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Towards Balanced Metrics: Evaluating Social Sustainability in Urban Policy Design

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Abstract

The assessment of social sustainability is fundamental to designing public policies, especially in housing, in order to align with the Sustainable Development Goals (SDGs), a condition established by Europe for access to public funding, as is the case of the EU's Next Generation funds. While environmental sustainability has clear criteria, social sustainability lacks standardized metrics. This study reviews the evaluation of social sustainability in urban environments based on academic publications and certifying bodies. From the review, it is clear that the publications and tools provide indicators that assess neighborhood cohesion and urban design, but both approaches neglect social equity, a key element of sustainability despite its importance already highlighted in the Brundtland Report (1987). Based on the information collected, an assessment tool is proposed that considers 45 indicators grouped into three categories: social equity, neighborhood cohesion and urban design. In addition, the indicators are aligned with the SDGs. Alignment with 12 of the 17 SDGs is obtained, with 11 having the highest alignment with the indicators (80%) followed by 10 and 16 (27% each). The proposed framework allows for adequate representativeness in the evaluation of social cohesion, overcoming the underrepresentation of previous proposals. In addition, the work highlights the need to advance social equity to ensure truly sustainable urban environments. Issues such as social inclusion, redistributive policies, accessibility to housing and employability must occupy a central place in the evaluations. The challenge now is to define solid indicators that allow objective evaluations that place the value of equity as a pillar of social sustainability.

Keywords

Social Sustainability, Urban Policy, Sustainability Indicators, SDGs, Social Equity

1. Introduction

The assessment of social sustainability has become a key issue in the design of

public policies. In housing policy, the design of intervention instruments and housing typologies incentivized with public funds must pursue the scope of the Sustainable Development Goals (SDGs), in order to be able to access, among other things, the Next Generation funds for economic recovery after the Covid-19 pandemic. In this context, there is a need to establish objective criteria to assess the sustainability of urban environments, but while environmental sustainability has made significant progress, social sustainability is still a pending issue to be assessed. This work, which is part of a research project aimed at implementing the evaluation of social sustainability in housing policy in Spain, focuses on the definition and parameterization of indicators of social sustainability in urban environments, based on the information provided by the academic literature and certifying bodies.

On the one hand, the academic literature tends to assess the social sustainability of urban environments using qualitative indicators focused on neighborhood cohesion. On the other hand, the systems proposed by certifiers tend to use quantitative indicators focused on urban design. However, both sources do not address the evaluation of a priority aspect of sustainability, social equity, for which it is necessary to include a set of indicators.

In light of what has been observed, a balanced system of indicators is proposed for the evaluation of the social sustainability of urban environments, useful for the analysis of both existing structures and new urban developments. An objective and balanced system of indicators will make it possible to guide public policies towards solutions that consider social equity as an essential objective in any urban development, present or future, that seeks public support for its creation or improvement.

2. Materials and Methods

For the purpose of the work, information will be gathered from a review of academic literature and publications from certifying bodies. The literature review will be conducted by searching the Web of Science for the terms "sustainability", "sustainable development", "social sustainability" and "urban social sustainability" and "urban sustainability measurement tools". The objective is to identify and analyze different approaches and tools for assessing social sustainability. Dempsey's 2011 paper, "The Social Dimension of Sustainable Development: Defining Urban Social Sustainability" (Dempsey et al., 2011), is the most cited article in the field of urban social sustainability, with 1221 citations recorded in the Scopus database. The methodology of this study draws inspiration from this seminal article. Given the relevance and content of Dempsey's paper, it serves as the foundation for several proposals that will be analyzed. These proposals are complemented by the contributions of international certifying bodies. A total of 228 indicators were identified, and in this initial catalog, indicators referring to the same concept are consolidated (e.g., "density/compactness"). Those indicators mentioned in isolation in a single work, due to their low relevance, are excluded (e.g., "trusting the

students"). All factors mentioned by Dempsey are preserved due to their seminal character. Following these steps, the total number of indicators was reduced to 45. The review of the above information also allows us to establish three types of categories in which the different indicators are grouped in a balanced way. The indicators are then linked to the SDGs. In this way, the consistency between the proposed system and the necessary response to the SDGs is analyzed, see Figure 1.
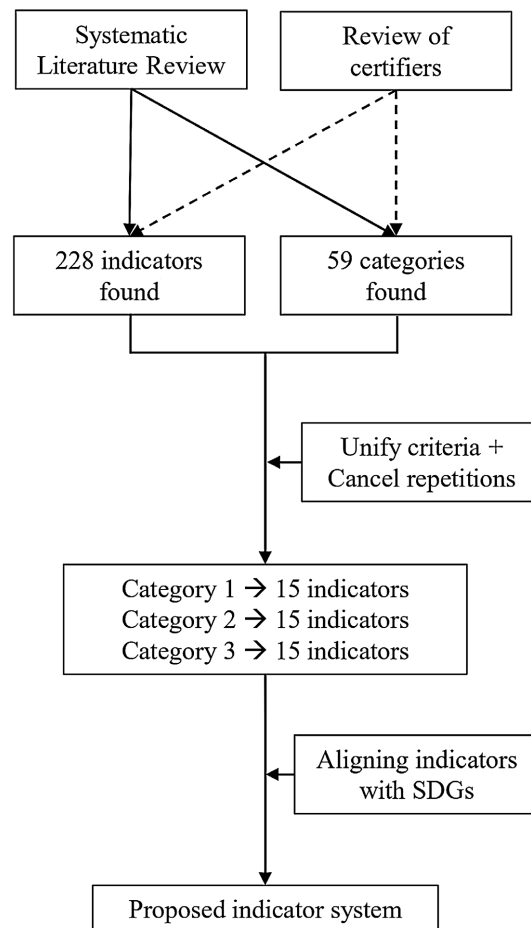

Figure 1. Methodology.

