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Research Article

Multicriteria Evaluation of Urban Regeneration Processes: An Application of PROMETHEE Method in Northern Italy

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The paper illustrates the development of an evaluation model for supporting the decision-making process related to an urban regeneration intervention. In particular, the study proposes an original multi-methodological approach, which combines SWOT Analysis, Stakeholders Analysis and PROMETHEE method for the evaluation of alternative renewal strategies of an urban area in Northern Italy. The article also describes the work carried out within an experts' panel that has been organized for validating the structuring of the decision problem and for evaluating the criteria of the model.

1. Introduction

In recent years many European cities have implemented relevant renewal programmes for enhancing physical, environmental, social, and economic long-term development of old industrial sites or areas under decline. Integrated regeneration processes represent the main concern in many experiences. Physical transformations are embedded within social, environmental, and economic as well as institutional aspects [1]. How to achieve a balance among interrelated and often conflictual goals in order to improve the quality of urban systems is still an open challenge. On one side the need of replacing top-down strategies with collaborative models, based on needs, expectations, and values shared by all the parties involved, is widely acknowledged as one of the driver of success [2–4]. On the other one, local oppositions often arise against both public and private works, thus causing interruptions and delays to development processes [5].

Territorial and urban regeneration programmes specifically point out the need of developing new combinations between analytical tools and participatory approaches, in order to strengthen the choices' legitimacy and to address the wealth of contradictory visions, and preferences of the different actors to a shared vision according to a multilevel governance perspective. A critical review of the notion of reuse over time has revealed an emerging attention to the quality issue that does not only depend on development and design tools focused on environmental targets, but also on the managerial approach of local authorities in structuring multiform partnerships [6].

Under these circumstances, evaluation plays a crucial role since it allows to codefine and rank alternative projects with respect to both technical elements, which are based on empirical observations, and non-technical elements, which are based on social visions, preferences, and feelings [7].

In this context, a very useful support is provided by Multiple Criteria Decision Analysis (MCDA) techniques, which are used to make a comparative assessment of alternative projects or heterogeneous measures [8, 9]. These methods allow several criteria to be taken into account simultaneously in a complex situation and they are designed to help decision-makers (DMs) to integrate the different options, which reflect the opinions of the involved actors, in a prospective or retrospective framework. Participation of decision-makers in the process is a central part of the approach.

Aware of the advantages and disadvantages of the many available MCDA techniques, this paper aims at testing the PROMETHEE (Preference Ranking Organisation Method

for Enrichment Evaluations), as an outranking method [10] to support decisions in urban planning and regeneration processes. Given the lack of robust assumptions on the decision maker preferences, the PROMETHEE can be effectively integrated with participatory methods in order to get enough information to understand whether one alternative is at least as good as another.

In particular, the paper refers to the assessment of different urban regeneration scenarios for the city of Collegno (Italy). Differently from Bottero et al. [11], who modeled urban resilience dynamics in Collegno by using Fuzzy Cognitive Maps, and complementing Bottero et al. [12] who combined Stakeholder Analysis and Stated Preference Methods to assess the social value of urban regeneration scenarios in Collegno and their related willingness to pay, we combine the PROMETHEE approach with SWOT Analysis and Stakeholder Analysis, to rank six urban regeneration alternatives and identify the solution that outranks the others, thus providing decision-makers with useful tools in making welfare-maximizing urban planning decisions. We thus aim to contribute framing a multimethodological evaluation process which can be transferred, once validated, in other decision contexts [13].

The remainder of the paper is organized as follows. Section 2 provides a methodological background and a brief literature review; Section 3 illustrates the application of PROMETHEE in the evaluation of urban renewal projects in the city of Collegno (Italy); in Section 4 results are discussed and conclusions are drawn.

