

Holistic Sustainability Evaluation: Preliminary Phases for a Methodology Application in Docks Dora, Turin (Italy)

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Abstract. The increasing complexity of urban transformation processes requires decision-support tools capable of integrating the different dimensions of sustainability. Traditional evaluation models, often based on single-dimensional indicators, are becoming increasingly inadequate for representing the multidimensional nature of urban regeneration interventions and building transformations. This contribution integrates life cycle–based approaches, namely Life Cycle Costing (LCC) and Life Cycle Assessment (LCA), with the Social Return on Investment (SROI) method to assess the social dimension.

The harmonization of economic, environmental, and social indicators is supported through the application of Saaty's Analytic Hierarchy Process (AHP), which enables the structuring of the decision problem and the weighting of the different sustainability criteria. The research focuses on the definition of the indicator system and, particularly, on the development of the social dimension, which still presents a limited level of methodological standardization compared to the economic and environmental components.

In order to contextualize the methodological framework, the study identifies the Docks Dora complex in Turin (Northern Italy) as a reference case study, a significant example of industrial heritage currently involved in urban regeneration processes. The integration of LCA, LCC, SROI, and AHP, still scarcely explored in the literature, may represent a relevant methodological support for the multidimensional evaluation of urban transformation processes and for the comparison of alternative design scenarios related to building retrofit and adaptive reuse.

Keywords: Holistic Sustainability · Social – Economic – Environmental Indicators · AHP · Docks Dora

1 Introduction

The increasing complexity of urban development processes, characterized by the presence of multiple stakeholders and often divergent objectives, requires the adoption of evaluation tools capable of harmonizing heterogeneous dimensions and different analytical languages and tools. In this regard, multidimensional approaches represent a

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fundamental support for understanding the effects generated by interventions and for structuring decision-making processes. Traditional decision-support models often rely on unidimensional indicators, which are increasingly inadequate to represent the complexity of urban transformation and regeneration processes that simultaneously involve economic, environmental, and social systems.

This contribution aims to clarify the assumptions underlying the research with reference to sustainability assessment in urban and building transformation processes, with particular attention to the need to integrate environmental and social components alongside the economic and financial aspects traditionally considered in investment analysis.

The study represents an advancement of the research conducted by [1], in which a methodological framework for the holistic assessment of sustainability in real estate projects was proposed, based on the integration of Life Cycle approaches, the AHP and SROI. Within this perspective, evaluation plays a central role in the decision-making processes that accompany urban regeneration interventions and building retrofit, supporting the definition and comparison of alternative project scenarios. This contribution builds upon that research with the aim of further integrating and developing the proposed framework. Starting from the overall methodological structure defined in [1], this paper examines the first three steps of the research path, with particular attention to the application and role of SROI. In particular, the focus is placed on deepening the definition of the indicators associated with sustainability criteria, with specific reference to social indicators and to the methods used to assess the social impacts generated by urban interventions.

Within the theoretical framework developed in the research by [1], among the approaches used for sustainability assessment in the construction and real estate sectors are those based on the life-cycle perspective. LCA allows the analysis of environmental impacts associated with the different phases of the life cycle of a product or building, while LCC enables the evaluation of costs incurred throughout the entire life cycle of the intervention. These dimensions are complemented by tools aimed at assessing the social value generated by projects, including SROI, which is used to estimate and monetize the social impacts of initiatives [2].

The presence of heterogeneous indicators requires the use of tools capable of integrating them. In this context, Multi-Criteria Decision Analysis (MCDA) plays a significant role in supporting decision-making processes and in enabling the comparison of alternative project scenarios. Among these, the AHP represents one of the most widely used tools for the hierarchical structuring of decision problems and for determining the weights associated with different evaluation criteria [3].

In order to frame the proposed methodological framework within a specific territorial context, this study identifies the Docks Dora complex and area in Turin as a reference case study. The site is an industrial archaeology complex characterized by the coexistence of multiple cultural and productive functions and is currently subject to potential urban regeneration strategies. The selection of this case study is motivated by its emblematic nature with respect to urban transformation processes and by the opportunity to explore the scalability of the proposed model, enabling analysis at both the urban and individual asset.

