
Significance of the Participatory Budget in Supporting Green Infrastructure

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Abstract:

Purpose: The purpose of this study is to identify the importance of participatory budget (PB) projects for the development of green infrastructure (GI) in cities, using the example of the city of Szczecin. Projects of this type are submitted for implementation by residents and it is the residents (through voting) who decide which projects will be implemented. The selection of certain types of projects can support the development of green infrastructure in urban areas, contributing to the objectives of sustainable development.

Design/Methodology/Approach: The following research procedure was used: 1. Literature review 2. Collection of qualitative and quantitative data on the implementation of the participatory budget in Szczecin in 2021-2023 3. Selection of projects for the development and maintenance of green infrastructure 4. Quantitative analysis of the number and value of projects by area of benefits achieved with the development of green infrastructure 5. Formulation of conclusions. The method of document analysis (desk research), which belongs to qualitative research, was used at the various stages. The technique used was to analyse the documents' content, taking into account an inductive approach combined with deductive reasoning, as well as elements of synthesis occurring at the conclusion stage.

Findings: The analysis carried out shows that the number of GI-related projects submitted has doubled over the period under study, while costs have increased many times over. There has also been a steady increase in the number of GI-related projects selected for implementation by residents. Despite the fact that among the projects submitted for successive editions of the PB, they represent only about 10-13%, half of them are selected for implementation. The selection of GI-related projects contributes to the creation or maintenance/renovation of elements that can be part of the green infrastructure of an area. However, these are mostly point elements that can enhance the functions of green infrastructure, but do not form a network, which is a key determinant of green infrastructure.

Practical Implications: The results of the study can provide important material for local authorities responsible for conducting socio-economic policy. Careful analyses of the projects submitted and selected for implementation indicate the possibility of using PB in the process of shaping green infrastructure that will contribute to improving the quality of life of city residents.

Originality/Value: The issues of the design and operation of green infrastructure in urbanised areas are a relatively new research area and their combination with PB projects is rarely found in the literature. Conclusions indicate the possibility of using PB in the planning and management of green infrastructure in urbanised areas.

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1. Introduction

The increasingly onerous consequences of socio-economic development, affecting virtually all aspects of the functioning of socio-economic systems in their environmental setting, have given rise to an in-depth look at sustainable development issues. Although it has been present in documents and practice for almost half a century, the solutions proposed and introduced do not have the desired effect on a global scale, allowing sometimes for moderate successes on a regional or local scale.

More and more new proposals are emerging for actions and processes that can contribute to improving the relationship between humans and the environment, without whose support human activity and existence is still impossible.

Urbanised areas, where the majority of the world's population lives, including highly developed societies that expect a high standard of living, remain a special case. One of the expectations is a city offering quality of life in the largest possible 'size' XXQ (Broniewicz 2017), and among the factors determining the standard of living of the inhabitants, emphasis is placed on ecological resources clean environment, low noise levels, urban greenery, water resources, open space resources.

The idea of green infrastructure (now also associated with the water environment and then called blue-green infrastructure) focuses on creating a structure that combines natural and anthropogenic elements, ensuring that environmental elements are protected and improve their functions, while improving the quality of life for people. This is crucial in the case of urbanised areas, where the development of the grey infrastructure necessary for the functioning of the city and its inhabitants has been considered a priority over the years, resulting in the levelling of the contribution of natural elements.

Their importance for the proper functioning of ecological systems is indisputable and, in addition, they are one of the basic determinants of the quality of life of the inhabitants.

The concept of participatory budgeting, which emerged in Brazil in 1990, allows residents to participate in decisions regarding the spending of public funds. In addition, it is the residents who can make proposals for investments that they consider important for the functioning of their neighbourhood and, through subsequent discussion and voting, select the most socially desirable projects.

Their decisions show that, above all, the projects chosen are those that improve the quality of life (including safety), allow for the creation of places where various leisure activities can be carried out, and are often aimed at tidying up or adapting green areas for specific activities. In a not entirely conscious way, this allows for the creation of green infrastructure elements in urbanised areas. The aim of this study is to identify the importance of projects implemented as part of the participatory budget for the development of green infrastructure in cities, using the example of the city of Szczecin.

2. The Concept of Green Infrastructure - A Literature Review

Green infrastructure (GI) is a concept that has emerged with varying intensity in different contexts of the use of the natural environment for the functioning of socio-economic systems. In contemporary terms, the concept of green infrastructure emerged in the last decade of the twentieth century, but the precursors of the idea are often considered to be the theories of garden cities (Matsler *et al.*, 2021) linking the optimal functioning of socio-economic systems to the system of green spaces, or studies in nature conservation and human-nature interactions undertaken as early as in the second half of the nineteenth century.

