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Decision Support for Effective Urban Regeneration Projects: A Model Based on Community Interests – Project Costs Analysis

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Abstract. In the realm of public policy-making, identifying and prioritizing regeneration interventions represent a critical challenge for the development of effective strategies and actions. This requires a comprehensive approach to understanding of the interplay between physical spaces, their users, and social practices and to evaluate the convenience of different projects both in economic and social terms. Among the decision-support methods that policymakers have at their disposal there are the Participatory Cost-Benefit Analysis (PCBA) that can guide in planning and investment programs towards optimal choices. This paper presents a methodology to perform a novel PCBA, based on two criteria: (1) the declared interest of the local community in the use of a specific space and (2) the estimated economic costs of the intervention needed for using a space. An exploratory case study within the city of Cagliari (Italy) is presented to evaluate advantages and limitations in the proposed method. This study was undertaken using qualitative economic analysis and through a participatory process that involved local stakeholders as part of a large collaborative project lead by the University of Cagliari.

The results provide a clearer understanding of the trade-offs/synergies involved in urban regeneration and a possible explanation of long-term poor results, which is likely to occur when investments do not consider both spatial and social dimensions. In particular, the integrated approach based on community interests and project costs can produce a more cost-effective social effects and can have a greater influence on the economic value of the intervention, representing a potential predictor of choice, over alternative scenarios.

Keywords: multi-criteria decision making · collaborative/participatory approaches · cost-benefit analysis · urban regeneration · neighbourhood scale

1 Introduction

Urban regeneration is a complex and multifaceted field of research, public policy and practice that seeks to revitalize urban areas and stimulate social and economic growth, with the ultimate goal of improving the quality of life for residents. Achieving this goal requires an integrated, multi-dimensional, and multi-level approach that considers the interplay between social and spatial dimensions, and the unique characteristics of each locality that influence their effectiveness of a project.

The importance of context-specific interventions has been recognized by the European Union as crucial for maximizing impact and sustainability [1]. By adopting a nuanced approach that considers the specific needs and aspirations of local communities, urban regeneration projects can be more responsive and effective in achieving their intended outcomes. In this context, social characteristics such as community engagement, social cohesion, and access to services and amenities are crucial for addressing underlying social issues and promoting inclusive growth. At the same time, the physical environment, including infrastructure, transportation, and public spaces, plays a significant role in shaping the social environment and residents' capabilities [2–6]. By carefully assessing these aspects, decision-makers can make informed choices about which projects are most likely to succeed and generate the greatest impact for communities.

The interlinkages between space characteristics and their perceived value are crucial, as they can determine investment priorities and influence project success. For instance, an urban area with good access to public transportation is likely to be perceived as valuable by residents and potential users or investors. This perception of value can influence investment priorities and decision-making choices. However, if investment priorities are not aligned with the values and needs of the community, the project may fail to achieve its intended outcomes and even create unintended negative consequences.

To avoid this, well-structured methodologies have been studied to make informed choices about which projects are most likely to succeed and generate the greatest impact for communities. Decision support tools based on multi-criteria decision-making (MCDM) techniques have been used extensively in the assessment of urban regeneration to evaluate the most performing interventions [7–11]. Many of these, incorporate social visions, preferences, and feelings of the stakeholders involved to ensure that decisions are more inclusive and reflect the diverse needs and values of the community [12, 13].

Within the scope of these studies, the aim of this article is to present a novel MCDM tool that aims to assist planners and public policy makers in their selection and prioritization of urban interventions. This tool operates based on two critical criteria that aim to ensure optimal outcomes for the community. The first criterion considers the expressed interest of the community – social and cultural associations and groups – in utilizing a particular space, while the second criterion assesses the estimated economic costs linked to the interventions required for utilizing a space.

Through this approach, the tool serves as a crucial resource for decision-makers seeking to strike a balance between community interests (benefits) and project costs (public expenditure) and in their efforts to promote sustainable urban development.

To demonstrate the efficacy and potential uses of our evaluation framework for urban analysis and policy design, we present the outcomes of a case study conducted within the city of Cagliari (Italy). The findings of this study provide a convincing explanation for the suboptimal long-term outcomes that may result from investments that do not incorporate the proposed cost-benefit assessment. The proposed approach has the potential to generate more cost-effective social effects and exert greater influence on the economic value of the intervention, serving as a crucial predictor of choice when compared to alternative scenarios.

