

## Overview on Sustainability Measurement in Public and Private Projects

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**Abstract:** The adoption of sustainability measurement criteria in public and private projects represents a crucial priority for ensuring compliance with sustainable development goals. Various European Union member states refer to European standards such as the European Green Deal and the Global Reporting Initiative, but they implement these with different interpretations according to national needs. To date, despite the centrality of issues related to sustainable development, a homogeneous framework that formulates universally adoptable KPIs is lacking.

Even the Sustainability Methods and Criteria (MEC), although extremely valid and efficient, are left to the free choice of companies, which select them based on corporate culture and territorial context. This study aims to evaluate which tools and methods are currently in use to pursue sustainability objectives in projects, focusing on both the role of institutions in regulatory activities and the technological potential of industries, which is essential for innovation. In conclusion, the corrective potential of public-private partnerships (PPPs) will be investigated within a still unclear framework, closely observing their nature as hybrid entities that perfectly reflect the multidimensionality of the concept of sustainability, as well as all the incentives—financial and otherwise—that state and supranational entities provide to encourage their establishment. The goal is to underline the need for standardized and harmonized criteria for sustainability, in order to ensure that both infrastructural and non-infrastructural projects effectively contribute to achieving the SDGs.

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**Keywords:** performance indicators, Sustainable Development Goals, public-private partnership, project-planning

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### 1. Introduction

The adoption of sustainability measurement criteria in public and private projects (PPPs) represents a crucial priority to ensure compliance with sustainable development goals, even within project activities that are not strictly infrastructural. Within the framework established by regulatory developments, starting from the Brundtland Report (Brundtland Commission, 1987), through the 2030 Agenda (United Nations, 2015), and arriving at post-pandemic guidelines, it is evident that the focus on measuring and monitoring progress towards the SDGs has become as necessary as traditional project efficiency evaluation criteria.

The National Recovery and Resilience Plan (PNRR) includes measures to promote sustainability in public and private projects as part of post-pandemic adjustments. The measures adopted by the PNRR, specifically in

missions 1, 2, and 3, also aim to support companies in transitioning to a green economy through direct and facilitated financing. For example, funding is provided for the creation of sustainable agricultural supply chains, energy efficiency in industrial plants, and the promotion of green research (Green Marketing Italia, 2020).

Despite these advancements, a primary issue remains the lack of truly standardized criteria—not only in terms of measurement units but also in terms of application context—for sustainability evaluation. This can lead to misalignments between designers, evaluators, and stakeholders, compromising the success of projects (OECD, 2020). Therefore, accurate and comprehensive measurement frameworks are necessary to evaluate the achievement of these objectives and to guide policies and projects towards sustainable results (Akomea-Frimpong et al., 2022; Liang & Wang, 2019). This study aims to provide an overview of the practices adopted by different

types of enterprises, both in the public and private sectors, to explore their strengths and weaknesses, in order to offer useful guidance for future research aimed at defining a universally valid measurement tool.

### 2. Background

Furthermore, the diverse regulations of EU member states show how each country adopts specific but varied measures to integrate sustainability into their projects.

The European regulatory context has further reinforced the importance of integrating sustainability into PPPs. Directive 2014/24/EU on public procurement encourages the inclusion of environmental, social, and economic criteria in procurement processes, promoting a sustainable approach to public infrastructure and services (European Commission, 2014). Moreover, the European Green Deal, launched in 2019, emphasizes the need for a green and inclusive transition, encouraging the use of clear and measurable indicators to assess the long-term impact of projects (European Commission, 2019).

Several EU member states have adopted specific regulations to integrate sustainability into their public and private projects. For instance, Germany has implemented the “Nachhaltigkeitskodex” (Sustainability Code), providing guidelines for sustainability in both public and private sectors (Rat für Nachhaltige Entwicklung, 2011). France introduced the Grenelle II law, requiring large companies to publish annual sustainability reports (Loi Grenelle II, 2010). Sweden has adopted stringent measures with the Corporate Sustainability Transparency Act, requiring companies to integrate sustainability criteria into their operations (Swedish Companies Act, 2005). The United Kingdom introduced the Climate Change Act in 2008, imposing carbon emission reduction targets and requiring public sectors to report their progress (UK Government, 2008). It is evident that progress in parameter development and their standardization do not always go hand in hand, especially in PPPs and other infrastructural projects (Jiang, 2023). For example, in the context of large infrastructure projects such as bridges and roads, it is essential to evaluate not only environmental impacts, such as land use and carbon emissions, but also social and economic implications, such as local employment and accessibility (Cui et al., 2019). In Europe, the new terminal project at Oslo Airport is an example of a PPP that implemented a wide range of sustainability criteria, including sustainable building materials and energy consumption reduction technologies (Aas et al., 2020).