It is assumed that the term 'green infrastructure' itself appeared in England at the end of the 19th century as an alternative to the phrase 'green belt' (Goździewicz-Biechońska, 2017), used in concepts of green belts around developing cities ((Benedict and McMahon, 2006). In the 1980s, the concept emerged that ecosystems should also be considered infrastructure (da Silva and Wheeler, 2017), and in the last decade of the 20th century the term 'green infrastructure' emerged in relation to networks of ecological corridors (Little, 1995; Benedict and McMahon, 2006).

In the 21st century, the term green infrastructure has come to be used increasingly in different contexts and meanings, and has replaced previously used terms such as green infrastructure, natural infrastructure, or green and blue infrastructure, among others (da Silva and Wheeler, 2017).

Today, there is no common coherent approach to the definition and conceptual scope of green infrastructure. The definition and conceptualisation of the concept are determined both by the scientific discipline on the basis of which the definition arises and the geographical area from which the researchers come. The scale of the issue in terms of research and implementation (from a single parcel of land to the supra-national level) and the variation in terms of the nature of land use to which it

can refer (urban, peri-urban, transitional, rural areas) are also of great importance (Baro *et al.*, 2016).

The diverse aspects of green infrastructure, both regarding its origins and contemporary conceptual and application expectations, are covered more extensively by Matsler and co-authors (Matsler *et al.*, 2021a), and Koc *et al.* (2017). A detailed overview of the publications on green infrastructure with an attempt to classify and categorise them (assigning them to specific research areas) is presented by Matsler, Meerow, Mell, and Pavao-Zuckerman (Matsler *et al.*, 2021).

Recent research recognises the conceptual vagueness of the term 'green infrastructure' and embraces the creeping nature of emerging definitions (Wang and Banzhaf, 2018). The ambiguity and multifunctionality of the term 'green infrastructure' makes it difficult to carve out a universal concept of it, which has been the goal of its advocates since the beginning of the 21st century (Benedict and McMahon, 2006).

However, the conceptualisation of green infrastructure in three distinct areas is still clearly noticeable: the concept of green space planning, the concept of urban ecology and the concept of water (rainwater) management.

A common part of the various green infrastructure concepts is the need to transform nature into infrastructure, involving many sustainability and resilience challenges. Transforming nature into infrastructure always requires the simultaneous transformation of socio-economic systems often requiring highly specialised knowledge (Beck *et al.*, 2021; Carse, 2012).

Treating ecosystems as infrastructure raises the profile of natural elements, which are then treated as interconnected parts of the spatial and functional structure of an area, as opposed to the traditional approach where they were treated as separate parks, woodlands or recreational and sports areas.

Defining natural elements as green infrastructure makes them an integral and necessary component of the continued existence and development of social systems. It gives green infrastructure characteristics immanent to infrastructure, such as basicity and indispensability for the proper functioning of the economy and society, systemicity, reciprocity of relations of its elements (Goździewicz-Biechońska, 2017).

Green infrastructure ceases to be an optional extra and becomes an equal element of the system, just like other, traditional types of infrastructure. Technical infrastructure (also referred to as grey infrastructure, which includes communication, energy and water and sewage networks) forms the basis for the functioning of socio-economic systems. It is complemented by social infrastructure, which ensures the provision of services necessary for the community: health, education, culture, administration, etc.

Since the end of the twentieth century, green infrastructure has been treated as an element that supports the optimal structuring of areas (especially urban areas) and aids harmonious development (Janiszek, 2015). Green infrastructure planning combines ecological and social perspectives, which is a more adequate and effective solution for complex urban systems that are multifunctional structures with a dynamic interaction of ecological, social and economic factors (Goździewicz-Biechońska, 2017).

At the beginning of the 21st century, green infrastructure was defined by Benedict and McMahon (2006), providing the basis for its understanding in the European Union area. The expanded EU definition defines green infrastructure as 'a strategically planned network of natural and semi-natural areas with other environmental features, designed and managed to provide a wide range of ecosystem services such as water purification, air quality, recreational space and climate change mitigation and adaptation' (John *et al.*, 2019).

The Natura 2000 network of sites is recognised as the cornerstone of green infrastructure in the European Union, and the benefits of its development are linked to the green economy, new jobs, maintenance of biodiversity and, consequently, improved environmental conditions and improved quality of life for residents.

3. Benefits of Developing Green Infrastructure in Urban Areas

In the first decade of the 21st century, the issue of green infrastructure was implemented in rapidly growing (spatially and population-wise) urbanised areas, as a 'strategically planned network of green spaces in cities for ecological purposes' (Little 1995; Benedict and McMahon 2006).