The novelty and significance of this paper can be traced to its contribution to the growing body of knowledge in the field of innovative digital tools for the management of

public buildings, open spaces, and community empowerment. Furthermore, the application of this framework in the case study provides a tangible demonstration of the utility and effectiveness of the proposed tool for policy design.

The paper is structured as follows: Sect. 2 provides an overview of the main MCDM tools utilized in urban regeneration, emphasizing the distinctiveness of our approach; Sect. 3 outlines the evaluation methodology and describes the protocol used for the community scoping and economic analysis of regeneration costs; Sect. 4 showcases a case study to illustrate the practical application of our approach; Sect. 5 analyzes the results; and finally, Sect. 6 presents concluding remarks, and outlines potential future perspectives.

2 Background and Previous Research

In the field of urban regeneration, the selection and prioritization of interventions poses a pivotal challenge for the formulation of effective policies and strategies. This involves optimizing economic resources while simultaneously improving social impacts, which requires a comprehensive evaluation of the spatial and physical characteristics of sites, as well as their current and potential uses [14]. Attention must be paid to not-for-profit cultural, social, and recreational activities managed by the community [15]. As highlighted by Voinov and Bousquet [13], in fact, the stakeholders' engagement is often only nominal in nature and this is one of the causes of projects' failure [16, 17].

Numerous studies have attempted to determine the optimal model for guiding and assisting stakeholders in making the best decisions, utilizing various criteria and procedures. Tasheva – Petrova [18] explores the feasibility of combining social dimensions and physical features to achieve sustainable management of open public spaces in large housing estates within the Nadezhda district of Sofia. The research utilizes qualitative and quantitative methods, spatial analysis, and participatory activities to examine the attitudes, perceptions, aspirations, and motivations towards public spaces from the perspective of pupils, citizens, and administration staff. By doing so, the study aims to enhance the community's engagement and commitment to public spaces.

A multitude of studies employ Cost-Benefit Analysis (CBA) to compare the social benefits against the costs of a particular investment. In recent years, in fact, several researchers have endeavored to address certain inherent limitations of the conventional CBA approach. For instance, challenges pertaining to the identification and quantification of intangible benefits, such as community-based values, have been highlighted [19, 20]. To tackle these limitations, a more effective approach is to combine economic evaluation with participatory evaluation, incorporating qualitative indicators based on the perceptions of citizens. This match is known as Participatory Cost-Benefit Analysis (PCBA), which leads to more informed and equitable decisions that better serve the interests of society at large. Among the first studies that focus on this topic, Sager [21] underlined the potential advantages of integrating cost-benefit analysis with participatory methods as a means of obtaining a more comprehensive understanding of transportation planning projects.

Drawing upon the insights of Campos et al. [22], PCBA can be described as a hybrid methodology that combines both quantitative and qualitative elements to enable

a more comprehensive appraisal of economic projects. This approach involves the use of diverse sources and methods, including interpersonal deliberation, to generate a deeper and broader understanding of the valuation and appraisal processes.

As an exemplar, García de Jalón et al. [20] implemented a PCBA to evaluate the economic benefits and costs associated with public initiatives that seek to facilitate citizen access to urban green spaces.

In order to understand the complex and ever-evolving dynamics of urban development, Haoyu [23] devised a game model, which takes into account the interplay of costs and benefits, as well as the actions and outcomes of various actors involved in the process. This model provides a useful framework for optimizing the integration and coordination of diverse interests in the development of urban spaces and can serve as a valuable resource for decision-making oriented towards ensuring inclusive and sustainable forms of urban planning and governance.

The proposed methodology offers a novel approach by placing emphasis on the impact of public expenditure for urban regeneration projects on potential community benefits. This is achieved through a dual analysis that integrates a comprehensive understanding of potential space utilization with the interception, evaluation, and normalization of community interests in these spaces.

The "projection" of interests from diverse individuals interviewed on different open spaces/buildings provides a means of prioritizing projects, serving as a valuable decision-support tool for local administrations in resource allocation. It is essential to evaluate the social impact of project costs to ensure that regeneration interventions have a positive effect on the community.

