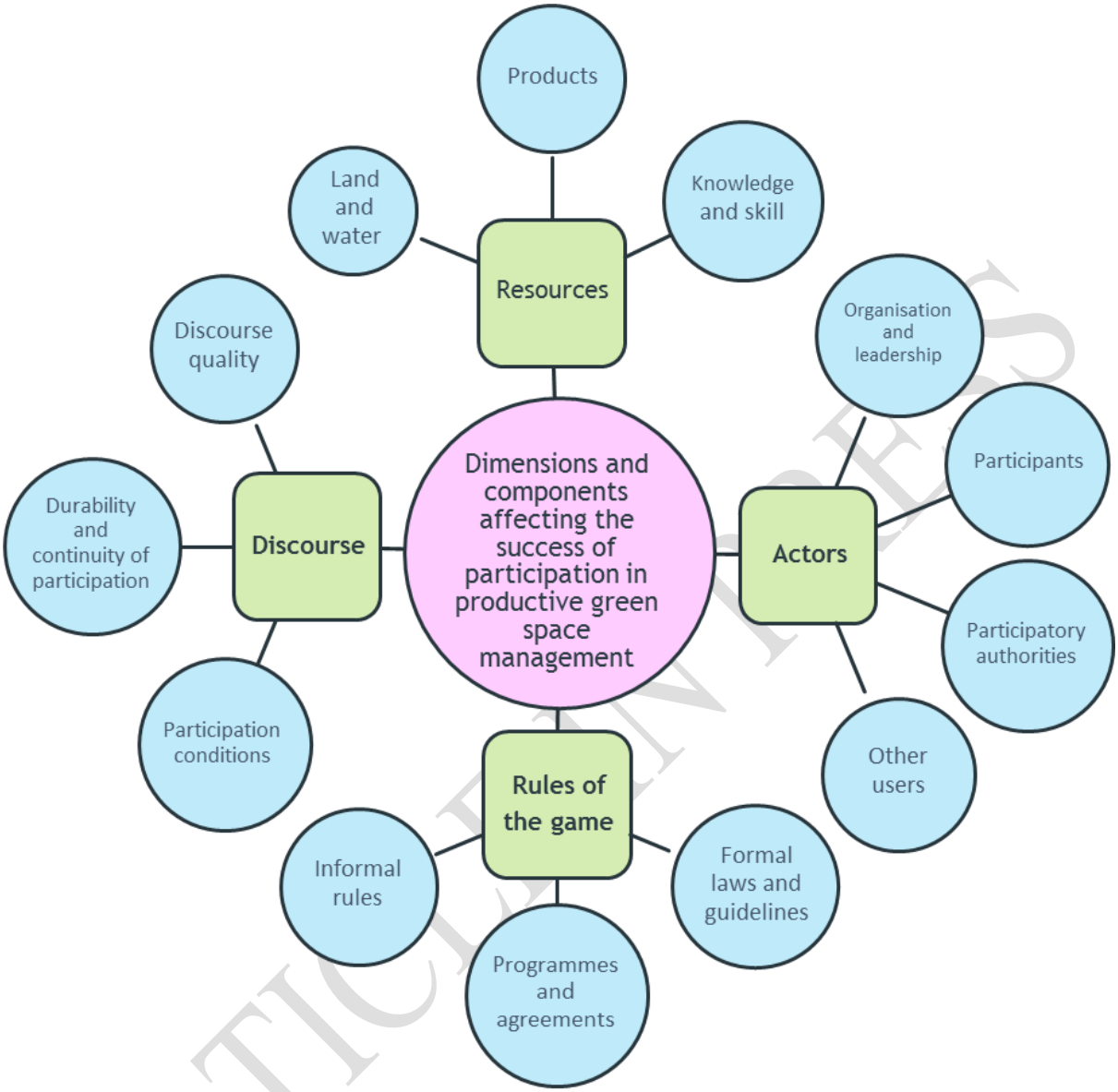

Figure 3: Dimensions and components affecting public participation in the management of productive public green space

various dimensions reflect the experts' preference for institutional and structural components of participation over individual factors. This result is consistent with findings from participatory governance studies (Fung, 2015).