2. Methodological Background

The PROMETHEE method is one of the most recent Multicriteria Decision Analysis (MCDA) methods which was firstly proposed by Brans in the early Eighties [10] and subsequently extended by Brans and Vincke [14], Brans et al. [15], Brans and Mareschal [16], and Brans and Mareschal [17]. Usually a multicriteria problem is an ill-posed mathematical problem as it does not find a solution which optimizes all of the criteria simultaneously. As other multicriteria methods, the PROMETHEE requires additional information to overcome the poorness of dominance relation on Preference (P) and Indifference (I), thus enriching the dominance graph [18]. The PROMETHEE is an outranking method for ranking a finite set of alternative actions when multiple criteria, which are often conflicting, and multiple decision-makers are involved [8]. PROMETHEE uses partial aggregation and by a pairwise comparison of alternative actions, it allows to verify whether under specific conditions one action outranks or not the others. The PROMETHEE methods are a family of outranking methods [19]: PROMETHEE I (partial ranking); PROMETHEE II (complete ranking); PROMETHEE III (ranking based on intervals); PROMETHEE IV (continuous case); PROMETHEE V (including segmentation constraints); and PROMETHEE VI (evaluating the degree of hardness of a multicriteria decision problem with respect to the weights given to the criteria, i.e., for human brain representation). In addition, in 2004 Figueira et al. [20] proposed two extensions of the PROMETHEE, namely PROMETHEE TRI to solve sorting problems, and PROMETHEE CLUSTER for nominal classification.

In this paper we implement PROMETHEE II in order to rank alternatives according to different criteria which have to be maximized or minimized. Once the decision group was constituted, we proceeded according to the following subsequent steps.

Step 1 (construction of an evaluation matrix). A double entry table for the selected criteria and alternatives has been compiled by using cardinal (quantitative) and ordinal (qualitative) data. This matrix accounts for deviations of evaluations on pairwise comparisons of two alternatives, a and b, on each criterion.

Step 2 (identification of the preference function $P_j(a, b)$ for each criterion j). The preference function is used to determine how much alternative a is preferred to alternative b and it translates the difference in evaluations of the two alternatives into a preference degree. These preferences are represented in a numerical scale ranging between 0 and 1. The value "1" represents a strong preference of alternative a over b, whereas "0" represents the indifferent preference value between the two alternatives. Six types of preference functions have been proposed by the developers of the PROMETHEE methodology: Usual criterion, Quasi criterion (U-shape), Criterion with linear preference (V-shape), Level criterion, Linear criterion, and Gaussian criterion [15, 21].

Step 3 (calculation of the overall preference index $\Pi(a, b)$). The overall preference index $\Pi(a, b)$ represents the intensity of preference of a over b and it is calculated as follows (1):

$$\Pi(a, b) = \sum_{j=1}^{k} w_j P_j(a, b) \tag{1}$$

where $\Pi(a, b)$ is the overall preference intensity of a over b with respect to all of the K criteria, w_j is the weight of criterion j, and $P_j(a, b)$ is the preference function of a over b with respect to criterion j. Clearly $\Pi(a,b) \sim 0$ implies a weak global preference of a over b, whereas $\Pi(a,b) \sim 1$ implies a strong global preference of a over b.

Step 4 (calculation of the outranking flows, i.e., positive flow $\Phi^+(a)$ and negative flow $\Phi^-(a)$). In PROMETHEE method two flow measures can be determined for each alternative. There are a positive flow (it expresses how alternative a is outranking all the others)

$$\Phi^+(a) = \frac{1}{n-1} \sum_{b \in A} \Pi(a, b) \tag{2}$$

and negative flow (it expresses how alternative a is outranked by all the others)

$$\Phi^-(a) = \frac{1}{n-1} \sum_{b \in A} \Pi(b, a) \tag{3}$$

Step 5 (comparison of the outranking flows to define the alternatives complete ranking). In detail, PROMETHEE II, here

implemented, provides a complete ranking of the alternatives by calculating the net flow (4):

$$\Phi(a) = \Phi^{+}(a) - \Phi^{-}(a). \quad (4)$$

The higher the net flow, the better the alternative. When PROMETHEE II is considered, no incomparability remains, as all the alternatives are comparable on all the criteria. It is worth noting that the net flow provides a complete ranking and thus can be compared with a utility function.