3. Theoretical Framework

Sustainability is a complex concept that is difficult to parameterize. Although some authors argue that there are differences between sustainability and sustainable development, these two concepts are considered to have the same dimensions and policy implications and can be used interchangeably (Holden et al., 2014). The concept of sustainable development was officially launched with the publication of "Our Common Future", better known as the Brundtland Report (WCED, 1987). The literature dealing with the analysis of the Brundtland Report posits the existence of four primary dimensions, which represent the "fundamental objective values, not individual subjective preferences" (Daly, 2007), that stem from the very definition of sustainable development and are considered inalienable: (i)

satisfying basic human needs, (ii) ensuring long-term environmental sustainability, (iii) promoting intragenerational equity, (iv) promoting intergenerational equity. It is important to note that in these analyses, economic growth is not considered as one of the primary dimensions of sustainable development, but as a potential means to achieve the four primary dimensions (Holden et al., 2014). This first definition of sustainable development differs significantly from the dominant model in the current policy debate, which understands sustainable development as a "triple bottom line" that seeks a balance between environmental, social, and economic issues without establishing a hierarchy among them (Elkington, 1997, 2013). New UNESCO positions in 2001 include culture as one of the dimensions of sustainable development and introduce "cultural identity" (Nurse, 2006) as a fourth dimension of sustainability necessary to address the problems of preserving the traditions, beliefs and values of diverse communities.

As with the broader concept of sustainability, there is no generally accepted parameterization of social sustainability. Some authors define it as "basic needs and equity, education, quality of life, social capital, social cohesion, integration and diversity, and sense of place" (Åhman, 2013), acknowledging that the concept of social sustainability is fuzzy and remains "under-rationalized". Other authors identify social sustainability with a set of elements for social homogenization: equitable income and access to goods, services, and employment; the importance of "cultural sustainability" as a balance between externally induced change and the continuity of the existing culture; and "political sustainability" reflected in democracy, human rights, and institutional control (Sachs, 1999). A complementary view identifies three types of social sustainability: social norms, social conditions for sustainable (ecological) development, and equitable distribution of resources and opportunities (Chiu, 2003). It highlights the potential conflicts that can arise when applying the concept of sustainability to the central concerns of urban planning: economic growth, ecology, and equity in the quest for livable cities (Godschalk, 2004). These visions can be grouped into three aspects: the first understands social sustainability as a precondition for sustainable development, assuming that the implementation of mechanisms designed to achieve sustainable development has not eliminated the problems of poverty, malnutrition, health and access to decent and adequate housing in "first world" countries, which is a necessary condition for people to begin to actively address environmental problems. The second strand understands social sustainability as a bridge to ecological sustainability by exploring changes in social behavior aimed at improving environmental ethics with a more or less transformative approach. Less transformative approaches advocate not making significant changes in our relationship with the world around us, relying on technological innovation to ensure global sustainability without making significant sacrifices in our way of life. Transformative approaches, on the other hand, identify current practices as divorced from nature, explore ways to dismantle the society-environment dualism, and propose radical changes in the way we live as the only way to ensure global sustainability. Finally, the third approach

understands social sustainability as the will to preserve certain existing elements that people value. This is the most recent strand of literature that focuses on the study of those traditions, practices, preferences, and places that people would like to see preserved or improved, such as low-density suburban living, private car use, and the preservation of natural landscapes (Vallance et al., 2011).

The evaluation of social sustainability applied to urban environments does not present a homogeneous parameterization. Two different trends can be observed: on the one hand, the definitions of the indicators that we can consider refer to the literature review, and on the other hand, those defined by the certifying bodies.

3.1. The Literature Review

The literature review conducted by Dempsey et al. (2011) identifies 20 non-physical and 8 physical factors to define urban social sustainability based on two fundamental concepts: community sustainability and social equity (Bramley & Power, 2009), see Table 1.

Table 1. Urban social sustainability contributory factors as identified in a literature review.

Factors	
Non-physical factors	Predominantly physical factors
• Education and training	• Urbanity
• Social justice (inter- and intra-generational)	• Attractive public realm
• Participation and local democracy	• Decent housing
• Health, quality of life and wellbeing	• Local environmental quality and amenity
• Social inclusion (and eradication of social exclusion)	• Accessibility (to local services and facilities/employment/green space)
• Social capital	• Sustainable urban design
• Community	• Neighbourhood
• Safety	• Walkable neighbourhood-pedestrian-friendly
• Mixed tenure	
• Fair distribution of income	
• Social order	
• Social cohesion	
• Community cohesion (e.g. between and among different groups)	
• Social networks	
• Social interaction	
• Sense of community and belonging	
• Employment	
• Residential stability (versus turnover)	
• Active community organisations	
• Cultural traditions	

Source: "The Social Dimension of Sustainable Development: Defining Urban Social Sustainability" (Dempsey et al., 2011).

Community sustainability refers to the collective aspects of social life in the neighborhood. Five dimensions are identified for its assessment: social interaction in the community, participation in community collectives, community stability, sense of belonging, safety and security. The second aspect, social equity in the urban context, refers to social and environmental non-exclusion, which guarantees the economic, social and political participation of individuals in society (Pierson, 2002; Ratcliffe, 2000). Some aspects, such as access to public transport, are directly related to the design of the built environment. Others, such as access to decent housing, depend not only on design but also on the access conditions offered by developers and public authorities, which can make it impossible for households with certain income levels to remain in or access housing (Dempsey et al., 2011).

We analyze four works that take Dempsey's work as a reference: (i) Four core dimensions of social sustainability in new housing development by Dixon & Woodcraft (2013) and the Berkeley Group, see Table 2; (ii) The Measurement of the City from Social Aspects (MCSA) model by Doğu & Aras (2019), see Table 3; (iii) the questionnaire proposal by Larimian & Sadeghi, (2021), see Table 4. (iv) and the "Triad of social sustainability" working definition for social sustainability of urban neighborhoods by Shirazi and Keivani (2019), see Table 5. On the other hand, in terms of certifying bodies, Kaur & Garg (2018) highlight the most implemented methods worldwide: (i) Leadership in Energy and Environmental Design (LEED), (ii) Building Research Establishment Environmental Assessment Method (BREEAM), (iii) Comprehensive Assessment System for Built Environment Efficiency (CASBEE), (iv) Green Building Index (GBI), (v) Indian Green Building Council (IGBC), and (vi) Green Rating for Integrated Habitat Assessment (GRIHA). The first three cases are analyzed in depth, together with the Guide for the Certification of Green Urbanism in 2020 by the Agència d'Ecologia Urbana de Barcelona (AEUB), which makes its own proposal of indicators based on previous analyses and the regulations in force in Spain.