Considering these premises, the paper is structured as follows. Section 2 presents the proposed methodological framework and the main analytical assumptions. Section 3 describes the case study. Section 4 illustrates the preliminary stages of applying the methodology, precisely the alternative scenarios definition and the system of indicators to be used for the evaluation. Finally, Sect. 5 presents the study's discussion, further research developments and conclusions.

2 Methodology Framework

The proposed methodological framework aims to support decision-making processes in contexts of urban transformation and regeneration in the presence of alternative design scenarios. The model is consistent with the theoretical framework outlined in [1] and involves applying Life Cycle approaches, multi-criteria analysis, and the SROI method. The methodological approach is based on the concept of "complementary methodology" [4, 5], which, as the United Nations Environment Programme (UNEP) indicates, requires analysing the different dimensions of sustainability using distinct but parallel approaches.

The framework is structured in the conventional six main steps, as illustrated in Fig. 1.

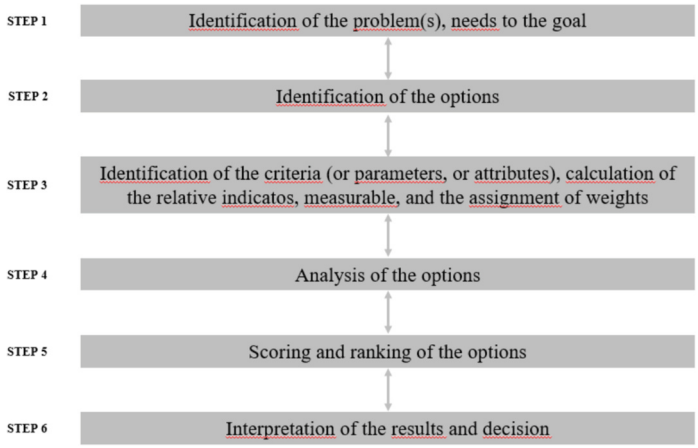

Fig. 1. Evaluation process: iterative workflow. Source: authors' elaboration.

The first step is to define the evaluation objective, identify the case study, and analyse the competitive analysis. In this phase, the decision-making problem is formalized, defined as the identification of the preferred design option.

The second operational step involves defining the alternative options to be evaluated. Within the methodological workflow, a limited set of mutually exclusive design scenarios is assumed, defined to ensure comparability across possible configurations of the intervention. The alternatives represent different design options, technological solutions, management strategies, or operational configurations related to the system being

analysed. These are selected based on technical, scientific, regulatory, and strategic criteria, with consideration of the study's objectives and the stakeholders involved in the decision-making process.

The third step involves identifying the criteria and related indicators for the three dimensions of sustainability. The economic and environmental dimensions are assessed using LCC and LCA approaches, which enable analysis of the costs and environmental impacts across the life cycle. The social dimension, on the other hand, is investigated using the SROI method, which estimates the social value generated by interventions by monetizing the impacts and benefits produced for stakeholders. Assessing sustainability criteria enables us to develop a set of indicators that holistically represent the performance of the various alternatives.

The fourth step involves harmonizing the selected specific indicators. To this end, we adopt the AHP [6] which enables us to structure the decision-making problem and assign relative weights to the criteria through pairwise comparisons of the hierarchy's elements. This allows comparison of heterogeneous indicators.

The fifth step consists of the option ranking phase, which involves selecting the most advantageous alternative or defining a ranking of preferences among the selected options. This step is closely linked to the preferences of the various stakeholders involved in the decision-making process.

The process concludes with the sixth and final step, which interprets the results from the previous steps and leads to a final decision.

3 Case Study

The urban regeneration and architectural redevelopment project of the Docks Dora complex, located in Turin (Northern Italy) in the Barriera di Milano district, within the Circoscrizione n°6 (Fig. 2), is assumed as a case study for the methodology application. The area where the Docks Dora are located is part of an urban transformation zone [7], characterized by a strong concentration of industrial activities and production infrastructure, representative also for the potential impacts on the Turin's property market values in the area [8, 9].