In the past decade, a growing interest arose in identifying solutions which reflect reality as much as possible by modeling it in a clear and understandable way by both analysts and decision-makers. Conceptually, PROMETHEE is a rather simple ranking method compared with other methods for multicriteria analysis [15] and the number of its applications to real world decision problems increased significantly [22]. The applications of PROMETHEE methods are varied and cover as major fields environmental management, water management, business and financial management, logistics and transportation, and energy management [22]. There are several applications as well in social sciences starting from seminal works by D'Avignon and Mareschal [23] and Urli and Beaudry [24] on hospital services and allocation of funds to development programs, respectively. Nonetheless, PROMETHEE applications in urban and territorial planning are quite recent. Mavrotas et al. [25] adopted PROMETHEE for comparatively evaluating control strategies to reduce air pollution in Tessaloniki and base their procedure on active involvement of local and central authorities; Anton et al. [26] applied PROMETHEE for the management and disposal of solid wastes in an Andine area; Juan et al. [27] used the PROMETHEE method combined with fuzzy set theory to determine the priority of 13 urban renewal projects in Taipei City, whereas Roozbahani et al. [28] combined PROMETHEE with Precedence Order in the Criteria (POC) to urban water supply management in Melbourne to assess operation rules in single or group decision-making contexts. More recently Cilona and Granata [29] implemented the PROMETHEE approach to support prioritization of subprojects in complex renewal projects at neighborhood scale; Esmaelian et al. [30] implemented PROMETHEE IV and GIS to identify most vulnerable urban areas to earthquakes and they prove its efficacy in electing the most suitable locations for the construction of emergency service stations; Polat et al. [31] proposed an integrated approach which combines the Analytic Hierarchy Process (AHP) and the PROMETHEE method to support construction companies to select urban renewal projects to invest in; Bottero et al. [32] used PROMETHEE methods to analyze different urban regeneration scenarios in Gran Canaria island; Cerreta and Daldanise [33] proposed PROMETHEE to support urban regeneration by a learning and negotiation process; Dirutigliano et al. [34] applied PROMETHEE as a support tool for promoting energy retrofitting of urban districts in Torino; Mendonça Silva et al. [35] used PROMETHEE method to solve an urban planning conflict in Recife; Wagner [36] adopted PROMETHEE to assist the decision-making process in spatial urban planning, whereas Tscheikner-Gratl et al. [37] compared PROMETHEE to other four multicriteria decision aiding/making methods (i.e., ELECTRE, AHP, WSM, and TOPSIS) in rehabilitation planning of urban water networks.

3. Application

The case study considered in the present paper is related to the urban regeneration program of the city of Collegno, located in the metropolitan area of Torino (Northern Italy). The program, promoted by the Municipal Administration, aims at finding answers to the economic and social needs of the city and to provide a coherent development strategy to a territory afflicted by an unregulated development and by the presence of many abandoned areas.

The objectives of the program are mainly related to the regeneration of the city as "Collegno Social Town". The creation of a nice and livable place and the elimination of physical and environmental limits are the key elements of the development strategy. The area of the Fermi metro station, including the site of Campo Volo, represents a crucial portion of the territory under investigation.

3.1. Structuring of the Decision Problem. The first step for the evaluation refers to the structuring of the decision problem, i.e. identifying the possible alternative strategies for the urban regeneration program and defining the criteria to be included in the model. For this purpose, an integrated framework has been proposed in the present application that aims at setting the problem and highlighting its key elements. More precisely, two different analyses have been performed, namely, the SWOT Analysis and the Stakeholders Analysis.

In detail,

(i) the SWOT (Strengths, Weaknesses, Opportunities, and Threats) Analysis is a technique used to define strategies, in those context which are characterized by complexity and uncertainty, such as urban regeneration. The analysis was used for a critical interpretation of the case under investigation and for supporting the definition of the goal of the transformation and the construction of the alternative projects;

(ii) the Stakeholders Analysis allows to define who are the actors of the process under investigation. As stated by Yang (2013), in the context of urban transformation real-world problems, only if stakeholders' interests are identified, it is possible to sufficiently empower them in the decision-making process. Moreover, the analysis permits to define which resources and objectives the actors are able to bring into play, showing possible conflicts. Finally, by means of Stakeholders Analysis the complexity of the decisional process can be represented, suggesting the evaluation criteria to be considered for the comparison of the alternative strategies (Figure 1).

3.2. Alternative Transformation Projects. In this experimentation, we have implemented an integrated approach to evaluate six different alternatives related to the development of the urban regeneration program of the city of Collegno.