Over the past 30 years, various actors, including academics, policymakers, and industry leaders, have formed networks and alliances, developed projects, and allocated substantial resources towards sustainability and development issues. For example, the C40 Cities Climate Leadership Group, a network of major world cities committed to combating climate change, has developed shared strategies to improve urban sustainability (C40 Cities, 2021). Additionally, the European Union's Horizon 2020 project has funded numerous research and innovation projects to promote sustainability in various sectors, from renewable energy to the circular economy (European Commission, 2021). The growing attention to

sustainability measurement involves both the public and private sectors as well as citizens, necessitating the implementation of robust information systems for performance management. For instance, the Global Reporting Initiative (GRI) provides a framework for sustainability reporting that is widely used by companies to monitor and communicate their environmental, social, and economic performance (GRI, 2020).

The measurement of sustainability is therefore crucial for both the public and private sectors. In the public sector, sustainability reporting is required due to its involvement in national economies and environmental and social issues (OECD, 2020). The importance of measuring sustainability in the public sector is underscored by the need for transparency and accountability in government operations. For instance, the city of Copenhagen has implemented an urban sustainability measurement system that includes key indicators such as energy efficiency, air quality, and land use. This system enables the city to monitor its progress towards its goal of becoming carbon neutral by 2025 (City of Copenhagen, 2021). In Italy, the environmental and sustainability monitoring project of the Municipality of Milan, through the use of urban sustainability indicators, represents another example of how local administrations are integrating these criteria into their management and planning processes (Comune di Milano, 2022).

In private companies, a way of assessing sustainability performance is offered by Integrated Management Systems. On the basis of the management's knowledge, experience and competence, the starting point is the choice of the right Key Performance Indicators/Indexes (KPIs), able to take a picture of the current state and to suggest possible improving actions. The objective is to improve operational efficiency, reduce costs, and enhance regulatory compliance and overall sustainability of the organization (ISO, 2023). The integration commonly concerns multiple management systems, such as quality management (ISO 9001), environmental management (ISO 14001), and occupational health and safety management (ISO 45001), into a cohesive system, even if there is not a common meaning of integration (Wilkinson & Dale, B.G. 1999). It is possible to consider different strategies of integration (Silvestri et al. 2021) and different management systems (Karapetrovic & Jonker 2003), together with specific techniques, such as simulation tools, for reengineering a process and improving its performance in a sustainable way (Di Bona et al. 2014).

Of course, not only economic-financial aspects can be considered, but also sustainability and resilience ones, that means the capacity to reacts to adverse events to internal and external factors in a sustainable way.

In the private sector, sustainability performance measures are often aligned with the Global Reporting Initiative (GRI) index. Companies use these standards to monitor and communicate their environmental, social, and economic performance. The Italian energy group ENEL, for example, adopts the GRI guidelines to draft its sustainability reports, highlighting efforts in renewable energy and social responsibility (ENEL, 2021). Another example is Unilever, which follows GRI guidelines to improve sustainability throughout its supply chain, from

sourcing raw materials to distributing final products (Unilever, 2022). Patagonia, an outdoor clothing company, measures its environmental footprint using the GRI framework and invests in sustainability initiatives such as material recycling and support for environmental organizations (Patagonia, 2020). Similarly, Tesla publishes detailed reports on its sustainability performance, including data on carbon emissions avoided through the use of its electric vehicles and renewable energy solutions (Tesla, 2021). However, the level of reporting by organizations claiming to follow GRI guidelines is often fragmented, and the reporting criteria are chosen autonomously by companies while still drawing from the same guidelines. Indeed, the aforementioned companies—though all referring to GRI standards—differ by emphasizing criteria more closely aligned with their activities, while evaluating sustainability is a process that should impartially judge every single impact produced.