This approach also ensures that the community's voice is heard and considered in the decision-making process, promoting a sense of ownership and participation in the project. Ultimately, assessing the social impact of public expenditure for urban regeneration projects is critical in promoting sustainable and inclusive urban development that benefits all members of the community.

3 Methodology

To achieve this twofold goal – maximize the social impacts and minimize costs of interventions – the model combines two different methodologies:

1) *Interest – Social analysis:* qualitative research design accomplished through the community scoping step, a technique for participatory design and analysis employed to better understand local conditions and to describe community needs, perceptions, and interests in using different public spaces. This step includes semi-structured in-depth interviews with different social actors (formal and informal organizations and associations, key individuals) that provide detailed information and data to be implemented in the evaluation model.
2) *Cost – Space analysis:* documentation, observation, surveying and cataloging of all public spaces into four main categories – ecological sites, urban parks, little gardens, sport areas – according to their potential uses and unique characteristics. Furthermore,

the current state of each space, as the level of intervention required for their use – no interventions, little interventions, great interventions – is defined to estimate the costs.

The results of these two steps are combined to define a community interests – project costs analysis that reveals what are: (1) the dominant or priority interventions (high effective – low expensive); (2) the inferior intervention options (low effective – low expensive) and (3) the questionable interventions (low effective – low expensive/high effective – high expensive). The data are synthetized into a two-dimensional chart (see Fig. 1).

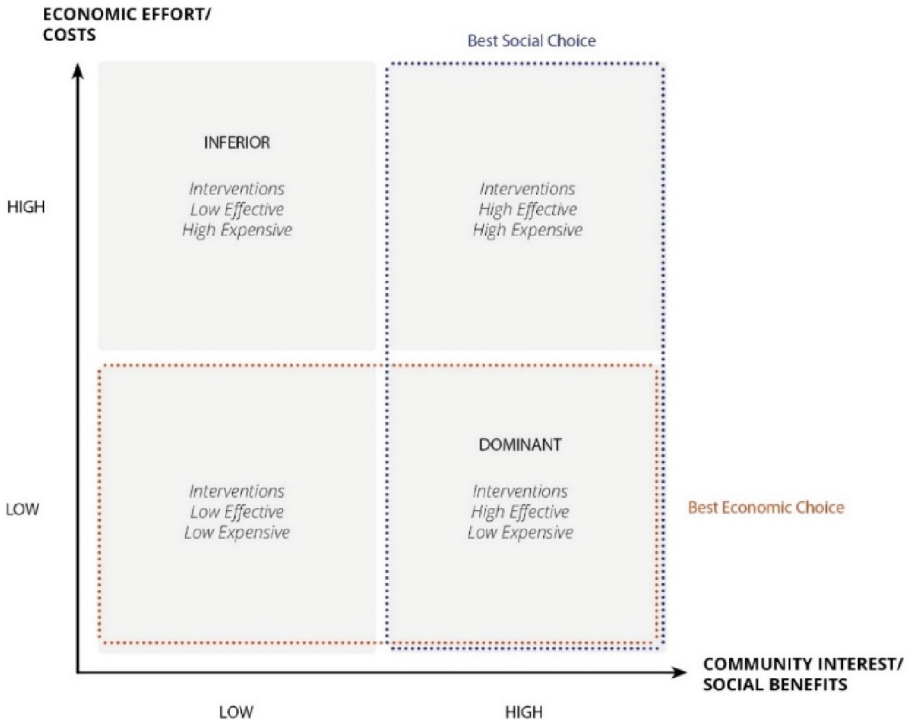

Fig. 1. Conceptual scheme of the proposed community interests – project costs analysis.

4 Case Study: Is Mirrionis – San Michele Neighbourhoods

The proposed methodology was validated by applying it to the case study of two neighbourhoods in the city of Cagliari (Italy). We have mapped and characterized using traditional on-the-ground techniques and open data sources, 21 public open spaces and

14 groups and associations that operate in these urban areas (see Tables 1 and 2). Then, we have conducted in parallel both social and spatial analysis and evaluation.