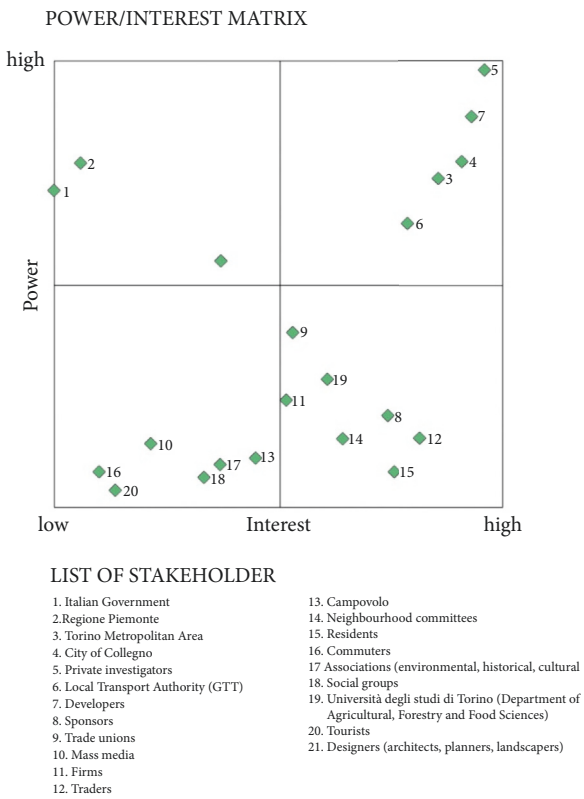

Figure 1: Stakeholders mapping for the case under investigation.

In detail, starting from the alternatives analyzed by Bottero et al. [11, 12], we have selected six alternative projects, which we consider the most relevant according to the SWOT and Stakeholders Analyses. These alternatives can be described as follows (Figure 2):

(1) Cultural district: this strategy is based on the creation of new cultural services for the area, including a new public library and residences for university students.

(2) Smart City: the goal of this strategy consists in providing a new identity to the area based on the concept of smart city.

(3) Start up: this project focuses on the creation of innovative business activities in the area.

(4) City and craft: this strategy is based on the valorization of the small economic activities in the area and on the creation of a new urban park in the Northern part of the area.

(5) Sharing city: the objective of this project is mainly related to the valorization of the public spaces in the area, with special attention to innovative shared solution for living and working.

(6) Green infrastructure: the main intent of this strategy is to improve the livability of the territory, with particular attention to the creation of new green infrastructures, such as pedestrian and bicycle paths.

3.3. Definition and Evaluation of the Criteria. In accordance with the results of the two aforementioned analyses, we identified the most important drivers of the transformation that can be summarized in Table 1. In particular, SWOT and Stakeholders Analysis allowed breaking down the complexity of the problem and identifying general aspects that characterize the transformation to be defined, namely, environmental, economic, social, regeneration, mobility, and services factors. These aspects have been then further investigated in order to obtain a set of measurable attributes for the evaluation of the alternatives.

The subsequent step consists in assessing the performance of the alternatives from the point of view of the evaluation criteria and in assigning a preference function with related thresholds of the criteria (q, p) (Table 2).

3.4. Weights Determination. For the development of the PROMETHEE II method, different decision scenarios have been taken into account. The different scenarios reflect the point of view of different actors who can face the problem under investigation. For this purpose, in the application of the methodology personal interviews with experts in different fields and local decision-makers were developed. In particular, 5 experts have been considered for the evaluation, whose expertise was in urban design, economic evaluation, history of architecture, landscape architecture, and sociology. According to the revised Simos procedure [38], the interviews were carried out through the set of cards methodology that allows for setting the criteria weights and determining their priority, according to actors' preferences. The weight values obtained by different experts are shown on the axes of radar charts displayed in Figure 3. As it is possible to see, all the actors agreed in considering the regeneration aspects as the most important ones. On the contrary, the criteria related to parking spaces and new commercial developments are not important according to all the actors involved in the evaluation.

3.5. Results. The ranking of alternative options was derived by implementing the decision support software Visual PROMETHEE 1.4 [39].

Figure 4 shows the final ranking of the alternative strategies with reference to the sets of weights resulting from the interviews to different actors involved. By direct inspection of Figure 4, it emerges that the ranking is preserved in all the cases and for all the strategies. The "Sharing city" alternative is confirmed as the best performing strategy for the successful implementation of the urban transformation/regeneration process. According to our results, the "Green infrastructures" alternative is worth of consideration too, as it is placed as second in the actors' ranking.

