Networks and Spatial Economics
https://doi.org/10.1007/s11067-026-09761-y

RESEARCH

Rethinking Incentives for Circular Urban Regeneration: Lessons from the City of Milan

Marco Rossitti[1] · Francesca Torrieri[1] · Marta Dell'Ovo[2] · Giulia Datola[2] · Danny Casprini[2] · Alessandra Oppio[2]

Received: 30 June 2025 / Accepted: 20 May 2026

Abstract

In recent decades, urban planning has increasingly shifted toward regenerative and circular approaches, placing a new emphasis on urban regeneration. However, existing legislation often fails to fully grasp the multifaceted nature of the issue, which extends beyond mere physical transformation. This limitation is evident in Italian regional policies, where incentives for the recovery of abandoned buildings are defined with limited consideration of contextual conditions. Based on these premises, the paper develops a three-phase evaluation tool to support public administrations in defining fair incentive schemes for urban regeneration. To this aim, the proposed evaluation tool integrates: (i) a property-based financial feasibility assessment based on the transformation value; (ii) a social sustainability assessment at the neighbourhood scale based on a multi-criteria decision analysis (MCDA), and (iii) a rule-based clustering of properties based on use, profitability, and social sustainability conditions. The tool is tested on a case study of 24 abandoned properties in Milan (Italy). The results highlight significant variations in both the financial feasibility of regeneration initiatives and social sustainability across properties, highlighting the need for differentiated incentive schemes. These findings reveal the potential of the evaluation tool to support more equitable and context-aware allocation of incentives toward designing more effective urban regeneration policies.

Keywords Social sustainability · Urban regeneration · Incentives · Evaluation · Decision support · Optimization

✉ Marco Rossitti
marco.rossitti@polimi.it

1 Department of Architecture, Built Environment and Construction Engineering (DABC), Politecnico di Milano, Milan, Italy

2 Department of Architecture and Urban Studies (DAStU), Politecnico di Milano, Milan, Italy

1 Introduction

In the last decades, the necessity to address socio-economic rapid changes through regenerative practices has been identified as a key area of concern in the planning agenda. In response, a new emphasis has been placed on urban regeneration processes and their contribution to promoting circular, integrated, and people-oriented approaches, thus extending beyond the scope of physical intervention. (Alpopi and Manole 2013).

Adopting people-oriented approaches to urban regeneration, inspired by a broader interpretation of the circularity concept (Iofrida et al. 2024), has steered the planning agenda to give prominence to public engagement and forms of partnership among players with different roles and capabilities (Arnstein 1969; Ball and Maginn 2005). In this context, the public sector's financial constraints and the need for efficiency have increased cooperation between public and private entities in leveraging their opportunities to achieve urban regeneration goals (Roberts 2016; Navarro-Yáñez and Rodríguez-García 2020).

The attempt to seize these opportunities has spread from single programs and interventions to a broader action scope, thanks to the definition of planning and legislative measures to promote private involvement.

However, these tools do not seem to capture the complexity of themes related to urban regeneration. The Italian legislation is emblematic in this sense: different legislative measures set by regional administrations define a system of incentives for private regeneration of abandoned buildings, but these measures do not consider the social and territorial context in which buildings are located.

Based on these premises, the paper proposes an integrated evaluation tool to support public administrations in fairly defining incentives for urban regeneration.

To this end, Sect. 2 adopts the relationship between social sustainability and urban regeneration as a lens to examine planning approaches, which trigger private interventions for urban regeneration in both the international and Italian contexts. Based on the emerging criticalities, Sect. 3 proposes an evaluation tool, which integrates a financial feasibility perspective and a social sustainability assessment to support decisions about the fair definition of regeneration incentives for the private. In Sect. 4, the tool, grounded on the integration of different evaluation models (transformation value, single-objective optimization model, Multi-Criteria Decision Analysis), is tested on a case study represented by 24 abandoned buildings in Milan. Such a test allows for discussing the limits and opportunities of the proposed evaluation model, focusing on its contributions to the fair regulation of incentives for urban regeneration.

2 Social Sustainability in Planning and Legislative Tools for Urban Regeneration: Which Space?

The approach to urban regeneration has significantly widened its focus and goals from the physical improvement of places to the social and economic impact dimension (Marra et al. 2016; Chen et al. 2020; Rossitti et al. 2023). This change has led public policy instruments to recognize the added value of partnerships with local stakeholders (Nzimande 2023), while bringing a greater emphasis on the relationship between social sustainability and urban regeneration. Furthermore, given spatial organizations' capacity to generate inclusion or inequality (Amin 2006), the planning debate has shifted towards interpreting the space dimension as the physical infrastructure to satisfy citizens' needs and contribute to their well-being (Zhou et al. 2024). From this perspective, urban regeneration initiatives can be seen as flexible processes to promote social sustainability, intended as «achieving a fair degree of social homogeneity, equitable income distribution, employment […], and equitable access to resources and social services, a balance between respect of tradition and innovation, and self-reliance, endogeneity and self-confidence» (Mc Guinn et al., 2020).

The growing acknowledgment of social sustainability's relevance in urban regeneration issues also finds a reflection in the official documents at the international level.

Concerning the European context, a long evolutionary path, starting from the "Aalborg Charter" in 1994 (European Conference on Sustainable Cities and Towns, 1994) and moving through the Leipzig Charter in 2007 (European Commission, 2007), has opened to recognizing the role of communities for sustainable development at the urban level.

A key point for the evolution of the urban planning approach on this line is the "Pact of Amsterdam" in 2016 (European Commission, 2016).

By adopting an integrated and coordinated approach to address urban issues, it identifies inclusion, urban poverty, and the promotion of regenerative economies as priorities for the urban agenda, thus clearly highlighting the social dimension and potential impact of interventions at the urban scale. Furthermore, it identifies multi-level and multi-actor partnerships as a key delivery mechanism to achieve its objectives in line with the "EU 2020 Strategy for smart, sustainable, and inclusive growth" and the "UN's Agenda on Sustainable Development". The implementation of the outlined Urban Agenda is re-launched by the "New Leipzig Charter" in 2020 (European Commission, 2020), which sets the urban policies' common goal to safeguard and enhance the quality of life in all European towns and cities and reaffirms the need to adopt a place-based and multi-level approach to urban development. In this context, it identifies social justice as one of the key dimensions to unfold the transformation potential of cities, which requires prioritizing the circular regeneration of urban areas.

All these documents and declarations raise interesting points about the social dimension of urban regeneration and hint at several convergences with the academic debate. However, none of them has traced an operative path to open the definition of planning or legislative tools to careful considerations about urban realities' social dimension and quality.

2.1 Urban Regeneration Incentives in the Italian Regulatory Framework

The lack of an operative guide to bring the complexity and plurality of themes related to urban regeneration to the core of planning and legislative provisions is reflected in national approaches. The Italian context is emblematic in this sense.

According to the Constitution of the Italian Republic (1947). Article 117, as modified by the Constitutional Law 18 October 2001; n. 3 (2001), land-use planning is recognized as a subject matter of "concurrent legislation" between the central state and the regions: the State sets the fundamental principles, while the Regions have the authority to enact detailed legislation under those principles. However, given the absence of a unitary regulatory system, Regions have produced different legislative measures to rule and promote urban regeneration by resorting to partnership mechanisms with the private sector. These measures provide incentives for private intervention on existing buildings, which range from volumetric premiums and building credits to discounts on planning fees and can be accessed under specific conditions (Table 1).

Concerning these conditions, they are mainly related to the buildings' use and safety, or the regeneration projects' characteristics in terms of intended use, energy efficiency, and environmental measures.

On the contrary, the legislative provisions lack specific consideration of the social conditions of the neighbourhoods in which the buildings are located.

Such a lack of attention, on one hand, clearly demonstrates the inability of legislative measures to effectively prioritize the social sustainability dimension. On the other hand, it risks undermining the effectiveness of these support measures in more critical areas due to the lack of economic profitability.

3 Assessing Incentives to Support Urban Regeneration: An Integrated Evaluation Tool

The excursus of legislative provisions to support urban regeneration in Italy reveals a mainstream frame in which incentives are assigned without considering the differences in the regeneration initiatives' profitability and the quality of the intervention context. Such an indiscriminate approach entails the risk of turning urban regeneration initiatives into planning devices to exacerbate inequalities. To deal with this issue, it becomes urgent to provide "correction mechanisms" to the definition of fair incentives by integrating the current and homogenous legislative provisions with a social sustainability perspective and the specific regeneration processes' needs. Such a "correction mechanism" can be based on integrating a financial assessment, aimed at evaluating the feasibility of the regeneration initiative and the effectiveness of the provided incentives, with a social sustainability assessment, as a comprehensive expression of the neighbourhood's capacity to answer the needs of local communities. In this sense, the paper proposes an integrated evaluation tool toward supporting the fair allocation of urban incentives, which is structured into three main phases (Fig. 1):

- Phase 1: Financial Feasibility Assessment. This phase focuses on assessing the transformation value of the regeneration project as the evaluation criterion to express a financial judgment on its feasibility and the effectiveness of the available incentives. Furthermore, it resorts to an optimization model to fairly quantify the public incentives, ensuring the feasibility of the regeneration initiative.

