A Methodological Framework for Identifying Compromise Solutions in Complex Urban Squatting Conditions

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Abstract. Complexity, uncertainty, and the coexistence of multiple stakeholders with divergent interests increasingly characterize contemporary urban contexts, making traditional decision-making approaches often inadequate.

This study aims to develop a structured methodological framework to support decision-making processes in complex urban environments, with particular attention to the identification of compromise solutions among conflicting actors.

The proposed approach integrates Social Multi-Criteria Evaluation (SMCE), the Best–Worst Method (BWM), and a MACBETH-inspired procedure within a coherent six-phase framework, guiding the process from problem structuring to the evaluation and comparison of alternative scenarios.

The framework enables the explicit representation of stakeholder preferences, the analysis of convergence and divergence among actors, and the identification of potential rejection conditions. From this perspective, evaluation is not only a technical tool, but also a support for transparent negotiation processes.

A key contribution of the study lies in its ability to distinguish between theoretically optimal solutions and those that are practically implementable, by explicitly addressing trade-offs and compromise conditions in multi-actor decision contexts.

The proposed framework contributes to advancing decision-support approaches in urban planning by providing a structured and replicable method for identifying context-sensitive and implementable solutions.

Keywords: Multi-criteria Decision Analysis · Decision Support Systems · Compromise Solutions

1 Introduction

Today, challenges related to the environment, economy, and society are changing cities in a rapid way. The conditions characterizing the new kind of urban development are ever more redefining climate-related risks, growing resource constraints, as well as shifting and modifying demographic patterns [1].

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At the same time, planning systems – required to respond to multiple and often competing expectations – are pressed by the increasing demand for more sustainable and resilient forms of expansion. In many contexts, these changes are not only quantitative but also qualitative, and influence the way urban areas are generated, exploited and managed [2].

There are no linear or predictable processes driving these changes. Rather, complex interactions between factors operating at different spatial and temporal levels [3] increasingly characterize urban systems. Local dynamics are influenced by worldwide processes, while short-term decisions may produce long-term and sometimes accidental and/or unintentional consequences.

In this respect, cities can be considered as evolving systems; environment is subjected to never-ending transformations whereas effects and consequences may be sometimes out of control. In such a context, reliance on usual and tested planning approaches built on stability, predictability and simplified representations of reality [4] becomes surely much more demanding and problematic.

This questions the validity of the efficacy and success of models which adopt a distinct separation between causes and effects, emphasizing instead the need to take into consideration feedback devices and collective and combining impacts [5].

Another relevant aspect to be considered concerns the gradual assimilation of various dimensions within urban policies. Nowadays environmental, economic and social questions are no longer managed as unconnected domains, but there is an ever more research-backed approach within the same frameworks [6]. On one side this integration is indispensable, on the other it clearly launches new challenges.

Objectives can be desirable from a certain point of view but they may clash with others; moreover, actions aimed at improving particular aspects of urban systems may generate negative outcomes on others [7]. For this reason, interventions on urban scenarios are often subjected to operations under conditions of tension and pressure, so it is inevitable finding a balance among several priorities. This is particularly manifest in spaces where resource constraints, environmental risks and social vulnerabilities intersect; this important factor requires a kind of coordinated responses, but these ones are seldom neat and direct [8].

The need for more flexible and integrated approaches has become greatly evident in this context. Rather than concentrating on isolated or single components, there is increasing attention towards structures able to seize the intrinsic and interconnected nature of urban systems, and to reinforce a more comprehensive understanding and knowledge of current transformations [9].

The good results of planning processes may be negatively influenced by two aspects: (i) if the multiplicity of factors implied is not focused, (ii) if the presence of uncertainty, partial information and changing variables is not recognized. Actually, these dynamics often arouse the necessity for flexible strategies, able to be revised and modified over time as new information becomes available or when previous conditions change [10].

Simultaneously, urban transformations are essentially built thanks to the interaction of multiple actors; the roles of these actors and general expectancies may vary significantly across contexts.

It is notorious that government institutions, private operators and local groups or communities give different contributions to the definition and implementation of urban strategies, as they bring with them different priorities and perspectives. This plurality has a twofold-aspect: it may be both a resource and a source of complexity, because it may produce good opportunities for cooperation but also states of rigidity and disagreement.