Current approaches to measuring the sustainability performance of a project often emphasize planning, costs, and quality. However, these approaches can lead to sub-optimal results due to the inherent complexity of projects and the associated risks if traditional performance measurement models are adopted. To achieve true sustainability, a life cycle perspective and comprehensive stakeholder management must be integrated into evaluation frameworks (Baxter & Casady, 2020). Performance must be measured from the perspective of various stakeholders, including customers, contractors, local communities, and future development companies. A shared terminology and comparable indicators can facilitate collaboration and improve performance evaluation by overcoming differences in organizational structure, sector-specific requirements, and political, cultural, and social contexts that make it difficult to agree on a common set of indicators (Bellringer et al., 2011). The examples listed above are just a few of the many public and private project activities that, based on company cultural background, territorial reference, etc., are inspired to varying degrees by evolving and perpetually inconsistent and elusive guidelines. The following paragraph will examine some examples of how supranational entities are trying to align their visions and needs towards a common point.

### 3. Methods and Tools

#### 3.1 Environmental Evaluation Indices and Methodologies

The analysis and management of environmental sustainability are fundamental for promoting responsible use of natural resources and improving the environmental performance of organizations and communities. Various indices and methodologies are used for this purpose, each with specific characteristics and areas of application; the most common indicators, covering not only the environmental dimension but also the social one, are the following:

**Ecological Footprint (EF):** This indicator measures the human demand on the planet's natural resources. It assesses how much biologically productive land and marine area is required to produce the resources consumed and to absorb the waste generated by a

population, using current technologies. This indicator is often used to compare the environmental sustainability of different populations and regions (Global Footprint Network, 2023).

**Environmental Performance Index (EPI):** Developed by Yale and Columbia universities in collaboration with the World Economic Forum, this index ranks countries based on their environmental performance using indicators that cover ten categories of environmental policy, including air quality, water resource management, biodiversity and habitat, greenhouse gas emissions, and waste management. The EPI provides a comprehensive overview of a country's environmental policies and their impact (Yale University, 2023).

**Green City Index (GCI):** Developed by Siemens and the Economist Intelligence Unit, this index evaluates the environmental performance of cities. It considers various parameters such as CO<sub>2</sub> emissions, energy efficiency, waste management, air and water quality, and sustainable mobility. The GCI helps cities identify areas for improvement and promote sustainable policies (Siemens, 2023).

**Wellbeing Index (WI):** This index is calculated as the average of two sub-indices: Ecosystem Wellbeing Index and Human Wellbeing Index. Human Wellbeing Index in turn represents the average of aspects including soil, water, air, species and genes, and resources use in relation to environmental, health and population, wealth, knowledge and culture, community, and equity, for the social part.

#### 3.2 Tools and Guidelines

The analysis suggested the use of various tools, the most frequent are:

**Multi-Criteria Decision-Making Methods (MCDM):** A set of techniques used to make complex decisions involving multiple conflicting criteria. These methods help decision-makers evaluate and compare different options based on criteria such as costs, benefits, environmental impact, and other relevant factors. Some commonly used methods include the Analytic Hierarchy Process (AHP), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), and Multi-Attribute Utility Theory (MAUT) (Saaty, 1980; Hwang & Yoon, 1981).

**Balanced Scorecards (BSC):** Strategic management tools used to monitor and improve organizational performance. BSCs integrate financial and non-financial measures into four perspectives: financial, customer, internal processes, and learning and growth. Recently, BSCs have been adapted to include environmental and social sustainability metrics, providing a more balanced and holistic approach to performance management (Kaplan & Norton, 1992).

**Life cycle sustainability assessment:** Life cycle sustainability assessment (LCSA) is an interdisciplinary framework for the integration of models rather than a real method. Therefore, there are many opportunities for integrating tools and methods to improve the applicability of LCSA.

Despite their strategic functionality in pursuing SDGs goals, the adoption of these tools is not mandatory for all public and private organizations, but they are strongly

recommended by various European regulations and guidelines.

Since 2021, several European regulations have been adopted to regulate non-financial reporting by private enterprises and public entities, with particular attention to ESG (Environmental, Social, and Governance) standards:

**The Corporate Sustainability Reporting Directive (CSRD):** Effective from January 5, 2023, this directive replaces and expands the previous Non-Financial Reporting Directive (NFRD). The CSRD requires a broader set of large companies and listed SMEs to report sustainability information, including data on environmental, social, and governance impacts. Companies must obtain external certification of their sustainability statements, with an initially limited level of assurance that will progressively increase (European Commission, 2023; Deloitte, 2021).

