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Shaping Sustainable Practices in Italy's Construction Industry: An ESG Indicator Framework

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Abstract: The construction industry is one of the most environmentally sensitive sectors, significantly impacting the adoption of sustainable development practices. Environmental, social, and governance (ESG) pillars are essential for assessing corporate sustainability performance, revealing risks, and guiding improvement. Despite the widespread use of indicators, a notable gap exists in ESG frameworks oriented to assess company performance within the sector, with limited research on achieving standard tools. This study proposes a practical standardized framework of indicators for the European construction industry and provides a set of KPIs for the Italian context, serving as a tool to measure and report ESG performance. The methodology consists of the selection of indicators from established protocols for assessing and reporting ESG criteria, such as the Global Reporting Initiative (GRI) and Global Real Estate Sustainability Benchmark (GRESB). The selection process resulted in the identification of 118 indicators, categorized into 44 environmental, 54 social, and 20 governance indicators, enabling construction companies to comprehensively measure and report their ESG performance in accordance with disclosure regulations. The result of this work serves policymakers seeking to develop standardized frameworks specific to the construction industry, for defining expert panels to evaluate mandatory disclosures from companies, and as guidance for companies who need guidelines to assess their sustainability performance and ensure compliance and alignment with existing frameworks.

Keywords: indicators selection; ESG indicators; construction industry; real estate

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1. Introduction

Environmental, social, and governance (ESG) is a topic that has gained relevance in recent years, considering the urgency of achieving sustainability and carbon neutrality goals, making the private sector responsible for climate targets a priority for the global sustainability agenda. Gradually, the market has started to encourage responsible corporate practices, as recent studies show that good financial performance reflects positively on environmental [1] and social performance [2]. Additionally, ESG issues are being considered in policy creation for investors in the global context and, for example, in the European context, a mandatory consideration for other economic actors.

The European Commission has committed to addressing sustainability in the finance sector in Europe to develop a common ground for sustainability disclosure and investments. The standardization process involved, as the first step, the definition of a taxonomy of sustainable activities to contribute to sustainable corporate finance [3], defined in the European policy context as investing to support economic growth while taking sustainability principles into account. It also increases transparency in disclosing risks associated with ESG factors that may have negative impacts on the financial system [4].

In a literature review previously performed on the state-of-the-art ESG criteria in the construction industry, the need for standardization in ESG assessment and disclosure was particularly highlighted within this sector. The authors of [5,6] point out that ESG ratings specific for each economic sector and geographical context [7] are essential, as key sustainability issues vary significantly across industries. This is particularly relevant for construction and real estate, given their high environmental sensitivity and their fundamental role in contributing to positive social impacts. The increasing interest in ESG standardization within construction and real estate can be attributed to ESG considerations being implemented by law. Furthermore, research suggests that companies with robust ESG implementation demonstrate increased resilience and financial stability when confronted with emerging risks [8]. However, there are great inconsistencies in the current state of ESG ratings and assessments.

The absence of standard social performance assessment methodologies, as highlighted in [9], demonstrates a lack of convergence in ESG practices and difficulty in gaining a better understanding of ESG effects [10]. The European Commission emphasizes the negative implications of inconsistent reporting, particularly for investors who require a reliable overview of sustainability-related risks faced by companies due to issues with the quality of sustainability reporting. The standardization of indicators further improves harmonization, consistency, and transparency, enabling the comparability of results [11].

The European Commission created the EU Taxonomy (Regulation 2020/852) to unify the definition of sustainability goals and data. It defines the criteria that determine which economic sectors can contribute to the six European environmental objectives of the EU, presented by the Do No Significant Harm (DNSH) principle: climate change mitigation, climate change adaptation, sustainable use and protection of water and marine resources, transition to a circular economy, and pollution prevention [12]. The EU Taxonomy's primary purpose is to support and standardize the disclosure of environmental performance data [3] by proposing sustainability indicators for specific economic sectors and supporting the definition of an ESG standard framework. The authors of [13] suggest that there is a strong correlation between the taxonomy and ESG ratings. For example, rating agencies conduct assessments using publicly available data or using information provided by the companies [7]. The information gathered serves as a foundation for identifying relevant criteria and indicators for disclosing ESG information.

The inconsistencies with these ratings are based on the divergence of scope, assessment methodology, and weight aggregation [14]. However, the proposal of standard approaches to ESG measurement and reporting presents a great difficulty, considering the collection, analysis, and disclosure of data [15].

The European Commission is looking to reduce the lack of clarity on the elements of ESG ratings, the assessment methodologies, and the definition of reliable data sources and reduce the lack of clarity about the operations of ESG rating providers [4].