For the most part, the achievement of a successful intervention derives from the capacity to navigate these dynamics, rather than on the real qualitative value of the proposed solution [11].

The study of this wider scenario shows that the focus of urban analysis is progressively moving from the search for ideal solutions towards the detection of practicable and context-sensitive results.

Very often, the success of an intervention derives not only from its theoretical performance, but also from its capacity to be embraced, subject to be negotiated and improved within a given urban context. This underlines the importance of the following concept: not only what is originally planned should be considered, but also what can practically be achieved in a real scenario [12]. In complicated environments – whereas restrictions are not only technical but also social and institutional [13] – the disparity between ideal solutions and implementable ones becomes particularly significant.

These reflections suggest the necessity of devising approaches capable of promoting a more structured knowledge of complex urban problems; moreover, these approaches should be able to accommodate manifold perspectives and to sustain and favour the identification of solutions that are not only theoretically complete, but also possible in a practical way.

2 Aim

The present study aims at developing a structured and widely articulated methodological framework to sustain decision-making processes in complex and difficult urban contexts, characterised by multiple stakeholders, conflicting interests, and heterogeneous evaluation criteria.

Definitely, the research tries to offer a framework that favours the methodical comparison of alternative scenarios, taking into account stakeholder-specific urgent priorities as well as the multiple dimensions that affect urban decision-making processes.

According to this viewpoint, evaluation is not conceived as a simple technical strategy, but as a structured process aimed at supporting negotiation, enhancing transparency, and clarifying the implications of different choices.

The study gives a contribution to a progress in decision-support approaches in urban planning by proposing an mixed framework that merges different evaluation techniques within a coherent and rational structure. The framework is designed to capture preference heterogeneity, assess the relative performance of alternative options, and make value trade-offs explicit in a clear, traceable and observable way.

Moreover, this research aims at supporting the recognition of conciliation solutions in multi-actor contexts, where the presence of contrasting interests may lead to rejection conditions or decision-making deadlock. Special attention is given to the distinction between ideally preferable alternatives and those that are actually implementable, without underestimating the necessity of a balance between different priorities and limits.

In conclusion, the proposed approach is intended to function as a decision-support instrument able to improve the quality and strength of urban policy choices, by providing a clearer knowledge of the relationships between stakeholders, evaluation criteria, and alternative scenarios.

The structure of the paper is outlined as follows. Section 3 provides the background framework. Section 4 describes the proposed methodological approach, detailing the different phases to be carried out. In Sect. 5 the conclusions are explained, discussing the main methodological implications and outlining possible future developments.

3 Background

In light of these challenges, the limitations of traditional evaluation approaches have been widely documented, particularly in contexts characterised by multiple stakeholders and conflicting objectives.

Conventional tools often fail to capture the multidimensional nature of decision problems and to adequately represent the diversity of stakeholder perspectives. In such settings, the coexistence of heterogeneous value systems and competing priorities makes it difficult to identify solutions that are both analytically strong and socially acceptable.

These challenges are further reinforced in governance arrangements marked by the interaction between public and private actors, such as public–private partnerships (PPPs), whereas decision-making processes are fundamentally shaped by the coexistence of different institutional logics, risk perceptions and investment objectives. In such settings, the different orientation of public interest and private profitability becomes a critical challenge, often requiring the definition of compromise solutions able to balance efficacy, impartiality and financial support [14].

As practical studies highlight, the success of these arrangements greatly is based on the capacity to manage conflicts, to negotiate trade-offs and to ensure the acceptability of decisions among involved actors.

In this scenario, Multi-Criteria Decision Analysis (MCDA) has been widely recognised as a successful framework for the support of complex decision-making processes. Applications in transport planning show that MCDA can structure decision problems and identify relevant criteria for infrastructure location, improving the transparency and traceability of the evaluation process [15, 16].

Likewise, studies in road safety analysis confirm that MCDA models allow the identification and ranking of multiple influencing factors, producing consistent and interpretable outputs even in highly problematic systems [17]. Multi-criteria approaches have been effectively used to compare and balance conflicting performance criteria in engineering contexts, so demonstrating the need of devising solutions that simultaneously satisfy various objectives [18, 19].