Table 1 Italian regional legislative measures in comparison

Region	Law	Typology of incentive	Articles
Bolzano	L. n.9/2018	Not specified	Art. 17 Art. 19
Calabria	L. n.25/2022	Volumetric or surface increase	Art. 4
Campania	L. n.13/2022	Volumetric increase Increase of the building index	Art. 3 Art. 4
Emilia Romagna	L. n.24/2017	Exemption from the extraordinary contribution Planning fees discount Concession of building rights	Art. 8
Lazio	L. n.7/2017	Existing gross floor area or volumetric increase	Art. 2 Art. 3 Art. 5 Art. 6
Liguria	L. n.23/2018	Exemption from the additional contribution on the construction cost Concession of building credit Financial or fiscal incentives	Art. 6
Lombardia	L. n.18/2019	Volumetric increase Planning fees discount	Art. 2 Art. 3
Marche	L. n.19/2023	Extraordinary contribution discount Planning fees discount	Art. 26
Piemonte	L. n.16/2018	Volumetric or surface increase Concession of building credit	Art. 12
Puglia	L. n.21/2008	Tax reduction Planning fees discount Volumetric increase	Art. 7
Sicilia	L. n.19/2020	Planning fees discount Concession of building credit	Art. 33
Toscana	L. n.65/2014	Surface increase	Art. 125, 126, and 127
Trento	L. n. 15/2015	Volumetric increase Concession of building credit Planning fees discount	Art. 88 Art. 109
Veneto	L. n.14/2017	Concession of building credits Volumetric or surface premium Planning fees discount	Art. 6

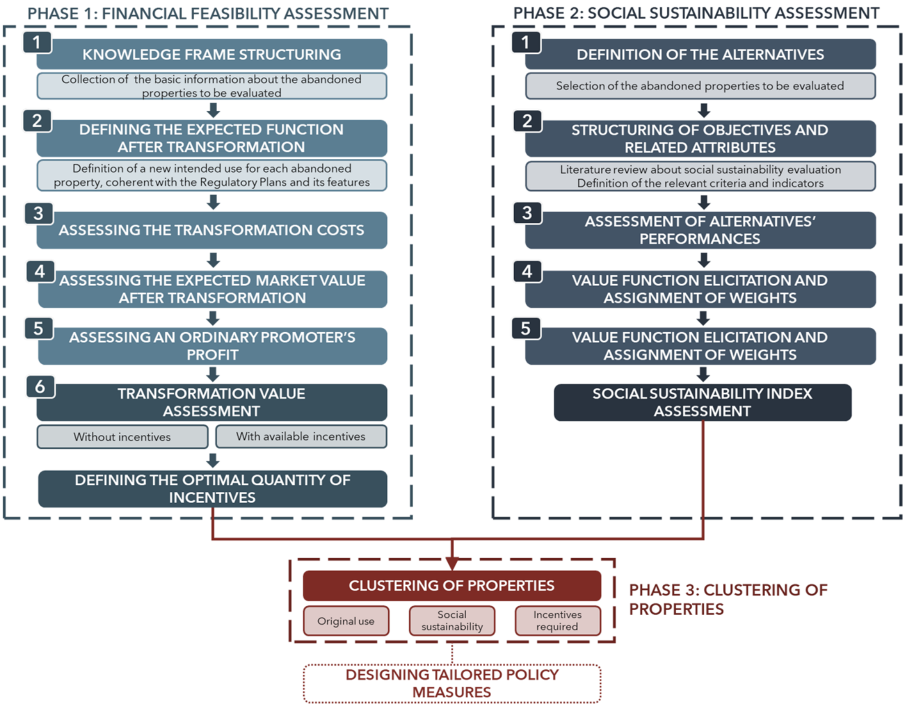

Fig. 1 Integrated evaluation tool to support urban regeneration policies (Authors' elaboration)

- Phase 2: Social sustainability Assessment. This phase aims at assessing social sustainability at the scale of the neighbourhood in which the abandoned building is located. Given the multidimensional nature of the urban regeneration issue, it resorts to a Multi-Criteria Decision Analysis (MCDA) to obtain a comprehensive social sustainability index (Nijkamp et al. 1990).
- Phase 3: Clustering of Properties. This step, grounded on the results from the previous phases, focuses on clustering abandoned properties with similar characteristics in terms of investment profitability and neighbourhoods' social sustainability conditions. Thus, it provides a valuable information layer to orient policy actions about urban regeneration.

The following sub-section briefly describes the different phases of the evaluation tool definition.

3.1 The Financial Feasibility Assessment

The Financial Feasibility Assessment aims to evaluate the financial feasibility of the regeneration intervention for a property and the effectiveness of the available incentives by adopting the transformation value appraisal criterion. The transformation value is defined as the difference between the market value of the property after the transformation and the transformation costs, and is equal to:

$$TV = \frac{MV - (TK + P)}{q^n} \tag{1}$$

Where:

- TV is the transformation value.
- MV is the expected market value of the property after transformation.
- TK is the cost of the transformation.
- P is the ordinary promoter's profit.
- $q^n = (1 + r)^n$ is the discount factor, based on the definition of the discount rate r.

Adopting this lens to the expression of a financial convenience judgment allows balancing the need for standardization, required by an evaluation tool to be extensively applied at the municipal level, with consideration of the specific conditions of the property under evaluation. Furthermore, to strengthen the extensive and easy applicability of the proposed methodology across diverse urban areas and a large number of buildings, the formulation adopted for estimating the transformation value (1) is intentionally simplified into:

$$TV = MV - (TK + P) \tag{2}$$

Specifically, such a formulation does not explicitly account for the time dimension of the discount rate that, even if fundamental in feasibility assessments, would require project-specific assumptions regarding risks and the financial structure of each regeneration investment. Given its methodological foundation and the underlying assumptions, the transformation value assessment task goes through different steps:

1. Knowledge frame structuring. This first step involves collecting all the basic and relevant information about the property under analysis.
2. Defining the expected function after transformation. It requires defining the new intended high and best use for the property, which is coherent with its characteristics and the planning rules.
3. Assessing the transformation costs. This step entails estimating the most probable transformation cost for the property.
4. Assessing the expected market value after transformation. It requires assessing its most probable market value, which reflects the actual market conditions in the property's area.
5. Assessing an ordinary promoter's profit. It involves estimating an ordinary promoter's profit, which expresses the compensation for the risk undertaken through the transformation process.
6. Assessing the transformation value of the property. Based on the defined input factor and by applying Eq. (1), it allows for defining the transformation value of the property in different conditions: without public incentives and after the application of the available incentives.

7. Defining the optimal quantity of incentives. This step resorts to an optimization model that, starting from the incentive provisions for urban regeneration available in a specific territorial context, identifies their optimal quantity, which allows for meeting the private ordinary expectation of return on investment (Manganelli et al. 2020). Its result, critically compared to existing incentive provisions, adds another information to the judgment about their effectiveness, while providing quantitative data to public policies toward fair and differentiated allocation mechanisms. The proposed optimization model finds its general conceptualization in:

$$\text{find x} \tag{3}$$

$$\text{subject to :}$$

$$\begin{cases} f\ (x) = T \\ L \leq\ x \leq\ U \end{cases}$$

Where:

- x is the vector of the available incentives.
- f (x) is the objective function (the transformation value or other financial indicators derived from it, as the Return on Investment).
- T is the target value for the objective function, representing the minimum and ordinary financial performance, making a regeneration investment profitable.
- L and U are the lower and upper bound constraints for the available incentives.

3.2 The Social Sustainability Assessment

The Social Sustainability Assessment adopts a Multi-Criteria Decision Analysis (MCDA) methodology toward assessing a social sustainability index of the neighbourhood in which the property is located (French and Roy 1997). Among the available MCDA methodologies, the evaluation task's specificities lead to choosing the Multi-Attribute Value Theory (MAVT).

Indeed, this MCDA methodology adopts a full aggregation and single-criterion approach to the evaluation issue, thus meeting the need to convert performances according to different dimensions into an overall social sustainability index. The MAVT's implementation goes through the following steps (Ferretti and Grosso 2019):

1. The definition of the alternatives to be evaluated, which are the buildings to be renovated.

2. Structuring of objectives and related attributes. This step provides the reference conceptual framework (criteria and indicators) for the evaluation, aimed at measuring social sustainability at the neighbourhood scale. Given the lack of uniformity and clarity in evaluating social sustainability, along with the multi-dimensional and contextual nature clearly emerging from its definition (McGuinn et al., 2020), its construction requires, firstly, investigating the scientific landscape of research on social sustainability assessment (Opp 2017).

3. Assessment of alternatives' performances. This step involves measuring, for each property, its neighbourhood's performance according to the selected indicators.

4. Value function elicitation and assignment of weights. Value functions allow for mathematically expressing human judgments about alternatives to be evaluated (Beinat 1997), while weights represent the relative importance of one attribute compared with another (Gan et al. 2017).