The Docks Dora complex (Fig. 3) was built between 1912 and 1914 as a general warehouse for the storage and conservation of duty-free goods, fitting into a territorial context that, in the first half of the twentieth century, established itself as one of the main hubs of Turin's industrial development.

From an architectural and construction point of view, the complex, designed by the engineer Ernesto Fantini and built by the company of Giovanni Antonio Porcheddu [10], constitutes a significant example of the use of the Hennebique system in reinforced concrete, an innovative technology for the time, which allowed for large structural spans and greater distribution flexibility.

The buildings, characterised by exposed brick facades and a modular structure organised into several functional pavilions, were equipped with internal railway connections that enabled the direct transfer of goods from wagons to warehouses.

Beginning in the second half of the twentieth century, functions as logistics systems were progressively reorganized, warehouses' original functions gradually diminished, and the area entered a phase of disuse and underuse.



Fig. 2. Localization of the Docks Dora in the Barriera di Milano neighborhood (Turin, Italy). Source: authors' elaboration from Piano Urbano della Mobilità Sostenibile (PUMS) (www.cittametropolitana.torino.it).



Fig. 3. Docks Dora complex. Source: authors' photos.

Since the 1980s, the Docks Dora complex, owned by private individuals available to accommodate scenarios with public implications, has been progressively reoccupied by commercial activities, creative studios, and cultural spaces, establishing itself as one of the city's main venues for artistic and cultural experimentation.

The complex today represents an emblematic example of the adaptive reuse of industrial heritage and the transformation of abandoned production infrastructure within the broader urban regeneration processes affecting the Barriera di Milano neighbourhood.

The complex borders the public green space of Peccei Park, one of the most strategic public spaces for use and socialization by neighbourhood residents.

4 Preliminary Phases for the Methodology Application

This contribution, as shown in Fig. 4, focuses on the first three operational steps of the methodological process, with particular attention to the social dimension of sustainability, while the subsequent steps will be further explored in future research.

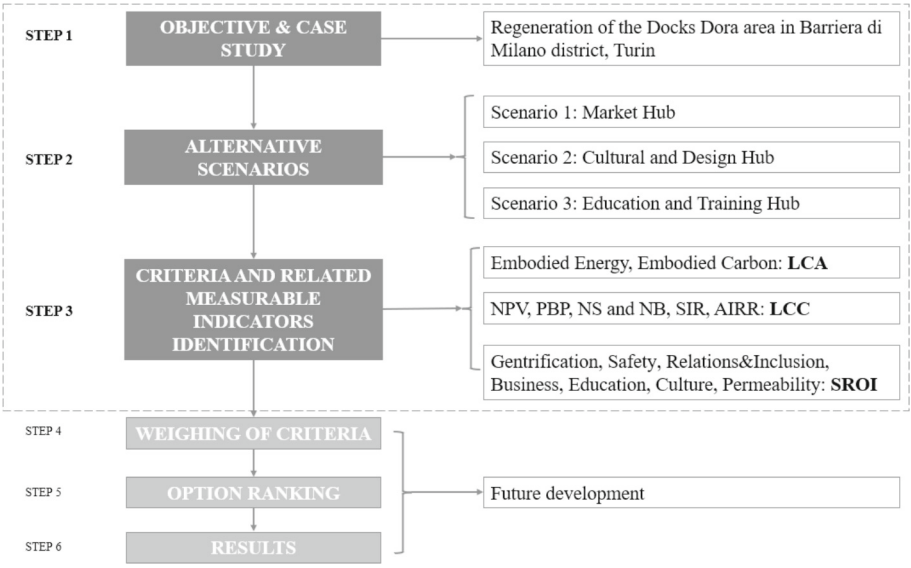

Fig. 4. Methodological process. Source: authors' elaboration.

4.1 Alternative Scenarios

The use of well-established methods, such as competitive analysis and SWOT analysis, led to the identification of the main sensitive issues and design strategies. Three alternative scenarios have been defined for the selected case study, which include interventions at urban and building level, with the aim of restoring the entire area to collective use and with attention to a potential permeability between private spaces with free access and public spaces bordering the complex. All alternatives require synergy between the private sector, private third-sector organizations, and public bodies. The scenarios are as follows:

- Market Hub: the alternative enhances the site's historical heritage, highlighting its commercial vocation through the creation of a market with indoor and outdoor spaces, complemented by a dedicated restaurant area. This alternative is expected to be completed in the short term, as it does not require any major architectural interventions.