To complement the discussion of our results, we consider worth of mentioning the novelty of our approach to the evaluation of complex urban transformation processes and their long-term effects.

Decision problems in urban planning, and specifically those which are concerned with the design and implementation of urban transformation/regeneration process, are often ill-structured problems, as they involve multiple actors

Table 1: Evaluation criteria for the PROMETHEE model [Table 1 is reproduced from Bottero et al. [11]].

Criteria	Description
C_1 Public/private spaces	Ratio between public and private surfaces
C_2 Co-working spaces	Surface of the structures for workshop, meeting, training courses
C_3 Co-housing inhabitants	Number of residents in new co-housing buildings
C_4 Permeable surface/territorial surface	Ratio between permeable areas and overall territorial surface of the program
C_5 Urban gardens	Total area used for community and private urban gardens
C_6 Waste production	Amount of waste produced in a year by the activities of the program
C_7 Residential areas	Surface for residential functions
C_8 Retail areas	Surfaces for commercial functions
C_9 Sport and leisure areas	Surfaces for sport and cultural activities
C_{10} Mixité index	Index that describes the functional mix of the area
C_{11} Slow mobility	Surface of the pedestrian tracks and bicycle lanes
C_{12} New public parking	Number of new public parking lots
C_{13} Car sharing/bike sharing	Number of car and bike sharing points
C_{14} Total Economic Value	Estimate of the social benefits delivered by the program
C_{15} Investment cost	Total cost of the program
C_{16} New jobs	Number of new jobs created
C_{17} Regeneration	Regenerated surface
C_{18} Via De Amicis regeneration	Qualitative index showing the level of the regeneration of Via De Amicis
C_{19} Territorial index	Ratio between the maximum buildable volume and the territorial surface

Figure 2: Alternative strategies considered in the evaluation model [Figure 2 is reproduced from Bottero et al. [11]].

Table 2: Input matrix for the PROMETHEE evaluation.

(a)

	SOCIAL		ENVIRONMENT				SERVICES			
	Ratio between public and private services	*Surface of the structures for workshop, meeting, training*	*No. of residents in new co-housing buildings*	*Ratio between permeable areas and overall territorial surface of the program*	*Total area used for community and private urban gardens*	*Amount of waste produced in a year by the activities of the program*	*Surface for residential function (SLP in m^2)*	*Surface for commercial functions (SLP in m^2)*	*Surface for sport and cultural activities (SLP in m_2)*	*Mixité index*
CULTURAL DISTRICT	4,31	20425	398	0,69	8.527	1.350.845	70.880	28.031	48.150	0,71
SMART CITY	3,25	24260	150	0,39	2.130	2.332.234	117.736	59.169	81.796	0,46
START UP	1,33	49880	255	0,58	25.569	2.692.663	82.330	95.000	26.960	1
CITY AND CRAFTS	8,35	11328	421	0,52	66.894	1.817.205	164.925	84.248	21.458	0,30
SHARING CITY	2,76	5108	2513	0,53	23.118	3.014.301	538.018	40.192	114.725	0,30
GREEN INFRASTRUCTURE	4,20	3300	1036	0,71	12.888	1.631.941	75.252	25.515	37.920	0,64

(b)

	MOBILITY		ECONOMICS				REGENERATION		
	Surface of the pedestrian tracks and bicycle lanes (m^2)	*No. of new parking lots*	*No. of car and bike sharing points*	*Estimate the social benefits delivered by the program (VET in €)*	*Total cost of the program (€)*	*No. of new jobs created*	*Regenerated surface (Regenerated SLP/Total SLP)*	*Qualitative Index for the regeneration of Via De Amicis*	*Ratio between the maximum buildable volume and the territorial surface (m^2)*
CULTURAL DISTRICT	68.326	1.385	7	2.550.746	233.336.184	1.010	0,2	3	0,38
SMART CITY	171.609	2.567	12	537.692	279.468.,021	1.545	0,12	5	0,16
START UP	16.000	2.100	2	3.500.000	100.000.000	300	0,51	4	0,23
CITY AND CRAFTS	132.541	1.137	3	7.471.328	183.948.594	736	0,36	4	0,52
SHARING CITY	624.933	1.689	14	7.707.778	494.055.026	3.229	0,06	5	0,40
GREEN INFRASTRUCTURE	251.831	1.394	19	531.155	231.527.860	768	0,20	5	0,13

