

## Definition of an ESG framework for sustainable urban regeneration

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## Abstract

Sustainable urban regeneration projects feature social, economic and environmental considerations and set ESG (Environmental, Social and Governance) compliance at the core of their operations (UN-Habitat, 2021). ESG criteria are used by investors to assess environmental, social and corporate governance issues and determine the future performance of their investments. ESG taxonomies are increasingly used also by city governments, that incorporate ESG factors into decisions about their assets.

Some examples of ESG assessment and measurement approaches are already available in sectors related with urban regeneration such as real estate and infrastructures, including certification standards (SuRe, Envision, CEEQUAL, ISO), reporting standards (GRI, SASB), financial impact analysis (SAVi, TREDIS, Autocase). These approaches have been defined by different actors, such as NGOs, international organizations, private companies, professional associations, research and academia with a variety of purposes. However, an ESG framework explicitly defined for sustainable urban regeneration is still missing.

The aim of this paper is to define relevant ESG criteria for sustainable urban regeneration, to systematize existing evaluation frameworks, to identify the gaps between existing frameworks and relevant criteria and to propose a new approach that could fill these gaps.

The methodology is multi-faceted and includes: a) an analysis of existing ESG evaluation frameworks which could be applicable to urban regeneration projects, in order to identify their main features and categorize their criteria and indicators; b) a systematization of ESG criteria and indicators, performed by detecting overlaps, duplications and merging similar criteria and indicators, when needed. The criteria and indicators are then evaluated according to their applicability within: i) the process to develop an urban regeneration project; ii) the impact assessment of an urban regeneration project; c) a gap analysis to detect and identify the substantial gaps of criteria and indicators in existing frameworks.

The paper contributes to the literature in several ways: firstly, it fills the gap between existing ESG evaluation frameworks and urban regeneration; secondly, it provides a new methodology that may be used by developers, private investors and policy makers to evaluate real projects.

## 1. Introduction

Urban regeneration is an integrative process aimed at converting pockets of deteriorated urban land in inclusive and sustainable loci, with increased economic productivity, lower social inequality and higher urban livability (World Bank, 2016). However, the idea of urban regeneration is not limited to that, but it is multifaceted, and many definitions are available in the literature. For example, Wang et al. (2014) defines urban regeneration as a process that involves the rehabilitation of existing structures, redevelopment of buildings and sites, or reuse of urban land. Roberts (2017) sees urban regeneration as a “comprehensive and integrated vision and action which seeks to resolve urban problems and bring about a lasting improvement in the economic, physical, social and environmental condition of an area that has been subject to change or offers opportunities for improvement”. Andreucci (2021) argues that urban regeneration generally indicates “a multiscale and multifunctional process that involves the retrofit of existing infrastructures and buildings, the rehabilitation of districts and sites, and/or the restoration of urban land, involving communities, as well as sociocultural infrastructures, at different stages of the planning, decision-making, design, and implementation process”.

These definitions show that urban regeneration is a complex process involving several components and layers: land, natural resources, buildings, physical and digital infrastructures, public and private services, as well as different public and private actors, including local governments, local communities, private developers, investors, construction firms, asset managers, other financial institutions, urban planners and designers. Urban regeneration projects may include a) district-wide efforts, such as the requalification of an abandoned industrial park, b) neighborhood-wide initiatives, such as the revitalization of an urban waterfront, the restoration of an historic city center and the retrofitting of roofs and facades, c) place-focused adjustments, such as the transformation of an old train station in a public mall or the conversion of a big, motorized roundabout into a walkable square.

Urban regeneration becomes intertwined with sustainable development when it entails a *vision* and *actions* that address interrelated technical, spatial and socio-economic problems with the aim of reducing environmental impacts, improving urban livability and guaranteeing good quality of governance (Zheng et al. 2014). The academic literature defines several paradigms for urban regeneration that can contribute to sustainable development and to improve the quality of life in cities. For example, the “15-minutes city” advocates for increased proximity, which would in turn decrease the use of cars and lead to more closely knitted community fabrics (Moreno et al. 2021). This is linked to the “isotropic city” concept, which

imagines a utopian city where from each point it is possible to reach job locations, amenities, centralities with a similar effort and to enjoy an equal level of urban pleasantness (D'Acci 2013, 2015, 2019). Further paradigms for sustainable urban regeneration are the "resilient city" (Manca et al. 2017), which envisions cities prepared to face environmental, socio-economic and political hazards, and the "circular city" (EIB, 2018), which calls for the conservation and reuse of resources and products.

These elements show that a sustainable urban regeneration processes features social, economic, physical and environmental dimensions, as well as governance and coordination between actors involved. These dimensions can be considered and assessed under an ESG (Environmental, Social and Governance) perspective.

ESG criteria can be used by investors and developers to assess risks and performances of their investments. ESG taxonomies are increasingly used also in the public sector, for example by city governments that incorporate ESG factors into decisions on government assets and liabilities (Pelissero, 2022).

Several approaches and metrics exist to assess ESG compliance at different levels, such as organizations, assets and projects. Some examples of ESG assessment and measurement approaches are already available in sectors related with urban regeneration such as real estate and infrastructures, including certification standards (SuRe, Envision, CEEQUAL, ISO), reporting standards (GRI, SASB), financial impact analysis (SAVi, TREDIS, Autocase). These approaches have been defined by different actors, such as NGOs, international organizations, private companies, professional associations, research and academia with a variety of purposes. However, an ESG framework explicitly defined for sustainable urban regeneration is still missing.

The development of an urban regeneration project comprises different phases (planning, construction, operations and end-of-life) and actors (both public and private). Furthermore, urban regeneration projects can produce several impacts - positive or negative - on socio-economic and environmental components. An ESG framework for urban regeneration should therefore enable to assess if and how ESG issues have been taken into consideration throughout the different phases of urban regeneration project development. At the same time, it should assess the transformative impact generated by the urban regeneration project, considering different dimensions. An ESG assessment approach for urban regeneration should be adaptable and flexible enough to be applicable to different phases and by different actors.

The paper aims to define an integrated ESG framework for sustainable urban regeneration that could be used by both public and private actors to evaluate regeneration projects considering the different phases of project development and assessing the impact generated by the project. It aims to contribute to the academic literature by applying a novel ESG

perspective to urban regeneration projects. Furthermore, it aims to bridge the gap between private and public players in urban regeneration by providing a common language to evaluate urban regeneration projects.

The paper is structured in the following sections: 1) Introduction; 2) ESG and Sustainable urban regeneration, which defines the ESG concept and how it is interrelated with urban regeneration; 3) Methodology, which describes in detail the different steps of analysis; 4) Results; 5) Proposed ESG framework for urban regeneration; 6) Conclusions and way forward.

## **2. ESG and Sustainable urban regeneration**

### **2.1. The ESG concept and its evolution**

ESG is a framework concept which comprises Environmental, Social and Governance factors, and derives from the field of responsible investments (Li et al., 2021). The first forms of socially responsible investing (SRI), date back to the 1970s, when the movements on racial equality, women's rights, consumer protection, and the environment gained prominence.

In the 1990s, a new theory of responsible investing emerged. Its advocates argued that a company's social or environmental performance could provide hidden information about future profits, and thus could help investors select stocks with higher returns (Pucker, 2021). However, uncovering the information needed for such investments required direct engagement between fund managers and corporate executives (an approach known as "deep green" investing), so the supply of sustainability-linked products was limited. To encourage their diffusion, in 1997, the UN Environment Programme created the Global Reporting Initiative, which was the first comprehensive sustainability reporting framework, aimed at enhancing the disclosure of firm-level information. Furthermore, in the early 2000s, public companies began to publish the first corporate social responsibility (CSR) reports. Thanks to this international push and to the resulting increase in data availability, between 1993 and 2007, market actors became more optimistic at the idea that CSR could be a source of profit (Ioannou and Serafeim, 2014).

In this context, the term ESG ("Environmental", "Social" and "Governance") was first coined (UN, 2004). ESG investing is not precisely defined but broadly refers to some investment strategies that link financial performance to sustainability. In general, ESG investment

vehicles are actively or passively managed funds, and might focus on one or more E, S, or G characteristics. Analysts typically group ESG investment strategies into one of five categories:

1. impact (seeking environmental or social outcomes and most often undertaken by private investors);
2. thematic (focusing on a theme such as water scarcity or energy transition);
3. engagement (direct communications between investors and companies);
4. negative screen (excluding certain industries);
5. or integration (considering ESG-related risks and opportunities).

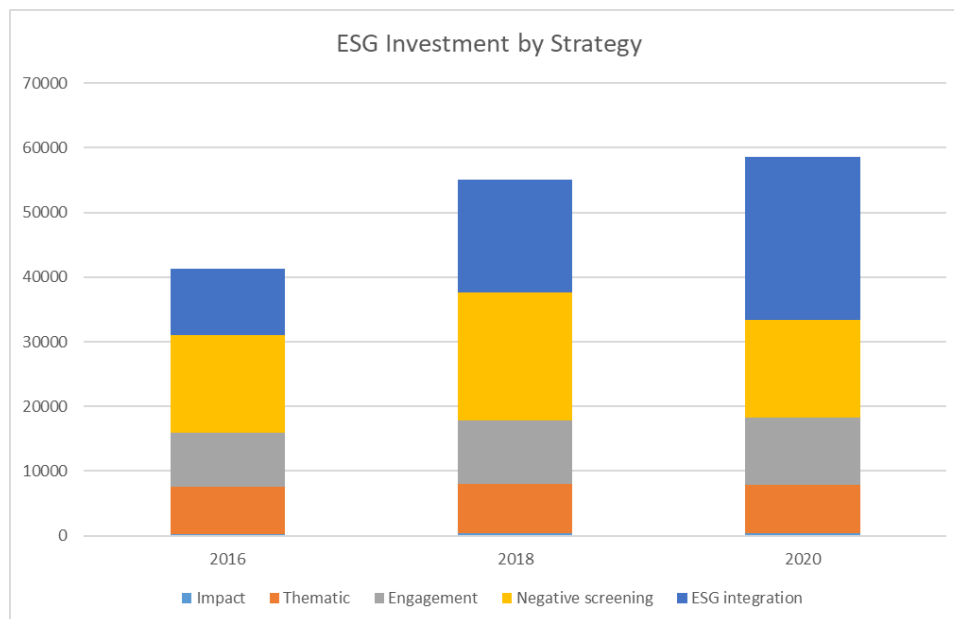


Figure 1: ESG investment by strategy (Source Global Sustainable Investing Report 2020)

From the perspective of institutional investors, ESG strategies represent a socially acceptable way to increase their exposure to performant assets, such as ESG-compliant firms. From the perspective of firms, being considered as ESG-compliant generates positive reputational feedback and capital inflow. For the sake of identifying ESG-compliant firms, rating companies, such as Sustainalytics or MSCI, measure the performance of firms and identify industry leaders and laggards in ESG integration.

ESG investing did not really take off until the 2010s, when two major research breakthroughs were published. Eccles, Ioannou and Serafeim (2012) examined 90 pairs of “twin” companies, each in the same industry, one classified as “high sustainability” and the other as “low sustainability.”. They concluded that sustainable firms outperform non-sustainable peers in stock returns. The other seminal work was published by Kahn, Yoon and Serafeim (2016), who found that “firms with good performance on material sustainability issues significantly outperform firms with poor performance on these issues, suggesting that investments in sustainability issues are shareholder-value enhancing”. By that year, the number of

signatories to the Principle for Responsible Investing grew to 1500 (from 63 in 2006) (PRI, 2023) and major news outlets began to talk about sustainable investing as “mainstream” (Davidson, 2016).

According to the Global Sustainable Investment Alliance Review, in 2020 the total value of ESG investing was 35.3 trillion USD. Bloomberg Intelligence estimated that this number could surpass 41 trillion USD by the end of 2022, and 50 trillion USD by 2025. However, after the first three quarters of 2022, total flows towards ESG-focused active funds have shrunk by 75%, amid global economic turmoil and doubts surrounding the robustness of ESG ratings (Pucker, 2021). In fact, following some recent ESG-linked scandal, like the one regarding Deutsche Bank-owned DWS (Reuters, 2022), the risk of greenwashing has gained prominence. Greenwashing is the exploitation of ESG labelling without any serious commitment to sustainable impacts and it is fueled by the flawed nature of ESG labels: the absence of a standard definition of what constitutes a robust ESG rating and the noisy metrics selected to measure ESG performance put the ESG narrative in peril (Pucker 2021, Simpson et al. 2021).