- Cultural and Design Hub: the approach combines conservation-oriented enhancement with a contemporary reinterpretation of the site's historic character. The site is designed as a multifunctional hub capable of integrating new cultural and professional functions, while maintaining the creative activities already present in the area. Through targeted architectural interventions aimed at improving urban permeability, the redevelopment includes the creation of shared open spaces for artistic expression, including street art in the near Peccei Park, and an open-air theatre accessible to the community. The alternative envisages medium-term construction as it requires targeted architectural interventions.
- Education and Training Hub: the scenario defines a clear and structured functional structure. On the ground floor of the buildings, the current purpose of the spaces as open and permeable areas is maintained and enhanced, intended for workshops, commercial activities, creative studios, and light manufacturing. The upper floor houses training facilities, with particular attention to programs aimed at the international population. The proposal also includes the creation of co-working spaces, designed to foster professional activities and dynamic collaboration. The alternative envisions long-term construction as it requires significant architectural interventions.

The alternative scenarios proposed above have been developed on the basis of ISTAT data [11] (e.g. resident population, birth and death rates, business register, per capita income etc.), of Statistical yearbooks of the municipality of Turin [12], of the Territorial Projects of the National Metro Plus Programme 2021–2027 [13], of the Turin Metro project – Line 2 [14] and Circoscrizione n°6 and neighborhood dataset [15].

4.2 Identification of Criteria and Related Measurable Indicators

The assessment of sustainability criteria is based on specific indicators across the three dimensions of environmental, social, and economic sustainability.

The set of criteria identified for the study are the following:

- economic sustainability: NPV, PBP, NS, NB, SIR, AIRR;
- environmental sustainability: embodied energy and embodied carbon,
- social sustainability: Gentrification, Safety, Relations&Inclusion, Business, Education, Culture, Permeability

The related indicators represent the status of a specific area, phase, or process in the life cycle [16] and can be qualitative, semi-quantitative, or quantitative in nature. They can also be classified as specific or generic, primary or secondary.

Assuming that "*An indicator is a synthetic measure, generally expressed in quantitative form, coinciding with a variable or composed of multiple variables, capable of summarizing the trend of the phenomenon to which it refers"* [17], the following paragraphs outline and discuss the indicators associated with the LCC and LCA approaches, as required by the relevant regulations and guidelines.

By contrast, the SROI method does not rely on standardized regulations or predefined indicators applicable across all contexts. For this reason, the present study focuses on identifying and selecting social indicators, aiming to address this methodological limitation and strengthen the analytical robustness of the approach.

Economic Indicators. The economic sustainability criterion is assessed using LCC, a methodology normed in the international standard ISO 15686-5:2017 [18], which serves as the reference framework for evaluating costs incurred throughout the life cycle of a building or construction system.

The LCC approach introduces the concept of sustainability by applying economic indicators, expressed in monetary, percentage, or time units, to evaluate different design scenarios, particularly technological ones [1].

For the Docks Dora case study, selected for this research, the indicators considered most suitable for assessing economic sustainability are described in the following Table 1, based on [19, 20]. Notice that the indicators calculation implies delicate steps, specifically in relation to the financial input data selection and the discount rate definition [21].