Apart from technical evaluation, a critical factor for the effectiveness of decision-making processes – clearly shown by realistic studies – is represented by the explicit incorporation of stakeholder perspectives. Multi-actor and multi-criteria frameworks demonstrate that ignoring stakeholder preferences may lead to the failure or rejection of planning solutions, in a particular way in urban contexts characterised by contrasting interests [20, 21].

In this sense, sharing approaches such as Social Multi-Criteria Evaluation (SMCE) have been widely applied in urban regeneration processes, showing that the inclusion

of stakeholder preferences can highly improve the acceptability and can legitimate decisions [22].

Case study applications confirm that the integration of technical and social evaluations allows the mediation between different stakeholder rankings, supporting the identification of more balanced and strong solutions [23, 24]. Likewise, participatory evaluation frameworks have been successfully applied in conflictual settings, where they contribute to structuring decision problems and facilitating the comparison of alternative situations [25].

Yet, empirical evidence also shows that stakeholder inclusion does not automatically generate consensus and/or a possible compromise. Decision-making processes often remain characterised by incessant struggles and divergent preferences, which may block the identification of shared solutions. In this regard, the idea of compromise plays a central role, as it enables the balancing of competing objectives and the construction of solutions that, while not optimal for all actors, are acceptable enough to allow improvements.

Studies on compromise-based decision methods show that the need to harmonise conflicting criteria is a usual and recurrent feature of complex decision problems [26, 27]. At the same time, research on stakeholder behaviour highlights that different groups may reveal heterogeneous attitudes towards compromise, ranging from willingness to negotiate to complete refusal; in some cases this factor leads to situations of conflict or decision-making gridlock [28].

To address these challenges, latest contributions have explored the integration of MCDA with conflict analysis and stakeholder-oriented approaches, showing that such integration can improve the capacity of decision-support instruments to deal with both technical and social dimensions of serious issues [29].

Hybrid models combining different multi-criteria techniques have been proposed to enhance the reliability and strength of evaluation results, particularly in contexts characterised by uncertainty and conflicting information [30].

In this framework, specific methods such as the Best–Worst Method (BWM) have been empirically validated as efficient tools for deriving consistent criteria weights with a reduced number of comparisons, while structured approaches based on pairwise comparisons contribute to the construction of transparent and reproducible evaluation models [31]. The flexibility and adaptability of multi-criteria methods in addressing heterogeneous decision-making environments [32] is further confirmed by the applications in urban and territorial contexts.

Despite the wide body of empirical and methodological contributions, an outstanding gap still emerges in the literature. In fact, limited attention has been devoted to the explicit identification of compromise solutions within integrated analytical frameworks, even if numerous studies demonstrate the effectiveness of MCDA in structuring and evaluating complex decision problems, and others emphasise the importance of stakeholder engagement.

Particularly, there is a lack of approaches able to distinguish between only theoretically valid alternatives and effectively implementable alternatives in real-world environments characterised by conflict, negotiation and institutional constraints, such as those detected in multi-actor governance arrangements and public–private partnerships. The gap underlines the need for methodological frameworks that explicitly address the

conditions under which compromise can emerge, supporting decision-makers in navigating compromise and identifying solutions able to balance competing interests while maintaining analytical consistency.

4 Methodology

The complexity of conflictual urban contexts, characterized by more stakeholders, heterogeneous value systems, and competing objectives, asks for the development of an integrated assessment framework able to represent divergent perspectives, multiple evaluation criteria, and the need to identify compromise solutions.

To address these challenges, the proposed model integrates three complementary methodological components:

– Social Multi-Criteria Evaluation (SMCE) as a conceptual framework;
– the Best–Worst Method (BWM) for criteria weighting;
– a MACBETH-inspired approach for the construction of value functions.

The framework is structured into six main phases described below.

The **first phase** consists in structuring the decision problem and identifying the relevant stakeholder groups involved in the evaluation process.

SMCE provides the conceptual foundation of the model, allowing the formal representation of a multiplicity of viewpoints and overcoming the constraints of one-dimensional economic evaluation.

Also, it allows incorporating different value systems, interests, and decision rationalities within a unified analytical framework.