King and Pucker (2022) argue that present “light green” ESG strategies are based on algorithms that fed on commercially available ESG rankings to select stocks. On one hand, this more automated approach allowed a wider variety of fund types to claim that they incorporated ESG data and enabled the asset class to scale quickly. On the other, it pushed the majority of the world’s biggest ESG funds to include firms that are not directly linked to sustainable activities (I.e. Alphabet, Apple, Microsoft, JP Morgan, Procter and Gamble). The reason behind this skewness is simple: algorithm are developed to increase the funds’ alpha, not to follow sustainability criteria. Furthermore, ESG ratings which underlie ESG fund selection are based on “single materiality” — the impact of the changing world on a company’s profits and losses, not the impact that the company has on the planet. According to Bloomberg, “[ESG] ratings don’t measure a company’s impact on the Earth and society. In fact, they gauge the opposite: the potential impact of the world on the company and its shareholders.”

For these reasons, ESG credibility has been undermined and its reliability as a market signal remains a controversial issue. Some studies say that highly rated assets are more performant and less risky than assets with low ratings (Scatigna et al. 2021, Hoepner 2022). Some others are more skeptical. Berchicci and King (2021) confuted the results of the seminal paper by Kahn, Yoon and Serafeim, referring to its results as “statistical artifacts” and demonstrating that ESG ratings do not predict higher stock returns. In addition, Berg et al. (2021) calculate that the correlation between the scores established by six ESG raters ranges from 0.38 and 0.71 and argue that the divergence is driven by: a) the fact that ratings are based on different attributes; b) raters use different indicators to measure the same attribute; and c) raters take different stance on the importance of some weights. Christensen



et al. (2022) find that encouraging ESG disclosure, rather than fixing the divergence, increases overall disagreement and Brandon et al. (2021) find that ESG disagreement, rather than the market preference towards green assets, is positively correlated with asset performance. Acknowledging the existing controversies around ESG ratings, this paper relies on the consideration that robust frameworks are needed in order to provide a comprehensive assessment of urban regeneration projects' compliance with ESG criteria.

## **2.2. Benefits of an ESG framework for urban regeneration**

There is a growing attention to ESG and to the integration of ESG criteria into organisations, activities and projects related to urban regeneration, as well as in urban regeneration policies and operations (UN, 2021). This is due on one side to the role of regulation and sustainability policies, as sustainability is increasingly pursued by international agreements, national and local policies and regulations. Urban regeneration actors are increasingly compelled to contribute to sustainability objectives. On the other side, the market shows a strong interest in sustainable urban redevelopment projects, as this is in line with the demand and the expectations of financial institutions, investors, tenants and other market players, who perceive different typologies of benefits and values from sustainable urban regeneration projects (JLL, 2021). An ESG framework for urban regeneration can constitute a common ground and language for the different public and private actors involved in the supply-chain of an urban regeneration project.

Indeed, regeneration projects involve a wide range of actors with different roles and interests. It is possible to identify actors that are directly involved in the project delivery (such as developers, land and property owners, investors, asset managers, designers, finance and insurance companies, consultants and professionals with specific competences in architectural, engineering and financial domains) and actors that define the regulatory and planning context where the project is inserted (such as different government institutions and agencies at the local, regional and national level), as well as actors that are directly or indirectly affected by the project (such as local communities, users of spaces and buildings, other city users) (Mathur et al., 2008). These actors may assign different priorities to ESG issues and how to address them in a urban regeneration project.

On the private side, there is a growing need for financial institutions and real estate developers to assess the risk and returns of urban regeneration projects and to demonstrate related social benefits to interact with policy-makers and regulators. Some categories of investors, such as real estate asset managers and insurers, gather capital from institutional customers and constitute funds that are invested in a portfolio of regeneration projects.

These investors have been integrating sustainability into their business, by offering ESG-oriented funds to their customers. In particular, ESG-oriented real estate funds are constituted by different types of real estate assets (residential, commercial, offices), in different phases of development.

ESG-oriented developers are interested in getting sustainability certifications, such as LEED, WELL, BREEAM and NABERS, to increase the value of their assets. Meta-analysis by Dalton and Fuerst of 42 studies between 2008 and 2016 showed that green building certifications yielded a rent premium of 6% and a sales premium of 7.6%. Other research found that spaces certified by WELL or Fitwel – both of which focus on health and wellbeing– could attract effective rents that were 4.4% to 7% more per square foot than nearby, non-certified and non-registered peers (Sadikin et al.2020). In the case of real estate assets, a high ESG rating has positive effects on cash flows, as it increases rents and occupancy levels, diminishes operating costs (insurance premia) and capital costs (repair and restoration) and fosters expected future demand and slows down the depreciation of the asset (Chadwick and Simo 2022). Finally, it stabilizes the cash flow volatility, improves the liquidity of the asset and guarantees its insurability (Clayton et al. 2021). Furthermore, ESG-oriented developers can enjoy a facilitated access to credit, foreseen by banks that set incentives at this purpose. More and more frequently, financial institutions worldwide aim to increase the share of green assets in their portfolios due to regulatory developments in the field of sustainable finance (for example, the EU Taxonomy requires that financial institutions report the share of their green assets through a specific indicator named "green asset ratio", disclosing their commitments on ESG investments).

A UNEP FI (2021) survey that took place between September 2018 and February 2019 and involved investors and developers who collectively represent more than \$1 trillion USD of assets under management (AUM) revealed that 93% of the respondent include ESG criteria in their decisions.

On the other side, public actors are interested in urban regeneration projects that contribute to public policy objectives in terms of sustainability and increase the quality of life of inhabitants and city-users. The public vision for sustainable urban regeneration is summarized in the UN-Habitat New Urban Agenda (2020) which entails four sustainability dimensions: social, economic, environmental and spatial. Social sustainability is intended as a mix inclusivity, gender equality and age-responsive planning. Economic sustainability focuses on job creation, better livelihood and productivity. Environmental sustainability tackles ecosystem conservation and climate mitigation and adaptation. Spatial sustainability regards spatial inequality and urban density.

In light of these considerations, we claim that ESG integration in sustainable urban regeneration projects provides the opportunity to harmonize private and public priorities. On one hand, private actors are interested in ESG-compliant investments to improve their reputational standing, to increase their capital gains and to align with regulation. At this purpose, they need an approach to assess urban regeneration projects in a comprehensive

way and to demonstrate related social benefits to interact with policy-makers and regulators. On the other, public entities are interested in urban regeneration projects that respond to ESG criteria and contribute to public objectives. Municipal decision-makers need instruments to assess the public interest in regeneration projects and to base agreements and partnerships with private operators.

### **2.3. Main elements of an ESG assessment framework for urban regeneration**

Urban regeneration projects generate a wide range of positive and negative impacts on the environment, society and economy, and entail a set of governance issues, which are relevant for an ESG assessment and should be included in an ESG assessment framework.

Considering the environment, the literature points out that urban regeneration entails multiple transformative effects which involve all environmental dimensions, especially soil, water, air, and waste materials. When regeneration projects involve new buildings and infrastructures, harmful effects on the environment can be generated by buildings construction and demolition, especially in terms of CO<sub>2</sub> emissions and energy consumption, waste generation and soil degradation for waste disposal in landfills. At the same time, urban regeneration projects can function as testbeds for implementing energy efficient solutions in buildings and infrastructures, or circular approaches in the construction sector, optimizing and reducing the consumption of materials and waste production.

Urban regeneration can facilitate the implementation of both climate change mitigation and adaptation policies. For example, it fosters climate mitigation by promoting district heating and cooling systems or by enabling the efficient use of inner-city land, exploiting modifications to land-use patterns and renovation of the existing building stock. In addition, it encourages the uptake of nature-based solutions and the provision of green infrastructure (Balaban 2013; Balaban & Puppim de Oliveira 2014). On the adaptation side, it fosters strategies that prevent climate-related disruptions, such as the improvement of stormwater management (de Gregorio Hurtado 2021, Mariano & Marino 2022).

Considering the social and economic dimensions, urban regeneration can produce a variety of impacts on the population and the local economy. Positive impacts refer to enhancing inhabitants' quality of life, improving indoor and outdoor comfort, reducing spatial inequalities, increasing access to services, facilitating people empowerment and social inclusion, employment creation, local development through new business activities. Economic regeneration refers to the reinvigoration of local economies and is associated with

improvements in housing supply and upgrades to the built environment. These impacts are diversified and have been evaluated in a number of studies.

Collins and Shester (2013) evaluate the effect of a series of urban renewal programs over a 30-year period across 458 cities in the U.S., and find positive and economically significant effects on income, property values, and population<sup>1</sup>. In addition, Rossi-Hansberg et al. (2010) used data compiled from residential urban revitalization programs implemented in Virginia (U.S.) between 1999 and 2004 and find that estate renewal increases housing prices and has positive price spillovers on surrounding buildings<sup>2</sup>. Other studies suggest a positive impact of urban regeneration projects on housing prices and rents but, overall, there is little support for the claim that they spur wider local development. Albanese et al. (2021) observe 26 different urban regeneration projects in Italy and find that house prices seem to be the only variable on which the projects have an impact. More so, increases in housing values seem to materialize only for programs with the highest funding. Conversely, they do not find evidence of positive externalities in employment, income and population.<sup>3</sup> Similarly, the report What Works Center for Local Economic Growth 2014, focused on the public realm, concluded that only large urban regeneration projects increase property prices, spur resident attraction and improve working conditions. Also the What Works Center report of the following year (2015), focused on estate renewal, found no evidence of impacts on income, employment, crime and social exclusion. Gibbons et al. (2021) examined the impact of the Single Regeneration Budget launched in the UK in 1994 and find that the program increased workplace employment in targeted areas but had no impact on the employment rates of local residents.

Following a correct implementation of urban regeneration, several actors can take advantage of this processes, such as local governments, local communities, private developers and investors. For example, local governments may be able to solve long-standing urban issues like spatial inequality, gentrification and pollution. Local communities may exploit the chance to participate in the various phases of development through, in order to inform the public about their needs. Private developers can buy or lease land and building rights to implement regeneration projects using their own or other investors' resources. Finally, investors can allocate capital to diversify their portfolio and to improve their reputation.

On the other side, if not planned properly, urban regeneration processes can bring unintended negative consequences, such as gentrification. Gentrification is a shift in an urban community toward wealthier residents and businesses, with consequent

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<sup>1</sup> Some of the programs evaluated in the paper, such as the Title I of the 1949 Housing Act, controversially refer to "slum clearance" and are largely considered to have failed in their aim of reducing inequality (Rector and Sheffield, 2014). The paper has also been criticized by Raymond (2014), who questioned the econometric methodology and argued for the inconsistency of their result.

<sup>2</sup> See also Schwartz et al. (2006) and Ahlfeldt et al. (2017).

displacement of old tenants caused by increases in property values changes in the economic texture (World Bank, 2015). In order to explain gentrification, Glaeser (2008) argues that while the increase in the value of local amenities have a positive impact on housing and local prices, the distributive effects of this change are ambiguous. In fact, the benefits of urban regeneration can be unequally distributed, depending on who owns the land and the commercial premises. Furthermore, even if we do not observe a change in total population (for instance because housing supply is extremely rigid), there might be a change in the income-composition of residents. Disadvantaged households might leave the area as rents become unaffordable.

A second unwanted consequence of regeneration projects—related to gentrification and out-migration of the original population—is the loss of social capital, or community ties. Broadly speaking, social capital can be defined as a set of social norms of conduct, knowledge, mutual obligations and expectations, and reciprocity and trust that are widespread within a given region or community. The concept is also connected with social networks (Colantonio and Dixon 2011). When households are crowded-out by the rise of assets and rents, they get separated from each other. As a result, communities get dissolved.

Considering the last dimension of an ESG framework, governance, the complex nature of urban regeneration processes and the involvement of many public and private stakeholders require cross-sectoral integrated strategies and collaborative governance models. Creating integrated strategies means covering gaps and blind spots in policy-making, and reconciling urban planning with other urban-related policy sectors, as well as harmonizing public and private interests.

Urban regeneration projects can have different forms of governance, which have been categorized into governmental models, entrepreneurial models and civic models (Xie et al., 2021). In the governmental models, public authorities are deeply involved in all the urban regeneration phases, and hold responsibility for decisions and funding. In the entrepreneurial model, the government collaborates with the private sector and forms a public and private coalition to implement urban regeneration. In this approach, the private sector plays a prominent role and holds responsibility for decisions, whereas the public authority acts as a facilitator. In the civic model, residents and the civil society are actively involved in different phases of the regeneration project and balance the relation among the government, residents and markets with their knowledge and skills. The assessment of governance aspects should therefore refer to variety of aspects which concern the urban regeneration process, including the activation of models for inclusive and fair governance, collaboration, transparency, public participation in decision-making, management of the urban regeneration process and its risks and opportunities.