5. The overall value calculation. This last step requires adopting a multi-attribute value function to the value assigned to alternatives for each considered indicator. Among the available ones, the simplest and widely used aggregation model is represented by the additive model, according to which an alternative's overall value *Va* is equal to:

$$V_\alpha = \sum \omega i \cdot vi\,(\alpha) \tag{4}$$

Where vi (a) is the single attribute value expressing the performance of the alternative a for the attribute i, and ωi is the weight assigned to the attribute i as the expression of its importance compared with other attributes.

Thus, the MAVT implementation allows for the aggregation of the neighbourhood's performances for the defined indicators into an overall index of social sustainability.

3.3 The Clustering of Properties

The Clustering of Properties phase involves integrating the results of the transformation value and social sustainability assessments. Specifically, properties are clustered based on three key dimensions: (i) original use; (ii) the level of the social sustainability index; (iii) the economic feasibility of the regeneration under the considered incentive schemes. By so doing, the clustering approach does not rely on a formal statistical algorithm, but rather on a rule-based classification procedure based on policy-relevant conditions. This approach is consistent with the objectives of the evaluation tool, which is designed to provide a coherent analytical structure while supporting the formulation of policy measures for the effective allocation of incentives. In this sense, the proposed classification can provide a valuable knowledge layer to inform the design of tailored and context-sensitive regeneration policies.

4 The Tool Implementation: Rethinking Incentives for Urban Regeneration in the Milan Municipality

4.1 Prologue and Selection of Case Studies

The proposed evaluation tool's possible implications for supporting the fair definition of incentives are tested through a case study represented by abandoned properties in Milan Municipality (Italy). Milan belongs to the Lombardy Region, which, in the last 10 years, has introduced different legislative measures to regulate land consumption and urban regeneration.

Among them, Regional Law n. 18/2019 (2019) marks a change of attitude towards urban regeneration. With the art. 40-bis, the Law establishes that municipalities must identify properties that have been abandoned for at least five years and show critical issues. For all these properties, the law allows the application of the following incentives to private interventions:

• A 20% increase in building rights over the set maximum building index, or over the current Gross Surface Area, whichever is higher.

• An additional 5% increase in building rights for interventions able to guarantee a waterproofed surface devoted to green spaces at least equivalent to the rise in the gross surface area obtained, as well as for initiatives resulting in a reduction in the building's footprint on the ground of at least 10%.

• A 60% decrease in planning fees.

These incentives are only available for the first three years after the notification of the inclusion in the municipal abandoned building list: in this time range, interested parties must start obtaining the license allowing the intervention.

The provisions of art. 40-bis are then substantially modified by the Regional Law n. 11/2021 (2021), which provides municipalities with a greater margin of action than the previous version. Its main change can be identified in the replacement of the "fixed" building right increase of 20% with a variable percentage (between 10% and 25%) based on the municipality's decision.

Milan municipality has identified 115 buildings as eligible or partially eligible for the application of Article 40-bis, and, within them, 81 buildings admitted to incentives and waivers (Fig. 2).

Among them, 24 buildings are selected (Fig. 3) to test the opportunities of the proposed integrated evaluation tool (Fig. 1), based on a representativeness criterion in terms of functions and location.

4.2 The First Phase of the Integrated Evaluation Tool Implementation: The Financial Feasibility Assessment

The implementation of the integrated evaluation tool moves from assessing the transformation value for the 24 selected properties. Based on the proposed methodological framework (Fig. 1), once defined the new intended use for each property, the different items contributing to the transformation costs are estimated as follows:

• The cost for the acquisition of the building is estimated based on the market values provided by the Official Observatory of the Real Estate Market in Italy (OMI) (Agenzia delle Entrate, 2023).

• The cost of the renovation project is estimated through a synthetic-direct procedure by referring to the parametric costs within the DEI Typological Price List (Collegio degli Ingegneri e Architetti di Milano, 2024).

• Planning fees are retrieved from the official tables of the Milan Municipality.

• Professional fees and general expenses are calculated as percentages of the renovation cost.

The expected market value of the property after its regeneration is estimated according to the market values provided by the OMI (Agenzia delle Entrate, 2023).

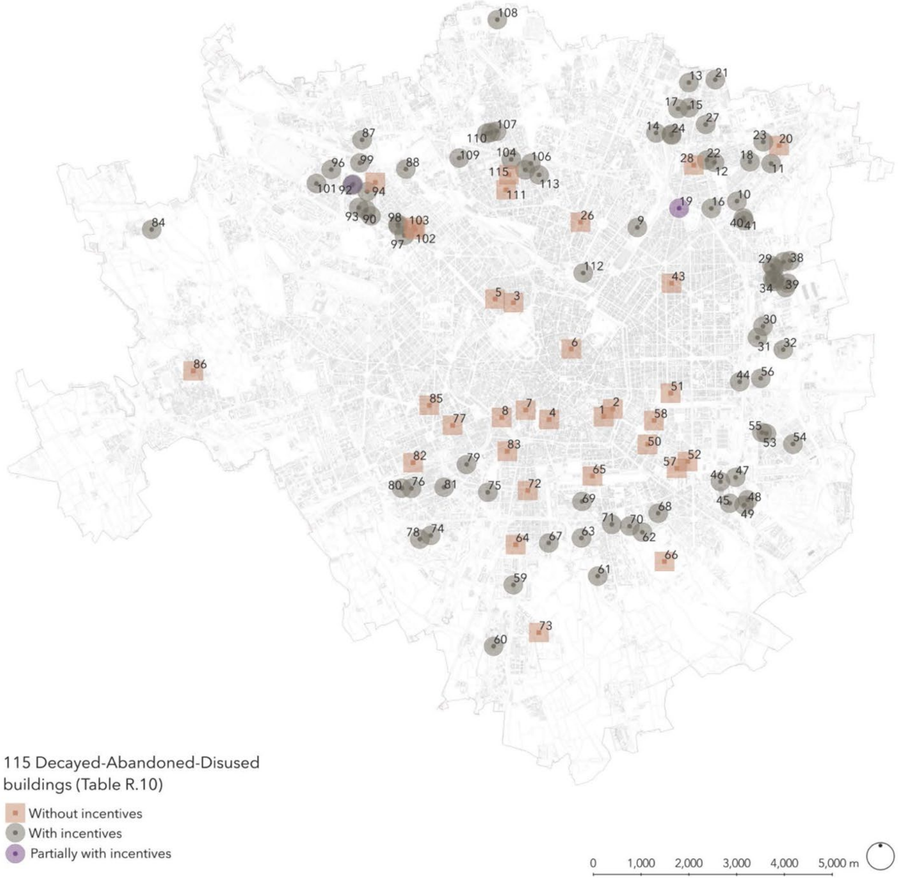

Fig. 2 115 abandoned buildings identified by the Municipality of Milan for applying the art. 40-bis (Authors' elaboration on Milan Municipality's cartography)

The ordinary promoter's profit, instead, is calculated as 10% of the expected market value after transformation.

By applying Eq. (1), the transformation value is estimated according to three different scenarios: without incentives; after the fee discount (60% of the due planning fees); after a volumetric bonus (25% of the existing volume). This estimation returns a differentiated situation, which becomes even more interesting when applying the incentives provided by the Regional Law (Table 2).

Indeed, it shows that almost all the regeneration interventions for the selected buildings are not feasible, thus strongly questioning the effectiveness of the incentives. Furthermore, if the residential functions emerge as the most convenient for building transformation, the property's location also stands out as a crucial factor in determining the feasibility of the intervention.

These rough results confirm the ineffectiveness of a "homogeneous" system of incentives and make it crucial to understand the fair system of incentives required for the profitability of the regeneration initiative.

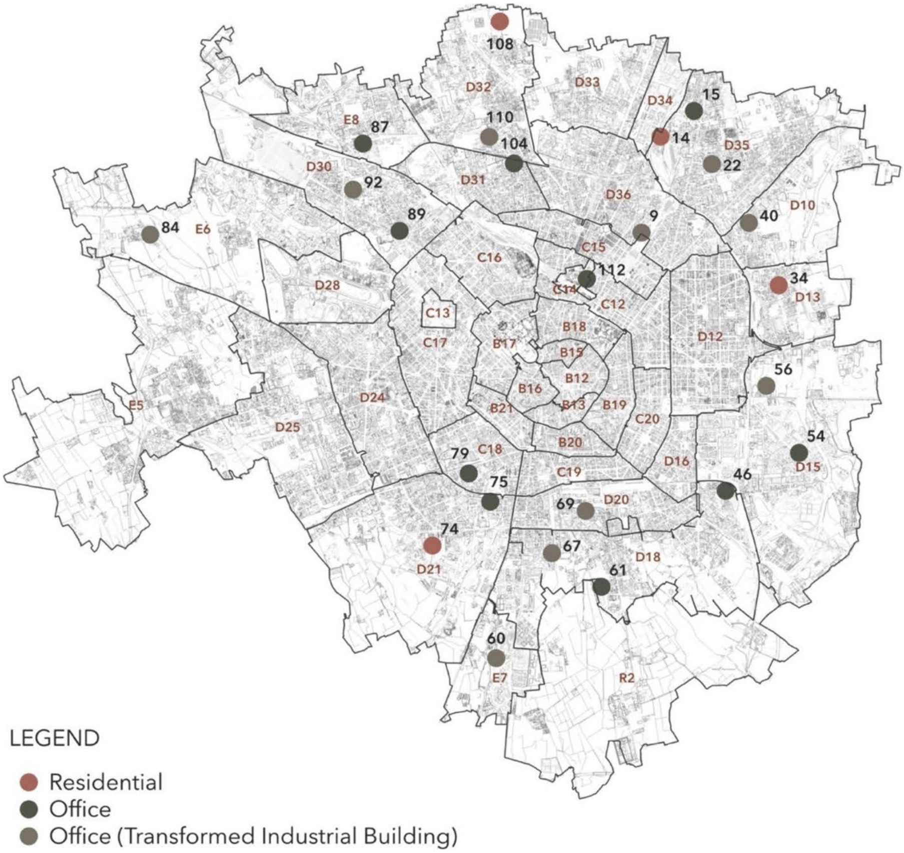

Fig. 3 Localization and original function of the 24 case studies within the municipality of Milan (Authors' elaboration on Milan Municipality's cartography)