Social analysis. We have engaged in a process of dialoguing with a range of stakeholders to gain a deeper understanding of the intricate social dynamics that affect the current use of public spaces. Subsequently, we conducted interviews with representatives from 14 associations to gather their perspectives and interests on the mapped spaces. These insights are crucial in ensuring that any interventions in urban regeneration are sustainable, inclusive, and reflective of the needs and desires of the community.

To further refine our understanding, we asked them to indicate their level of interest in suggested spaces on a three-level ordinal scale, ranging from low to high. To aggregate the resulting scores, we employed the Borda count method [24], which assigned points of 0, 1, and 2 to the low, intermediate, and high levels of interest, respectively.

The overall score for each space was determined by adding up the points assigned to each level of interest. As a result, we have established five categories of community interest: Very low (<5); Low (5–10); Medium (10–15); High (15–20); Very high (>20) (see Table 2).

Table 1. Case study analysis. Associations, groups, and social actors selected for the in-depth analysis.

Code	Name of social actor	Type/Level	Main Sector	Number of associates/ involved residents
A01	Casa del Quartiere	Association/Local	Culture	100–200
A02	Acli Cagliari	Association/National	Culture	4500–5000
A03	Istituto Gramsci	Association/National	Culture	100–150
A04	Teatro del Segno	Association/Local	Arts	100–150
A05	Mutuo Soccorso	Association/Local	Social	100–150
A06	Associazione Anziani	Association/Local	Social	300–350
A07	Amici Naturalmente	Association/Local	Environment	25–50
A08	TDM 2000	Association/Local	Culture	50–100
A09	Sarditinera Onlus	Association/Local	Culture	25–50
A10	Aladin Pensiero	Association/Local	Comunication	25–50
A11	Legambiente Sardegna	Association/National	Environment	500–550
A12	Sant'Eusebio	Church	Religion	-
A13	S.M. Kolbe	Church	Religion	-
A14	SS. Pietro e Paolo	Church	Religion	-

Spatial analysis: To evaluate the potential for future projects, we conducted a comprehensive mapping of public spaces. This involved gathering documentation, conducting observations, and surveying and cataloguing each open public space. We classified these

spaces into four main categories, namely ecological sites, urban parks, small gardens, and sports areas, based on their unique characteristics and potential uses.

To refine our assessment, we conducted a comprehensive evaluation of the current state of each public space and estimated the level of intervention required to make them usable. To obtain accurate and reliable evaluative judgments, we consulted with a panel of experts, who considered various factors, such as direct costs of construction or site upgrading, the local construction market, the type of proposed intervention, the conservation state of buildings and the quality of the open spaces.

Furthermore, the experts also considered costs related to possible overheads due to legal and ownership issues, such as private/public ownership and property fragmentation, as well as planning and conservation constraints established during the surveying of each individual space [25]. These additional considerations are crucial for a comprehensive understanding of the costs and feasibility of urban regeneration projects.

Based on these evaluations, we classified the required interventions into five categories of project costs: Very Low (<50 k€), Low (50–200 k€), Medium (200–500 k€), High (500–2.000 k€), and Very High (>2.000 k€) (see Table 2). This classification provides a useful tool for urban planners and decision-makers to determine the appropriate level of investment needed for each public space, based on its unique characteristics and potential uses.

Table 2. Case study analysis. For each public open space: code/name, type of space, estimated cost of intervention and declared interest of social actors (associations and groups)

Code	Name of space	Type/current state	Estimated Cost (k€)	Interest
S01	Piazza Mercato Quirra	Square	400	16
S02	Spazio aperto Quirra/Brianza	Little Garden	500	10
S03	Parco San Michele	Urban Park	200	24
S04	Spazio aperto via Sirai	Little Garden	3.000	0
S05	Spazio aperto via Cinquini	Little Garden	2.000	12
S06	Parco di Monte Claro	Urban Park	100	21
S07	Tuvixeddu-Tuvumannu	Ecological Area	9.000	15
S08	Polisportiva Johannes	Sport Area	650	2
S09	Campi via Argonne	Sport Area	250	5
S10	Campi via Montesanto	Sport Area	650	6
S11	Piazza Is Maglias	Square	100	11
S12	Piazza San Michele	Square	50	21
S13	Piazza Medaglia M	Square	500	13

(*continued*)