An effective framework for ESG assessment of urban regeneration projects should include these dimensions in order to evaluate the transformative impact of regeneration projects on the environment, communities, the urban territory at large and economy.

## **2.4. Existing ESG frameworks related to urban regeneration**

In the last decades, a variety of approaches and frameworks have been developed to mainstream and evaluate the sustainability of projects in several sectors, such as energy, transportation, water, waste, nature-based solutions, food systems, buildings (OECD, 2019). The development of these approaches has been driven by the importance of incorporating sustainability across different investment domains for an effective functioning of societies and economies, as well as by the need to orientate development in order to balance the social, economic and environmental impacts of infrastructure while delivering effective services. Even if they are not labelled as “ESG”, many of these approaches cover topics which are relevant also in an ESG-perspective and provide indicators that could be applied to evaluate ESG dimensions and criteria.

The Agenda 2030 for Sustainable Development adopted by the UN in 2015 is often used as an overarching framework for several sustainability assessment approaches (applied at national, regional, local level as well as at company level) and can provide a valuable reference for sustainable urban regeneration. In fact, urban regeneration is considered as a key approach to achieve sustainable development in cities and thus can be evaluated through the lens of the Sustainable Development Goals (SDGs). Urban regeneration can contribute to many SDGs, but in particular the Goal 11 is dedicated to making “cities inclusive, safe, resilient and sustainable”. This goal is articulated in 10 targets and 15 underlying indicators which track the progress of cities in regeneration-related topics like housing, transport, cultural heritage, climate adaptation, climate mitigation, waste management and disaster risk management.

Another overarching framework that helps to define and measure sustainable activities in the context of urban regeneration is the EU Taxonomy, formulated by the European Commission to meet the EU’s climate and energy targets for 2030 and reach the objectives of the European Green Deal. The EU taxonomy is a classification system that provides companies, investors, and policy-makers with appropriate definitions for which economic activities can be considered environmentally sustainable. In this way, it should create security for investors, protect private investors from greenwashing, help companies to become more climate-friendly, mitigate market fragmentation and help shift investments where they are most needed.

The Taxonomy is focused on the environmental dimension of sustainability and establishes six main objectives: climate mitigation, climate adaptation, circularity, pollution prevention, biodiversity protection and marine resources protection. The EU taxonomy includes different sectors, including Construction and real estate and other activities linked to urban regeneration.

Over time, several organizations have developed a variety of instruments to support policy-makers, decision makers, planners, private and public investors in integrating and considering ESG factors in their projects and investments. These instruments can be divided into different typologies according to the main purpose of their application:

*Principles* aim to provide users with orientations on how a project should be designed, planned, operated and implemented in order to incorporate sustainability, and they can be used as reference to define and develop monitoring and assessment schemes.

*Guidelines* aim to operationalize sustainability principles and their application to projects by identifying key issues, providing approaches and methods at this purpose. They can include suggestions and indications on monitoring approaches and frameworks.

*Checklists* aim to encourage the incorporation of sustainability objectives into projects. It is a measuring stick for users to ensure that project development proceeds in accordance with sustainability objectives and criteria. Checklists are usually associated with regulatory requirements and are not necessarily linked to a quantitative evaluation. For this reason, they are seldom advertised by the evaluated entity.

*Standards* provide information about the compliance of projects or assets with a given set of sustainability criteria, and they can be used by third parties to assess conformity with such criteria and issue a certification. Reporting standards, more specifically, provide indications on the topics, indicators and metrics to report about sustainability and ESG factors.

*Rating and certification systems* adopt a set of criteria and indicators to assess and rate a project based on environmental, social and economic dimensions, in order to provide a quantified result which can be used to release a certification about the achievement of specific performance levels. Certifications can be associated with a merit mark, like "platinum/gold/silver". Once the asset/project gets certified, it can publicly display its achievement on documents and online. This should improve its reputation and/or provide a signal to the market of its sustainability performance.

*Impact assessments* enable to measure the impacts of assets or projects on environmental, social and economic dimensions. They are usually based on the quantitative evaluation of the asset/project performance vis-à-vis certain thresholds. They come with a quantitative score that can be either displayed or kept confidential by the evaluated entity.

*Economic-financial evaluations* are focused on the analysis of economic/financial performance and risks of projects.

*Sustainability benchmarks* enable the comparison between the sustainability performance of assets, projects or funds.

*Project preparation software* support the development and implementation of projects following sustainability criteria.

Finally, *modelling tools* can simulate the outcomes of different alternatives in order to simulate the effects the impacts of decisions and support decision-making.

<b>Typologies</b>	<b>Purpose</b>	<b>Examples</b>
<i>Principles</i>	support sustainability incorporation at institutional or strategic level.	
<i>Guidelines</i>	operationalize sustainability principles and their application to projects.	
<i>Checklists</i>	incorporate sustainability objectives into projects	
<i>Standards</i>	provide information about the compliance of projects or assets with a given set of sustainability criteria	SuRe, Envision, CEEQUAL, ISO
<i>Rating &amp; certification systems</i>	provide quantifiable sustainability ratings and / or certification for projects or assets.	LEED, BREEAM, WELL
<i>Impact assessment</i>	evaluate the impacts of assets or policies on the environment and local livelihoods.	
<i>Economic-financial evaluations</i>	analyse the economic/financial value and risks related to projects.	SAVi, TREDIS, Autocase
<i>Sustainability benchmarks</i>	compare the sustainability performance of assets or funds.	
<i>Project preparation software</i>	support the preparation and management of sustainable projects	
<i>Modelling tools</i>	simulate economic, social, and physical systems to help planners optimize outcomes from different decisions.	

*Table 1: Typologies of sustainability and ESG tools (based on Sustainable Infrastructure Tool Navigator, 2023)*

In the real estate sector, several protocols and standards are available for green buildings that combine both a rating and a certification purpose (such as BREEAM, LEED, WELL), as they aim to assess and certify that a building is environmentally responsible and resource-efficient throughout its life-cycle. Over time, these systems have evolved by widening their assessment scale and considering communities, neighborhoods, and the city level, providing useful elements for the assessment of urban regeneration projects.



Despite the richness of approaches to evaluate sustainability in different domains, an ESG framework explicitly defined for sustainable urban regeneration as a whole is still missing from the literature. Filling this gap entails many challenges. First of all, an urban regeneration project is articulated in multiple phases of development, such as planning, construction, operations and maintenance, and end of life. Each of these phases is characterized by its own criticalities and covers different economic sectors. Consequently, a comprehensive framework requires the identification of synergies and trade-offs among sectoral impacts. Secondly, the scale of the intervention may change from one project to another. One example is the difference between a project that aims at transforming an old industrial area into a new district and another one that focuses on the renovation of a single building. Urban regeneration projects may deliver impacts at different scales, according to the type of interventions that they entail. As a result, no “one size fits all” methodology can be applied. As mentioned above, several sustainability assessment approaches are available which are applied at different scales, from the building to the city level. However, these systems do not necessarily interact with one another. While there are relevant connections between assessment systems applied to building and neighbourhood scales, city-scale ones show rather peculiar features (Orova and Reith, 2019). The integration of assessment scales could deliver a more comprehensive and efficient approach to evaluate urban sustainability (ibid).

Finally, urban regeneration projects often combine a private investment and a public policy-oriented approach. These proclivities make the identification of common and standardized metrics and indicators harder for a project than the measurement of the performance of a company or of an asset.

### 3. Methodology

The paper aims to define an integrated ESG framework for sustainable urban regeneration that could be used by public and private actors to evaluate regeneration projects considering their development phases, and assessing the transformative impact generated by the project on social, economic and environmental dimensions.

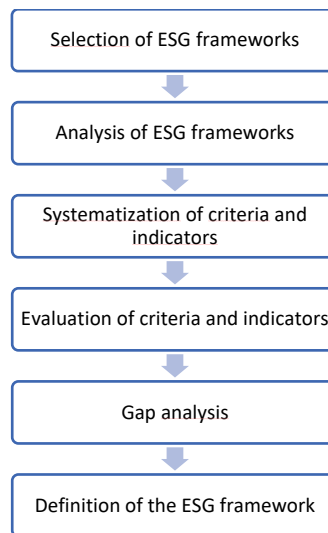
Our methodology is multi-faceted and includes:

a) an analysis of existing ESG evaluation frameworks which could be applicable to urban regeneration projects, in order to identify their main features and categorize their criteria and indicators; this allows us to assume an informed perspective on the topic, providing a ready-to-use nomenclature and a list of ESG criteria to analyze;

b) a systematization of ESG criteria and indicators, performed by detecting overlaps, duplications and merging similar criteria and indicators, when needed. The criteria and indicators are then evaluated according to their applicability within: i) the process to develop an urban regeneration project; ii) the impact assessment of an urban regeneration project.

c) a gap analysis to detect and identify the substantial gaps, namely the ESG criteria that are relevant for urban regeneration, but that are currently missing from existing frameworks, also leveraging the results of the focus group with urban regeneration stakeholders.

As last step, an overall ESG framework is structured in a comprehensive set of assessment criteria.



*Figure 2: Methodology*

Our contribution aims to expand the academic literature by applying an ESG perspective to urban regeneration projects. Past works on sustainability assessments of regeneration projects focused on a set of synthetic sustainability indicators (Hemphill et al. 2004), on single case studies (Wedding and Crawford-Brown 2007, Chan 2008) and never explicitly targeted ESG ratings (Peng et al. 2015). Other studies have investigated the benefits of ESG assessments in sectors related with urban regeneration. Clayton et al. (2021) and Chadwick and Simo (2022) studied the benefits of ESG application on real estate. Dalton and Fuerst (2021) and Sadikin et al (2020) analysed the effects of sustainability ratings on the real estate sector, but they refer to single sustainability certifications and not to a wider ESG framework. We also aim to bridge the gap between private and public players in the urban regeneration universe by providing a common ESG framework to evaluate urban regeneration projects, considering both the project development process and the project impact. With the perspective of private investors and developers, the adoption of an ESG framework would foster reputational standing and support the alignment to public regulations. With regards

to the government, this framework represents a list of fundamental criteria to assess the public interest of a project.

### 3.1. Selection of ESG frameworks

Considering the variety of approaches that have been developed for ESG assessments in sectors related with urban regeneration, we select a subset of frameworks applied in the infrastructure and real estate sector to be analysed in depth. We concentrate on these two sectors as they are closely related with each other, largely involved in regeneration projects and widely exposed to the ESG discourse (Deloitte, 2021). When it comes to ESG integration in alternative investment, infrastructure investors lead the way, with 35% of infrastructure investors having an active ESG policy for the asset class, the highest level across alternative assets (Preqin, 2020). In the real estate sector, 60% of respondents to the 2021 Global Investor Intentions survey affirmed that they have already integrated ESG in their investment strategies (CBRE, 2021).

An initial list of 23 frameworks was compiled by using OECD (2020) and data available at the Wharton Research Data Services (WRDS) database, showing the vast landscape of approaches that apply ESG principles to the economic sectors crucially involved in urban regeneration. Each framework has been categorized considering several features, including:

Features considered	Definition	
Provider Type	Typology of framework's provider	No profit Private company Public Authority Public Agency International Organization
Object	Object of analysis	Asset Project Company Districts/Cities
Output	Output of the assessment	Rating Certification Financial Impact Analysis Reporting Impact Assessment Checklist
Openness	If documentation about the frameworks, their criteria and indicators is publicly available	Open Close Partially open

*Table 2: Features considered in categorizing ESG frameworks*

We filter the list considering three features:

- *Object*: we select frameworks whose objects of analysis are individual assets, projects, districts/neighbourhoods or whole cities. Frameworks that can be applied exclusively to companies to disclose their economic, environmental and social impact and sustainability performances have been excluded from the analysis.
- *Output*: we focus on frameworks that deliver ratings/certifications as well as impact assessments, as they usually include criteria and indicators that can be applied or adapted to measure ESG factors.
- *Openness*: we keep only those frameworks whose documentation about criteria and indicators was publicly available and could be accessed and analysed.

Among the variety of sustainability rating systems for buildings available in the real estate sector, we decided to include in the analysis only the most widely diffused worldwide (BREEAM, LEED, WELL) and LEVEL(s) which is a reference framework in the EU to assess and report on the sustainability performance of buildings.