To this end, the last step in this evaluation task proposes an optimization model to determine the combination of incentives ensuring the feasibility of the regeneration initiative for each case study. To reduce computational complexity, the estimated transformation value is translated into a Return On Investment (ROI) measure (Migliaccio and De Palma 2023), which is obtained by dividing the net income of the investment (the expected market value after transformation) by the transformation cost (Table 3).

Assuming a target ROI of 110% as the acceptability threshold for a private investor undertaking the transformation[1],and given the provided incentives (discount on planning fees and volumetric bonus), this model is specified as a non-linear single-objective optimization model with bound constraints (Keirstead and Shah 2013), that can be formalized as follows:

[1] Such a target ROI is set equal to the minimum acceptable rate of return, as identified through direct engagement with real estate operators, thereby reflecting industry-informed reflections.

Table 2 Unitary transformation value assessment for the considered case studies before and after the application of the incentives

ID	Case study	Current function	Expected function	TV without incentives [€/sqm]	TV after fees discount [€/sqm]	TV after volum. bonus [€/sqm]
9	*Sammartini 55*	IND	OFF	**-549**	**-197**	**-474**
14	*Breda 41*	RES	RES	**74**	**244**	**542**
15	*Livraghi 19*	OFF	OFF	**-582**	**-230**	**-353**
22	*Asiago 35*	IND	OFF	**-699**	**-347**	**-674**
34	*Sbodio 16*	RES	RES	**-427**	**-257**	**-59**
40	*Monfalcone 30*	IND	OFF	**-899**	**-547**	**-949**
46	*Toffetti 121*	OFF	OFF	**-685**	**-333**	**-556**
54	*Fantoli 3/5*	OFF	OFF	**-535**	**-183**	**-344**
56	*Cavriana 24–26,30*	IND	OFF	**-699**	**-347**	**-711**
60	*Gratosoglio 65*	IND	OFF	**-1249**	**-897**	**-1374**
61	*Amidani 15-17-19*	OFF	OFF	**-685**	**-333**	**-556**
67	*Perussia 1*	IND	OFF	**-1049**	**-697**	**-1124**
69	*Morivione 5/7*	IND	OFF	**-899**	**-547**	**-924**
74	*Salamanca 7*	RES	RES	**-45**	**136**	**444**
75	*Valsolda 19*	OFF	OFF	**-885**	**-533**	**-731**
79	*Villoresi 13*	OFF	OFF	**-485**	**-133**	**-131**
84	*Giuscano 20*	IND	OFF	**-749**	**-397**	**-761**
87	*Barrella 6*	OFF	OFF	**-985**	**-633**	**-956**
89	*Francesco 18*	OFF	OFF	**-285**	**67**	**-6**
92	*Trapani 7*	IND	OFF	**-499**	**-147**	**-424**
104	*Germana 6*	OFF	OFF	**-685**	**-333**	**889**
108	*Senigallia 6*	RES	RES	**-445**	**-264**	**-106**
110	*Pedroni Lisiade 28*	IND	OFF	**-1099**	**-747**	**-1174**
112	*Pirelli 39*	OFF	OFF	**-285**	**67**	**1244**

IND Industrial, *OFF* Office, *RES* Residential

$$\text{find x, y} \tag{5}$$

$$\text{Subject to :}$$

$$\begin{cases} ROI\ (\mathrm{x,y}) = \frac{V\ (1+x)\bullet C_r + V\bullet C_p + V\bullet P_F\bullet (1-y) + G_E + P_E}{V\ (1+x) MV} = 1.10 \\ 0 \leq\ x \leq\ 0.35 \\ 0 \leq\ y \leq\ 1.00 \end{cases}$$

Where:

- V is the volume of the subject property.
- x is the volumetric bonus, expressed as a percentage. It can vary between 0 (no bonus) and 35%, because a higher value could not be feasible and would dramatically change the urban morphology and the buildings' characteristics.
- C_r is the unit cost of the renovation project [€/m^3].
- C_p is the unit cost for the acquisition of the building [€/m^3].
- P_F are the planning fees, expressed in unit terms [€/m^3].

Table 3 Case studies' Return On Investment (ROI) before and after the incentive's application, and corresponding social sustainability index

Case Study ID	ROI without incentives	ROI with a fee discount	ROI with volum. Bonus	ROI with discount and volum. Bonus
14	102%	106%	113%	118%
9	85%	94%	87%	98%
15	**83%**	**93%**	**89%**	**101%**
22	**80%**	**90%**	**81%**	**92%**
34	**90%**	**94%**	**99%**	**103%**
40	**74%**	**84%**	**72%**	**84%**
46	**78%**	**89%**	**82%**	**95%**
54	**83%**	**94%**	**89%**	**101%**
56	**79%**	**90%**	**79%**	**90%**
60	**64%**	**74%**	**60%**	**71%**
61	**78%**	**89%**	**82%**	**95%**
67	**70%**	**80%**	**67%**	**79%**
69	**74%**	**84%**	**74%**	**85%**
74	**99%**	**103%**	**110%**	**115%**
75	**74%**	**84%**	**78%**	**90%**
79	**87%**	**96%**	**97%**	**107%**
84	**78%**	**88%**	**78%**	**89%**
87	**67%**	**79%**	**68%**	**81%**
89	**91%**	**102%**	**100%**	**112%**
92	**86%**	**96%**	**88%**	**99%**
104	**80%**	**90%**	**86%**	**97%**
108	**89%**	**94%**	**97%**	**102%**
110	**69%**	**79%**	**66%**	**78%**
112	**97%**	**101%**	**115%**	**120%**

- y is the volumetric bonus, expressed as a percentage. It can vary between 0 (no discount) and 100%.
- G_E are the general expenses.
- P_E are the professional expenses.

The results from the optimization model, thus, provide valuable insights for the fair definition of urban regeneration incentives (Table 4).

4.3 The Second Phase of the Integrated Evaluation Tool: The Social Sustainability Index Assessment

The preliminary results from the Transformation Financial Feasibility Assessment return the relevance of the location attribute in determining the feasibility of the regeneration initiative and point to the opportunity to integrate the incentive definition with a broader perspective on social sustainability of the properties' contexts. For this reason, the Social Sustainability Assessment phase stands as a crucial step in the integrated evaluation tool by providing a social sustainability index of the property's neighbourhood. Based on the methodological framework behind this evaluation task (Fig. 1), its implementation requires structuring the reference dimensions for

Table 4 Results from the implementation of the optimization model

Case study ID	ROI without incentives	Planning fees discount	Volumetric bonus	Goal (ROI)
9	**85%**	100%	35%	**110%**
14	**102%**	0%	21%	**110%**
15	**83%**	77%	35%	**110%**
22	**80%**	100%	35%	**104%**
34	**90%**	94%	35%	**110%**
40	**74%**	100%	0%	**89%**
46	**78%**	100%	35%	**110%**
54	**83%**	75%	35%	**110%**
56	**79%**	100%	0%	**96%**
60	**64%**	100%	0%	**77%**
61	**78%**	100%	35%	**110%**
67	**70%**	100%	0%	**84%**
69	**74%**	100%	0%	**89%**
74	**99%**	0%	25%	**110%**
75	**74%**	100%	35%	**104%**
79	**87%**	50%	35%	**110%**
84	**78%**	100%	0%	**94%**
87	**67%**	100%	35%	**95%**
89	**91%**	95%	0%	**110%**
92	**86%**	96%	35%	**110%**
104	**80%**	92%	35%	**110%**
108	**89%**	100%	35%	**110%**
110	**69%**	100%	0%	**82%**
112	**97%**	0%	19%	**110%**

the assessment (criteria and indicators) through a literature review process on social sustainability in urban contexts.

The implemented literature review process, articulated in four steps, returns 20 relevant papers for the evaluation model construction (Fig. 4).

These papers provide the basis for the definition of the criteria, representing the different but essential dimensions to interpret social sustainability.