Table 2. (*continued*)

Code	Name of space	Type/current state	Estimated Cost (k€)	Interest
S14	Piazza Paese di Seui	Square	100	0
S15	Piazza Premuda/Abruzzi	Square	250	4
S16	Piazza Paese di Desulo	Square	500	0
S17	Giardino via Barigadu	Little Garden	50	4
S18	Giardino Montevecchio	Little Garden	50	20
S19	Campi via Cornalias	Sport Area	350	12
S20	Piazza Scuola Popolare	Square	250	23

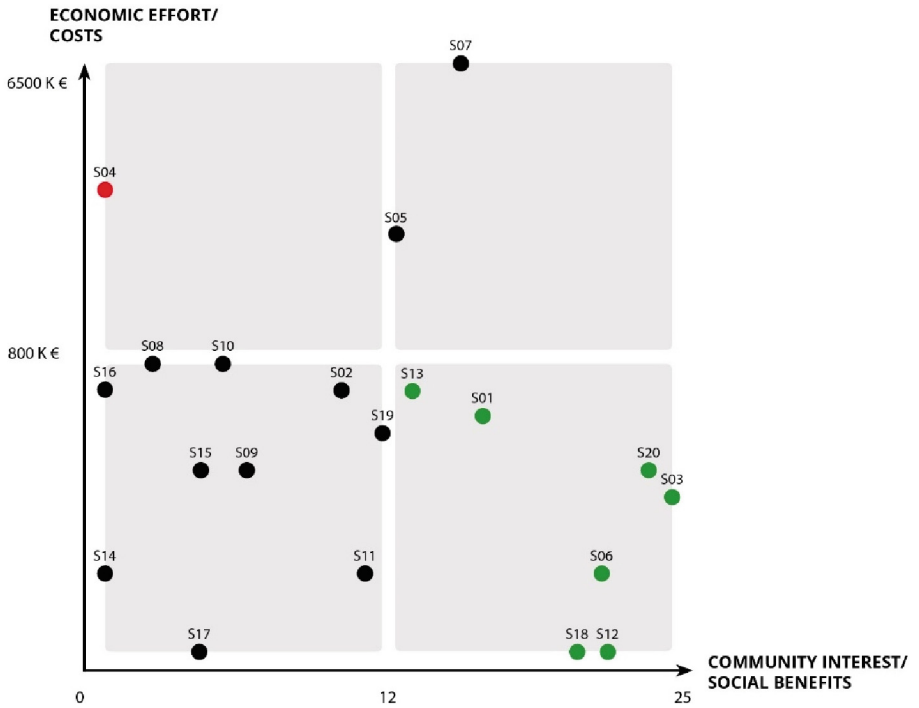

Fig. 2. Case study analysis: the community interests – project costs analysis. The dots indicate: the priority interventions (green); the questionable interventions (black) and the secondary interventions (red).

5 Discussion

The findings revealed that out of the 20 spaces considered: seven were categorized as priority spaces for intervention (35%); one as a secondary space for intervention (5%); and 12 as questionable spaces for interventions (60%) (Fig. 2). An additional evaluation of the level of priority was conducted for the eight spaces belonging to the first two categories (Fig. 3), and the results are presented in the last column of Table 3.

Table 3. Case study analysis: priority and secondary spaces for intervention.

Code	Name of space	Interest	Estimated Cost	Priority
S12	Piazza San Michele	Very High	Very Low	Very High
S18	Giardino Montevecchio	Very High	Very Low	Very High
S06	Parco di Monte Claro	Very High	Low	High
S03	Parco San Michele	Very High	Medium	High
S20	Piazza Scuola Popolare	Very High	Medium	High
S01	Piazza Mercato Quirra	High	Medium	Medium
S13	Piazza Medaglia M	Medium	Medium	Medium
S04	Spazio aperto via Sirai	Very Low	Very High	Very Low

Fig. 3. Image of the priority (green) and secondary (red) spaces for intervention.

Among the seven identified priority spaces for intervention, two large urban parks (S03 and S06) were perceived by the majority of interviewees as neighborhood landmarks and were found to be in good condition, requiring minimal intervention to accommodate a variety of activities that could cater to different user categories.