We also integrated the list by adding ISO Standards related with sustainability in cities, as they provide a standardized framework and sets of indicators which are widely used globally to support city leaders and urban planners in evaluating sustainable urban development.

The final list of frameworks analysed is reported below:

<b>Framework</b>	<b>Object</b>	<b>Output</b>
SuRe	project	certification
Envision	project	certification
CEEQUAL	project	certification
GRESB	asset	rating
LEED	project, asset, city	certification
WELL	asset	certification
BREEAM	asset	certification
RESET	project, asset	certification
NABERS	asset	certification
IRIS	asset	Impact assessment
ISO 37120	city	certification
ISO 37122	city	certification
ISO 37123	city	certification
LEVEL(S)	asset	reporting

*Table 3: List of analysed ESG frameworks*

A short description of each framework is provided in Annex 1.

These systems have been created for different purposes and uses, but due to the topics they address – which can be related to several dimensions of sustainability – they can be applied to evaluate ESG aspects.

### 3.2 Analysis of selected ESG frameworks

Each framework comes with its own hierarchical classification that describes the content of their ESG criteria. We reclassify each original classification to standardize the hierarchy.

“Area” is the first and most general layer of the original classification. Areas describe in broad terms what is assessed in the evaluation, and therefore they represent the main structure of each evaluation framework. Areas may include for example: “real estate”, “diversity and inclusion”, “energy”, or others.

“Criteria” are the second layer of the original classification. Criteria are less general than areas and describe more in detail the aspect of the project, asset or city that is assessed by each evaluation framework. In our own classification, criteria are the main object of analysis. Examples of criteria are: “air pollution”, “stakeholder engagement”, “public disclosure”, “functional mix”.

"Indicator" is a “quantitative or qualitative factor or variable that provides a simple and reliable means to measure achievement, to reflect the changes connected to an intervention, or to help assess the performance of a development actor” or “a measure of an aspect or dimension of change that is unrelated to any particular policy, programme, or project” (OECD, 2010). We define three typologies of indicators: qualitative, quantitative and mixed. Qualitative indicators are reported as words; quantitative indicators are reported as numbers, such as units, prices, proportions, rates of change and ratios. Mixed indicators contain both qualitative descriptions and quantitative measures (INTRAC, 2017).

"Metric" is the formula and the unit of measure in which a quantitative indicator is assessed. Only quantitative indicators have metrics.

After this reclassification, a long list of criteria is obtained. We then assign each criterium to two further categories: “clusters” and “dimensions”.

We aggregate the criteria in different clusters, with the aim of identifying how many criteria evaluate the same aspect. A new cluster is created whenever at least two criteria can be aggregated in that cluster. The difference between an area and a cluster is that the former is part of the original nomenclatures, the latter is a new nomenclature proposed by the authors, that gathers all the existing nomenclatures under one label.

We define the "dimension" as one of the three categories of sustainability issues defined by the Global Compact (2005): "Environmental" (E), "Social" (S) and "Governance" (G). Each cluster is assigned to one dimension, each criterion is assigned to one or more dimensions.

The final hierarchy is exemplified in Figure 3. Each dimension has its own clusters, which in turn include a certain number of criteria. Each criterium has zero, one or more indicators, which in turn can be quantitative, qualitative or mixed. Quantitative and mixed indicators are associated to one or more metric.

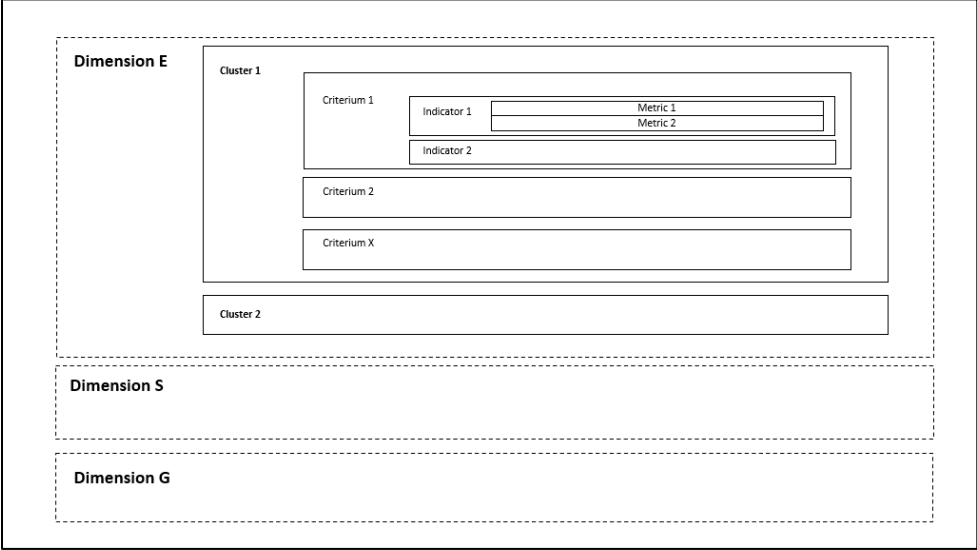


Figure 3: Hierarchy to categorize criteria

### 3.3. Systematization of criteria and indicators

We then perform a systematization of all criteria that have been identified in the previous phases by detecting overlaps, duplications and merging similar criteria into a single one, when needed.

At this purpose, we check each criterion identified from existing frameworks for redundancy and relevance for urban regeneration. A criterium is redundant when it overlaps with a criterium that has been already included in the list. A criterium is selected when it is relevant in the process of urban regeneration. We proceed in a gradual fashion, screening the redundant criteria first.

The screening for redundancy is carried out cluster-wise, so that for each cluster we detect all duplicated criteria both in terms of their name and of their indicators. In particular, if a criterium has the same name of another criterium, we select the more complete one and we discard the one with less indicators. If the discarded criterium is associated with indicators

that are not yet associated with the selected one, then we integrate the selected criterium with the indicators of the discarded one. The criteria that will constitute the output of this first screening will have the names of the criteria selected in this phase. In this way, redundant criteria are merged together into a unique criterion.

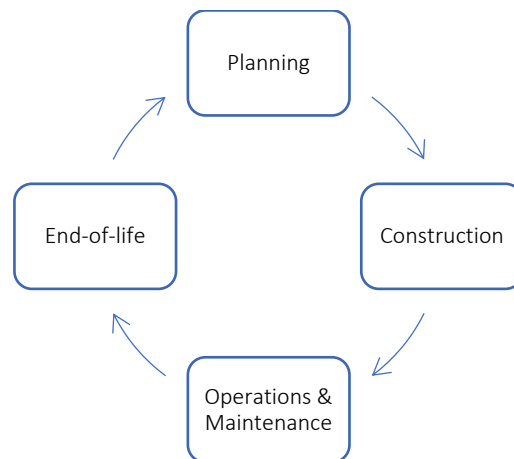
As a next step, we systematize also the indicators associated with criteria, in order to eliminate any duplications among indicators.

### 3.4. Evaluation of criteria and indicators by project development phase and impact

The ESG criteria and indicators systematized in the previous step are then evaluated considering their applicability and usability within: i) the process to develop an urban regeneration project; and ii) the impact assessment of an urban regeneration project.

#### *Project development phases*

The development of an urban regeneration project can be regarded as a cyclical process, involving a series of activities that are performed in several phases.



*Figure 4: Main phases in the development of an urban regeneration project*

“Planning” includes the **strategic assessment** of the socio-economic and environmental context for the urban regeneration project, also through the use of different types of analysis and analytical tools, as well as the analysis of the relevant planning and regulatory

framework. This phase aims to identify the strategic issues that should be addressed by the project.

This phase also aims to define:

- the **financial, contractual, and institutional relationships** between the public and private sectors;
- the **business models** that will be adopted to implement the project;
- the **management and evaluation approach**, including the management and monitoring **plans and procedures**;
- the **participatory mechanisms** that will be adopted along the project to engage the local community and other stakeholders.
- the **design of the structural and infrastructural elements of the project, its services and functions**.

“Construction” refers to the **construction phase** and the **management of the construction site** and related activities.

“Operations and Maintenance” includes the **operations and ordinary maintenance of buildings, facilities and spaces** included in the urban regeneration project. It refers to the **actual use** of the urban regeneration area and its elements. Criteria and indicators of this phase can be used to evaluate actual performances and the operational state of the urban regeneration project and its components.

“End-of-life” includes the **demolition** phase of a specific district/parcel that might undergo a new urban regeneration process, as well as all issues related to demolition **waste management, disposal and recycling**.

### *Impact*

As described in the previous sections, urban regeneration produces a wide range of positive and negative impacts, concerning the physical, environmental, social, and economic dimensions. Impacts of urban regeneration projects can originate at different spatial scales - from building and street level to district and neighborhood level, to the overall city system. They also appear in different timings, starting from the construction phase up to project completion, and also afterwards, in the long term. Different stakeholders such as public institutions, the private sector, communities, and citizens (both residents and city-users) are impacted in different ways.



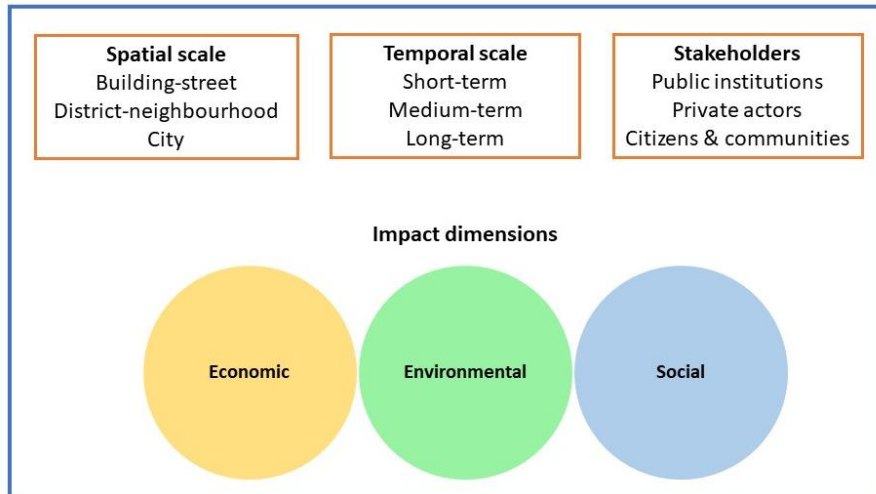


Figure 5: Key elements of impact assessments

### Evaluation

Each criterion is evaluated based on their applicability to one or more phases of project development or to measure a project impact, by answering the following questions:

- Is the **criterion** applicable in the considered **phase**? (i.e. planning, construction, Operations & Maintenance, end-of-life)
- Is the **criterion** applicable to measure the possible **impact** of the urban regeneration project?

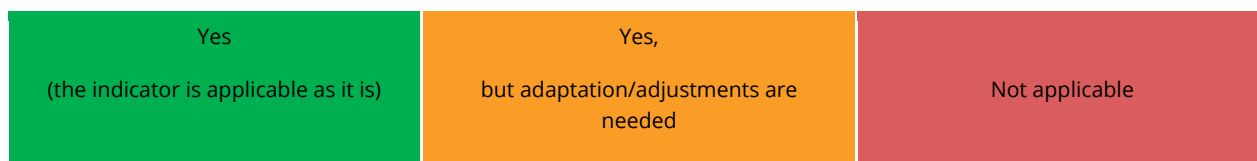
We focus in particular on the suitability to assess the impacts generated by the project after the project implementation, in a medium and long-term perspective, on social, economic and environmental aspects.

Also each indicator is evaluated based on its applicability to one or more phases of project development or to measure a project impact, with similar questions:

- Is the **indicator** applicable/usable in the considered **phase**? (i.e. planning, construction, operations&maintenance, end-of-life)
- Is the **indicator** applicable/usable to measure the possible **impact** of the urban regeneration project?

The evaluation of indicators differentiates between three types of results:

- directly applicable (to one or more project phases or to measure impact)
- applicable to an urban regeneration project after adaptation/adjustments
- not applicable.



*Figure 6: Color codes for the evaluation of indicators' applicability*

### 3.5. Gap Analysis

Based on the evaluation results, the gap analysis aims to identify for each cluster of Environmental, Social and Governance dimensions, if and where there is a lack of indicators to measure the criterion in the different project development phases and to measure the project impact. The gap analysis differentiates between: i) criteria that have at least one fully applicable indicator; ii) criteria that have high adjustment needs, because the indicators detected from analysed framework only provided indicators in need of an adjustment or not applicable; iii) criteria with a gap, that do not have applicable indicators for one or more phases or to measure the impact.