The UK housing developer Berkeley Group, together with the Social Life Foundation and the University of Reading (Dixon & Woodcraft, 2013), has developed a methodology for measuring social sustainability in new housing developments. The proposed framework has four core dimensions. 1) "Amenities and infrastructure," which lays the foundation for a thriving community in the mix of housing types, public spaces, landscaping, transport links, and the presence of community infrastructure. 2) "Social and Cultural Life", which considers the personal experience of urbanism in terms of quality of life, perception of safety, sense of belonging, and interaction with neighbors. 3) "Voice and Influence", which reflects the potential for residents to shape their future through participation. "Neighborhood Change" captures the impact of a new community on surrounding neighborhoods and the broader region. In particular, the model helps to understand how new developments change a neighborhood's demographic profile and local housing affordability (Dixon & Woodcraft, 2013). The methodology used consists of 45 questions to assess the 13 proposed indicators, see Table 2. The research team

wanted to conduct local resident surveys, where possible, using pre-tested and validated questions, so that resident survey results could be compared with national datasets from national surveys: British Household Panel, Participation, British Crime and Citizenship.

Table 2. Four core dimensions of social sustainability in new housing development.

Indicators			
Social and cultural life	Voice and influence	Amenities and infrastructure	Change in the neighbourhood
• Positive local identity • Relationships with neighbours • Well-being • Feeling of safety • Community facilities	• Willingness to act to improve area • Perceptions of ability to influence local area	• Provision of community space • Transport links • Place with distinctive character • Integration with wider neighbourhood • Accessible street layout • Physical space on development that is adaptable in the future	• Pending definition

Source: Creating strong communities-measuring social sustainability in new housing development (Dixon & Woodcraft, 2013).

In line with the Berkeley Group's approach, we will analyze two proposals for assessing social sustainability in urban environments by applying Likert scale questionnaires. The "Measurement of the City from Social Aspects" (MCSA) model by Doğu & Aras (2019) and the work of Larimian & Sadeghi (2021). In the first proposal, a 21-item questionnaire is developed, and Cronbach's alpha reliability coefficients are applied to the seven defined subscales: sense of belonging, social capital, environmental perception, social interaction/security, interaction with space, satisfaction with space, voice and influence, see Table 3.

The second proposal by Larimian and Sadeghi measures urban social sustainability at the neighborhood level, based on 32 variables on 7 predefined dimensions: neighborhood satisfaction, sense of place, safety, social equity, social interaction, housing satisfaction, and social participation, using a multidimensional Likert scale test, see Table 4. The authors also defend the quality of urban design as a key element of urban social sustainability (Chan & Lee, 2008; Choguill, 2008).

The work of Shirazi and Keivani (2019) based on a qualitative analysis of numerous resources points out several key aspects in the assessment of social sustainability: being multi-scale (from the building to the region), requiring different methodologies (qualitative and quantitative) to establish indicators, and including both physical and non-physical factors. In addition, it highlights the existence in the literature of some consensus on key concepts such as equity, democracy and social engagement, social inclusion and social mix, social interaction, sense of

Table 3. Sub-scales and indicators of urban social sustainability.

Indicators						
Sense of Belonging	Social Capital	Perceived Environment	Social Interactions/ Security	Interaction with Space	Satisfied with Space	Voice and Influence
• Community stability • Sense of community • Well-being/ Happiness • Sense of place • Sense of belonging to the house	• Relationship with neighbors • Chatting with neighbors • Trusting neighbors • Spending time with neighbors	• Satisfied with maintenance • Satisfied with transportation • Satisfied with sport centers • Satisfied with health centers	• Contribution of the university students • Trusting students	• Satisfied with the spatial organization of the house • Satisfied with the size of the house	• Climatic comfort of the house during summer • Climatic comfort of the house during winter	• Climatic comfort of the house during summer • Climatic comfort of the house during winter

Source: "Measuring social sustainability with the developed MCSA model: Güzelyurt case" (Doğu & Aras, 2019).

Table 4. Variables as asked in the questionnaire for measuring urban social sustainability.

Variables						
Neighbourhood Satisfaction	Sense of Place	Safety and Security	Social Equity	Social Interaction	Housing Satisfaction	Social Participation
NS1: This neighbourhood is a good place in which to live NS2: This neighbourhood is a good place for children to grow up in NS3: The quality of life in this neighbourhood is high NS4: People should be happy to say they live in this neighbourhood NS5: Living in this neighbourhood is good for my mental and physical health	SOP1: I miss this neighbourhood when I'm away from it for too long SOP2: I feel like I belong to this neighbourhood SOP3: Living in this neighbourhood gives me a sense of community SOP4: I like to think of myself as similar to the people who live in this neighbourhood SOP5: I am willing to remain resident of this neighbourhood for a number of years	SS1: I feel safe when out and about in the neighbourhood during the day SS2: I feel safe to walk alone in the neighbourhood after dark SS3: I don't worry about crime in my neighbourhood SS4: I am not aware of crimes committed in the neighbourhood within last 12 months	SE1: Access to essential facilities SE2: Access to recreational facilities SE3: Access to educational facilities SE4: Access to transportation facilities	SI1: I know the first names of my next door neighbours SI2: I am satisfied with the level of contact I have with my neighbours SI3: I visit my neighbours in their homes SI4: I believe my neighbours would help me in an emergency SI5: I borrow things and exchange favours with my neighbours SI6: I regularly stop and talk with people in my neighbourhood	HS1: Housing in my neighbourhood is affordable HS2: I am satisfied with the size and condition of my house	SP1: I am willing to work together with others on something to improve my neighbourhood SP2: I participate in activities in a social group in my neighbourhood SP3: I have done some volunteer work in my neighbourhood within the last 12 months SP4: We have a strong and active community in our neighbourhood SP5: I want to be a part of things going on in my neighbourhood

Source: "Measuring urban social sustainability: Scale development and validation" (Larimian & Sadeghi, 2021).

place, safety and security, and quality of the built environment and housing. The work of Shirazi and Keivani (2021) and Shirazi et al. (2022) posits a threefold perspective for defining and assessing social sustainability in neighborhoods. First, the Neighbourhood as the space in which social sustainability is evaluated and practiced; its quantitative indicators are density, mixed land use, urban pattern and street network, building typology, and quality of the center. Secondly, Neighbouring, the practice of social qualities, whose qualitative indicators are access to amenities, social networks and interaction, safety and security, sense of attachment to place, sense of attachment to community, participation, perception of neighborhood quality and perception of home quality. Third and finally, Neighbours, the people who engage in these practices, are the most likely to have a positive impact on the quality of their homes, see Table 5.