The prioritisation of the top ten indicators—namely, physical access, space allocation, programme-based continuity, security, policy-making, attachment and belonging, clear participation objectives, participation level, willingness and interest, and spatial quality—also shows that citizen participation in urban agriculture depends, above all, on the provision of physical contexts, institutional stability, and clarity of objectives, an issue emphasised in research on public green spaces and urban agriculture (Dennis & James, 2016; Lovell, 2010; Russo & Cirella, 2018).

In summary, the findings indicate that citizen participation in urban agriculture within public green spaces can only be realised through the alignment and effective interaction of the four institutional dimensions: resources, transparent legal frameworks, a networked organisation of actors, and an output-oriented participatory discourse. The absence of any of these dimensions can weaken the effectiveness of the others. For example, access to resources without institutional support or a trust-building discourse, or the creation of a participatory discourse without legal structuring, will not guarantee sustainable participation. A study by Khalilnezhad and Golchin (2021) on participation in urban agriculture-based green space projects at the University of Sistan and Baluchestan

focused on participants, resource conditions, physical context, and spatial quality. The study concluded that, despite the provision of resources, the voluntary capacity for participation was insufficient; the researchers therefore suggested using professional labour, which would make the project model non-participatory, or promoting a participation discourse among students to increase the number of participants (Khalilnezhad & Golchin, 2021). This implies that resources, actors, and discourse must be considered simultaneously. Furthermore, in a study by HosseiniMofrad et al. (2022) on the participatory behaviour of people in District 22 of Tehran, the researchers concluded that individuals' participatory behaviour is mainly influenced by citizens' perceived behavioural control, which consists of three sub-components: self-efficacy, facilitating conditions, and access to resources. They therefore recommended that the municipality provide resources, consider legal conditions and coordination among different organs and people's representatives, and pursue cultural development and education (HosseiniMofrad et al., 2022). This implies simultaneous attention to the dimensions of resources, rules of the game, actors, and discourse. This demonstrates the explanatory capacity and generalisability of the conceptual model based on the Policy Arrangements Approach in analysing citizen participation in urban agriculture across different urban contexts, taking into account institutional and cultural differences.

7 .Conclusion

The present study set out to explain citizen participation in urban agriculture within public green spaces. Using the Policy Arrangements Approach (PAA) and integrating qualitative and quantitative methods (content analysis and fuzzy Delphi), it arrived at a comprehensive framework comprising 38 confirmed indicators, 13 components, and four institutional dimensions: resources, actors, rules of the game, and discourse. The main finding is that participation in this domain is a multi-dimensional and structured process, not merely an individual voluntary action.

The findings revealed that the resources dimension has the highest priority. Indicators such as physical access, space allocation, security, and spatial quality are of the greatest importance. The non-confirmation of the privacy indicator confirms the inherently social nature of participation in public spaces. The rules of the game dimension ranked second in importance. Formal laws and transparent policy-making take priority over informal rules, and the non-confirmation of the deviation from the law indicator reflects a preference for lawful and institutionalised participation. The largest number of indicators were found in the actors dimension, but individual characteristics (such as physical capacity, values and beliefs, and demographic effects) do not play a decisive role. Instead, institutional organisation and leadership, networking, and coordination among actors are the main priorities. The discourse dimension ranked fourth, but this does not signify its unimportance; rather, it indicates that discourse becomes effective only when formed on a foundation of resources, rules, and active actors. Priority is given to clear participation objectives, programme-based continuity, and participation level, rather than merely the depth or diversity of theoretical discussions. Based on the results and the analytical framework of the study, the following policy recommendations are offered for urban managers, planners, and institutions responsible for urban agriculture and public green spaces.

a) Policy Recommendations for the Resources Dimension

• Systematically integrate urban agriculture into public green space development plans and programmes, and make provision for multi-functional land uses in urban planning documents.

• Allocate space, land, and basic resources (water, soil, equipment) for participatory urban agriculture projects in a formal, transparent, and sustainable manner.

• Develop educational, extension, and continuous capacity-building programmes for citizens, with an emphasis on practical and participatory learning.

• Provide financial and technical support for pilot urban agriculture projects to reduce participation risks and enhance the transferability of policies.

b) Policy Recommendations for the Rules of the Game Dimension

• Formulate and approve specific regulations and guidelines for the implementation of urban agriculture in public green spaces, clearly defining rights and responsibilities. The communication of the "Guide to Urban Agriculture in Parks and Equipped Urban Spaces" by the Supreme Council of Urban Planning and Architecture of Iran represents an effort in this direction.