Table 1. Economic Indicators. Source: authors' elaboration from [20]

Indicators	Description	Aims	Applicability condition
Net Present Value (NPV)	It represents the discounted value of costs over the entire time horizon considered. "Non-cost" components such as operational savings, strategic benefits, residual value, and economic incentives are also considered	– Comparison of alternative solutions through the application of the LCC; – Production of a ranking of alternatives based on cost-effectiveness principles; – Identification of the best alternative; – Verification of the economic acceptability of an alternative	As low as possible
Pay-Back Period (PBP)	Represents the number of periods necessary for the savings achieved to compensate for the initial costs of the initial investment	– Acceptance/rejection of alternative projects on the basis of a cost-effectiveness principle	Less than the useful life of the product
Net Saving (NS) and Net Benefits (NB)	Allow us to quantify the net economic margin of an alternative scenario compared to the reference one, by comparing their respective discounted costs. A positive value highlights the greater economic convenience of the alternative solution	– Single-option evaluation to rank alternative technology scenarios based on the lowest life cycle cost; – Selection of the most cost-effective products/processes/components; – Selection of optimal system/scenario combinations	Acceptable if >0 Rejectable if <0

(*continued*)

The calculation of the selected indicators will be developed subsequently, based on primary data collected through direct interviews with stakeholders and secondary data derived from scientific literature and available documentary sources.

Table 1. (*continued*)

Indicators	Description	Aims	Applicability condition
Saving to Investment Ratio (SIR):	It is a cost-effectiveness indicator that expresses the ratio between the savings achieved during the operational phase and the additional investment required, excluding residual value. Specifically, it compares the operational savings achieved with the incremental costs incurred for the adoption of improved technological solutions	– Acceptance/rejection of technological scenarios; – Ranking of alternative options	Acceptable if >0 Ascending order of values
Adjusted Internal Rate of Return (AIRR)	It measures a project's overall return by considering the reinvestment of intermediate cash flows over the analysis horizon and is determined using a specific financial mathematical formula. The AIRR expresses the project's effective annual rate of return, incorporates the effect of intermediate reinvestments, and allows for the identification of alternatives with the highest net returns	– Acceptance/rejection of technological scenarios; – Ranking of alternative options	>r (discount rate) Ascending order of values

Environmental Indicators. The evaluation of the environmental sustainability criterion is based on the use of specific indicators, understood as parameters or values derived from parameters capable of describing the state of the environment, the pressures exerted on it, the dynamics that influence its evolution and the effects produced on human health, ecosystems and materials [22–24].

Environmental impact refers to the modification of the quality of one or more environmental elements resulting from an action or activity, i.e., the alteration of an environmental aspect susceptible to interaction with the natural system. Impact represents the phase preceding the effect and can generate consequences at local, regional, or global scales, often resulting from the combination of multiple contributions distributed across space and time. Its assessment involves analyzing emissions, diffusion, and transformation processes in the environment, and final concentrations or deposition [25].

The choice of impact categories must be consistent with the study's objectives and relevant to the subject being analyzed; the main ones include climate change, acidification, eutrophication, stratospheric ozone depletion, resource consumption, land use,

and toxicity. Environmental indicators are divided into midpoints, which quantify the contributions to specific environmental phenomena along the cause-effect chain using characterization factors, and endpoints, which express the final damage to the environment and human health through further aggregation and normalization processes [5].

The selection of indicators is a crucial step and must ensure methodological consistency, scientific validity, transparency, and compatibility with any standardization and weighting procedures, in line with ISO recommendations and the guidance provided by [17].

In this study, the environmental indicators suggested are Embodied Energy (EE) and Embodied Carbon (EC), considered particularly representative of the impacts associated with materials and construction systems throughout their life cycle [26].

Embodied Energy (EE) is the total primary energy incorporated into a product, including the phases of extraction, production, transport, construction, and end-of-life.

Embodied Carbon (EC) measures the overall greenhouse gas emissions generated along the same phases and is expressed in kg of CO_2 equivalent. The reference indicator for climate change is the Global Warming Potential (GWP), expressed in kg CO_2eq, while CO_2 indicates only carbon dioxide, CO_2 equivalent includes all greenhouse gases weighted according to their global warming potential.

Notice that the calculation of the environmental indicators will be the subject of a subsequent in-depth study during which the concrete possibility of proceeding with their quantification will also be verified in relation to the availability and quality of the data collected. Alternatively, data from the literature will be assumed as a proxy for the simulation.

Social Indicators. The social criterion explicitly refers to the SROI index, a quantitative metric calculated using a numerical value that functions as an "efficiency" indicator. It assesses an entity or organization's capacity to convert invested resources into initiatives that generate measurable social impact [1].