Table 5. Working definition for social sustainably of urban neighbourhoods indicators and definitions. The Triad of Social Sustainability: Defining and Measuring Social Sustainability of Urban Neighbourhoods (Shirazi & Keivani, 2019).

Indicators		
Neighbourhood	Neighbouring	Neighbours
• Density /Measures concentration (building and population density) • Mixed land use/Mixture, proximity, and diversity of different functions in a specific area • Urban pattern and street network/Describes connectivity, integration, and permeability of space • Building typology/Diversity of buildings based on their common formal characteristics (type, height, age, function, style) • Quality of centre/Spatial qualities of the neighbourhood's focal point	• Acces to facilities /Equal availability and accessibility of key amenities needed at neighbourhood level • Social networking and interaction/Verbal or non-verbal interrelationships between individuals • Safety and security/How inhabitants perceive level of safety at the public spaces • Sense of attachment (place)/Feel connected to the place and its spatial qualities and environmental characteristics. • Sense of attachment (community)/Feel connected to the community members based on shared values, common interests, and human ties. • Participation/Level of engagement of residents in dealing with neighbourhood problems and neighbourhood-related initiatives • Neighbourhood quality perception/Degree of satisfaction of the residents with their immediate environment • Home quality perception /Degree of satisfaction with interior space of home such as room size and bedroom number	• Social mix/State of neighbourhood diversity according to socioeconomic status

3.2. The Certifiers Review

The review conducted on certification bodies also provides numerous analyses of the most widely implemented urban sustainability certification tools worldwide. The comprehensive review conducted by Kaur & Garg (2018) identified 23 categories applicable to the 5 dimensions of urban sustainability applied at the scale of building, urbanization, neighborhood, district, city or territory. The 5 dimensions are environmental, social, economic, cultural and institutional. The authors analyze six tools: Building Research Establishment Environmental Assessment Method (BREEAM) developed in the UK for community assessment; Comprehensive

Assessment System for Built Environment Efficiency (CASBEE) developed in Japan for urban development; Green Building Index (GBI) developed in Malaysia for municipalities; Leadership in Energy and Environmental Design (LEED) developed in the US for neighborhood projects; Indian Green Building Council (IGBC) for green communities; and Green Rating for Integrated Habitat Assessment (GRIHA) for large developments, the latter two implemented in India. From the review, the authors conclude that the six analysis tools take into account the categories of infrastructure and resource management (energy, water, waste, construction) and transport and connectivity, which consider factors of a physical nature, and that the categories relating to social aspects, based on criteria of justice, fairness and equity, are only considered with the appropriate weight in BREEAM and GBI. In addition, cultural and institutional aspects are not given the appropriate weight in any of the six tools. The authors also conclude that business and innovation and finance and economics are not given much weight in any of the six tools. Finally, they point out that each factor is evaluated in isolation, without taking into account the influences of one on the other.

Another relevant work, the report "Green Urbanism Certification" by AEUB (2020) analyzes three certifiers: BREEAM Communities, CASBEE for Urban Development and LEED for Neighborhood for Development. As a result of its analysis, the guide proposes three systems of indicators to evaluate different working contexts: pre-existing conditions, planning to be developed and existing fabrics. Twelve evaluation categories are established: urban planning context, land occupation, public space and livability, mobility and services, urban complexity, green spaces and biodiversity, urban metabolism, social cohesion, management and governance, developing specific sub-areas, indicators and parameterizations for each system, see Figure 2.

4. Founds

Analyzing the origin of the 228 indicators initially found, 53% come from sources related to sustainability certification (LEED, BREEAM, CASBEE, AEUB), while 47% come from academic literature. After reviewing both the academic literature and the main certifiers of urban social sustainability, a proposal is made in which the 228 indicators are grouped into 45 and the 59 categories into 3: (i) urban design, (ii) neighborhood cohesion, and (iii) social equity. Each category has 15 indicators, see Appendix Table A1. The process followed is as follows: we start with the 228 indicators collected from the survey carried out. From here, each of the indicators found is assigned to one of the three categories mentioned above, taking into account its original category or subcategory. Subsequently, redundancies among indicators pertaining to analogous concepts are eliminated, as are indicators of minimal pertinence. This process serves to neutralize the overrepresentation of indicators associated with both urban design and neighborhood. The objective is to establish as priorities Demsey's factors, which pertain to social equity, despite the absence of associated indicators. The result is a balanced

Figure 2. Indicators and criteria in the evaluation of urban sustainability by AEUB. Source: Own elaboration based on AEUB (2020).

purpose, with 15 indicators per category, wherein certain indicators are endowed with numerous evaluation parameters, while others necessitate enhancement.

Looking at each of the three proposed categories, the indicators categorized under "Urban Design" represent 45% of the total, 85% of them coming from sources related to sustainability certification. The indicators in the "Neighborhood Cohesion" category represent 40% of the total and 88% of them come from academic literature. The indicators of the "social equity" category have a much lower presence than the two previous categories, representing only 15% of the total, which is surprising if we take into account the original conceptualization of sustainable development (WCED, 1987). Of this last group of indicators, 60% come from certification-related sources and 40% from academic literature.

The analysis reveals an imbalance between indicators that evaluate the built

environment, the container, and indicators that evaluate the communities that inhabit them, the content. It is observed that the evaluation systems of certifiers tend to focus on quantitative indicators to evaluate aspects of urban design. The academic literature, on the other hand, tends to focus more on qualitative indicators aimed at evaluating neighborhood cohesion. It should be noted that the evaluation of social equity is hardly considered in either area. This is surprising, given that social equity is a necessary and prior condition for any other aspect of sustainable development, especially for policies that require or intend to align with the SDGs.

Once the proposal of indicators and categories has been made, Figure 3 shows the origin of the different indicators included in the proposal. The indicators related to urban design have been mainly developed by the certifying bodies, while those related to neighborhood cohesion have been mainly dealt with in the academic literature. The third category, social equity, has been addressed to a much lesser extent by both.