Considering the regulatory landscape, the EU Taxonomy and The Corporate Sustainability Reporting Directive (CSRD Directive (EU) 2022/2464) [16] offer a baseline for developing a standardized ESG reporting system that accounts for both geographical and legal local contexts.

The challenge for the construction industry specifically lies in the differentiation between ESG and green building certification indicators, which are widely used in the industry and often considered interchangeable [17].

The Italian construction industry is one of the most significant sectors of the national economy and, according to GRESB data, was the second-fastest growing ESG market in

Europe in 2021. However, in recent years, the industry has faced setbacks, mainly because of unfavorable access to finance [18]. Sustainable investments in the sector represent an opportunity for its recovery [19], and the country is actively trying to develop approaches and methodologies to rate ESG in the sector and increase transparency in the assessments. [20].

To develop a real estate and construction-specific framework, the questions that arise for the proposal of an indicators framework focused on the construction industry are as follows:

- How can a set of indicators be defined to standardize ESG assessment and reporting within the construction and real estate sector?
- What key indicators should be included in an ESG framework tailored to the construction and real estate sector in the Italian context?

This study aims to bridge these gaps by proposing a framework of standardized ESG indicators tailored to the construction and real estate industry. These indicators aim to harmonize reporting practices, improve comparability, and ensure consistency while addressing the unique challenges of this sector through the participation of industry stakeholders. By aligning with regulatory efforts, this framework also supports the effective implementation of sustainability goals at both national and European levels. Moreover, it identifies existing gaps in disclosure regulations within the Italian context, providing a foundation for policymakers to support the effective implementation of the EU Taxonomy.

Additionally, this study defines the boundaries between construction and real estate activities, which are often treated together in prior ESG references and current European policies [21]. To achieve the stated objectives, this research study adopts a comprehensive multi-step approach based on participatory methods through a structured workshop that aims to facilitate consensus among a group of experts. This methodology was used to define the boundaries of the activities and to validate the pre-selected indicators.

The methodological approach started with a pre-selection of indicators aligned with the objective. Later, through a survey, a sample of stakeholders was invited to evaluate the relevance of the preselected indicators. Based on the survey results, a refined selection of relevant indicators and a definition of KPIs was proposed. The indicators presented in this paper establish a baseline framework to assess and disclose ESG criteria in construction companies, laying the groundwork for consistent and transparent reporting practices.

2. Methodology

The proposed framework presents a set of indicators for ESG assessment and disclosure in the construction and real estate sectors. This is achieved by analyzing existing ESG indicators that are currently used in this sector and then contextualizing them to the EU policy context. The methodology outlined in Figure 1, consists of four stages: (i) identification, (ii) refinement, (iii) validation, and (iv) adaptation.

The first stage (identification) consists of performing a preliminary selection of indicators using existing ESG disclosure and rating tools, i.e., GRI and GRESB. The criteria considered for selecting these frameworks include their widespread use and recognition, as well as whether they propose either a sector-specific set of indicators tailored for construction/real estate or are explicitly designed for this economic sector. In this stage, 278 indicators are obtained. In step two, the indicators are classified and divided into the three main ESG categories: environmental, social, and governance, considering that the categories vary within each one of the frameworks.