The multiple benefits associated with the creation of green infrastructure in cities derive directly from its key characteristics, namely connectivity at the structural and functional levels and multifunctionality (Goździewicz-Biechońska, 2017), which is an integral part of it regardless of the scale of consideration. Among the most relevant functions of green infrastructure that can generate positive effects are (Puzdrakiewicz, 2017):

- 1) Structural, including:
 - Ensuring continuity of the landscape and connectivity between its elements, e.g., through rows of trees or shrubs;
 - Counteracting suburbanisation, e.g., by providing residents with proximity to green areas or using a green zone around urbanised areas;
 - Improving the aesthetics of urban areas through varied and harmoniously fitting elements of the natural environment into the architecture;
 - Creating urban greenery systems.

2) Environmental, related to the creation of systems based on elements of the natural environment to support water and heat management in cities (e.g., green roofs), reducing pollution or noise (green areas).

3) Social, related to:

- A greater sense of order introduced by greenery into the urban space, having a positive impact on people's mental and physical health;
- Opportunities for passive and active recreation in green surroundings;
- Implementation of didactic, pedagogical and educational functions within green areas (parks, nature trails, botanical gardens, cemeteries);
- A cultural function, resulting from a variety of joint activities in green spaces, such as maintenance and joint decisions on the development of such spaces or the realisation of artistic projects in such areas.

4) Economic:

- Development of property values;
- Reducing losses due to natural disasters (regulation of the local climate, increasing retention, protection of natural elements);
- Supporting the operation of some grey infrastructure (storm sewers).

5) Productive, e.g., production of oxygen to the atmosphere or food (allotments).

6) Technical, e.g., noise and wind protection.

The multitude of benefits directly and indirectly linked to the development of green infrastructure in urban areas is resulting in the increasing presence of related issues in the strategic documents created by local authorities and the strategies implemented.

At the same time, the growing trend of involving local communities in the decision-making process concerning their immediate environment can amplify the positive effects of green infrastructure development, not only at the social level.

One of the possibilities to activate residents is the idea of participatory budgeting (PB), which has been considered for years in the world and Polish literature (in Poland, the term civic budget is used interchangeably). More extensively on the essence of participatory budgeting is written, among others, by (Wampler, 2007), (Ganuza and Frances, 2011), and in Poland by such researchers of this phenomenon as (Kocota, 2014; Wojciechowski, 2016; Mucha, 2018). Detailed rules for the construction of participatory budget in Poland can be found in Kębłowski's work.

The participatory budget, the idea of which emerged in 1990 in Porto Alegre (Brazil), is most often defined as 'a process during which the inhabitants of a

territorial unit directly decide or co-determine the allocation of all or part of the available public funds' (Kocot, 2014).

Similarly, participatory budgeting is defined by international institutions (World Bank) or foreign researchers of the phenomenon. Although the detailed rules for participatory budget change over time and vary locally, the basic principles remain similar.

4. Data and Methods

In order to achieve the objective of the study defined as the identification of the importance of the projects carried out as part of the PB for the development of green infrastructure in cities, on the example of the city of Szczecin, the desk research method, belonging to qualitative research, was used.

The technique used was that of analysing the content of projects, taking into account an inductive approach combined with deductive reasoning, as well as elements of synthesis occurring at the conclusion stage.

A set of qualitative and quantitative data on projects submitted, selected and implemented as part of the PB in Szczecin in the years 2021-2023 was analysed. In the next stage, a selection of projects aimed at developing and maintaining green infrastructure in Szczecin was made, followed by a quantitative and value analysis.

Szczecin is a city located in north-western Poland, on the River Oder, with a population of just under 400,000, a spatially extensive area (over 300 km²), a diverse natural environment and a high proportion of water and green areas (25% and 20%). The diversity of Szczecin's natural environment provides a good basis for creating a green infrastructure network.

The first edition of PB in Szczecin took place in 2013, and its formula evolved until 2016 when it took the recurrent form of voting for city-wide and district projects. Since 2014, electronic voting has been possible. The amount of PB has been gradually increasing, doubling from the first edition to 2019, and in 2023 it amounted to more than PLN 17.5 million. For several years, the PB amount represented 0.28% of the city's overall expenditure, from 2020 it is 0.5% of this amount (Table 1).

Table 1. *Participatory Budget in Szczecin*

Year	PB (PLN million)	Share in total expenditure %	Number of voters	Number of projects selected	Number of all projects
2023	17,5	0,5	28 348	23	153

2022	16,7	0,5	25 199	24	114
2021	14,6	0,5	28 689	29	113
2020	12,7	0,5	31 690	29	122
2019	9	0,28	21 600	13	110
2018	8	0,28	26 000	13	113
2017	7	0,28	34 000	13	122
2016	6	0,30	35 000	4	170
2015	5	0,22	48 000	9	143
2014	5	0,26	29 000	2	194

Source: Own elaboration based on <https://sbo.szczecin.eu>

5. Results

Between 2021 and 2023, 380 very diverse projects were put to a vote by residents as part of Szczecin's PB. They ranged from infrastructural solutions (cycle paths, public transport stops), to renovation, to cultural, sporting or educational solutions. The determination of whether a project fulfils the principles of creating and/or maintaining green infrastructure was based on a thorough analysis of the documentation submitted by the applicants.