Once the indicators have been grouped into their categories and subcategories, the relationship between indicators and SDGs is established. The resulting data are then organized from the highest indicator/SDG ratio to the lowest, with consideration given to the relationship between indicators and SDGs targets. The proposed indicators are associated with 12 of the 17 Sustainable Development Goals (SDGs), with 80% of the indicators pertaining to SDG 11: Sustainable Cities and Communities, particularly within the domain of Urban Design. The scope of SDG 11 extends beyond mere physical infrastructure, encompassing social, cultural, and economic dimensions. These dimensions include affordable housing and fundamental services, sustainable transportation, inclusive and accessible public spaces, urban resilience, and conservation of cultural and natural heritage. This alignment closely mirrors the approach of certifiers and the research of Dempsey and subsequent authors examined, using both quantitative and qualitative indicators for evaluation. The present proposal, in its effort to prioritize social equity as a fundamental characteristic of urban social sustainability, proposes a 27% proportion of the indicators that are closely related to "SDG 10: Reducing inequalities," more closely aligned with the category of "Social equity." Conversely, neighborhood participation, a pivotal element in the implementation of social sustainability policies, is addressed by 27% of the indicators, which pertain to "SDG 16: Peace, justice and strong institutions," particularly within the domain of "Neighborhood cohesion." Furthermore, 24% of the indicators pertain to "SDG 13: Climate Action." However, this objective is addressed within the context of urban design due to the observed social nature of environmental sustainability. "SDG 3: Health and well-being" and 'SDG 9: Industry, innovation and infrastructure' are related with 16% of the indicators, mainly in urban design, however, 'SDG 8: Decent work and economic growth' with 16% is more present in the category of 'Social equity'. More minority relationships present "SDG 4: Quality education" (13%), "SDG 1: End poverty" (11%), "SDG 2: Zero hunger" (4%). The

CATEGORIES	SUBCATEGORIES	INDICATORS	ACADEMIC LITERATURE					CERTIFYING COMPANIES			AEUB GUIDE		
			Larimian, T.; Sadeghi, A.	Shirazi M.; Keivani R.	Doğu, F.; Aras, L.	Dixon T.; Woodcraft S.	Dempsey, N.; Bramley, G.	LEED	BREEAM	CASBEE	New developments	Pre-existing areas	Pre-existing conditions
URBAN DESIGN	Environmental and landscape protection	Protection of spaces and habitats						x	x	x			x
		Protection of elements of cultural or historical interest.						x	x	x			x
		Availability of agricultural land (mixed land use)		x									x
		Urban green space									x	x	x
	Urban Space Design	Density/compactness		x				x			x	x	x
		Urban Complexity/Diversity					x				x	x	x
		Road space for pedestrians					x	x	x		x	x	
		Quality/accessibility/proximity/flexibility of public space		x		x	x	x	x	x	x	x	
		Quality/accessibility/proximity of services and equipment	x	x			x	x	x	x	x	x	x
		Building Desig		x			x	x	x	x			
		Functionality/Connectivity of urban planning action.									x	x	x
	Mobility, transport, communication	Proximity to public transport, capacity, efficiency					x	x	x	x	x	x	
		Bicycle network, parking						x	x		x	x	x
		Car parking, flexibe, reduced						x	x		x	x	
		Accessibility to telecom systems							x	x			
SOCIAL EQUITY	Social Justice	Social vulnerability of the population											x
		Social inclusion					x						x
		Redistributive policies					x						
		Social Mixing		x								x	
	Housing	Provision of social housing									x	x	x
		Diversity and spatial distribution of social housing						x	x			x	
		Mixed tenure					x						
		Residential stability					x						
		Housing affordability	x										
		Decent housing					x						
		Proximity between housing and workplaces						x					
	Local economy and work	Labor self-containment										x	
		Knowledge-dense activities										x	
		Innovation						x					
		Utilization/training of people							x	x			
NEIGHBOR- HOOD COHESION	Community and participation	Social Capital					x						
		Social cohesion					x						
		Social networks and neighborhood interaction	x	x	x	x	x						
		Provision of community spaces				x							
		Participation	x	x	x	x	x	x	x	x	x	x	
		Sense of community and belonging to the place	x	x	x	x	x						
		Sense of belonging to the house			x								
		Active Community Organizations					x						
		Community Stability				x	x						
	Health, education and well-being	Health, quality of life and well-being	x		x	x	x						
		Education and training			x		x						
		Cultural traditions					x						
		Feeling safe and secure	x	x	x	x	x						
	Management and governance	Instruments in the transformation processes							x	x	x	x	
		Managing changes in scope				x							

Figure 3. Proposed indicators in relation to sources consulted. Source: Author's elaboration.

paucity of indicators pertaining to SDGs 1 and 2 is noteworthy, despite the evident correlation with the "social equity" category. This is attributable to the fact that the targets of these goals pertain predominantly to actions to be executed at the global and national levels. On the urban scale, these objectives are partially incorporated into SDGs 11 and 10. Finally, "SDG 15: Life of terrestrial ecosystems" (4%), "SDG 7: Affordable and clean energy (energy efficiency)" (2%), see Figure 4.