• Establish supportive legal frameworks for citizen participation and resolve ambiguities related to ownership, utilisation, and space management.

• Align urban agriculture policies with upstream documents in the fields of environment, green space, and sustainable urban development.

• Design urban agriculture programmes as long-term, phased, and evaluable initiatives, given the greater importance of programme-based continuity over ad-hoc project implementation.

• Combine project-based and programme-based approaches to contribute to the sustainability of participation.

c) Policy Recommendations for the Actors Dimension

• Strengthen the role of intermediary and facilitating institutions in organising, coordinating, and guiding the citizen participation process.

• Design transparent mechanisms for distributing roles and responsibilities among citizens, executive bodies, and the private sector.

• Support networking among local actors to exchange experiences, promote collective learning, and enhance social capital.

d) Policy Recommendations for the Participation Discourse Dimension

• Promote a participation discourse based on effectiveness, tangible outcomes, and the shared socio-economic environmental benefits of urban agriculture.

• Clarify the objectives, expectations, and outcomes of participation to increase public trust and citizen motivation.

• Utilise communication, media, and educational tools to reinforce positive narratives surrounding urban agriculture and citizen participation.

Ultimately, urban agriculture in public green spaces can serve as an effective instrument for enhancing participatory urban governance and achieving sustainable urban development goals, provided that policies follow an institutional, integrated, and evidence-based approach. The indicators and framework presented in this study can be used as a practical guide for policymakers, planners, and urban green space managers in designing and implementing sustainable participatory programmes.

7.1 Limitations of the Study

The authors acknowledge that every study faces limitations, and stating them can help in better understanding the results. This study also encountered limitations, including: the non-response of more than half of the initially selected experts (30 out of the initial 56) to the research questionnaire, especially those who received the questionnaire via email (who belonged to the academic expert group); the exclusive use of expert panel opinions without direct participation of ordinary citizens in the fuzzy Delphi process, meaning that citizens' views were not incorporated in this study. Furthermore, this research focused on identifying and ranking indicators based on predominantly international previous studies and a domestic expert panel; due to research constraints, international experts were not consulted.

7.2 Suggestions for Future Research

The findings and limitations of this research open several avenues for future investigation. First, it is recommended that, based on the institutional framework and confirmed indicators of this study, a quantitative measurement tool for citizen participation in this context be developed and validated using methods such as confirmatory factor analysis and structural equation modelling. Such a tool would enable a systematic assessment of the level and quality of participation in urban agriculture projects. Second, given the place-based on the nature of participation, testing the proposed model in different cultural and institutional contexts—such as cities of varying population sizes, for example, Tehran, Isfahan, and Kashan—would help examine its generalisability. Third, conducting longitudinal studies to analyse the dynamics of interaction among the institutional dimensions of resources, actors, rules, and discourse over time would provide a deeper understanding of the formation and continuity of participation. Furthermore, comparative studies of policies in Iranian cities (e.g., Tehran) with European city cases—especially leading cities in the international Edible Cities Network such as Berlin, Rotterdam, and Oslo—focusing on participatory-building institutions, could identify successful models of participatory governance in urban agriculture within their contexts. Additionally, in the present study, the expert panel consisted of domestic academics and practising professionals; forming expert panels from international experts in future research may yield results with greater generalisability. Finally, investigating the role of discourses and the social and environmental consequences of participation could strengthen the link between institutional participation and sustainable urban development goals.

Author Contributions

All authors contributed to the writing of this research.

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Declaration of Competing Interest

The authors declare that there is no conflict of interest regarding the conduct of this research.

Appendices

Appendix Table 1. Comparison of indicator prioritisation results using the Fuzzy Delphi method and the non-parametric Friedman test