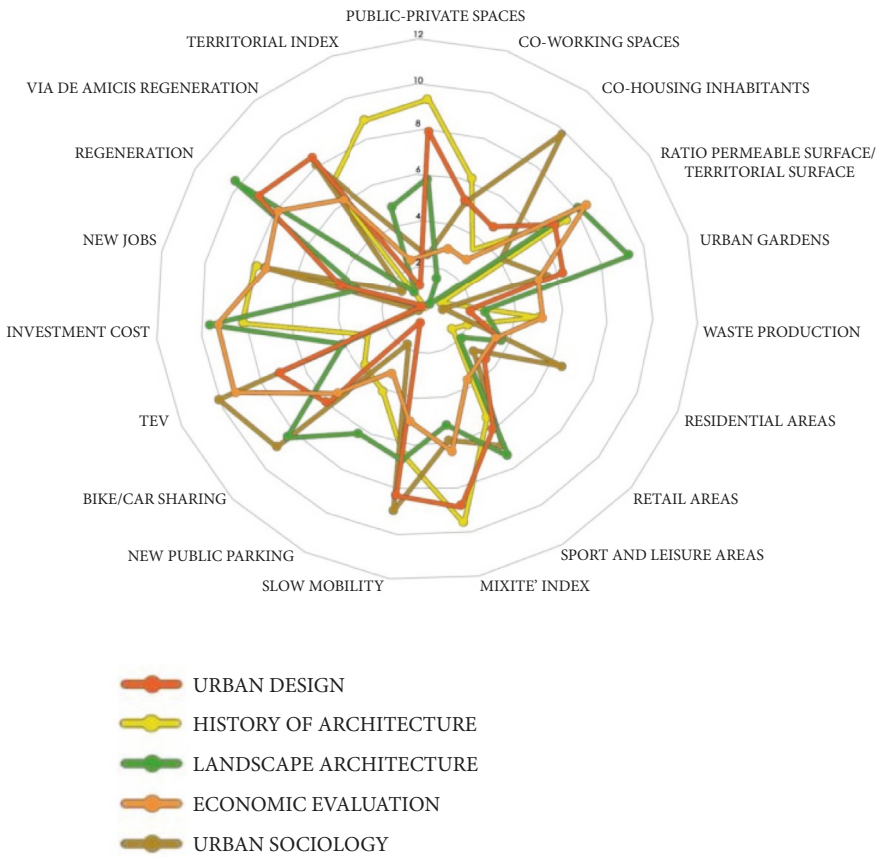

Figure 3: Sets of weights resulting from the different actors.

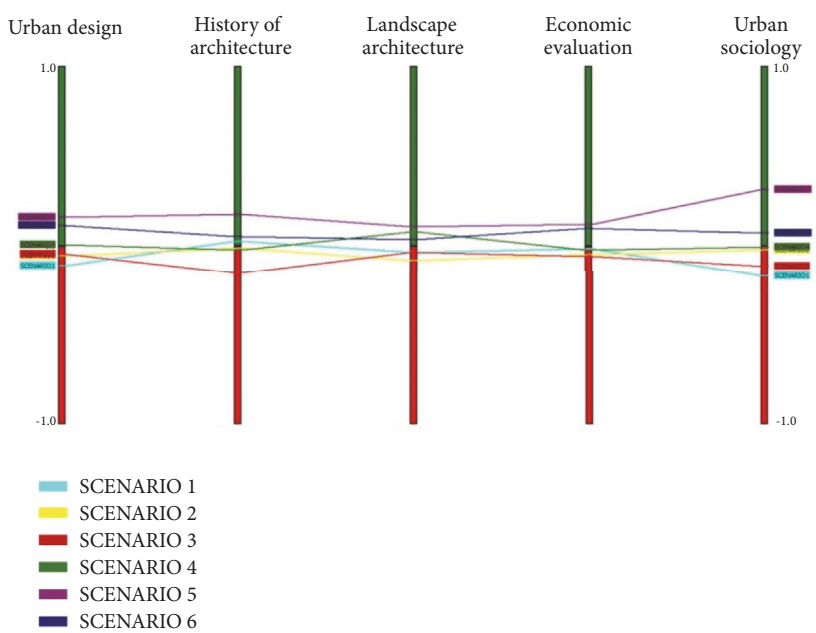

Figure 4: Ranking comparison for the different actors.