As per the methodology, SROI is developed in six stages: (i) establishing scope and identifying stakeholders; (ii) mapping outcomes; (iii) evidencing outcomes and giving them a value; (iv) establishing impact; (v) calculating the SROI; (vi) reporting, using, and embedding. In this contribution, which is an in-depth analysis of the methodology with respect to the article [1], we have reached stage iv.

One of the core elements of the SROI method, particularly in the "Theory of Change" phase, is the involvement of stakeholders from the earliest stages of the analysis through to the final phase of reporting and disclosing results. As Jeremy Nicholls's guide highlights, SROI seeks to foster accountability to stakeholders [27].

A primary objective of SROI, whether evaluative or forecast, is to assess the extent to which a project generates change for the stakeholders involved, namely those who "experience change, whether positive or negative, as a result of the activity being analysed" [27 p. 20]. For methodological consistency, these actors must therefore be fully integrated into the evaluation process, contributing to the identification of outcomes and indicators, as well as to the definition and valuation of the impact generated.

However, although the importance of stakeholder involvement is repeatedly emphasized, Nicholls [27] does not provide detailed operational guidance on specific engagement methods. As a result, practical applications have led to the development of heterogeneous approaches: "practitioners developed the SROI framework according to their specific needs" [28].

On this basis, stakeholder identification was conducted by combining the CIA method [29] and the Salience Model [30] to obtain a more comprehensive assessment of each key actor. The Salience Model classifies stakeholders according to the combination of three core attributes: (i) power, defined as the stakeholder's capacity to influence decisions, processes, or project outcomes; (ii) legitimacy, understood as the perception that a stakeholder's actions or claims are appropriate and socially accepted within the project context; and (iii) urgency, referring to the degree to which stakeholder claims require immediate attention, based on their criticality and time sensitivity. The integration of these two approaches enabled a more robust mapping and prioritization process.

In the case study of Docks Dora in Turin, the analysis (see Sect. 3) identified the stakeholders most directly involved in and affected by the transformation process across the three alternative scenarios (Fig. 5).

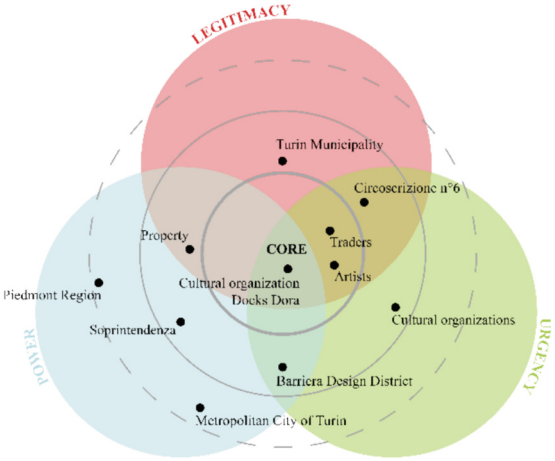

Fig. 5. Stakeholders mapping: Salience Model application. Source: authors' elaboration

This has led to the involvement of stakeholders of different types and backgrounds, since "research shows that how social value is understood and operationalized, is shaped by subjective interests, professional norms, and broader ideological positions" [31, p. 1]. The stakeholders involved are: users, comprising artists with studios within the complex as well as commercial operators (including restaurant and bar owners); the property owners; and the local government, encompassing the Municipality of Turin, Circoscrizione n°6, the Piedmont Region, and the Soprintendenza Archeologia Belle Arti e Paesaggio for Turin (Superintendency for Archaeology, Fine Arts and Landscape), given the site's protected status.

Tourists, who may access the site through private tours, and residents of the Borgata Montebianco subarea were excluded from the present analysis. This decision was made because these groups are not directly involved in the specific transformation process under examination and because the study focuses primarily on the individual asset rather than the broader territorial impacts. Moreover, both categories constitute large and internally heterogeneous groups whose systematic engagement would have required substantial financial and time resources. This constraint reflects one of the principal criticalities of the SROI methodology: "resources are not only monetary costs but also time of people, expertise of the practitioners, and the required information which is not always available (e.g., inexistent standardized indicators, or financial proxies)" [32, p. 4].