All projects submitted for voting in the 2021, 2022 and 2023 Szczecin PB (a total of 380 projects) were examined. Based on the information contained in the project forms, such as the purpose, description, justification and estimated costs of the project, it was determined whether and to what extent the project contributes to the development of green infrastructure in Szczecin.

It was assumed that if half or more of the tasks and/or funding proposed in a project relate to green infrastructure, then it is qualified as a project developing green infrastructure in the city, if less, then as a partially supporting project. Projects that do not address green infrastructure elements to any extent were classified as not supporting green infrastructure development.

Of all the projects voted for in the Szczecin PB in 2021-2023, only 11.3% were related to GI development, but only 3.9% were partially supportive. However, there is a clear increase in both the number of submitted projects (from 10 to 21, i.e. double) and their costs (Table 2). The multiple increase in the cost of such projects in 2023 is due to the submission of 4 high-cost projects (over 5 million PLN), concerning the planting of trees in the city (*1,000 trees for Szczecin*) and the development of recreational and leisure infrastructure in extensive areas.

Of the projects selected by residents for implementation, those related to green infrastructure account for almost 28% (21 out of 76 total projects selected). Of these, half (11) are projects that partially support the development of green infrastructure.

As in the case of the projects put to the vote, a clear increase in the share of GI projects (from about 21% to about 40%) and their share of costs (from about 18% to about 28%) can also be seen in the case of projects selected for implementation. It seems significant that GI projects account for about half of the projects selected for implementation (42%, 50% and 60%) despite the fact that they represent about 10% of the projects voted.

This may indicate a preference for residents choosing projects that include green space development. However, projects in which elements of the natural environment are a part of larger infrastructure solutions, rather than projects that relate directly to green infrastructure development, such as *Green bus stops*, *1000 trees for Szczecin*, or *Let's take care of the water*, dominate.

Table 2. GI projects

Year	Number of GI projects selected (% of all projects selected)	Cost of selected GI projects in PLN (% of total PB)	Number of GI projects submitted (% of all projects)	Cost of GI projects submitted (PLN)
2023	9 (39,1%)	4 865 401 (27,8%)	21 (13,7%)	40 598 721
2022	6 (25%)	2 408 680 (14,4%)	12 (10,5%)	14 313 156
2021	6 (20,7%)	2 551 597 (17,4%)	10 (8,85%)	7 984 790

Source: Own elaboration based on <https://sbo.szczecin.eu>

6. Conclusions

The issue of the maintenance and development of green infrastructure, often in combination with blue infrastructure, is one of the key areas of socio-economic systems in the modern world. Particularly in urban areas, green infrastructure can perform many diverse functions, both on an environmental, social or economic level.

From the residents' point of view, its development and proper functioning have a significant impact on their quality of life in an urbanised area. This is particularly true of the health aspects and the shaping of areas for recreation and relaxation, as well as the aesthetics of the surroundings. The PB institution allows residents to decide how to spend a portion of city funds on projects they consider important.

In the case of Szczecin, for several years this has been 0.5 per cent of the municipal budget, which is distributed to selected projects. The analysis carried out to identify the importance of PB projects for the development of green infrastructure in cities (using the example of the city of Szczecin), allows us to conclude that the number of GI-related projects selected by residents is steadily increasing. Despite the fact that among the projects submitted to successive editions of the PB, they account for only about 10-13%, half of them are selected for implementation.

In the context of the essence of the term "green infrastructure" defined as "physically occurring elements in space that are networked and offer a range of ecosystem services" and at the same time "...a process of conscious planning and management of these elements" (Benedict and McMahon 2006), it can be concluded that the selection of projects submitted under the PB contributes to the creation or maintenance/renovation of elements that can form components of an area's green infrastructure.

However, these are mostly point elements that can enhance green infrastructure functions, but do not form a network, which is a key determinant of green infrastructure. This situation may change as a new category '*Green PB*' has been created in the new edition of PB 2024, allowing projects to be submitted in areas such as, for example: planting of vegetation in urban green areas, construction or transformation of recreational spaces, construction of pocket parks, rain gardens, renovation of existing green areas, or sustainable use of existing natural resources.

The aim of these projects must be to improve the condition and increase the area of green spaces in Szczecin and/or to mitigate the effects of climate change. Projects in the Green PB category will be allocated 30% of all PB funding in a given edition, which means PLN 5,160,000 in 2024. The introduction of such changes to the PB rules may indicate an attempt to plan green infrastructure in Szczecin also using the PB.

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