Despite addressing the topic in various territorial contexts and at different scales, they show similarities in the criteria proposed, but the differences in the adopted language require a rationalization effort toward defining a common reference frame. To this aim, among all the criteria mentioned in the selected papers, a set of 23 elements is defined by eliminating redundant items. Then, to identify the most relevant ones for the social sustainability assessment, all 23 criteria are scored based on the number of papers in which they are mentioned (Fig. 5), and the criteria showing the highest frequency score (equal to or higher than 50%) are selected within the final set.

They include: sense of place (Doğu and Aras 2019); social interaction (Soltani et al. 2022); safety (Shirazi and Keivani 2019); community participation (Colantonio 2010); accessibility (Alipour and Galal Ahmed 2021); environmental quality (Alipour and Galal Ahmed 2021); education (Opp 2017).

Based on the selected criteria, indicators, as the reference parameters for the evaluation of urban contexts' performances (Almeida 2019; Julve et al. 2017), are

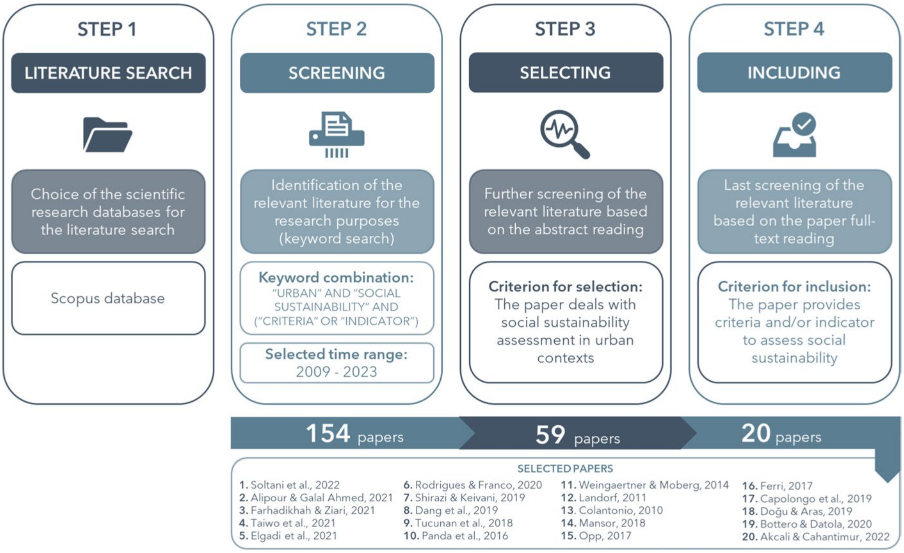

Fig. 4 Literature review process (Authors' elaboration on Parsare and Gheewala, 2017)

REFERENCE CRITERIA	SELECTED PAPERS																				FREQUENCY SCORE
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	
Sense of place	•	•	•	•	•		•		•		•		•			•	•	•		•	65%
Social interaction	•	•		•	•		•		•							•	•	•		•	50%
Safety	•	•	•	•	•	•	•	•	•	•	•			•	•	•		•		•	85%
Community stability	•							•			•	•	•	•	•	•	•	•	•	•	20%
Community participation	•	•	•	•			•					•			•	•		•		•	50%
Equity				•	•	•		•	•	•	•	•			•						45%
Density		•			•	•	•			•		•		•		•					40%
Accessibility/Services		•	•	•		•	•		•	•	•	•	•		•	•			•	•	70%
Mobility		•					•				•		•		•			•	•		35%
Integration	•	•		•																	15%
Choice and Diversity	•	•																			10%
Mixed-use		•					•	•			•						•		•		30%
Environmental quality		•			•		•			•	•	•	•	•	•	•		•	•		60&
Cultural heritage regeneration					•	•				•	•	•							•		30%
Education level					•	•			•	•	•	•	•	•	•	•				•	55%
Health					•	•				•	•	•		•	•	•		•			45%
Quality of life						•		•								•				•	20%
Quality of Public and Open Spaces							•										•	•		•	20%
Social Mix					•		•	•	•	•	•					•				•	40%
Poverty/Fair distribution of income										•	•	•	•	•	•	•			•	•	35%
Sharing																			•		5%
Social Democracy			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	10%
Social Capital				•											•						10%

Fig. 5 List of social sustainability criteria and related frequency score (criteria mentioned by at least 50% of the selected papers are highlighted in red)

retrieved from a detailed analysis of the papers selected through the literature review process.

Such an analysis returned a broad set of indicators that can be distinguished into "physical" and "non-physical" aspects of the selected criteria. However, in this first application, the willingness to obtain an 'objective' evaluation frame, together with the time-demanding nature of activities aimed at measuring "non-physical" indicators, leads to a limitation of the set to the "physical ones" (Table 5).

The obtained reference frame for the evaluation stands as the ground for the assessment of the performances of the neighbourhoods in which the 24 case studies are located (Fig. 6).

Once the performances of the different case studies have been calculated, value functions are elicited for each indicator by:

• Defining the value function's trend (increasing or decreasing).

• Identifying the points with the lowest (0) and the highest value (1) for the indicator: these points are calculated by referring to the best or worst values registered in the whole Municipality of Milan (Table 6).

• Specifying the value function's form.

• Providing the related mathematical formulation of the value functions: performances are normalized based on the min-max normalization method (Akanbi et al. 2014).

Thus, after eliciting value functions (Fig. 7), the application of the related equations allows to obtain the normalized performances of the different case studies for each indicator.

Concerning the definition of weights, this first application doesn't foresee the involvement of experts or local actors and, thus, applies an indifferent system of weights.

Table 5 Reference set of indicators

Criteria	Indicators
Sense of Place(S.1)	Cultural assets
	Immigration Rate
SocialInteraction(S.2)	Mixed-use
	Cultural Associations
	Sport Facilities
Community Participation (S.3)	Religious Places
	NGOs
	Social Services
Safety (S.4)	Accidents
	Crimes
Accessibility (S.5)	Tram & Bus Stops
	Metro and Train Stations
	Number of Public Parking
	Bike Lanes
	Services
Environmental Quality (S.6)	Green Open Spaces
	Air Pollution
Education (S.7)	Educational Institutions
	Libraries and Archives

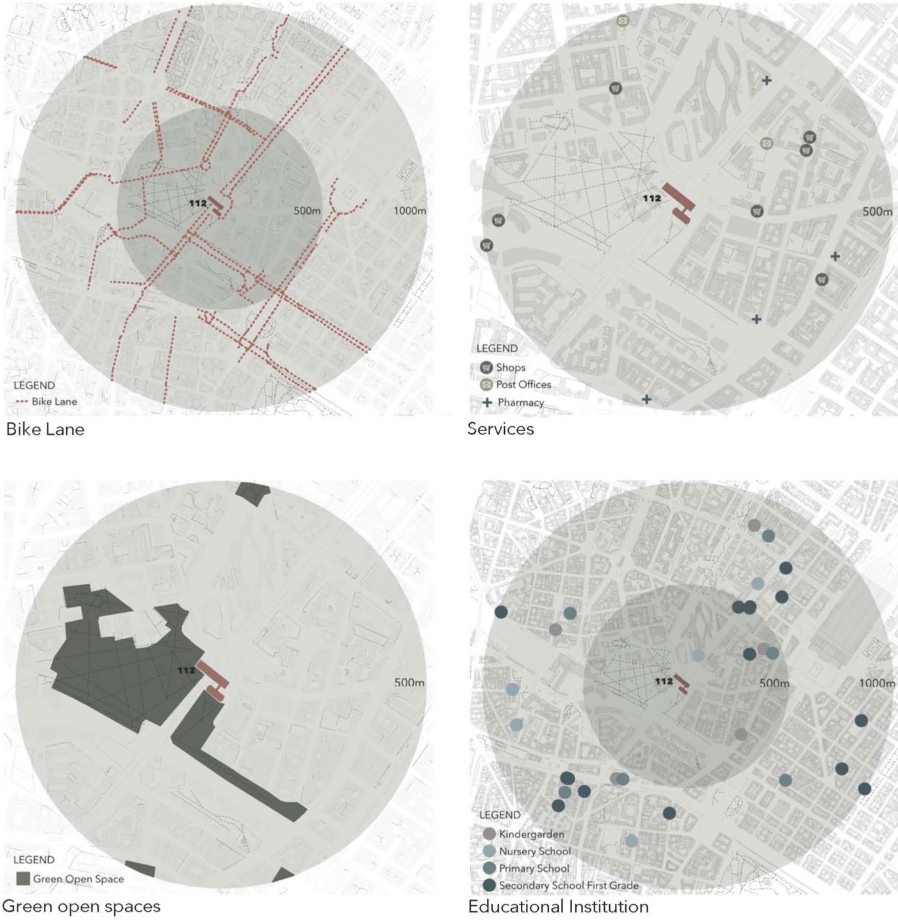

Fig. 6 Examples of maps for the calculation of the case study 112's performances (Authors' elaboration on Milan Municipality's cartography)

Finally, the additive model is implemented (4), thus obtaining an overall index of social sustainability for all the selected case studies (Table 7).