Table 2 highlights the stakeholders, the reasons for their inclusion and their characteristics in the Salience Model.

Table 2. Stakeholders included. Source: authors' elaboration.

Stakeholders	Reasons for inclusion	Salience Model
Users	Those who will be most affected by the change	Legitimacy: ++ Urgency: +++ Power: +
Local Government	Those who make decisions and money	Legitimacy: ++ Urgency: + Power: ++
Property	Those who make decisions and money	Legitimacy: ++ Urgency: ++ Power: +++
Cultural organizations	Those who actively operate in the area	Legitimacy: + Urgency: +++ Power: +

Once stakeholders had been identified, participants were engaged through a master's degree program at the Politecnico di Torino, informal semi-structured interviews, and a series of participatory workshops. The workshops, organized as discussion sessions involving artists, commercial tenants, property representatives, and local institutional actors, were designed to facilitate collective reflection on the expected effects of the regeneration process and to elicit shared and divergent perspectives [33].

Consistent with the SROI methodology, these activities enabled the systematic mapping of the outcomes that the various scenarios aim to achieve. The engagement process revealed that each identified outcome is relevant to multiple stakeholder clusters, indicating a shared interest in transforming the area under analysis despite the differing roles, expectations, and institutional positions of the actors involved.

The outcomes identified are: (i) limiting the phenomenon of gentrification; (ii) improvement in perceived safety; (iii) intensification of social relations; (iv) development of business activities; (v) improvement in the quality of educational provision; and (vi) permeability of the site.

Finally, as explained in the methodology section, specific indicators were defined for each outcome, along with corresponding financial proxies (Table 3). This stage is pivotal because it enables monetizing outcomes that are inherently qualitative. At the same time, it constitutes one of the principal methodological limitations of the approach. The absence of a universal standardized database of financial proxies limits comparability across studies and reduces the degree of international standardization of SROI applications [34, 35]. As a result, practitioners are often required to develop contextualized proxies grounded in their own assumptions, perceptions, and professional judgment [36–38] further argue that SROI analyses should place greater emphasis on including a control group (a group not affected by the intervention) to measure and compare outcomes at baseline, during implementation, and upon project completion, to ensure accurate attribution of effects. This issue could be further addressed through the Delphi method, which brings together a panel of experts to assess and refine project scenarios through structured consultation [39–42].

Furthermore, since many of the outcomes under consideration are intangible and not directly market-valued, identifying appropriate proxies is particularly complex. This often requires integrating complementary valuation techniques, such as contingent valuation methods or structured stakeholder surveys. In the case of perceived safety, for example, focus group-based data collection was used to estimate stakeholders' willingness to pay for improvements in safety, thereby assigning monetary values to the corresponding indicators. Another applicable approach is cost comparison, using the market value of a comparable activity as a proxy. This method was employed to calculate the indicators "Use of public spaces and gathering places" and "New activity courses". Table 3 presents the identified outcomes along with their respective indicators and financial proxies.

The final impact (the impact map) associated with a given benefit does not always correspond to the value derived from the financial proxy, as in some cases the latter may result in an overestimation. To mitigate this risk, four adjustment factors can be applied: (i) deadweight defined as the measure of the quantity of outcome that would have occurred even if the activity had not taken place; (ii) attribution, i.e., the evaluation of how much of the outcome comes from the contribution of other organizations or people; (iii) displacement, i.e., how much what is a benefit for a given group of stakeholders may have the opposite effect on another group of stakeholders; (iv) drop-off, i.e., the quantity of the outcome will likely decrease over time [43].

In the case study presented here, the deadweight factor was applied to the indicators "Housing price trends in the area", "Identification of elements of degradation", and "Increase in events during nighttime opening hours". The drop-off factor was applied to the indicators "Housing price trends in the area," "Use of public spaces and gathering places", "Opening of new businesses", "Number of people enrolled", and "Quantity and type of cultural events".

In this contribution, the specific adjustment percentages for each factor are not reported; they will be further developed and discussed in a future study.