These results are also compared and cross-checked with the main ESG dimensions of urban regeneration identified in the literature and the outcomes of a Focus Group with experts, in order to identify the ESG criteria and indicators that are relevant for urban regeneration but that are currently missing from existing frameworks.

The Focus group took place at Bocconi University (Milan) on 30 November 2022, with the aim of gathering information about the application of ESG criteria in urban regeneration projects by surveying a high-level panel of experts. The experts belonged to a vast array of different sectors, representing the development and production chain associated with urban regeneration projects. The focus group was attended by representatives of public entities (an Italian municipality and its local municipal agency), financial institutions, constructor associations, developers and asset managers. The Focus Group was conducted by a facilitator from the Sustainable Urban Regeneration Lab, who guided the discussion. Participants presented the ESG evaluation methodology adopted by their respective organizations within urban regeneration projects. Furthermore, they actively debated on what are the drivers, the benefits and the costs of ESG integration in urban regeneration. Finally, they discussed about urban regeneration governance.

As the Focus Group was attended by representatives of organizations that are involved in different segments of the urban regeneration value-chain, and which have different roles in urban regeneration projects, we consider that its outcomes provide a representative set of views and needs in the ESG evaluation of urban regeneration projects.

The identification of gaps has been a starting point in the next stages of this research paper for integrating the list of ESG criteria and indicators with additional ones and define the ESG framework for urban regeneration.

## 4. Results

### 4.1 Main features of selected ESG frameworks

The final list of frameworks considered in the review includes 14 of them, summarised in Table 4.

Framework	Object	Output	Areas	Criteria	Indicators	Metrics
SuRe	project	certification	14	61	45	59
Envision	project	certification	5	14	64	59
CEEQUAL	project	certification	8	30	245	53
GRESB	asset	rating	2	17	50	81
LEED	project, asset, city	certification	7	32	59	38
WELL	asset	certification	11	98	166	105
BREEAM	asset	certification	9	56	95	34
RESET	project, asset	certification	5	16	11	17
NABERS	asset	certification	4	12	10	7
IRIS	asset	impact assessment	4	17	17	14
ISO 37120	city	certification	19	103	103	103
ISO 37122	city	certification	19	79	79	79
ISO 37123	city	certification	19	64	64	64
LEVEL(S)*	asset	reporting	\	6	16	\
Total				607	1,024	713

*Table 4: Analysed frameworks and key features*

*Each criterium falls within one and only one area, while one or more indicators can be associated with a single criterium. There are also criteria with no indicators. If the indicator as no name, it counts as a single indicator. One indicator is associated with one (or more) metrics only if it is quantitative.*

*\* LEVEL(s)'s nomenclature only has two layers: major objectives and indicators. We rename the former as criteria and the latter as indicators.*

Unlike the ESG frameworks applied in the financial sector, which are focused on companies, these frameworks target single assets, projects or even entire cities. Considering the object of evaluation, 6 frameworks are applied to assets, 3 to projects, 3 to cities, while 2 are applied to different objects.

Another difference from financial ESG frameworks concerns the output of the evaluation. In fact, financial ESG frameworks assign ratings to firm, while our sample includes also

certifications, impact assessments and reporting. The majority of frameworks analysed (11/14) have certifications as outputs, while 3 of them focus each one respectively on rating, impact assessment and reporting.

After the reclassification of all criteria included in the 14 frameworks, a list of 606 criteria is obtained. In absolute terms, the Environmental (“E”) dimension is the most represented one, followed by “S” and “G” (Figure 7). However, when the data is disaggregated at the framework level, we observe that most of the frameworks (7 out of 14) are mainly focused on the “E”, while 5 are specialized in “S” (Figure 8). There are only two frameworks (GRESB and SuRe) in which the dimension “G” is the most represented one.

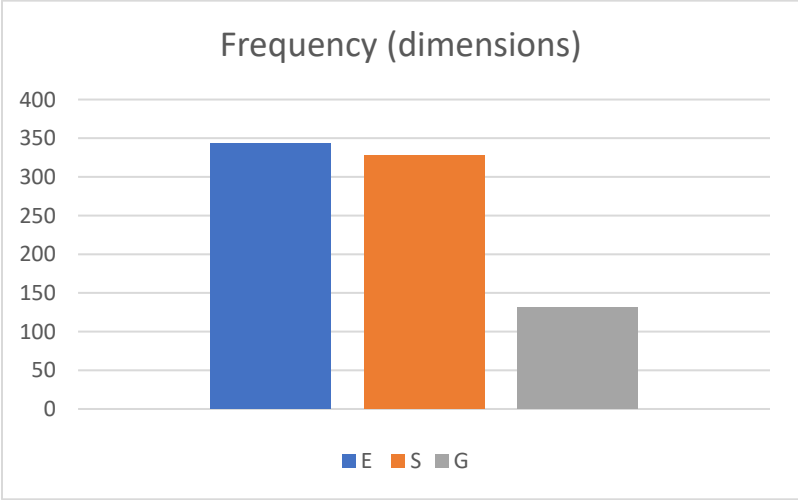


Figure 7: Frequency of dimensions

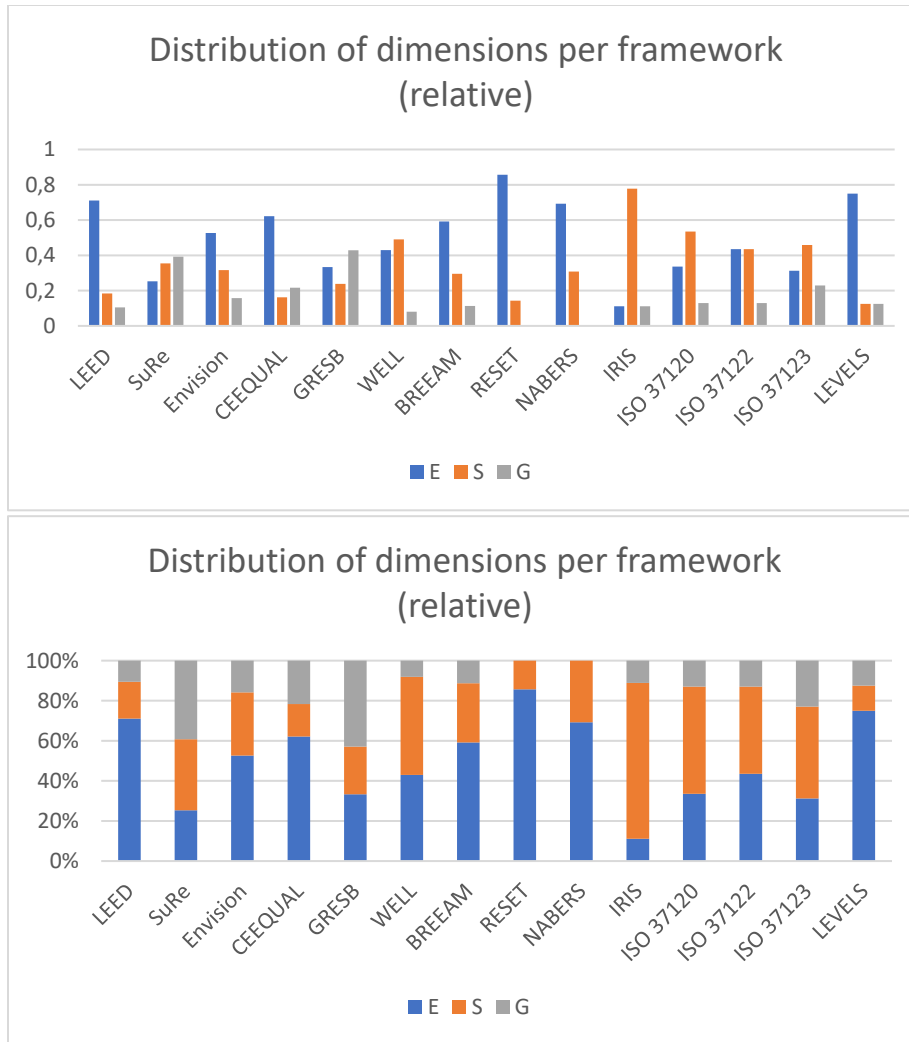


Figure 8: Distribution of dimensions per framework

Next, we aggregate the criteria in different clusters. We identify 40 clusters, covering about 98.2% of the total number of criteria. The uncovered criteria (12) could neither be aggregated in any of the existing clusters neither contribute to the creation of a new one.

Table 5 shows that the most covered cluster is “Health protection”, followed by “Water and Wastewater management” and “Energy Management”. At the disaggregated level (Figure 9), some frameworks appear to be specialized in one cluster, like SuRe in “Responsible labour practices”, WELL in “Health Protection”, BREEAM in “Energy Management”, ISO 37122 in “Digitalization”.

<b>Clusters</b>	<b>Number of criteria per cluster</b>	<b>% of criteria per cluster</b>
<b>Health Protection</b>	53	8,92%
<b>Water and Wastewater Management</b>	48	8,08%
<b>Energy Management</b>	40	6,73%
<b>Waste Management</b>	36	6,06%
<b>Air quality</b>	26	4,38%
<b>Climate Adaptation</b>	24	4,04%
<b>Financial sustainability</b>	22	3,70%
<b>Nature Based Solutions</b>	22	3,70%
<b>Services Accessibility</b>	22	3,70%
<b>Sustainable Mobility</b>	22	3,70%
<b>Digitalization</b>	21	3,54%
<b>Materials and products sustainability</b>	21	3,54%
<b>Responsible labour practices</b>	17	2,86%
<b>Responsible management</b>	17	2,86%
<b>Public Safety</b>	16	2,69%
<b>Social Justice</b>	16	2,69%
<b>Processes and reporting</b>	14	2,36%
<b>Climate Mitigation</b>	12	2,02%
<b>Inclusiveness</b>	12	2,02%
<b>Economic development</b>	11	1,85%
<b>Emergency and Disaster Risk Management</b>	11	1,85%
<b>Indoor Thermal Comfort</b>	11	1,85%
<b>Noise Pollution</b>	11	1,85%
<b>Education</b>	10	1,68%
<b>Partnerships</b>	10	1,68%
<b>Indoor Light Comfort</b>	9	1,52%
<b>Climate Vulnerability</b>	8	1,35%
<b>Land Use and Transformation</b>	8	1,35%
<b>Social Housing</b>	8	1,35%
<b>Land Remediation</b>	6	1,01%
<b>Community engagement</b>	5	0,84%
<b>Functional and Social Mix</b>	5	0,84%
<b>Other Pollution</b>	5	0,84%
<b>Water Pollution</b>	4	0,67%
<b>Customer Satisfaction</b>	2	0,34%
<b>Light Pollution</b>	2	0,34%
<b>Local Food Sourcing</b>	2	0,34%
<b>Social value</b>	2	0,34%

<b>Urban Planning Policy and Regulation</b>	2	0,34%
<b>Pollution (combined)</b>	1	0,17%
<b>Uncovered</b>	12	1,98%
<b>Total</b>	<b>606</b>	<b>100%</b>

Table 5: Number of criteria per cluster

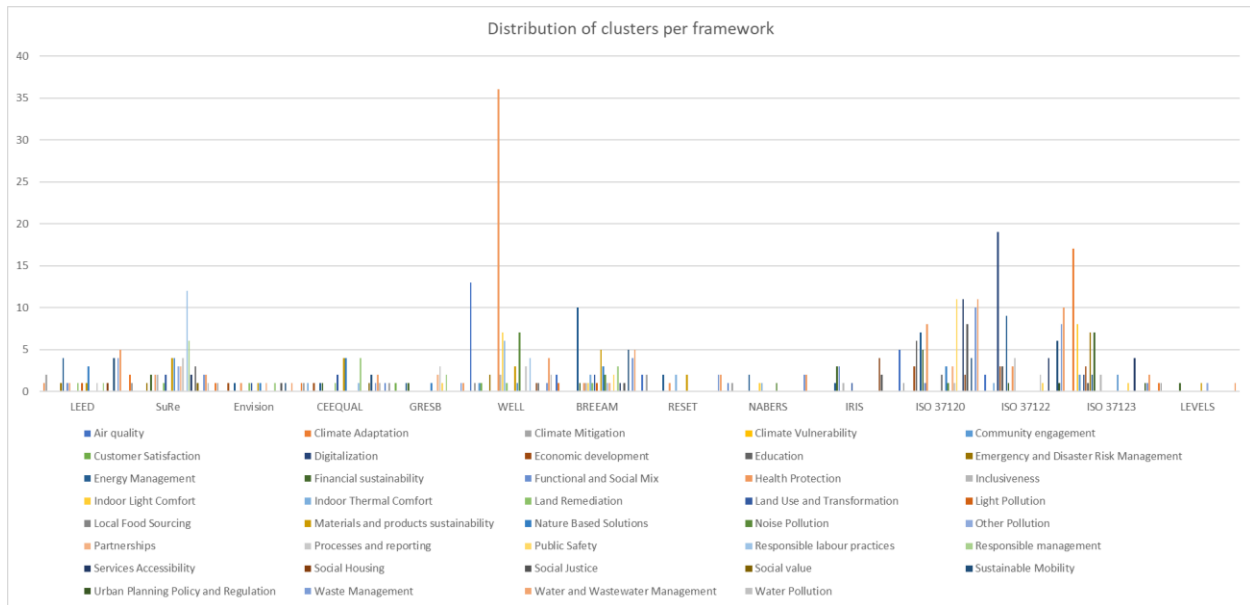


Figure 9: Distribution of clusters per framework

After the systematization, the Environmental dimension includes 19 clusters, 56 final criteria and 517 indicators in total. Of these, 411 have been selected as significant for urban regeneration (see table).