Stakeholders are selected to represent the diversity of actors that are typically involved in questioned urban contexts, including institutional actors, private interests, and civil society groups.

Their inclusion ensures that the evaluation reflects the multiplicity of perspectives and potential conflicts underlying the decision-making process.

The **second phase** involves the definition of evaluation criteria.

Criteria are selected through a triangulation procedure that integrates insights from the scientific literature, contextual knowledge, and planned logic.

Particular attention is given to ensuring the internal coherence and non-redundancy of the selected criteria.

In this perspective, criteria are defined in such a way as to avoid overlaps or intersections and double counting effects, even if they continue to maintain their capacity to seize distinct dimensions of the decision issue.

Moreover, when necessary, criteria can be structured hierarchically into sub-criteria: in this way they allow a more detailed representation of complex evaluation dimensions.

This hierarchical organisation improves both the transparency of the evaluation process and the intelligibility of outputs; this is particularly true in contexts characterised by interdependencies among social, economic and institutional factors.

This ensures that the criteria capture the key dimensions of the decision problem—social, legal, economic, urban, and institutional—while maintaining enough discriminative capacity with respect to the alternatives.

The **third phase** focuses on the definition of alternative scenarios, ensuring consistency with the previously identified evaluation criteria.

Ensuring consistency means maintaining uniform standards to achieve reliable results. Also, it involves the creation of ordered and replicable procedures. Quality characterizes consistency.

A set of alternative scenarios is defined to represent feasible intervention options. The identification of alternatives responds to the need, inherent in the SMCE approach, to make decision options clear and comparable within a formalised evaluation structure.

These scenarios constitute an analytical translation of possible solutions typically emerging in complex urban conflicts.

The **fourth phase** focuses on the estimation of criteria weights for each stakeholder using the Best–Worst Method (BWM), a multi-criteria decision-making technique that allows for consistent and efficient elicitation of preferences.

The approach identifies the best and worst criteria and performing pairwise comparisons between them, and generates optimized weights through an optimization model.

For each stakeholder, the most important criterion considered ("Best") and the one considered least relevant ("Worst") are identified. Then, two sets of ordinal comparisons are defined: comparisons between the Best criterion and all other criteria, and comparisons between all criteria and the Worst.

In contexts where direct elicitation is not possible, preference structures can be rebuilt through the analysis of secondary sources, such as institutional documents, press articles, interviews, and public statements. These sources are collected and triangulated in order to formalise stakeholder positions within the BWM framework.

In case of ambiguity, judgments are assigned using conservative suppositions, minimising the intensity of preferences to reduce potential bias.

The produced comparisons are used to derive an optimal weight vector by solving a minimisation problem that reduces inconsistency between expressed preferences and resulting weights.

The use of BWM is particularly suitable in this context due to its capacity to reduce the cognitive weight connected to traditional pairwise comparison methods, while ensuring a high level of consistency in the derived weights.

In addition, a first-level sensitivity analysis can be performed on the weights and/or adjacent comparison intensities (e.g. $\pm$ 10%) to verify the stability of the outputs.

In the **fifth phase**, planning alternatives are evaluated through the building of value functions based on qualitative judgments, using a MACBETH-inspired approach.

This method allows for the construction of cardinal value scales (interval scales) derived from qualitative pairwise comparisons of differences in attractiveness between alternatives.

For each criterion and stakeholder, alternatives are compared in pairs and the intensity of preference is expressed using an ordered semantic scale (e.g. from "no difference" to "extreme difference").

These qualitative judgments are then translated into numerical values that preserve both the ranking and the relative intensity of differences, ensuring consistency with the logical constraints of the MACBETH approach.

In cases involving a limited number of alternatives, the problem can be reduced to the positioning of intermediate options between the most and least ideal alternatives. In such cases, a ratio-based positioning rule can be adopted, allowing the construction of a closed and reproducible value scale consistent with the expressed semantic judgments.

The internal consistency of judgments can be verified in terms of monotonicity and coherence of preference intensities, with minimal adjustments applied where it is necessary to restore logical consistency.

In the **sixth phase**, the scores derived from the value functions are aggregated using a weighted additive model, combining them with the criteria weights acquired through BWM for each stakeholder.