and stakeholders, often conflicting objectives and views and are characterized by significant uncertainty over potential outcomes of alternative design options and planning actions. In this context the valuation of alternative scenarios is a complex process, where various aspects need to be accounted for simultaneously. These aspects comprise both technical and non-technical issues and characteristics. The formers build on empirical observations, whereas the latters are usually based on social visions, preferences and feelings [13].

In this paper we adopted a mixed-method research approach to address the issue of urban planning and projects evaluation. In detail, in accordance with Creswell et al. [40], we developed a multiphase mixed-method that allows for considering the subsequent phases of projects formulation and implementation, and thus considering as inputs for the next analysis the results/outputs of the previous one. We combined different methods for the design and selection of alternative urban regeneration projects and strategies, and structured a multiphase decision aiding process meant to support strategic planning. To structure the decision problem we implemented a SWOT Analysis and a Stakeholder Analysis. Problem structuring is in fact a fundamental phase in any decision problem, which involves multiple actors and perspectives, and conflicting stakes to be conciliated, but it becomes of greater importance when alternatives are not a priori designed in detail as in this case [41–45]. We firstly carried out a SWOT Analysis, which provided an in-depth knowledge of the problem and context under investigation, and of the correlation between endogenous and exogenous factors. In this phase, data and information were collected, the objectives were identified and potential alternative scenarios were defined at a preliminary stage. We then performed a Stakeholder Analysis, informed by the SWOT Analysis, through which we identified the actors involved in the problem, and their values and objectives. Stakeholder Analysis allowed to identify conflicting interests at an early stage of the process and develop a strategic view of the human and institutional framework, the relationships among different actors and their concerns. In fact it plays a key role in strategic planning and urban regeneration processes. The above-mentioned analyses informed the last phase of the mixedmethod approach (e.g., criteria express actors' objectives and needs), in which PROMETHEE method was implemented to assess the alternative scenarios under investigation, obtain a list of priorities, and identify the best performing urban regeneration strategy. Table 3 provides an insight in our multiphase decision aiding process, synthetizes strengths and limitations of SWOT Analysis, Stakeholder Analysis and PROMETHEE method respectively, and illustrates main results obtained from their implementation in the city of Collegno case study.

4. Discussion and Conclusions

Multicriteria Analysis is nowadays widely implemented in decision and valuation processes, and specifically in urban planning. Urban planning and urban regeneration processes are multidimensional concepts and involve socioeconomic, environmental, technical, and ethical perspectives, which are strongly interconnected and cannot be addressed by referring exclusively to economic issues: urban renewal projects are often faced by many challenges, such as destruction of existing social networks, expulsion of vulnerable groups, and adverse impacts on the living environment.

Therefore, in urban planning, due to intrinsic complexities and to the high number of stakeholders and actors involved in the decision process, multicriteria techniques and methodologies can be efficiently implemented to identify efficient solutions, which accounts for decision-makers and actors preferences, as well as for public choice policy objectives [46]. To some extent, urban planning is meant to respond to challenges, improve communication between government or public administrations and stakeholders, allocate budgets according to a list of priorities, and favor long and mid-term investments. In addition, to be effective and successful, urban planning requires a commitment by the government to achieve strategic goals, a common understanding on prioritization of actions, and the involvement of the society and the private sector that collaborate to develop and implement strategic plans.

This paper shows how the PROMETHEE II method can be usefully implemented in decision problems related to urban planning and development projects; namely, in this paper the PROMETHEE method is used to determine the projects' priority. In detail, we evaluated different regeneration scenarios for the city of Collegno according to a set of qualitative and quantitative criteria, which account for social, environmental, mobility and economic key factors. As the dominance relation is poor on preference and indifference, incomparability holds for most of pairwise comparisons and additional information is needed to make a decision. By outranking relations, the PROMETHEE method provides realistic enrichments of the dominance relation despite incomparability relations are not completely eliminated. In this respect, the integration of SWOT Analysis and Stakeholder Analysis increased the information useful for ranking the scenarios, thus confirming the importance of supporting cross-sector approaches in sustainable regeneration projects.