The Social dimension includes 14 clusters, 45 final criteria and 233 indicators in total. Of these indicators, 167 have been selected as significant and relevant for urban regeneration.

The Governance dimension includes 7 clusters, 35 final criteria and 177 indicators in total. Of these indicators, 145 have been selected as significant and relevant for urban regeneration.

	<b>Environmental</b>	<b>Social</b>	<b>Governance</b>
Clusters	19	14	7
Criteria	56	45	35
Total indicators	517	233	177
Significant indicators	411	167	145

Table 6: Number of clusters, criteria and indicators after the systematization

## 4.2. Applicability of criteria and indicators by project development phase and impact

### Environment

In the environmental dimension, the majority of clusters (11/19), is applicable in the planning, operations & maintenance phases and to evaluate the project impact, while 7 out of 19 are applicable in the construction and end-of-life phases (Figure 10).

Similarly, considering the criteria, the majority of them is applicable in the planning phase (100% of criteria), O&M (95%), and to measure impact (93%), while a lower share is applicable to construction and end-of-life (61% and 57% respectively). This is confirmed also for indicators, as a higher number of indicators is concentrated in the planning and O&M phases, as well as in the impact category.

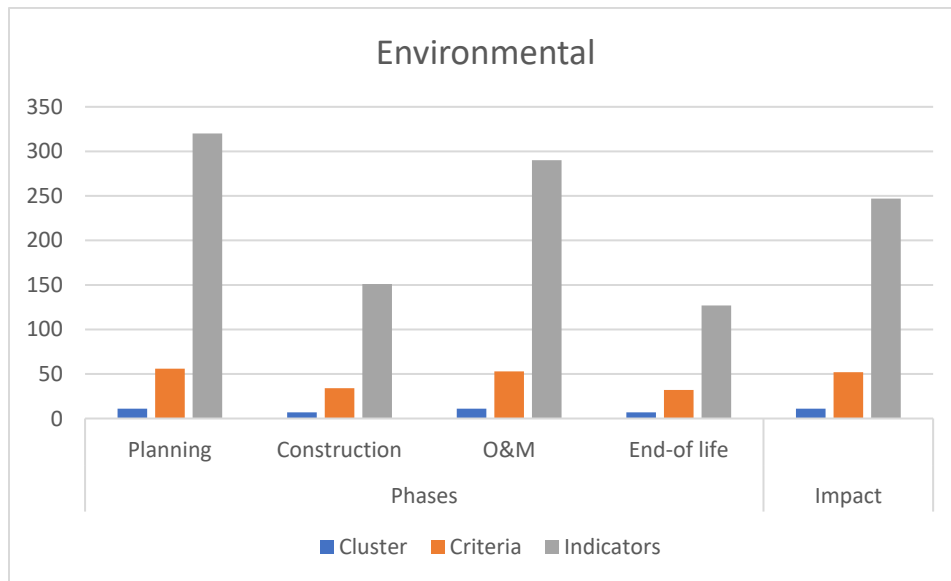


Figure 10: Environmental dimension: criteria and indicators' applicability (absolute numbers)

In terms of indicators' applicability readiness, on average half of indicators are fully applicable in project development phases (47% planning, 60% construction, 66% O&M), whereas a lower share is directly applicable in the end-of-life phase (39%). Impact is the area



where there is the greatest need for indicators adjustment, as only 14% indicators are fully applicable.

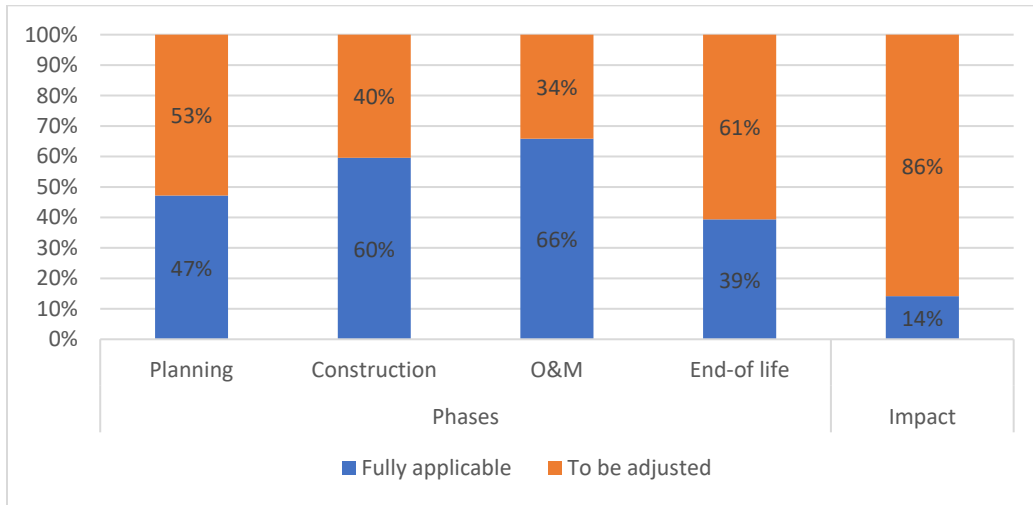


Figure 11: Environmental dimension: indicators' applicability readiness (%)

### Social

Considering the Social dimension, all 14 clusters are applicable to planning, O&M and impact, whereas 9 out of 14 to construction and end-of life (Figure 12). Looking at criteria, a high percentage of them is applicable in the planning and O&M phases (98% and 91% respectively), whereas only 33% and 36% in the construction and end-of life phases. A high share of criteria (98%) is applicable in the impact category.

The same pattern is confirmed also for indicators. This could be explained by the relevance of involving other actors of society and in particular of the community in the planning phase

of an urban regeneration project and their relevant role in the operations phase. This might have led to a wider availability of indicators on this topic in the existing frameworks.

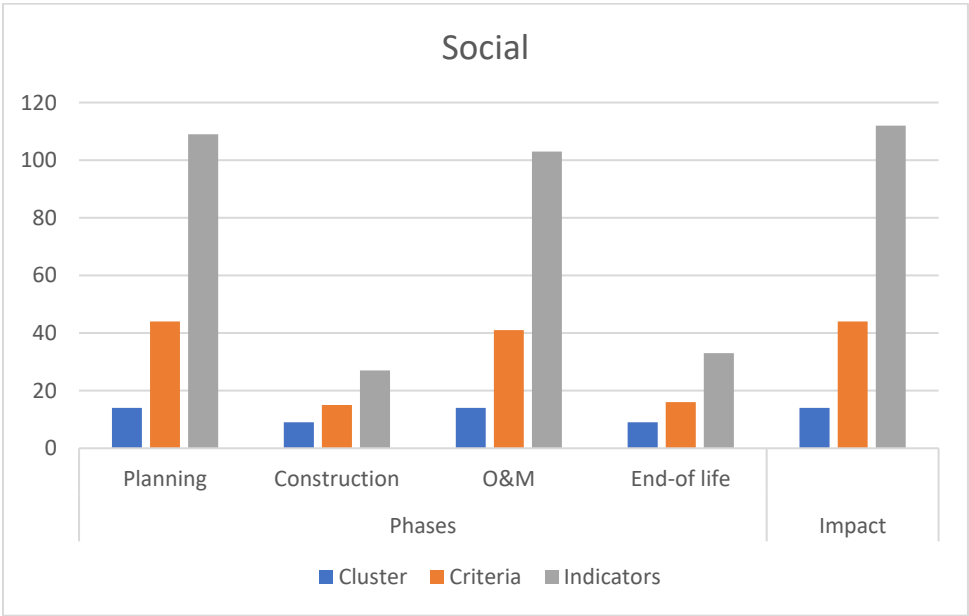


Figure 12: Social dimension: criteria and indicators' applicability (absolute numbers)

Considering the readiness of applicable indicators to be used for an urban regeneration project, in the Social dimension we detect that about half of indicators is fully applicable in the planning phase (47%), construction (63%) and end-of-life phase (58%), whereas a lower

share of indicators (29%) is fully applicable in the O&M. Furthermore, about half of indicators (49%) is fully applicable to measure impact.

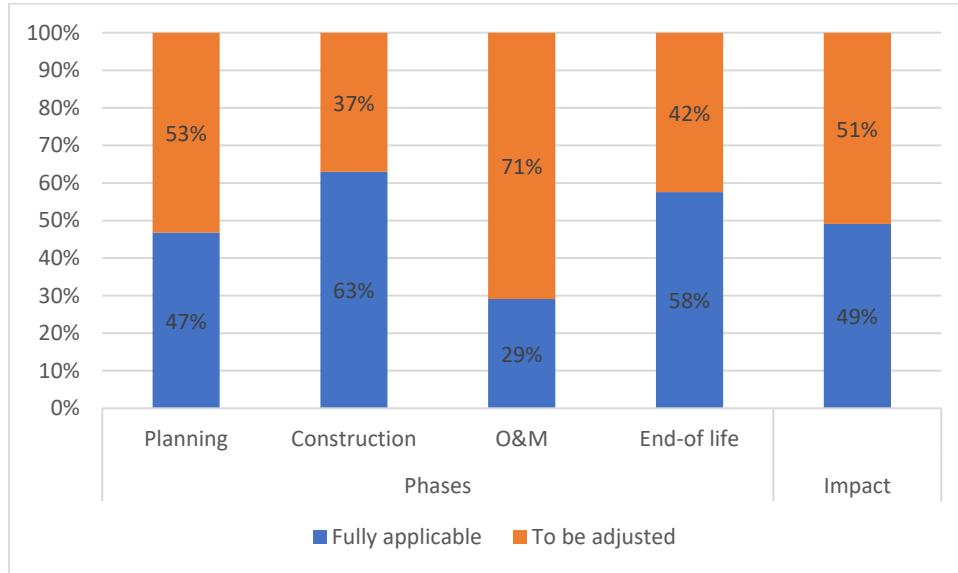


Figure 13: Social dimension: indicators' applicability readiness (%)

### Governance

Considering the applicability of Governance clusters, all 7 Governance clusters are applicable to all process phases and to measure project impact (Figure 14). Looking at criteria, a high percentage of them is applicable in the four phases (100% planning, 94% construction, 91% O&M, 91% end-of-life). Instead, 66% of criteria can be applied to measure project impact. Similarly, indicators are more concentrated in the project development phases. The project impact category is the one with the lowest number of indicators for the Governance dimension. This is consistent with the fact that Governance per se does not have a direct impact on the social, economic and environmental context of the project, but it is rather a

transversal dimension that indirectly affects the overall project and its performances and impacts.