This process generates an actor–alternative evaluation matrix; this matrix allows for the construction of stakeholder-specific rankings, as well as the analysis of convergence and divergence among actors.

The framework enables the identification of value conflicts, potential compromise solutions (due to conflicts), and alternatives that may produce rejection conditions or de facto vetoes for specific stakeholder groups.

In this way, both the distinction between theoretically preferable solutions and those that are effectively implementable in multi-actor decision contexts are supported.

Figure 1 summarises the six phases of the proposed methodological framework.

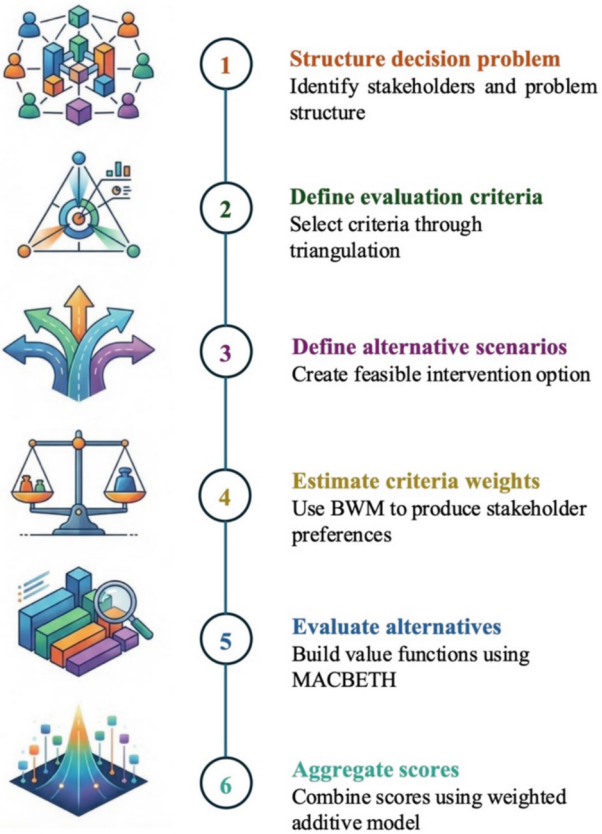

Fig. 1. Phases of the proposed methodological approach.

5 Conclusions

As stated previously, the present study confirms and strengthens the necessity for decision-support approaches that better conform to the complexity of today's urban contexts. Decision-making cannot be reduced to a simple technical practice in situations involving several stakeholders, and when everyone's interests seem not to be aligned. On the contrary, decision-making needs means that can take different perspectives into consideration, make trade-offs unambiguous, and promote the identification of possible and reasonable solutions [33].

In light of this perspective, this framework proposes a structured way to address these challenges. The integration of SMCE, BWM and a MACBETH-inspired approach allows the synchronized consideration of stakeholder inclinations, evaluation criteria and alternative settings. This makes it possible not only to arrange alternatives, but also to understand the origin of conflicts emerged (where and why), and what are the conditions that might reduce this contrast.

Among the most significant aspects of the framework one them comes out: its focus on the difference between what is theoretically desirable and what is effectively implementable. In many real-world conditions, the so-called "best" solution from an analytical point of view may not be acceptable to all stakeholders. The model openly cope with this gap, and it helps identify conciliation solutions that, even if not optimal or ideal for everyone, can be considered balanced enough to be realistically and reasonably carried out [34].

At the same time, the study shows the existence of some limits that should be acknowledged and considered. The reconstruction of stakeholder preferences and/or inclinations through secondary sources may introduce a certain degree of approximation, especially when direct interaction with actors is impossible. Also, the framework has been developed at a methodological level and would benefit from further testing through empirical applications [35].

Future developments could include a stronger integration and involvement of sharing processes, so allowing for direct stakeholder participation and responsibility, as well as the extension of the model to dynamic contexts where preferences and favourite conditions evolve over time [36].

In order to fortify the strength of the results, further work could also concentrate on the incorporation of ambiguous analysis.

In general, the proposed approach contributes to a more evident and complete decision-support paradigm, reinforcing the ability to focus on complexity and to contribute to the development and implementation of practicable and context-sensitive urban interventions and intermediations.

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