The scenarios under investigation were evaluated according to experts judgments, local stakeholders and decision-makers' preferences, values and objectives.

According to the results of PROMETHEE II, scenario 5 the "Sharing city project" is the most desirable and comprising alternative to implement, whereas scenario 6 the "Green Infrastructure" is ranked as second, except for the judgments expressed by the expert in landscape architecture. Our results show that the other alternatives cannot be listed in the same descending order of their net flows for each expert. As multiactor analysis shows, the "Sharing City" alternative encompasses the preferences of the entire group of five experts involved in the decision process. The results obtained from the Visual PROMETHEE software highlight the usefulness of multicriteria outranking methods in spatial decision-making problems. Multiactors analysis was indeed useful in clarifying the most appropriate project, by taking into account the point of views of different actors.

The comprehensive and integrated approach proposed in this paper accounts for key factors in urban renewal, provides

Table 3: Strengths and limitations of the proposed evaluation methods and relative results from the city of Collegno case study.

Evaluation method	Strengths and Limitations	Results from the city of Collegno case study
SWOT Analysis	+ Improvement of overall understanding of the decision problem general framework + Provision of a systematic approach to analyse and decompose complex problems + Identification of correlation between internal factors, strengths and weaknesses and external factors, opportunities and threats + Ease of use and understanding of results – Open nature and unstructured method – Preliminary level of analysis – Tendency to overemphasize opportunities – Lack of prioritisation of factors (no requirement for their classification and evaluation) – Risk of oversimplification – Risk of over-subjectivity in the generation of factors	The SWOT Analysis allowed the definition of the guidelines for the design and implementation of the general masterplan as well as the identification of the transformation process layout. It played a key role in supporting experts and planners in the identification of alternative scenarios for urban transformation/regeneration.
Stakeholders Analysis	+ Improvement in stakeholders management and mobilization of their support in achieving a goal + Identification of purpose and time-dimension of interest + Identification of time-frame and resource availability + Provision of comprehensive analysis meant to produce new knowledge about policy-making processes + Prediction or encouragement of stakeholder alliances – Need for great reliance on quantitative approaches to data collection – Need for iterative processes in data collection and analysis – Inappropriateness of feedback of results when stakeholders may influence or control analysis results – Uncertainty over validity and reliability of results – Potential biases generated by analysts who become implicitly stakeholders who bring to the analysis their own values, perspectives and problem understanding	The Stakeholders Analysis provided the identification of relevant actors in the transformation and relative values and perspectives. These actors are mostly private investors and developers, who have financial resources available for undertaking investments and carry out the urban regeneration process. The Municipality of Collegno and the social groups involved in the process proved to be relevant actors as well.

Table 3: Continued.

Evaluation method	Strengths and Limitations	Results from the city of Collegno case study
PROMETHEE Approach	+ Ease of use + Provision of a complete ranking + Accuracy of results + Adoption of the concordance non-discordance principle in the definition of the overall preference index + Limited total compensation between pros and cons + No assumption on the requirement of criteria to be proportionate +Avoidance of the commensurability problem – Non triviality in preference structuring in detail – Assignment of weights that does not build on a clear method – No information on the cost-effectiveness or profitability of alternatives (are they welfare-maximizing?) – Assignment of values that does not build on a clear method – Difficulties in selecting the generalized criterion functions and the associated thresholds for each criterion – Computational limitations with respect to the number of decision alternatives	The analysis performed by implementing the PROMETHEE method allowed the comparisons of urban transformation alternative options and the identification of the best performing solution for the regeneration process. The results show that the considered sets of weights converge in ranking the "Sharing city" alternative as the most preferred option, and the "Green infrastructure" alternative as the second best option.

a useful tool to assess renewal projects from the standpoint of urban competitiveness and sustainability, and may have interesting policy implications by providing policy makers with useful guidelines for investments to be undertaken. Successful implementation of urban renewal is de facto a crucial driver in promoting sustainable urban development and improving urban competitiveness and attractiveness. In this respect the PROMETHEE method can be useful in assisting decision-makers in selecting urban renewal programs and projects in a more objective and realistic way.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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