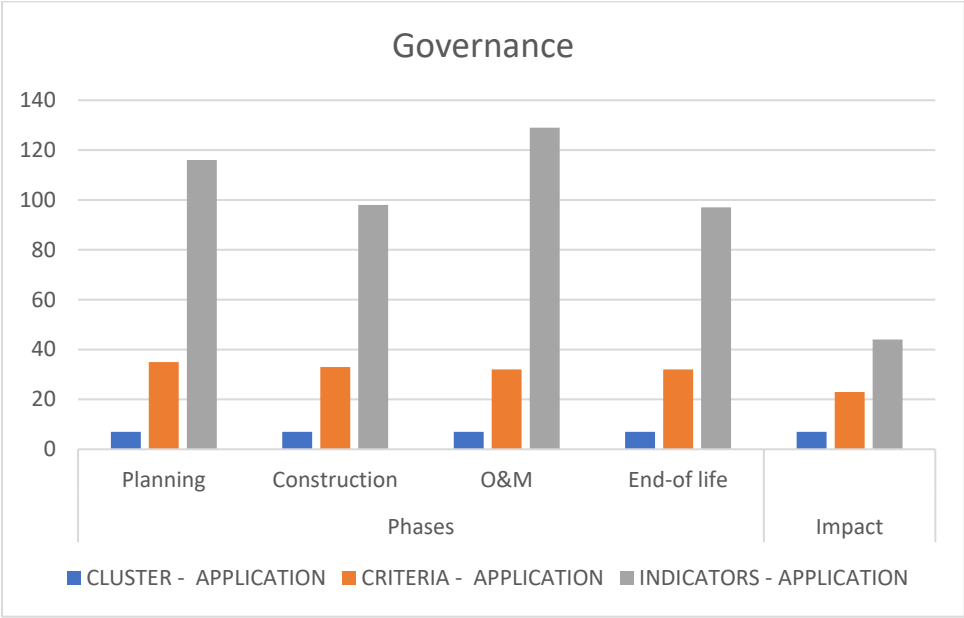


Figure 14: Governance dimension: criteria and indicators' applicability (absolute numbers)

Considering more in depth the readiness of applicable indicators to be used for an urban regeneration project, in the Governance dimension we detect that about half of indicators is fully applicable across the development phases.

Finally, the impact category is the one where the applicability readiness of indicators is the lowest, as only 11% of impact indicators are fully applicable whereas 89% needs adjustments.

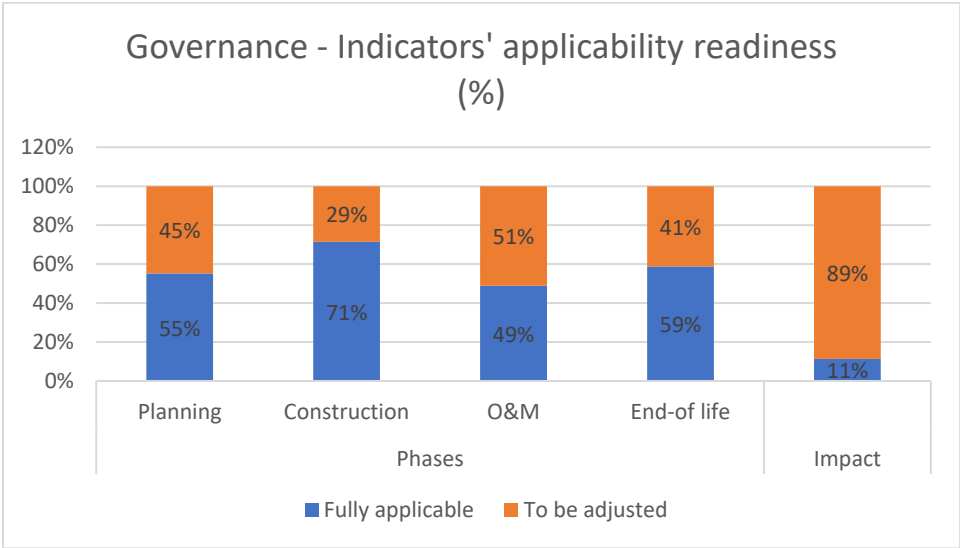


Figure 15: Governance dimension: indicators' applicability readiness (%)

### 4.3. Main gaps identified in existing ESG frameworks

The review of existing ESG frameworks shows that the Environmental dimension and related criteria are the most widely represented. Also, most of the frameworks (7 out of 14) are mainly focused on the “E” dimension. The most frequent thematic clusters include Water and Wastewater Management, Energy Management, Waste Management, Air Quality and Materials & Products sustainability. The Social dimension is the second most represented, with 5 frameworks specialized on it. Health protection, Service Accessibility and Digitalization are the most frequent ones. Finally, in absolute terms, the “Governance” dimension is the least represented across the analysed criteria, and only in two evaluation frameworks the “G” dimension is the most represented one. Most frequent clusters include Financial sustainability and Responsible Management.

The systematization of criteria and indicators and their evaluation by project development phase and project impact enables a deeper analysis of gaps, considering their distribution.

For each criterion, we measure the availability of indicators for the different project development phases and the impact category. In particular we differentiate between:

- Criteria that have at least 1 fully applicable indicator
- Criteria that have only indicators in need of an adjustment or not applicable
- Criteria with a gap (i.e. the phase or impact has no applicable indicators).

For the environmental dimension, some gaps are visible in all the project development phases and impact category. Gaps are higher in the planning, construction and end-of-life phase, whereas they are the lowest in the O&M.

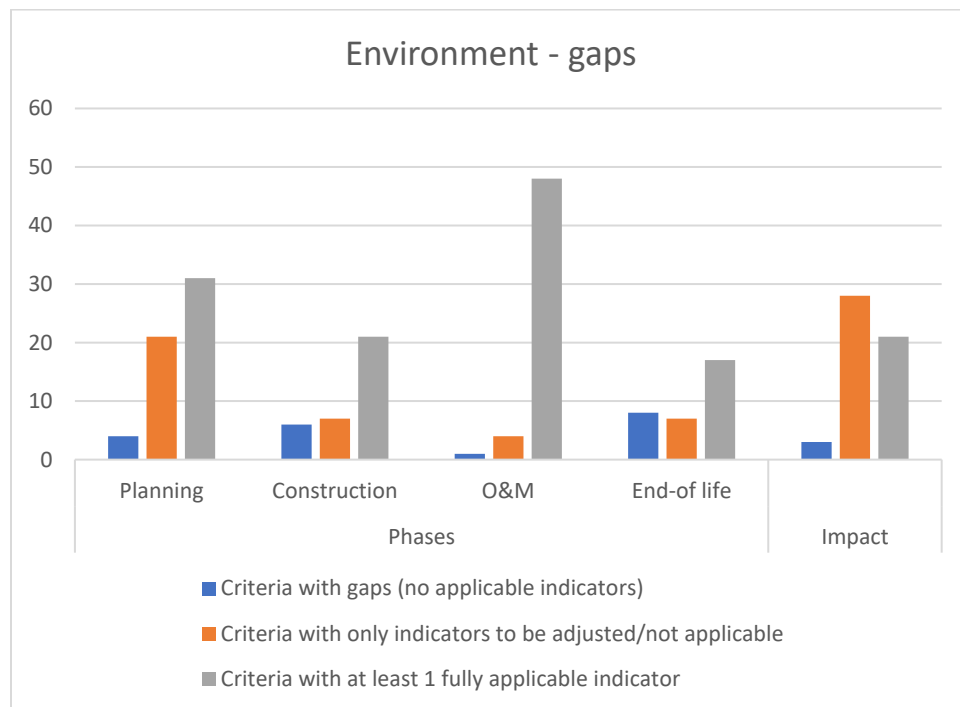


Figure 16: Environmental dimension – Criteria with indicators’ gaps

The following criteria need an integration of indicators:

Phases	Planning	
	Construction	

	Energy consumption	
	Construction logistics	
	Soil pollution	
	Urban Agriculture	
	Renewable energy	
	Energy consumption	
	Climate proofing	
	Resilience planning	
	Noise pollution control	
	Heat	

	<b>O&amp;M</b>	Soil pollution
	<b>End-of-life</b>	Land preservation Renewable energy Energy consumption Climate proofing Building indoor air quality Noise pollution control Soil pollution Heat
<b>Impact</b>		Heritage preservation Moisture management Construction pollution management

For the social dimension, some gaps are visible in all the process phases and the impact category. In the planning and O&M phases there is a high need of indicators adjustments.

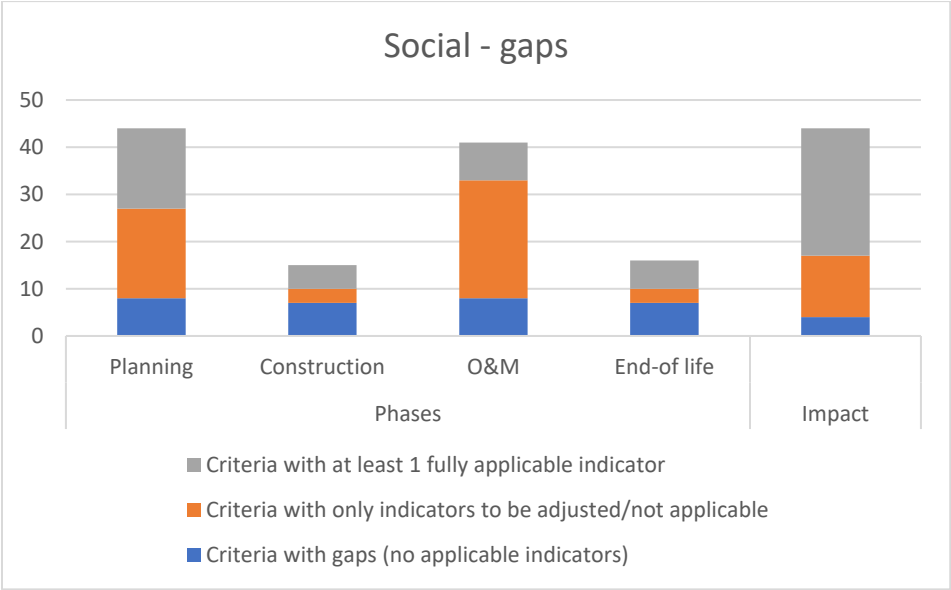


Figure 17: Social dimension - Criteria with indicators' gaps

In particular, the following criteria of the Social dimension need an integration of indicators:

<b>Phases</b>	<b>Planning</b>	Benefits to firm Higher education Cultural activity Natural hazards Road accidents Telecommunications Labour rights
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		Wider social benefits
	<b>Construction</b>	Exposure to climate risks Community diversity Functional mix Natural Hazards Road accidents Labour Rights Wider Social Benefits
	<b>O&amp;M</b>	Digital payments Higher Education Cultural Activity Natural Hazards Road accidents Telecommunications Labour Rights Wider Social Benefits
	<b>End-of-life</b>	Exposure to climate risks Community diversity Functional mix Natural Hazards Road accidents Labour Rights Wider Social Benefits
<b>Impact</b>		Customer Satisfaction Quality of Education Restoration Community Identity



For the governance dimension, some gaps are visible in all the process phases and the impact category. Overall, the number of criteria that have at least 1 fully applicable indicator is satisfactory, apart for the impact category where there is more need of adjustments.

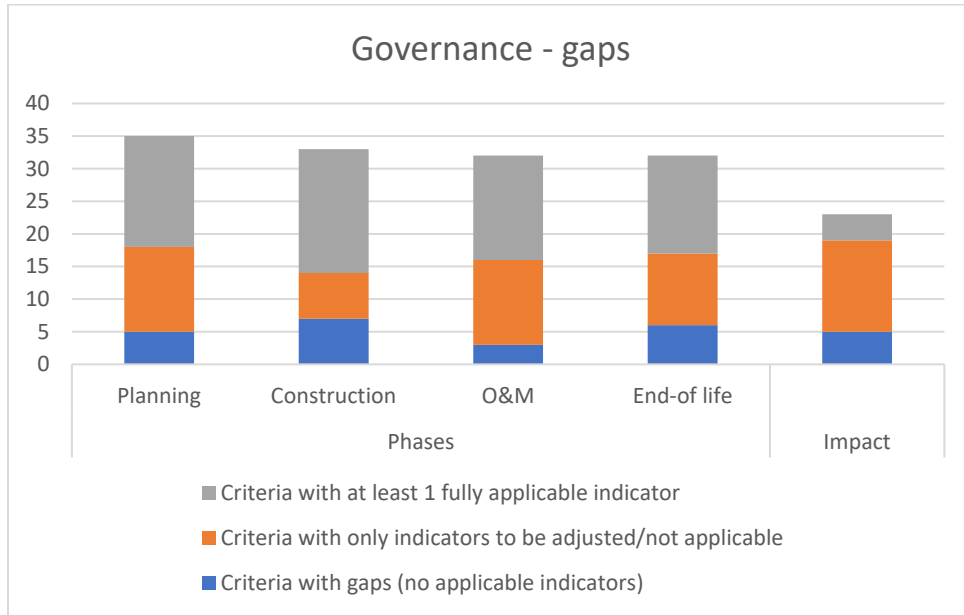


Figure 18: Governance dimension - Criteria with indicators' gaps

The following criteria of the Governance dimension need an integration of indicators:

Phases	Criteria
<b>Planning</b>	Financing sources Fiscal impact Business model Financial performance Investment planning
<b>Construction</b>	Financing sources Fiscal impact Business model Financial performance Investment planning Compliance Insurance
<b>O&amp;M</b>	Business model Financial performance Investment planning
<b>End-of-life</b>	Fiscal impact

		Business model Financial performance Investment planning Compliance Insurance
<b>Impact</b>		Business model Financial performance Investment planning Gender Inclusiveness Parental leave

In particular, the cluster of “Financial sustainability” of urban regeneration appears to be underrepresented across all the project development phases and impact categories, and this is the cluster that shows the most relevant gaps in terms of criteria and indicators.