4.4 The Third Phase of the Integrated Evaluation Tool: The Clustering of Properties

The second phase in the evaluation tool returns an index for each case study (Table 5). The obtained indices range from a minimum value of 0.35 to a maximum of 0.71, thus revealing the existence of big differences in the social sustainability of different areas within the same urban environment.

They confirm the ineffectiveness of a "homogeneous" system of incentives, already revealed by the transformation feasibility assessment. Integrating the social sustainability index results with the transformation values for the 24 properties can provide a robust knowledge base to support public policies in designing differenti-

Table 6 Lowest and highest value definition for each indicator

Indicators	Measurement	Area	V min	V max	Source
Cultural assets	Number of Cultural Assets per sq.km [N / sq. km]	500 m radius	**0.00**	**6.30**	*Comune Milano*
Immigration Rate	Immigration balance	NIL	**-15.05**	**72.07**	*Comune Milano*
Mixed-use	Non-Residential Area Ratio [%]	500 m radius	**0%**	**34%**	*Regione Lombardia*
Cultural Associations	Number of Cultural Associations per sq.km [N /sq. km]	1 km radius	**0.00**	**6.30**	*Comune Milano*
Sport Facilities	Number of Sport Facilities per sq.km [N /sq. km]	1 km radius	**0.00**	**2.73**	*Comune Milano*
Religious Places	Number of Religious Places per sq.km [N / sq. km]	1 km radius	**0.00**	**2.30**	*Comune Milano*
NGOs	Number of NGO offices per sq.km [N / sq. km]	1 km radius	**0.00**	**0.43**	*Comune Milano*
Social Services	Number of Social Service offices per sq.km [N /sq. km]	1 km radius	**0**	**2.11**	*Comune Milano*
Accidents	Number of Accidents per sq.km per year [N /sq. km]	500 m radius	**55.76**	**0.00**	*thesubmarine*
Crimes	Number of Crimes per sq.km per year [N /sq. km]	500 m radius	**5.10**	**0.00**	*ilgirodellanera.wordpress.com*
Tram & Bus Stops	Number of Tram & Bus Stops per sq.km [N /sq. km]	500 m radius	**0**	**36.18**	*Comune Milano*
Metro and Train Stations	Number of Metro & Train Stations per sq.km [N /sq. km]	1 km radius	**0**	**0.89**	*Comune Milano*
Number of Public Parking	Number of Public Parking per sq.km [N /sq. km]	500 m radius	**0**	**0.56**	*Comune Milano*
Bike Lanes	Bike lane length per sq.km [km /sq. km]	1 km radius	**0**	**2.27**	*Comune Milano*
Services	Number of Services per sq.km [N /sq. km]	500 m radius	**0**	**9.18**	*Comune Milano*
Green Open Spaces	Green Open Space Area Ratio [%]	500 m radius	**0%**	**21%**	*Regione Lombardia*
Air Pollution	No2 Concentration [μg/m3]	50 m radius	**33**	**60**	*cittadiniperlaria*
Educational Institutions	Number of Educational Institutions per sq.km [N /sq. km]	1 km radius	**0**	**8.31**	*Comune di Milano*
Libraries and Archives	Number of Libraries and Archives per sq.km [N /sq. km]	1 km radius	**0**	**2.28**	*Comune di Milano*

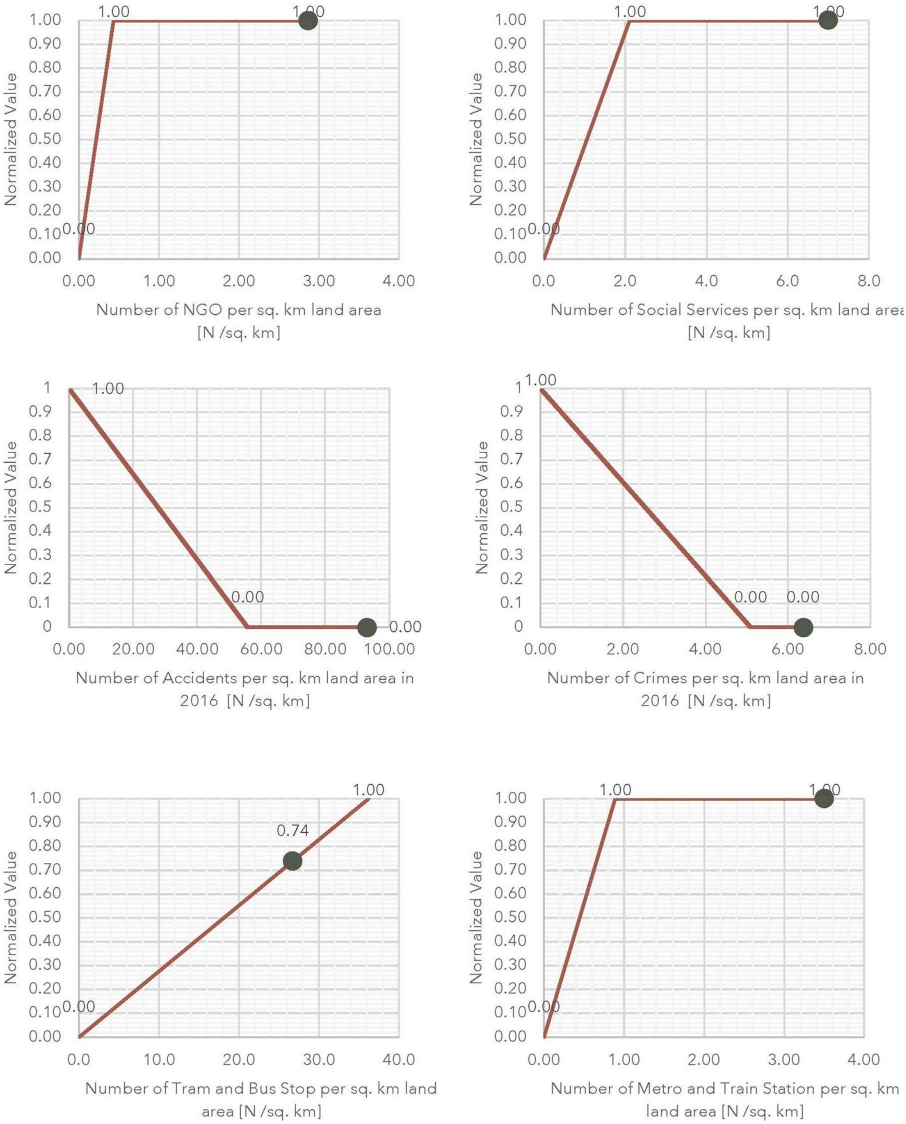

Fig. 7 Examples of elicited value functions for the selected indicators (Authors' elaboration)

ated and effective incentive systems for urban regeneration. Analysing the evidence from the feasibility assessment (Table 3) through the social sustainability index (Table 7) shows that residential and office buildings in areas with a social sustainability index above 0.55 exhibit greater feasibility potential than those located in areas with an index below that threshold. For instance, focusing on residential properties, the comparison between *Salamanca 7* (id 74) and *Senigallia 6* (id 108) reveals the detected correlation between social sustainability and feasibility. In contrast, when

Table 7 Social sustainability index calculation for the selected case studies

Case study ID	Score per criterion							Social Sust. Index
	S1	S2	S3	S4	S5	S6	S7	
9	0.65	0.73	0.94	0.00	0.74	0.33	0.78	0.60
14	0.20	0.80	0.52	0.72	0.70	0.39	0.55	0.56
15	0.10	0.66	0.57	0.67	0.68	0.47	0.41	0.51
22	0.26	0.67	0.97	0.12	0.62	0.75	0.50	0.55
34	0.41	0.76	0.58	0.54	0.47	0.53	0.57	0.55
40	0.30	0.82	0.92	0.28	0.58	0.81	0.64	0.62
46	0.08	0.80	0.34	0.80	0.30	0.70	0.33	0.48
54	0.12	0.57	0.23	0.66	0.31	0.60	0.21	0.38
56	0.20	0.83	0.34	0.80	0.48	0.57	0.50	0.53
60	0.29	0.31	0.14	0.54	0.26	0.56	0.50	0.37
61	0.11	0.26	0.19	0.79	0.19	0.78	0.18	0.36
67	0.26	0.64	0.48	0.35	0.37	0.56	0.48	0.45
69	0.13	0.91	0.39	0.03	0.56	0.72	0.50	0.46
74	0.18	1.00	0.72	0.54	0.44	0.85	0.38	0.59
75	0.36	0.67	0.99	0.00	0.91	0.73	0.56	0.60
79	0.33	0.82	0.94	0.00	0.70	0.62	0.78	0.60
84	0.27	0.16	0.05	0.86	0.08	0.71	0.11	0.33
87	0.15	0.65	0.33	0.39	0.50	0.74	0.47	0.46
89	0.30	0.98	0.91	0.00	0.79	0.59	0.74	0.62
92	0.63	0.65	0.62	0.00	0.35	0.50	0.33	0.44
104	0.11	0.57	0.43	0.05	0.51	0.67	0.64	0.43
108	0.06	0.15	0.05	0.73	0.26	0.93	0.28	0.35
110	0.23	0.80	0.39	0.40	0.31	0.73	0.44	0.47
112	0.73	0.84	1.00	0.00	0.95	0.42	1.00	0.71

considering former industrial assets, none of the available incentive measures allow for profitable regeneration, especially in areas with lower sustainability levels.