Table 3. Identification of outcomes, indicators, and financial proxies. Source: authors' elaboration.

Stakeholders	Outcome	Indicators	Financial proxy	Sources
Users, Cultural organizations	Limiting the phenomenon of gentrification	– Housing price trends in the area	– Market value (€/sqm)	– OMI data (Agenzia delle Entrate) – OICT_ricerche
Users, Local Government	Improvement in perceived safety	– Identification of elements of degradation – Number of complaints	– WTP	– Survey – Municipality of Turin
Users, Cultural organizations	Intensification of social relations and inclusion	– Use of public spaces and gathering places – Quantity of events	– Average household expenditure on recreational activities – Opportunity cost	– ISTAT – Municipality of Turin - Green Division, Parks and Animal Protection – Survey
Users, Local Government, Property	Development of business activities	– New type of businesses – New jobs	– Quantity of new business – Average salary	– Chamber of Commerce of Turin/Industrial Union of Turin – ISTAT
Local Government, Cultural organizations	Improvement in the quality of educational provision	– New activity courses – Number of people enrolled – New jobs	– Cost of private training courses – Average household expenditure on educational activities – Average salary	– ISTAT – Barriera Design District (BDD) association data

(*continued*)

Table 3. (*continued*)

Stakeholders	Outcome	Indicators	Financial proxy	Sources
Users, Cultural organizations, Property	Promotion and growth of cultural activities	– Quantity and type of cultural events	– Average household expenditure on cultural activities	– Osservatorio Culturale del Piemonte (Cultural Observatory of Piedmont) - Barriera Design District (BDD) association data – VivoIn dataset
Users, Cultural organizations, Local Government, Property	Permeability of the site	– Increase in events during nighttime opening hours	– WTP	– Survey

5 Discussion, Further Research Developments and Conclusions

This contribution examines the methodological aspects involved in developing multidimensional evaluation tools for urban and building transformation processes. Specifically, the study focuses on selecting the case study and defining alternative scenarios, along with the sustainability criteria and indicators identified.

The analysis shows that integrating life cycle-based approaches (LCC and LCA) with tools designed to assess the social dimension (SROI) can provide a more comprehensive understanding of the impacts generated by urban transformation interventions. In this context, the AHP enables the integration of heterogeneous indicators and supports structuring the decision-making process by defining a weighting system for the different sustainability criteria.

Several methodological challenges arise, primarily due to the heterogeneity of the indicators adopted. This heterogeneity complexifies the comparability of results and the definition of shared units of measurement, particularly about the social dimension [44]. In this area, the definition of proxies used to monetize social benefits remains limitedly standardized, resulting in a certain level of subjectivity in evaluation procedures. By contrast, relatively consolidated methodological references exist for the economic and environmental components. Additional challenges arise from the operational complexity of integrating heterogeneous datasets, which can affect the replicability of the proposed models, the long timescales required for developing individual approaches, and the large number of stakeholders involved. Within this framework, the selection and structuring of the indicator system play a crucial role, as they directly influence the model's ability to consistently represent the different dimensions of sustainability. In this context, particular attention is given to the selection of indicators, the use of financial proxies within the SROI component, and the transferability of the framework to other contexts, which are

addressed consistently with the methodological scope of the study while acknowledging the need for context-specific adaptations.

Despite these challenges, integrating Life Cycle approaches, AHP, and SROI is particularly effective in supporting complex decision-making processes. By simultaneously considering the three dimensions of sustainability, the framework enables explicit consideration of trade-offs among competing project objectives and greater transparency in selecting alternative scenarios.

Based on these findings, several directions for future research can be identified. A first area concerns the operational application of the methodological framework to the selected case study through the calculation of the identified indicators and the implementation of the AHP, with the aim of validating the methodology and assessing its replicability. Moreover, the integrated framework proposed here (combining LCA, LCC, SROI, and AHP) remains relatively underexplored in the literature and has been applied only to a limited extent in this research field. In this perspective, integrating these tools may provide a valuable methodological contribution to addressing the growing complexity of project-related decisions, enabling a multidimensional, holistic assessment of urban and building transformation processes and facilitating comparisons of alternative scenarios.

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