By comparing the results of the frameworks’ review with the analysis of literature and the Focus Group outcomes, it stands out that “Governance” is of key importance for sustainable urban regeneration, but this dimension is not yet fully captured and represented in existing evaluation frameworks.

To achieve ESG-objectives in urban regeneration processes, a supply chain perspective and an integrated vision of the various topics are needed. Urban regeneration interventions are complex and involve a wide range of public and private actors. The construction supply chain, in particular, is broad and articulated, involving companies from different sectors and sizes. From the experts’ discussion, the need to adopt a supply chain perspective and an integrated vision of ESG topics emerged, to identify synergies and trade-offs between different sustainability aspects and objectives which characterize urban regeneration projects. For example, circular approaches can improve the environmental performance of construction projects, by promoting reuse and recycling of materials or changes in uses and functions of buildings. However, regulatory obstacles might prevent the possibility to adopt circular approaches in the construction sector or could hamper their success. A holistic view to circularity should consider the overall system (in terms of regulations, infrastructures and skills needed, etc.) to integrate this approach successfully into regeneration projects.

A further element which emerged from the discussion is the need for an effective *public-private collaboration*. New models and approaches are needed to foster collaboration between the public and private sectors, and between private entities themselves. Governance mechanisms and arrangements are needed to enable a convergence of public and private interests and balance different views and priorities in the same project. For example, co-management and co-financing schemes could enhance collaboration on specific activities (e.g. land remediation).

Tools like incentives or rewarding mechanisms can orientate the private sector towards public objectives and help private companies to integrate these considerations into their projects (e.g. integrated assessment tools).

Finally, the planning context has emerged as a key element in assessing ESG factors in urban regeneration projects. Municipal plans and policies at different levels of government represent a framework for defining the sustainability objectives of urban regeneration projects (and the related monitoring indicators). However, plans and policies sometimes contain objectives and measures that not consistent among each other or are not aligned with sustainability objectives. There is therefore an urgent need to update the regulatory and planning framework and ensure a greater coordination between planning and sustainability policies at different levels, and between the various sectoral policies.

Planning can provide a useful reference and monitoring framework for integrating ESG aspects into urban regeneration interventions. However, new planning tools are needed at this purpose, which should enable an integrated perspective and provide the right scale for analysis.

The scale of these innovative planning tools should refer to the neighbourhood level, as intermediate level between the individual project and general urban planning. This scale would be the ideal one to evaluate the neighbourhoods' needs, orientate investments and regeneration projects and increase their coherence.

To summarise, the following main elements related to governance have emerged from the analysis, and should be integrated into the framework:

- **Financial sustainability:** consider the business model of the urban regeneration project and the mechanisms for value creation, considering both private value and public value.
- **Policy alignment:** considering the regulatory and planning framework in which the urban regeneration project is implemented; foreseeing suitable planning instruments and tools for integrating ESG into urban regeneration, and to enable a convergence of public and private interests in the same project.
- **Partnerships:** defining effective public-private collaboration models to design, finance and govern urban regeneration projects; involve all actors of the supply-chain in a collaborative way;
- **Integrative planning:** implementing an integrated approach throughout the project, adopting a holistic view that considers synergies and trade-offs between the different aspects of sustainability and a supply chain perspective.

## 5. Proposed ESG framework for sustainable urban regeneration

The final framework emerging from the overall analysis is displayed below:

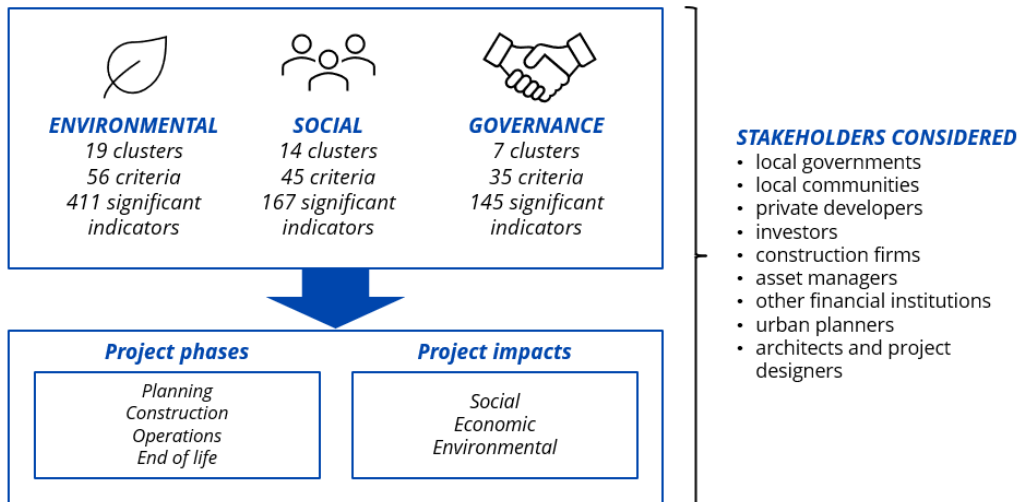


Figure 19: ESG framework for sustainable urban regeneration

The framework is structured into the three ESG dimensions and articulated into clusters and criteria, associated with indicators that aim to measure:

- How criteria are incorporated across the different phases of project development (planning, construction, operations & maintenance, end-of-life)
- Project impact on several dimensions.

The framework is meant to be used by different types of stakeholders involved in urban regeneration: local governments, local communities, private developers, investors, construction firms, asset managers, other financial institutions, urban planners and designers.

The list of clusters and criteria builds on the analysis of existing ESG assessment frameworks developed for sectors related with urban regeneration (mainly real estate and sustainable infrastructure), integrated with results from the gap analysis and the discussion with experts performed within the project.

As indicators are characterized by different levels of applicability to urban regeneration, they will be further refined, adapted and tailored on the specific context of regeneration processes and included in an operational evaluation tool. Within the tool, criteria and indicators will be weighted according to the relevance that has been assigned to them in the scientific literature and based on discussions and dialogue with stakeholders.

## 6. Conclusions

The complexity of crises affecting our society, economy and the natural environment demands a systemic effort to integrate sustainability in investment decisions across all sectors and domains. Urban regeneration is no exception, as it is an investment opportunity that can have relevant positive and negative impacts on the community, district, and wider city level across the different dimensions of sustainability. For these reasons, the ESG discourse has gained prominence also in this domain and is a key priority for public and private decision makers worldwide.

Integrating ESG into urban regeneration requires a thorough consideration of distinctive elements that characterize regeneration projects: the coexistence of different structural and infrastructural elements that affect the neighborhood and different spatial scales; the complexity of the supply chain involved; the variety of economic, social and environmental repercussions of regeneration; the variety of public and private actors involved; the synergies and trade-offs between the different dimensions of sustainability; the relationship with the policy and planning framework defined at local, regional, national and supranational level.

To date, an integrated ESG framework for sustainable urban regeneration, which takes into account the specificities of regeneration processes, does not yet appear to be available. Organizations and companies adopt a plurality of approaches and tools to integrate ESG issues into their organisations, activities and projects. This research paper has defined an ESG framework proposal for urban regeneration relying on the analysis of existing approaches, the identification and integration of relevant gaps.

From the overall analysis performed, several elements stand out as reference guide for the implementation of ESG into urban regeneration: the need to adopt an integrated and supply chain perspective; the relevance of municipal planning in directing regeneration projects; the coherence between interventions (at micro, macro and urban scale); the need to find new models of collaboration between public and private entities and between private entities themselves; coordination between policies at different levels; the need for updating policies and the regulatory framework with respect to sustainability objectives.

In the next phase of the research, the ESG framework will be implemented by developing a dedicated evaluation tool, including indicators for each project phase and to measure impact. Indicators will be further selected, refined and adjusted to the context of urban regeneration projects starting from the list of analysed indicators provided in this work. A key step in the tool development will be the definition of weights to be assigned to criteria and indicators, which could rely on inputs from the scientific literature and from stakeholders.



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## Annex 1 – Analysed ESG frameworks

Framework	Description	Sector
SuRe	SuRe is a certification standard developed in 2015 by the Global Infrastructure Basel Foundation (GIB) and the French investment bank, Natixis, to assess and integrate ESG performance in infrastructure projects.	Infrastructure
Envision	A rating system for sustainable infrastructure. It provides a framework for evaluating and rating the community, environmental, and economic benefits of infrastructure projects during the planning and design phase, as well as when projects are finished.	Infrastructure
CEEQUAL	International evidence-based sustainability assessment, rating and awards scheme for civil engineering.	Infrastructure
GRESB Infrastructure Assessment	The Infrastructure Asset Assessment assesses ESG performance at the asset level for infrastructure asset operators, fund managers and investors that invest directly in infrastructure. The Assessment into separate Management and Performance Components. The Management Component measures the entity's strategy and leadership management, policies and processes, risk management and stakeholder engagement approach, comprising of information collected at the organizational level. The Performance Component measures the entity's performance, comprising of information collected at the asset level. It is suitable for any infrastructure company with operational assets	Real-Estate

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LEED	LEED is run by the non-profit US Green Building Council and has certified more than 13.8 billion square feet of building space. LEED provides a framework for cost-saving and highly efficient green buildings and rates buildings and construction projects to verify if the structure complies with an environmentally friendly building qualification.	Real Estate
WELL	WELL Certification is a score -based system for measuring, certifying and monitoring the building's environmental performance built on the LEED certification system. WELL is administrated by the international WELL Building Institute (IWBI) and allows construction projects and/or buildings scoring in each of the seven categories on one of the three levels: Silver, Gold and Platinum .	Real Estate
BREEAM	BREEAM is a leading buildings' environmental assessment certification system that was conceived by the BRE group and first used in 1990. 116000 buildings have been certified against the BREEAM schemes (BREEAM courts, Ecohomes, healthcare, education, offices, prisons, etc.). The BREEAM certification is organized in different chapters to cover the building environmental evaluation (management, health and wellbeing, energy, transport, water, materials, waste, land use and ecology, pollution, innovation).	Real Estate
RESET	The RESET Standard is a data quality standard designed for continuous monitoring sensors in the built environment. The Standard outlines the requirements necessary for the deployment of monitors, collection of monitor data and reporting of results.	Real Estate

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NABERS	NABERS (National Australian Built Environment Rating System) is a sustainability assessment and rating system that can be applied across building sectors like hotels, shopping centres, apartments, offices, data centres, and others.	Real Estate
IRIS	IRIS is an impact framework developed by the Global Impact Investing network (GIIN) addressing impact measurement, management and optimization in order to set up guidance to impact investors. IRIS+ offers thematic taxonomy for relevant impact themes and facilitate the use of best-in class data through core metric sets in impact investing.	Real Estate
LEVEL(S)	The Level(s) common framework is based on six macro-objectives that address key sustainability aspects over the building life cycle. The sustainability indicators within each macro-objective describe how the building performance can be aligned with the strategic EU policy objectives in areas such as energy, material use and waste, water, indoor air quality and resilience to climate change	Real Estate
ISO 37120	<i>Sustainable cities and communities</i> — Indicators for city services and quality of life: It provides a standardized set of indicators to a) measure performance management of city services and quality of life over time; b) learn from one another by allowing comparison across a wide range of performance measures; and, c) support policy development and priority setting.	
ISO 37122	<i>Sustainable cities and communities</i> — <i>Indicators for smart cities</i> : this standard specifies and establishes definitions and methodologies for a set of	

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ISO 37123

indicators for smart cities. It helps cities to identify indicators for applying city management systems such as ISO 37101 and to implement smart city policies, programmes and projects.

*Sustainable cities and communities — Indicators for resilient cities:* It specifies and establishes definitions and methodologies for a set of indicators for resilient cities. The indicators have been developed to help cities: a) prepare for, recover from and adapt to shocks and stresses; b) learn from one another by allowing comparison across a wide range of performance measures, and by sharing good practices.

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*Source: OECD 2020, EY 2020, authors' own research.*