**European Sustainability Reporting Standards (ESRS):** Developed by the European Financial Reporting Advisory Group (EFRAG) and adopted by the European Commission, these standards define detailed requirements for the disclosure of sustainability information and are designed to be applicable to all companies subject to the CSRD, regardless of their sector. The ESRS cover environmental, social, and governance aspects, with particular emphasis on transparency and comparability of information (Harvard Law School, 2023).

For public administrations, the guidelines for ESG ratings include:

- **Sustainability Assessment:** Public administrations must evaluate and report their environmental, social, and governance impacts using the criteria established by the ESRS. This includes managing natural resources, social responsibility, and administrative transparency.
- **External Assurance:** Administrations are required to obtain external verification of their sustainability statements, initially with a limited level of assurance that will be raised to "reasonable" over time. This process ensures the accuracy and reliability of the reported information (European Commission, 2023).
- **Integration into Annual Reports:** Sustainability information must be included in a dedicated section of the annual reports of administrations, ensuring that it is accessible and comparable across different entities (Deloitte, 2021).

These regulations, which have undergone various implementations and diversifications in their application timelines, represent a significant step towards greater transparency and accountability for the sustainability impacts of businesses and public administrations, promoting more ethical and sustainable management of resources and economic activities. The European Commission's guidelines recommend the use of standardized methods to measure and communicate environmental, social, and governance performance. These include recommendations for adopting reporting practices consistent with the principles of the Taskforce on Climate-related Financial Disclosures (TCFD) and other international standards (European Commission, 2019).

#### 4. Results and discussion

The conducted research reveals that both indices and guidelines combine multiple dimensions of sustainability to offer a comprehensive assessment. However, the application of these indices varies across sectors, with some focusing exclusively on financial performance while others incorporate broader sustainability measures. Sustainable development involves the establishment of minimum regulated environmental criteria and methodologies recognized by the scientific community: the MEC, as defined in the Italian legislative framework, establish environmental requirements for different stages of the procurement process, ensuring that the most ecological solutions are chosen (European Commission, 2021). These criteria play a crucial role in promoting green public procurement policies, reducing environmental impacts, and promoting sustainable production and consumption patterns. All those criteria have indisputable scientific validity. The problem arises when choosing which of those to adopt, given their variety and the impossibility to make valid comparisons between systems that cannot have the exact same boundaries. Often, beyond the actual system boundaries in which the project is inserted, there are a series of political and legal obstacles that reflect the administrative peculiarities of the territorial system to which the project refers. In fact, one of the major obstacles to the adoption of universal sustainability criteria, both in the public and private sectors, is the lack of standardization and harmonization of regulations at a global level for different problems:

- **Diversity of Regional Regulations:** This creates a fragmented environment, complicating compliance for multinational companies due to significant differences in reporting and sustainability requirements (European Commission, 2023).
- **Complexity of Reporting Requirements:** Companies must manage numerous datasets and indicators, which can be daunting, especially for small and medium-sized enterprises (SMEs) (Skadden, 2023).
- **Divergence in Measurement Systems:** Systems like the Ecological Footprint and the Environmental Performance Index make it difficult to compare and integrate data, complicating the adoption of universal criteria (Global Footprint Network, 2023; Yale University, 2023).
- **Resistance to Change and Costs:** The costs associated with transitioning to new sustainability standards are significant barriers. Investments in new technologies, staff training, and external consultancy are required, representing a particularly heavy burden for organizations with limited resources (EY, 2022).
- **International Coordination and Support:** The lack of international coordination and institutional support for the implementation of universal standards is another relevant obstacle. Initiatives to standardize sustainability criteria often lack concerted support from global institutions (European Commission, 2019).

Studies supporting the need for standardized KPIs consistently identify public-private partnerships (PPPs) as

the primary tool for systematizing practices, know-how, and methods capable of providing a universally applicable taxonomy for sustainable project planning. Indeed, although in the public imagination Public and Private are seen as vectors moving in different directions, such alignment could provide substance to this now strictly necessary interrelation. The private sector's contribution would consist of employing methods and technologies capable of performing in any sector; the public sector's contribution would be maximized in the coordination and institutional support derived from the organizational structure of public entities.