Fuzzy Delphi calculation and prioritisation results					Non-Parametric Friedman test prioritisation results		
Item No.	Indicator	Crisp Score (Defuzzify)	Decision		Item No.	Indicator	Mean Rank
Q2	Physical access	0.83	Accepted		Q2	Physical access	33.15
Q1	Spatial allocation	0.79	Accepted		Q5	Security	31.69
Q43	Programme-based continuity	0.78	Accepted		Q1	Space allocation	30.13
Q5	Security	0.77	Accepted		Q43	Project-based continuity	29.23
Q31	Policy-making	0.76	Accepted		Q39	Participation level	28.44
Q19	Attachment and belonging	0.75	Accepted		Q37	Clear participation objectives	28.4
Q37	Clear participation objectives	0.75	Accepted		Q31	Policy-making	28.29
Q39	Participation level	0.75	Accepted		Q19	Attachment and belonging	27.85
Q17	Willingness and interest	0.74	Accepted		Q11	Production costs	27.38
Q3	Spatial quality	0.74	Accepted		Q17	Willingness and interest	26.85
Q11	Production costs	0.74	Accepted		Q30	Formal laws	26.85
Q22	Community support	0.73	Accepted		Q28	Structuring	26.79
Q24	Interactivity	0.73	Accepted		Q24	Interactivity	26.56
Q30	Formal laws	0.72	Accepted		Q22	Community support	26.52
Q8	Educational spaces	0.72	Accepted		Q3	Spatial quality	26.44
Q10	Time to harvest	0.71	Accepted		Q10	Time to harvest	26.31
Q7	Expert knowledge	0.71	Accepted		Q35	Programme levels	26.02
Q29	Network formation	0.71	Accepted		Q8	Educational spaces	25.75
Q9	Empowerment programme	0.71	Accepted		Q26	Awareness raising	25.44
Q36	Nature of participation	0.7	Accepted		Q34	Programme timing	25.42
Q28	Structuring	0.7	Accepted		Q7	Expert knowledge	25.38
Q26	Awareness raising	0.7	Accepted		Q36	Nature of participation	25.19
Q35	Programme levels	0.7	Accepted		Q41	Participation process	25.15
Q21	Perception of impact	0.7	Accepted		Q38	Social aspect of participation	25.13
Q38	Social aspect of participation	0.69	Accepted		Q9	Empowerment programme	25.06
Q34	Programme timing	0.69	Accepted		Q21	Perception of impact	24.4

Q32	Cultural norms	0.68	Accepted	Q29	Network formation	24.02
Q41	Participation process	0.67	Accepted	Q32	Cultural norms	23.71
Q6	Educational materials	0.67	Accepted	Q25	Internal cooperation	23.29
Q20	Management style	0.65	Accepted	Q44	Mixed approaches	23.21
Q42	Project-based continuity	0.65	Accepted	Q42	Project-based continuity	22.83
Q25	Internal cooperation	0.65	Accepted	Q6	Educational materials	22.38
Q44	Mixed approaches	0.64	Accepted	Q45	Diversity of discussions	21.81
Q40	Mix of participation tools	0.64	Accepted	Q14	Physical capacity	21.75
Q45	Diversity of discussions	0.64	Accepted	Q20	Management style	21.56
Q27	External cooperation	0.63	Accepted	Q40	Mix of participation tools	21.46
Q23	Integration	0.61	Accepted	Q27	External cooperation	20.48
Q16	Adaptability	0.601	Accepted	Q16	Adaptability	19.71
Q14	Physical capacity	0.596	Rejected	Q46	Depth of discussions	19.52
Q13	Group presence	0.59	Rejected	Q23	Integration	18.94
Q47	Impact of discussions	0.56	Rejected	Q13	Group presence	18.81
Q46	Depth of discussions	0.56	Rejected	Q15	Skill capacity	18.75
Q18	Values and beliefs	0.55	Rejected	Q18	Values and beliefs	17.75
Q15	Skill capacity	0.55	Rejected	Q47	Impact of discussions	17.08
Q33	Deviation from the law	0.55	Rejected	Q33	Deviation from the law	16.23
Q12	Demographic effects	0.54	Rejected	Q4	Privacy	15.5
Q4	Privacy	0.51	Rejected	Q12	Demographic effects	15.42

Appendix Table 2. Calculation of the fuzzy mean for the dimensions and components encompassing the research indicators

Dimensions	Components	Item No.	Indicator	Combined opinion in Fuzzy terms (L, M,U)			Crisp value	Decision	Fuzzy mean of the component			Crisp value of the component	Crisp value of the dimension
Resources	Land and water resources	Q1	Space allocation	0.57	0.82	0.96	0.79	Accepted	0.56	0.81	0.95	0.78	0.74
		Q2	Physical access	0.62	0.87	0.99	0.83	Accepted					
		Q3	Spatial quality	0.51	0.76	0.92	0.74	Accepted					
		Q4	Privacy	0.28	0.51	0.75	0.51	Rejected					
		Q5	Security	0.56	0.8	0.94	0.77	Accepted					
		Q6	Educational materials	0.44	0.68	0.88	0.67	Accepted	0.48	0.72	0.89	0.7	
		Q7	Expert knowledge	0.48	0.73	0.9	0.71	Accepted					