For this reason, the cross-reading of the results from the feasibility evaluation and the social sustainability assessment can guide the detection of some "clusters" of buildings as the basis for a catered and differentiated provision of incentives (Table 8). More in detail:

• The first cluster is made up of residential properties with a social sustainability index higher than 0.55 (i.e., id 14). For them, even just one of the current incentive provisions ensures the profitability of the regeneration initiative.

• The second cluster includes residential properties with an index lower than 0.55 (i.e., id 34). The current incentive provisions cannot ensure the profitability of their regeneration, thus calling for stronger measures.

• The third cluster is made up of office properties with an index higher than 0.55 (i.e., id 79). As for the previous cluster, the feasibility of regeneration requires stronger incentive measures than the existing ones. This is not true for *Pirelli 39* (id 112), which has the highest sustainability index among the 24 case studies (0.71): for this property, only one of the existing incentives ensures the regeneration feasibility.

• The fourth cluster includes office properties with an index lower than 0.55 (i.e., id 15 and id 46). In this case, stronger incentives are required to make the regeneration process profitable from a private perspective.

Table 8 Results from the optimization model and the social sustainability assessment

Case study ID	Planning fees discount	Volumetric bonus	Goal (ROI)	Social Sust. Index
9	100%	35%	**110%**	**0.60**
14	0%	21%	**110%**	**0.56**
15	77%	35%	**110%**	**0.51**
22	100%	35%	**104%**	**0.55**
34	94%	35%	**110%**	**0.55**
40	100%	0%	**89%**	**0.62**
46	100%	35%	**110%**	**0.48**
54	75%	35%	**110%**	**0.38**
56	100%	0%	**96%**	**0.53**
60	100%	0%	**77%**	**0.37**
61	100%	35%	**110%**	**0.36**
67	100%	0%	**84%**	**0.45**
69	100%	0%	**89%**	**0.46**
74	0%	25%	**110%**	**0.59**
75	100%	35%	**104%**	**0.60**
79	50%	35%	**110%**	**0.60**
84	100%	0%	**94%**	**0.33**
87	100%	35%	**95%**	**0.46**
89	95%	0%	**110%**	**0.62**
92	96%	35%	**110%**	**0.44**
104	92%	35%	**110%**	**0.43**
108	100%	35%	**110%**	**0.35**
110	100%	0%	**82%**	**0.47**
112	0%	19%	**110%**	**0.71**

• The fifth cluster includes industrial properties (i.e., id 84 and 110). In this case, making regeneration profitable is challenging and requires different and stronger incentives than existing ones: in 8 out of 10 cases, even the combination of a 35% volumetric bonus and a 100% discount on planning fees doesn't allow for reaching an "ordinary" profit from the investment.

5 Discussion and Conclusion

The paper proposes a three-phase evaluation tool to support public administrations in rethinking and fairly defining incentives to support the effective implementation of regenerative practices at the urban scale. Indeed, existing legislative tools, as emerging from the Italian context, are still unable to capture the complexity of themes related to urban regeneration, and incentives are usually assigned without considering differences in initiatives' profitability and the quality of the reference context.

To address these issues, the proposed evaluation tool, which couples a financial sustainability evaluation with a social sustainability index for different neighbourhoods, offers a scientific basis to apply 'correction mechanisms' to the definition of fair incentives. It allows for the identification of clusters of abandoned properties while quantifying, through the optimization model, the incentives required for each cluster to make the investment profitable.

The test on the selected case studies prompts interesting reflections on the opportunities offered by the evaluation model for the planning agenda. Indeed, as shown by the profitability analysis based on the transformation value assessment, the available incentives are not effective in ensuring the feasibility of interventions. Furthermore, the joint analysis of the transformation values for the different buildings' recovery interventions and the assessed social sustainability indexes shows that the feasibility conditions are more difficult to achieve with the available incentives, if not impossible, in urban areas with lower levels of social sustainability. From this perspective, the social sustainability index can serve as the reference element for clustering properties, and the results from the optimization model offer a scientific and quantitative ground for designing tailored policy provisions.

To this aim, future developments of this work will focus on extending the analysis to a wider set of case studies, thus creating broader evidence for a differentiated system of incentive allocation. The results from this preliminary application, indeed, offer a clustering of the selected buildings according to their intended use and the social sustainability of their context. However, these clusters need to be refined, thus providing each of them with a tailored set of incentives and strengthening the effectiveness and context awareness of legislative tools. Furthermore, future efforts will be devoted to a deeper consideration of the properties' conservation state, which is crucial in properly estimating the transformation cost and, thus, determining the feasibility of the regeneration interventions. Additionally, given the contextual nature of the social sustainability concept, its assessment framework will be revised by integrating indicators related to the "not-physical" dimension and engaging local stakeholders, both to elicit value functions and to assess criteria and indicator weights, thus overcoming the rigidity of the proposed "standardized" evaluation approach.

Acknowledgements We thank Mohammad Kazerani for his contribution to implementing the evaluation tool for case studies as part of his master's thesis in Architecture and Urban Design at the Politecnico di Milano.

Author Contributions Authors: Marco Rossitti (MR); Francesca Torrieri (FT); Marta Dell'Ovo (MDO); Giulia Datola (GD); Danny Casprini (DC); Alessandra Oppio (AO)Conceptualization MR, FT, AOMethodology MR, FT, AOSoftware MR, MDO, GDValidation FT, AOFormal analysis MR, MDO, GDInvestigation MR, FT, MDO, GD, DC, AOResources MR, DCData Curation MR, DCWriting - Original Draft MR, AOWriting - Review & Editing FT, MDO, AOVisualization MR, GDSupervision FT, AOProject administration AO.

Funding Open access funding provided by Politecnico di Milano within the CRUI-CARE Agreement. The authors received no funding for the research.

Data Availability No datasets were generated or analysed during the current study.

Declarations

Competing interests The authors declare no competing interests.

References

Agenzia delle Entrate (2023) Osservatorio del mercato immobiliare – Quotazioni immobiliari. Retrieved from: https://www.agenziaentrate.gov.it/portale/web/guest/schede/fabbricatiterreni/omi/banche-dati/quotazioni-immobiliari. Accessed June 15, 2024

Akanbi OA, Amiri IS, Fazeldehkordi E (2014) A Machine-Learning Approach to Phishing Detection and Defense. In *A Machine-Learning Approach to Phishing Detection and Defense*. https://doi.org/10.1016/c2014-0-03762-8

Akcali S, Cahantimur A (2022) The Pentagon Model of Urban Social Sustainability: An Assessment of Sociospatial Aspects, Comparing Two Neighborhoods. Sustain (Switzerland) 14(9). https://doi.org/10.3390/su14094990

Alipour SMH, Galal Ahmed K (2021) Assessing the effect of urban form on social sustainability: a proposed 'Integrated Measuring Tools Method' for urban neighborhoods in Dubai. City Territory Archit 8(1). https://doi.org/10.1186/s40410-020-00129-4

Almeida ACL (2019) Multi actor multi criteria analysis (MAMCA) as a tool to build indicators and localize sustainable development goal 11 in Brazilian municipalities. Heliyon 5(8). https://doi.org/10.1016/j.heliyon.2019.e02128

Alpopi C, Manole C (2013) Integrated Urban Regeneration – Solution for Cities Revitalize. Procedia Econ Finance 6. https://doi.org/10.1016/s2212-5671(13)00130-5

Amin A (2006) The good city. Urban Stud 43(5–6). https://doi.org/10.1080/00420980600676717

Arnstein SR (1969) A Ladder Of Citizen Participation. J Am Plann Association 35(4). https://doi.org/10.1080/01944366908977225

Ball M, Maginn PJ (2005) Urban change and conflict: Evaluating the role of partnerships in urban regeneration in the UK. Hous Stud 20(1). https://doi.org/10.1080/0267303042000308705

Beinat E (1997) Value functions for environmental management. In *Value Functions for Environmental Management*. https://doi.org/10.1007/978-94-015-8885-0_4

Bottero M, Datola G (2020) Addressing social sustainability in urban regeneration processes. An application of the social multi-criteria evaluation. Sustain (Switzerland) 12(18). https://doi.org/10.3390/su12187579

Capolongo S, Sdino L, Dell'Ovo M, Moioli R, Torre D, S (2019) How to assess urban regeneration proposals by considering conflicting values. Sustain (Switzerland) 11(14). https://doi.org/10.3390/su11143877

Chen X, Zhu H, Yuan Z (2020) Contested memory amidst rapid urban transition: The cultural politics of urban regeneration in Guangzhou, China. Cities 102. https://doi.org/10.1016/j.cities.2020.102755