In Italy, the regulatory framework that defines and underscores the validity of PPPs is set out in Legislative Decree 50/2016 (Public Contracts Code), where Article 180 specifies the modalities for the use of partnership contracts, project financing, and concessions for services and works. This regulatory framework aims to ensure transparency, efficiency, and competitiveness in public procurement processes (Lumi4Innovation, 2024). Another relevant initiative is Decree Law 133/2014 (Sblocca Italia), which aims to stimulate economic growth through increased private investment in public infrastructure, thereby reducing the shortage of public resources (FASI, 2015).

At the European level, the Green Paper on Public-Private Partnerships and Community Law on Public Contracts and Concessions (COM/2004/0327) and the European Initiative for Growth are two fundamental documents that propose a legal framework to facilitate these agreements. The former distinguishes between contractual and institutionalized PPPs, addressing issues related to the selection of the private partner and the implementation of the partnership; the latter promotes PPPs as essential tools for financing and developing cross-border infrastructure and projects of common interest in sectors such as transport, health, waste management, and others (EUR-Lex, 2004). Regulation (EU) 2021/695 under the Horizon Europe program establishes public-private partnerships in various research and innovation sectors, setting out the modalities for cooperation and funding, thus promoting the adoption of innovative and technologically advanced solutions (Sinloc, 2024).

PPPs can facilitate the implementation of projects that improve energy efficiency and reduce greenhouse gas emissions. For example, Energy Performance Contracts (EPCs) are a form of PPP where payment is linked to energy performance improvements, with the operational risk borne by the service provider (Lumi4Innovation, 2024). These contracts incentivize the adoption of green technologies and improve the environmental sustainability of public infrastructure. PPPs allow the mobilization of private capital to finance sustainable projects that might not otherwise be realized due to the lack of public resources. This is particularly relevant for countries with high public debt and infrastructure deficits, where PPPs can accelerate investments and generate positive impacts on GDP and the environment (Sinloc, 2024). The involvement of private partners in PPPs can bring innovation and advanced technological expertise to public projects. The expertise of private operators in configuring innovative technological and managerial solutions can be

leveraged, contributing to the development of sustainable and resilient infrastructure (EUR-Lex, 2004). PPPs ensure the financial sustainability of projects through an economic-financial balance that allows generating sufficient cash flows to ensure the repayment of financing. In cases where the project does not generate sufficient cash flows, the economic-financial balance is achieved through public contributions (Lumi4Innovation, 2024). This mechanism ensures that sustainable infrastructure projects are financially viable in the long term. PPPs can have a significant positive impact on local communities by promoting economic and social development. Urban regeneration projects and local infrastructure, such as waste management and water distribution, are examples of how PPPs can improve the quality of life and sustainability of local communities (Sinloc, 2024).

### 5. Conclusions and Developments

This study aimed to provide an overview of measurement and design practices aligned with sustainability goals in both the public and private sectors. It highlighted the variety of guidelines and regulations that aim to converge towards the same objectives but often contradict or overlap, where effective integration should result in a solid interrelationship. In conclusion, the findings suggest that future research should focus on developing integrative models capable of ensuring comprehensive and comparable assessments, supporting the effective implementation of sustainability strategies while respecting intrinsic project needs. Another challenge, beyond scalable and repeatable adjustment, lies in incorporating practices from different areas of expertise and disciplinary sectors (engineering, marketing, social research, law) in project management, particularly concerning the necessary interrelation between social parameters and purely economic-environmental ones, necessitating a holistic approach to sustainability (Tavanti, 2023). Additionally, the cultural and economic difficulties that often hinder the incubation of new integrated systems with adjustments to ESG ratings must be acknowledged, even when the involved actors are large international players or public entities of various sizes.

The solution might lie in Public-Private Partnerships (PPPs), which should become the default in project management. PPPs can facilitate the implementation of projects that improve energy efficiency and reduce greenhouse gas emissions. For instance, Energy Performance Contracts (EPCs) are a form of PPP where payment is linked to energy performance improvements, with the operational risk borne by the service provider (Lumi4Innovation, 2024). These contracts incentivize the adoption of green technologies and improve the environmental sustainability of public infrastructure. PPPs allow the mobilization of private capital to finance sustainable projects that might otherwise not be realized due to a lack of public resources. This is particularly relevant for countries with high public debt and infrastructure deficits, where PPPs can accelerate investments and generate positive impacts on GDP and the environment (Sinloc, 2024). The involvement of private partners in PPPs can bring innovation and advanced technological expertise to public projects. The

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