	Knowledge and skill resources	Q8	Educational spaces	0.5	0.74	0.89	0.72	Accepted					
		Q9	Empowerment programme	0.48	0.73	0.89	0.71	Accepted					
	Products	Q10	Time to harvest	0.49	0.73	0.9	0.71	Accepted	0.5	0.75	0.91	0.73	
		Q11	Production costs	0.52	0.76	0.91	0.74	Accepted					
Actors	Participants	Q12	Demographic effects	0.31	0.54	0.78	0.54	Rejected	0.47	0.71	0.9	0.7	0.69
		Q13	Group presence	0.36	0.6	0.82	0.59	Rejected					
		Q14	Physical capacity	0.38	0.61	0.8	0.596	Rejected					
		Q15	Skill capacity	0.34	0.55	0.77	0.55	Rejected					
		Q16	Adaptability	0.37	0.61	0.83	0.601	Accepted					
		Q17	Willingness and interest	0.51	0.76	0.94	0.74	Accepted					
		Q18	Values and beliefs	0.32	0.56	0.78	0.55	Rejected					
		Q19	Attachment and belonging	0.53	0.78	0.93	0.75	Accepted					
	Participatory authorities	Q20	Management style	0.42	0.66	0.87	0.65	Accepted	0.46	0.69	0.87	0.68	
		Q21	Perception of impact	0.47	0.71	0.89	0.7	Accepted					
		Q22	Community support	0.51	0.75	0.92	0.73	Accepted					
		Q23	Integration	0.39	0.62	0.82	0.61	Accepted					
		Q24	Interactivity	0.52	0.75	0.88	0.73	Accepted					
		Q25	Internal cooperation	0.42	0.66	0.85	0.65	Accepted					
	Other park users	Q26	Awareness raising	0.47	0.71	0.89	0.7	Accepted	0.43	0.67	0.87	0.66	
		Q27	External cooperation	0.39	0.63	0.85	0.63	Accepted					
	Organisation and leadership	Q28	Structuring	0.48	0.72	0.88	0.7	Accepted	0.48	0.72	0.91	0.71	
		Q29	Network formation	0.47	0.72	0.93	0.71	Accepted					
Rules of the game	Formal laws and guidelines	Q30	Formal laws	0.49	0.74	0.92	0.72	Accepted	0.51	0.76	0.94	0.74	0.7
		Q31	Policy-making	0.53	0.78	0.95	0.76	Accepted					
	Informal rules	Q32	Cultural norms	0.44	0.68	0.89	0.68	Accepted	0.44	0.68	0.89	0.68	
		Q33	Deviation from the law	0.33	0.55	0.78	0.55	Rejected					
	Programmes and agreements	Q34	Programme timing	0.47	0.7	0.89	0.69	Accepted	0.48	0.71	0.89	0.69	
		Q35	Programme levels	0.48	0.71	0.88	0.7	Accepted					
Participation discourse	Participation conditions	Q36	Nature of participation	0.47	0.71	0.92	0.7	Accepted	0.47	0.72	0.9	0.7	0.68
		Q37	Clear participation objectives	0.53	0.77	0.94	0.75	Accepted					
		Q38	Social aspect of participation	0.46	0.71	0.89	0.69	Accepted					
		Q39	Participation level	0.52	0.77	0.94	0.75	Accepted					
		Q40	Mix of participation tools	0.4	0.65	0.86	0.64	Accepted					
		Q41	Participation process	0.46	0.68	0.87	0.67	Accepted					
	Durability and continuity of participation	Q42	Project-based continuity	0.41	0.66	0.87	0.65	Accepted	0.46	0.71	0.9	0.69	
		Q43	Programme-based continuity	0.55	0.8	0.98	0.78	Accepted					
		Q44	Mixed approaches	0.41	0.65	0.86	0.64	Accepted					

	Discourse quality	Q45	Diversity of discussions	0.4	0.65	0.86	0.64	Accepted	0.4	0.65	0.86	0.64	
		Q46	Depth of discussions	0.36	0.56	0.76	0.56	Rejected					
		Q47	Impact of discussions	0.34	0.56	0.79	0.56	Rejected					

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