Another priority area is Piazza San Michele (S12), situated strategically in front of a church and at the intersection of urban connecting roads. Recently redeveloped, the

square no longer functions as a temporary open-air market, which had previously made it a vital space during the day. The interviewees expressed their desire to use the square for various purposes and restore its previous functions, including that of the market.

Similarly, the gardens of Montevecchio (S18) is a recently redeveloped space which has great potential but requires additional interventions to fully enhance its social potential. In particular, the presence of criminal activities that are favoured by the urban design and the particular conformation of streets, is underlined by the interviews. To deal with this, they suggest integrating the gardens with the services and other surrounding open spaces.

The square that accommodates the building of the former Popular School (S20) was deemed a highly significant space by the interviewees. It holds a special historical value as the site of the popular school that was established in the 1970s to provide education for workers. Additionally, it is located in the heart of the district, serving as a suitable area for both the residents of neighbouring buildings and those seeking access to other activities, such as the hospital.

Piazza Mercato (S01) currently serves two primary functions. During the day, it hosts a large open market that attracts visitors to the city market located within it. In the afternoon, once the market closes, it transforms into a large, but scarcely used, car park. The interviewees strongly perceived the potential of this space, viewing its redevelopment as an opportunity to revitalize the area where many disadvantaged families reside.

Piazza Medaglia (S13) is a square surrounded by buildings, forming a central block at the intersection of the main urban connecting roads in the San Michele district. The adjacent kindergarten, serving as a meeting point for many families in the area, adds to the square's significance. Despite its poor state of maintenance, the square remains of great interest to the interviewees due to its strategic location and the presence of the kindergarten.

On the contrary, the area of Via Sirai (S04) is not considered a priority by the interviewees. This largely depends on the conformation of the space itself. It is, in fact, a large disused area requires major interventions and investments.

6 Conclusions

In this paper, a method for evaluating priority regeneration interventions is presented. Our approach involves an analysis of the relationship between community interest and project costs, which is designed to support policy makers in their decision-making process.

To ensure a comprehensive evaluation, our methodology incorporates both social and spatial analysis methods. The social analysis component allows for more effective and targeted interventions that are tailored to the specific needs and priorities of the community. Furthermore, our community scoping activity promotes a collaborative and participatory approach to research, fostering a positive and productive relationship that can be leveraged for future projects and initiatives.

In terms of spatial analysis, our methodology takes a systematic approach to mapping and categorizing public spaces, which provides a more accurate understanding of their unique features and potential for future development. By considering the current state

of each space and the level of intervention required, we are able to provide detailed and accurate cost estimates that are useful for decision-making and planning.

The case study results show that our procedure has promising feasibility and efficiency. The Participatory Cost-Benefit Analysis used to carry out a comparative analysis of the economic costs of a project and their community benefits, expressed by the declared interests of local populations and groups, allows for a better understanding of of the potential role of urban regeneration in promoting social inclusion objectives. At the same time, the qualitative analysis used to estimate the economic expenditure that could be covered by public administrations for each project allows to increase awareness of the importance of proper decision-making in the early design process.

Moreover, two potential directions for the future of this study can be identified. Firstly, social evaluation may be partially automated through digital participation platforms that enable participants to engage in decision-making processes in a structured manner. Specifically, online forums and surveys could be employed ex ante to assess subjective interests and identify community priorities, and ex post to evaluate the effectiveness of programmes, policies, or projects.

Accordingly, spatial analysis can be significantly enhanced through the utilization of Geographical Information System (GIS) platforms [26–28]. Through GIS, detailed databases can be constructed that combine geographical information with data on the present and potential uses of a space, as well as its overall condition, thereby enabling the estimation of regeneration costs. By employing GIS in this manner, it is feasible to obtain more profound insights into the complexities of urban spaces. This approach also facilitates the development of cost-benefit analyses that are tailored to the unique requirements and proclivities of the community. By so doing, decision-makers can make informed choices regarding which interventions are most likely to be efficacious and offer the highest return on investment.

Second, the synthetic evaluation of places based on two criteria is merely a preliminary step towards a more intricate evaluation process. By introducing further criteria to the model, it is conceivable to develop more refined and precise tools for ranking or rating places, or for evaluating and selecting places for a range of purposes.

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