Colantonio A (2010) Urban social sustainability themes and assessment methods. Proc Institution Civil Engineers: Urban Des Plann 163(2). https://doi.org/10.1680/udap.2010.163.2.79

Collegio degli Ingegneri e degli Architetti di Milano (2024) Prezzi Tipologie Edilizie 2024. DEI. Tipografia del Genio Civile

Constitution of the Italian Republic (1947) Art. 117. Retrieved from https://www.senato.it/documenti/repository/istituzione/costituzione_inglese.pdf. Accessed September 09, 2024

Constitutional Law 18 October (2001) n. 3. (2001). *Gazzetta Ufficiale*, n. 248, 24 October 2001. Retrieved from https://www.gazzettaufficiale.it/eli/id/2001/10/24/001G0430/sg. Accessed June 09, 2025

Dang VT, Wang J, Van-Thac Dang W (2019) An integrated fuzzy AHP and fuzzy TOPSIS approach to assess sustainable urban development in an emerging economy. Int J Environ Res Public Health 16(16). https://doi.org/10.3390/ijerph16162902

Doğu FU, Aras L (2019) Measuring social sustainability with the developed MCSA model: Güzelyurt case. Sustain (Switzerland) 11(9). https://doi.org/10.3390/su11092503
Elgadi AA, Wahab IA, Ismail LH, Abbas F, Samsudin EM (2021) Urban planning of sustainable development model for Libyan cities. J Islamic Archit 6(4). https://doi.org/10.18860/jia.v6i4.13031
European Commission (2007) Leipzig Charter on Sustainable European Cities. Retrieved from https://territorialagenda.eu/wp-content/uploads/leipzig_charter_2007.pdf. Accessed June 06, 2025
European Commission (2016) Urban Agenda for EU. Pact of Amsterdam. Retrieved from https://ec.europa.eu/regional_policy/sources/policy/themes/urban-development/agenda/pact-of-amsterdam.pdf. Accessed June 07, 2025
European Commission (2020) New Leipzig Charter- The transformative power of cities for the common good. Retrieved from https://urbact.eu/sites/default/files/2023-05/new_leipzig_charter_final.pdf. Accessed June 07, 2025
European Conference on Sustainable Cities and Towns (1994) Alborg Charter. Retrieved from https://conferences.sustainablecities.eu/fileadmin/user_upload/Materials/Aalborg_Charter_English.pdf. Accessed June 06, 2025
Farhadikhah H, Ziari K (2021) Social sustainability between old and new neighborhoods (case study: Tehran neighborhoods). Environ Dev Sustain 23(2). https://doi.org/10.1007/s10668-020-00688-z
Ferretti V, Grosso R (2019) Designing successful urban regeneration strategies through a behavioral decision aiding approach. Cities 95. https://doi.org/10.1016/j.cities.2019.06.017
Ferri B (2017) Social sustainability in urban regeneration: Indicators and evaluation methods in the EU 2020 programming. Stud Syst Decision Control 66. https://doi.org/10.1007/978-3-319-40585-8_8
French S, Roy B (1997) Multicriteria methodology for decision aiding. J Oper Res Soc 48(12). https://doi.org/10.2307/3010757
Gan X, Fernandez IC, Guo J, Wilson M, Zhao Y, Zhou B, Wu J (2017) When to use what: Methods for weighting and aggregating sustainability indicators. Ecol Indic 81. https://doi.org/10.1016/j.ecolind.2017.05.068
Iofrida N, Spada E, Gulisano G, De Luca AI, Falcone G (2024) The social impacts of circular economy: disclosing epistemological stances and methodological practices. Environ Dev Sustain. https://doi.org/10.1007/s10668-024-05438-z
Julve C, Kane KR, Wolfslehner B, Guldin R, Rametsteiner E (2017) Using criteria and indicators for sustainable forest management: A way to strengthen results-based management of national forest programmes. Food Agric Organization United Nations 37(1)
Keirstead J, Shah N (2013) The Changing Role of Optimization in Urban Planning. In: Chinchuluun A, Pardalos P, Enkhbat R, Pistikopoulos E (eds) Optimization, Simulation, and Control. Springer Optimization and Its Applications, vol 76. Springer, New York, NY. doi: https://doi.org/10.1007/978-1-4614-5131-0_11
Landorf C (2011) Evaluating social sustainability in historic urban environments. Int J Herit Stud 17(5). https://doi.org/10.1080/13527258.2011.563788
Manganelli B, Tataranna S, Pontrandolfi P (2020) A model to support the decision-making in urban regeneration. Land Use Policy 99. https://doi.org/10.1016/j.landusepol.2020.104865
Mansor MA (2018) Economic and social sustainability for Iraqi middle provinces. Adv Sci Technol Eng Syst 3(5). https://doi.org/10.25046/aj030551
Marra G, Barosio M, Eynard E, Marietta C, Tabasso M, Melis G (2016) From urban renewal to urban regeneration: Classification criteria for urban interventions. Turin 1995–2015: Evolution of planning tools and approaches. J Urban Regen Renew 9(4)
McGuinn, Study for the Committee on Employment and Social Affairs (2020) Social sustainability, Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament, Luxembourg, 2020. Retrieved from: https://www.europarl.europa.eu/RegData/etudes/STUD/2020/648782/IPOL_STU(2020)648782_EN.pdf. Accessed April 15, 2026
Migliaccio G, De Palma A (2023) Profitability and financial performance of Italian real estate companies: quantitative profiles. Int J Productivity Perform Manage 73(11). https://doi.org/10.1108/IJPPM-02-2023-0075
Navarro-Yáñez CJ, Rodríguez-García MJ (2020) Urban policies as multi-level policy mixes. The comparative urban portfolio analysis to study the strategies of integral urban development initiatives. Cities 102. https://doi.org/10.1016/j.cities.2020.102716
Nijkamp P, Rietveld P, Voogd HM (1990) Multicriteria evaluation in physical planning
Nzimande NP (2023) Stakeholders' perceptions of urban regeneration: the case of Kis-Pongrác in Budapest. Environ Res Commun 5(5). https://doi.org/10.1088/2515-7620/accfeb

Opp SM (2017) The forgotten pillar: a definition for the measurement of social sustainability in American cities. Local Environ 22(3). https://doi.org/10.1080/13549839.2016.1195800

Panda S, Chakraborty M, Misra SK (2016) Assessment of social sustainable development in urban India by a composite index. Int J Sustainable Built Environ 5(2). https://doi.org/10.1016/j.ijsbe.2016.08.001

Prasara AJ, Gheewala SH (2017) Sustainable utilization of rice husk ash from power plants: A review. J Clean Prod 167. https://doi.org/10.1016/j.jclepro.2016.11.042

Regional Law n (2019) 18/ (2018). *Bollettino Ufficiale della Regione Lombardia*, n. 48, 29 November 2019. Retrieved from https://www.bosettiegatti.eu/info/norme/lombardia/2019_018_L_modifiche_12.pdf. Accessed June 09, 2025

Regional Law. n. 11/2021 (2021) *Bollettino Ufficiale della Regione Lombardia*, n. 25, 25 June 2021. Retrieved from https://anci.lombardia.it/documenti/12358-SUP25_25-06-2021.pdf. Accessed June 13, 2025

Roberts P (2016) The Evolution, Definition and Purpose of Urban Regeneration. In *Urban Regeneration*. https://doi.org/10.4135/9781473921788.n2

Rodrigues M, Franco M (2020) Measuring the urban sustainable development in cities through a Composite Index: The case of Portugal. Sustain Dev 28(4). https://doi.org/10.1002/sd.2005

Rossitti M, Oppio A, Torrieri F, Dell'Ovo M (2023) Tactical urbanism interventions for the urban environment: Which economic impacts? Land 12(7). https://doi.org/10.3390/land12071457

Shirazi MR, Keivani R (2019) The triad of social sustainability: Defining and measuring social sustainability of urban neighbourhoods. Urban Res Pract 12(4). https://doi.org/10.1080/17535069.2018.1469039

Soltani S, Gu N, Ochoa JJ, Sivam A (2022) The role of spatial configuration in moderating the relationship between social sustainability and urban density. Cities 121. https://doi.org/10.1016/j.cities.2021.103519

Taiwo OM, Samsudin S, Daud DZ, Ayodele OM (2021) Integration of sustainability indicators in urban formation: A gap analysis. Plann Malaysia 19(4). https://doi.org/10.21837/pm.v19i18.1040

Tucunan KP, Sutikno, Medha AN (2018) Social sustainability indicators in kampung; Dialogue between Ibn Khaldun's Tamadun concepts and sustainable developments approaches. IOP Conf Series: Earth Environ Sci 202(1). https://doi.org/10.1088/1755-1315/202/1/012073

Weingaertner C, Moberg Å (2014) Exploring social sustainability: Learning from perspectives on urban development and companies and products. Sustain Dev 22(2). https://doi.org/10.1002/sd.536

Zhou K, Warwick E, Zimmermann N (2024) Sustaining attention to sustainability, health, and well-being in urban regeneration. Organ Environ 37(1). https://doi.org/10.1177/10860266241236972