5. Discussion and Conclusion

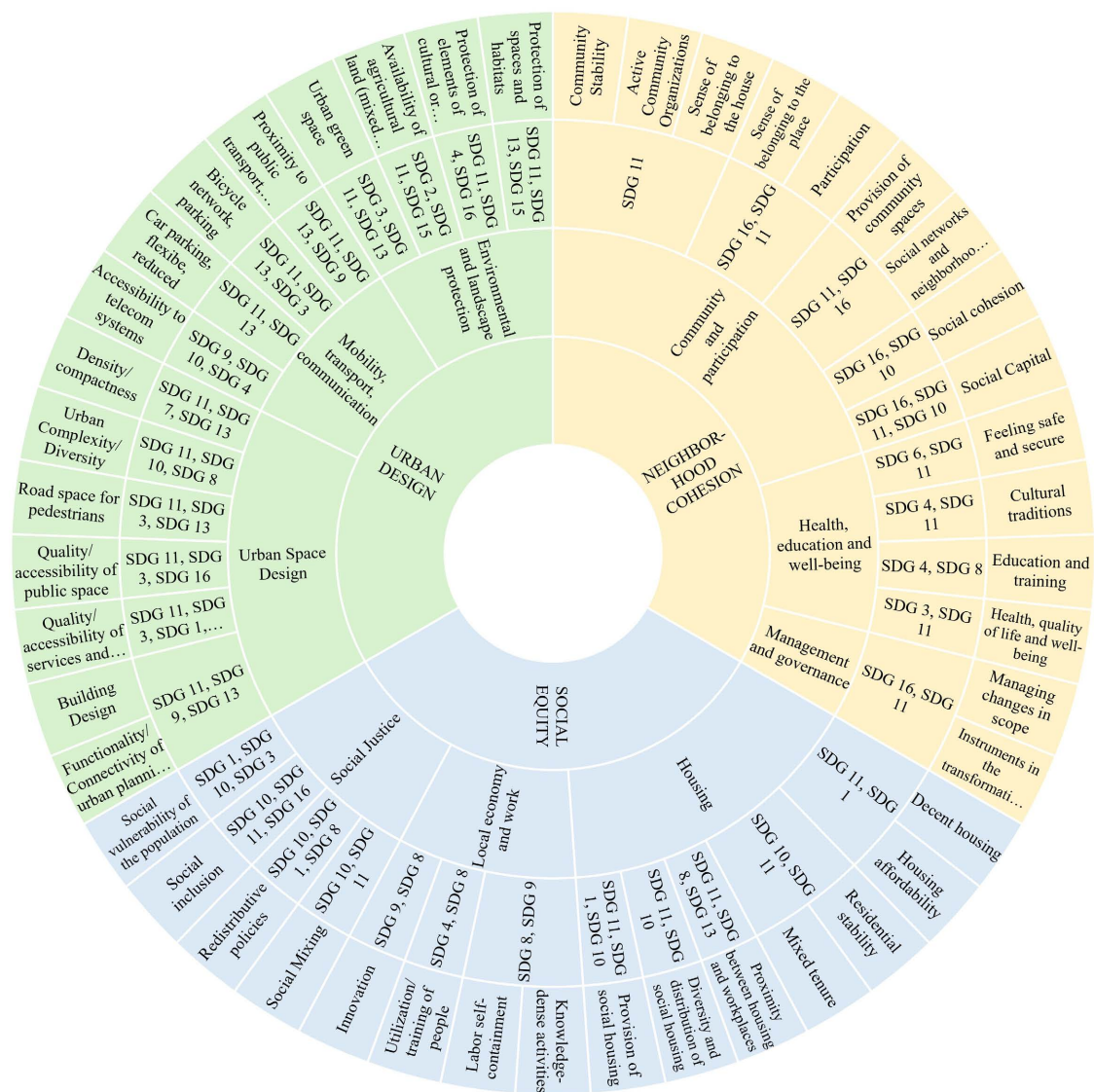While this topic has been addressed in the academic literature and by certifiers,

Figure 4. Proposed indicators, characterization and relationship with the SDGs. While this The proposed framework incorporates studies conducted in various territorial areas, including London (United Kingdom), Berlin (Germany), Güzelyurt (Cyprus), and Dunedin (New Zealand). It also encompasses globally implemented certification tools from the United States, United Kingdom, and Japan, as well as other systems from Indonesia and India. By adapting the parameters for evaluating each indicator to the specific reality to be analyzed, the framework ensures scalability and adaptability to different urban contexts, such as developed and developing countries.

there is a lack of consensus on how to define and assess social sustainability in urban environments. This lack of consensus results in a variety of approaches and methodologies. We found differences between certifiers and the academic literature. While certifiers focus on urban design, the academic literature prioritizes neighborhood cohesion. However, neither approach considers social equity, which is a necessary condition for sustainable development as stated in the Brundtland Report (WCED, 1987).

In accordance with the criteria of Shirazi and Keivani (2021) and Shirazi et al. (2022), the proposed system is applicable at different scales, includes quantitative and qualitative methods, and refers to physical and non-physical factors. Moreover, following the structure proposed by the AEUB Methodological Guide, 2020 includes valid indicators for different situations to be evaluated, both existing neighborhoods and new developments in pre-existing environments. In line with Dempsey et al. (2011), the proposed system includes indicators directly related to the design of the built environment, such as access to public transportation and indicators that depend on the conditions of access to adequate housing.

The assessment of social sustainability should not be limited to the definition of indicators but should go a step further and be able to align the indicators with the scope of the SDGs in order to contribute to sustainable development. This is all the more important given that the contribution to the SDGs is a requirement that economic policies in Europe must meet in order to access co-financing, as in the case of the Next Generation Funds.

In the assessment of social sustainability in urban environments, it is necessary that social equity is no longer an element of lesser weight compared to aspects such as urban design and neighborhood cohesion: social inclusion, redistributive policies, housing affordability and people's employability, among others, are aspects that cannot be left aside to achieve true social sustainability.

The scalability and adaptability of the proposed scheme are contingent upon the appropriate adaptation of the parameters selected for the evaluation of the indicators. Consequently, it is imperative to possess a comprehensive understanding of the context to be analyzed, in order to foresee the potential technical, social, or institutional impediments that may emerge during the implementation of the proposed indicators.

The challenge now is to assign the most appropriate parameterization to each indicator in order to obtain an objective and balanced assessment, emphasizing the importance of making equity prevail over any other criterion to achieve socially sustainable urban environments.

Conflicts of Interest

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

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Appendix

Table A1. Relationship between the 228 indicators found and the 45 proposed indicators.

Indicators found	Source	Proposed indicators
Protection of spaces and habitats of natural and/or agricultural interest	AEUB	Protection of spaces and habitats of natural and/or agricultural and landscape interest
Preservation of historical or landscape heritage	LEED	
Consideration of the local landscape and development of plans	BREEAM	
Design statement and consideration of context, quality of spaces, etc.	BREEAM	Protection of elements of cultural or historical interest. Formation of the urban context
Conservation and restoration of historical, natural and cultural assets	CASBEE	
Consideration and formation of the context and urban scenario	CASBEE	
Design that considers and promotes harmony with the urban environment	CASBEE	
Protection of elements of cultural interest	AEUB	
Availability of agricultural land	AEUB	Availability of agricultural land (mixed land use)
Mixed land use	Shirazi & Keivani (2019)	
Tree density	AEUB	Urban green space
Urban green corridors	AEUB	
Green space deficit	AEUB	
Soil biotic index	AEUB	
Green space per inhabitant	AEUB	
Simultaneous proximity to green spaces	AEUB	
Green roofs	AEUB	
Visual perception of urban green	AEUB	
Minimum density of 17 or 25 homes/ha	LEED	Density/compactness
Density between 25 and 155.7 homes/ha	LEED	
Density	Shirazi & Keivani (2019)	
Corrected compactness	AEUB	
Living space per inhabitant	AEUB	
Housing density	AEUB	
Absolute compactness	AEUB	
Increase in urbanized area	AEUB	
Urban diversity	AEUB	Urban complexity/diversity
Balance between activity and residence	AEUB	
Proximity to everyday commercial activities	AEUB	
Urban complexity	AEUB	
Adaptable physical space in the future	Dixon & Woodcraft (2013)	

Continued

Street design for pedestrian safety and comfort	LEED	Road space intended for pedestrians
Pedestrian district	Dempsey et al. (2011)	
Pedestrian road space	AEUB	
Road space intended for pedestrians	AEUB	
Air quality	AEUB	Quality/accessibility/proximity/flexibility of public space
Acoustic comfort	AEUB	
Thermal comfort	AEUB	
Accessibility of the road	AEUB	
Street proportion	AEUB	
Connectivity of urban development	AEUB	
Public space deficit	AEUB	
Access to civic and public space	LEED	
Street network design	LEED	
Design for universal accessibility	LEED, BREEAM, CASBEE	
Urbanity	Dempsey et al. (2011)	
Attractive public space	Dempsey et al. (2011)	
Sustainable urban design	Dempsey et al. (2011)	
Accessible street layout	Dixon & Woodcraft (2013)	
Space with distinctive character	Dixon & Woodcraft (2013)	
Urban pattern and street network	Shirazi & Keivani (2019)	
Quality of the center	Shirazi & Keivani (2019)	
Proximity to basic service networks	AEUB	Quality/accessibility/proximity of basic services and facilities
Lack of basic equipment	AEUB	
Provision of equipment	AEUB	
Proximity to facilities	AEUB	
Access to recreational services	LEED	
Access to open spaces	BREEAM	
Proximity to medical services	CASBEE	
Proximity and accessibility to schools/cultural facilities	LEED, CASBEE	
Proximity to services and facilities for daily use	LEED, BREEAM, CASBEE	
Environmental quality and services	Dempsey et al. (2011)	
Accessibility to services	Dempsey et al. (2011)	
Active facade design	BREEAM	Building design
Facade orientation to street	BREEAM	
Open space design for ventilation	CASBEE	

Continued

Consideration of the solar path	LEED, CASBEE	
Design for safety	BREEAM, CASBEE	
Security	Dempsey et al. (2011)	
Building typology	Shirazi & Keivani (2019)	
Spatial and functional continuity of the street	AEUB	
Use of local, low-impact, and recyclable materials	AEUB	
Availability of construction materials for reuse	AEUB	Functionality/Connectivity of the urban development.
Proximity to waste collection points	AEUB	
Closing the organic matter cycle	AEUB	
Existence of activities to close the organic matter cycle	AEUB	
Mode of population movement	AEUB	
Proximity to alternative transport networks to the automobile	AEUB	
Proximity to city centre or transport service	BREEAM	
Proximity to public transport	LEED	
Mobility/Accessibility Plan (capacity)	LEED, BREEAM, CASBEE	Proximity to public transport networks, capacity, efficiency.
Plan to reduce car/traffic dependency	LEED, BREEAM, CASBEE	
Adequate and safe transportation services and shelters	BREEAM, CASBEE	
Transport infrastructure impact management plan	BREEAM	
Introduction to clean energy transport	CASBEE	
Transport efficiency	CASBEE	
Transport links	Dixon & Woodcraft (2013)	
Proximity to public transport stops and bicycle network	AEUB	
Nearby bicycle parking	AEUB	
Bicycle parking	AEUB	
Provision of bicycle parking spaces	AEUB	Bicycle network, parking.
Bicycle lane network and storage	LEED	
Effective, safe and accessible bike lane design	BREEAM	
Connections with different means of transport	BREEAM	
Off-road car parking	AEUB	
Provision of parking spaces for vehicles	AEUB	Flexible, reduced off-road car parking.
Reduction of parking area	LEED, BREEAM	
Flexible parking	BREEAM	
Services and communication, accessibility	BREEAM	
Flexibility in response to demand and innovation	CASBEE	Accessibility to telecommunication systems.
Ensuring uninterrupted information systems	CASBEE	

Continued

Accessibility to communication systems, internet, mobile phones and digital television	CASBEE	
Contribution to social infrastructures	CASBEE	
Logistics distribution platforms	AEUB	
Reservation of space for underground service galleries	AEUB	
Social vulnerability of the population. Municipal sphere	AEUB	Social vulnerability of the population.
Social vulnerability of the population. Area of action and surrounding neighbourhoods	AEUB	
Fair distribution of income	Dempsey et al. (2011)	Redistributive policies
Social justice: inter and intragenerational	Dempsey et al. (2011)	
Social inclusion (and eradication of social exclusion)	Dempsey et al. (2011)	Social inclusion
Access to essential services	Dixon & Woodcraft (2013)	
Access to recreational facilities	Dixon & Woodcraft (2013)	
Access to educational services	Dixon & Woodcraft (2013)	
Access to health services	Dixon & Woodcraft (2013)	
Access to facilities	Shirazi & Keivani (2019)	
Population aging index	AEUB	Social mixing
Foreign population	AEUB	
Synthetic index of social inequality	AEUB	
Social mixing	Shirazi & Keivani (2019)	
Housing deficit	AEUB	Housing affordability
Provision of protected housing	AEUB	Provision of protected housing
Spatial distribution of protected housing	AEUB	Diversity and spatial distribution of protected housing
Diversity and distribution of social housing	LEED	
Provide social housing that is indistinguishable and distributed proportionally throughout the development	BREEAM	
Proximity between housing and jobs	LEED	Proximity between housing and jobs
Mixed ownership	Dempsey et al. (2011)	Mixed ownership
Residential stability	Dempsey et al. (2011)	Residential stability
Decent housing	Dempsey et al. (2011)	Decent housing
Employment	Dempsey et al. (2011)	Employment
Labor self-restraint	AEUB	
Study of the impact on local employment and job creation	BREEAM	
Utilizing local industry, people and skills	CASBEE	

Continued

Diagnosis for the installation of priority businesses in the area	BREEAM	
Research for the installation of a complementary business	BREEAM	
Compatibility between supply and demand of businesses in the field	BREEAM	
Knowledge-dense activities	AEUB	Knowledge-dense activities
Utilization and training of local people	BREEAM	Utilization and training of local people
Innovation	LEED	Innovation
Social capital	Dempsey et al. (2011)	
Relationship with neighbors	Doğu & Aras (2019)	
Chatting with the neighbors	Doğu & Aras (2019)	
Trusting the neighbors	Doğu & Aras (2019)	Social capital
Spending time with neighbors	Doğu & Aras (2019)	
Community	Dempsey et al. (2011)	
Social order	Dempsey et al. (2011)	
Social cohesion	Dempsey et al. (2011)	Social cohesion
Social networks	Dempsey et al. (2011)	
Social interaction	Dempsey et al. (2011)	
I know my neighbor's name	Larimian & Sadeghi (2021)	
I am satisfied with the level of contact with my neighbors	Larimian & Sadeghi (2021)	
I visit my neighbors in their homes	Larimian & Sadeghi (2021)	
I think my neighbors would help me in case of emergency	Larimian & Sadeghi (2021)	Social networks and neighborhood interaction
I borrow things and exchange favors with my neighbors	Larimian & Sadeghi (2021)	
I regularly stop to talk to my neighbors	Larimian & Sadeghi (2021)	
Neighborhood associations and friendships mean a lot to me	Larimian & Sadeghi (2021)	
Social networks and interaction	Shirazi & Keivani (2019)	
Integration with wider neighborhood	Dixon & Woodcraft (2013)	
Sense of community and belonging	Dempsey et al. (2011)	
Sense of belonging	Doğu & Aras (2019)	
Sense of community	Doğu & Aras (2019)	
Positive local identity	Dixon & Woodcraft (2013)	
Relations with neighbors	Dixon & Woodcraft (2013)	Sense of community and belonging to the place
You miss the neighborhood when you're not there	Larimian & Sadeghi (2021)	
You feel like you belong to the neighborhood	Larimian & Sadeghi (2021)	
Sense of community	Larimian & Sadeghi (2021)	
I like to feel equal to my neighbors	Larimian & Sadeghi (2021)	

Continued

I want to stay in the neighborhood for a few years.	Larimian & Sadeghi (2021)	
Sense of attachment (community)	Shirazi & Keivani (2019)	
Sense of attachment (place)	Shirazi & Keivani (2019)	
Community cohesion	Dempsey et al. (2011)	
Satisfaction with spatial organization	Doğu & Aras (2019)	
Satisfaction with maintenance	Doğu & Aras (2019)	
Satisfaction with transportation	Doğu & Aras (2019)	
Satisfaction with the sports center	Doğu & Aras (2019)	
Satisfaction with the health center	Doğu & Aras (2019)	
Satisfaction with the quality of the neighborhood	Shirazi & Keivani (2019)	
The neighborhood is good to live in	Larimian & Sadeghi (2021)	
The neighborhood is good for children	Larimian & Sadeghi (2021)	
High quality of life	Larimian & Sadeghi (2021)	
People should be happy to say they live in the neighborhood	Larimian & Sadeghi (2021)	
Perception of the quality of the house	Shirazi & Keivani (2019)	
Satisfaction with the size of the house	Doğu & Aras (2019)	
Satisfaction with the climatic comfort of the house in winter	Doğu & Aras (2019)	Sense of belonging to the house
Satisfaction with the climatic comfort of the house in summer	Doğu & Aras (2019)	
Sense of belonging to the house	Doğu & Aras (2019)	
Satisfaction with the size and condition of the house	Larimian & Sadeghi (2021)	
Housing in the neighborhood is affordable	Larimian & Sadeghi (2021)	
Active community organizations	Dempsey et al. (2011)	Active community organizations
Community stability	Doğu & Aras (2019)	Community stability
Health, quality of life and well-being	Dempsey et al. (2011)	
Welfare	Dixon & Woodcraft (2013)	Health, quality of life and well-being
Wellbeing and happiness	Doğu & Aras (2019)	
Living in the neighborhood is good for mental and physical health	Larimian & Sadeghi (2021)	
Education and training	Dempsey et al. (2011)	
Contribution of university students	Doğu & Aras (2019)	Education and training
Trusting the students	Doğu & Aras (2019)	
Cultural traditions	Dempsey et al. (2011)	Cultural traditions
Feeling of security	Dixon & Woodcraft (2013)	
Safety and protection	Shirazi & Keivani (2019)	Feeling of safety and protection
Perception of safety when walking during the day	Larimian & Sadeghi (2021)	

Continued

Perception of safety when walking at night	Larimian & Sadeghi (2021)	
He has no concern about crimes in the neighborhood	Larimian & Sadeghi (2021)	
He is not aware of any crimes in the neighborhood in the last 12 months.	Larimian & Sadeghi (2021)	
Provision of community spaces	Dixon & Woodcraft (2013)	Provision of community spaces
Community facilities	Dixon & Woodcraft (2013)	
Participation	Shirazi & Keivani (2019)	
Willingness to act to improve	Dixon & Woodcraft (2013)	
Perception of ability to influence	Dixon & Woodcraft (2013)	
Willingness to work with people	Doğu & Aras (2019)	
Having a say in decisions	Doğu & Aras (2019)	
Participation and local democracy	Dempsey et al. (2011)	
Citizen participation in urban transformation processes	AEUB	
Citizen participation in urban processes	AEUB	
Willingness to work with others to improve the neighborhood	Larimian & Sadeghi (2021)	
Participation in activities in social groups in the neighborhood	Larimian & Sadeghi (2021)	
I have volunteered in my neighborhood in the last 12 months	Larimian & Sadeghi (2021)	Participation
Strong and active community in the neighborhood	Larimian & Sadeghi (2021)	
I want to be part of what happens in my neighborhood	Larimian & Sadeghi (2021)	
Activities for community participation in the planning process	LEED	
Consultation and consideration of people's needs in design	BREEAM	
Consultation and consideration of community needs and participatory processes	BREEAM	
Creating opportunities for the public sphere	CASBEE	
User guide and information for the community	BREEAM	
Actions that facilitate community development management	BREEAM	
Monitoring and management system for environmental conservation	CASBEE	
Cross-cutting management instruments in urban transformation processes through local administration	AEUB	Management tools in the transformation processes of the field
Territorial and temporal management instruments in urban transformation processes	AEUB	
Changes in the neighborhood	Dixon & Woodcraft (2013)	Managing changes in the neighborhood