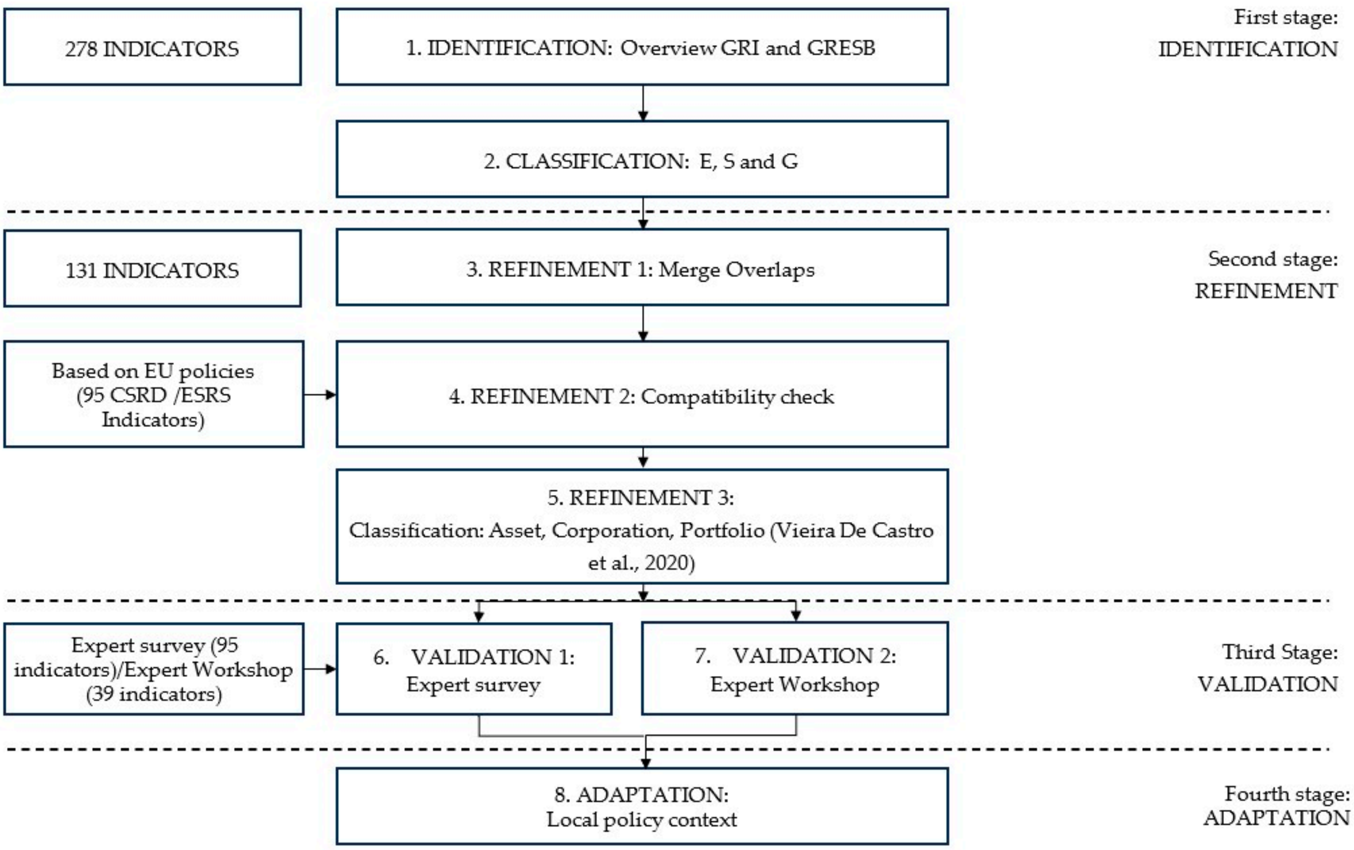

Figure 1. Flowchart of the methodology [17].

An overview of existing ESG frameworks relevant to the construction industry is performed, analyzing the frameworks' origin, primary focus areas, and relevant requirements. Several tools are available in the market to measure ESG performance of corporations; however, a key limitation is that only a few disclose information on the criteria and methodology used behind their ESG measurements [22]. European regulations primarily focus on disclosure and compliance criteria and do not provide a standard methodology for assessment, even though it is under development. In contrast, ESG-oriented developers pursue sustainability building certifications to increase the value of their assets since they are targeted toward a segment of premium sales and rents in the sector [23]. However, these certifications usually prioritize environmental issues and may not comprehensively assess an organization's social responsibility [17]; therefore, the framework selection focuses on company-level assessment while acknowledging that some indicators consider building certifications.

An overview of the regulatory frameworks in the European context is conducted to identify the indicators that overlap with the pre-selection.

The third stage (validation) involves collaborating with relevant industry stakeholders and experts through participatory processes to validate and refine the pre-selected indicators in stages 1 and 2. First, a questionnaire-based survey is applied to assess the relevance of the indicators (95) individuated as mandatory by European law to the construction industry and the feasibility of assessment of each indicator. The selection of the experts considers a group of participants with a high level of expertise, knowledge in the field of sustainability, and experience in the sustainability areas of construction-related companies. The validation process involved inviting 16 experts to participate in a survey, followed by a workshop. The resulting number of indicators until this stage is considerable and difficult to implement. As mentioned by [24], managing fewer criteria could improve the assessment of sustainability. The second step of the validation process consists of the development of a workshop to define if the remaining (39) indicators not required by European law should be considered or are fundamental in the definition of a framework specific to the construction industry. The adaptation stage focuses on adapting the resulting framework to the Italian policy context. According to [25], the directive has a great impact on Italian companies' non-financial reports, and Italian firms have shown in empirical studies to have a positive response to ESG incentives [26]. The main framework used by Italian companies that are obliged to comply with disclosure regulations is GRI since it covers all mandatory aspects by national regulation [27]. According to a study performed by [28], the construction and infrastructure sector is one of the most mature economic sectors in non-financial reporting, where 63% of the analyzed companies are long-standing reporters. A total of 77% of the companies have used GRI as a model or baseline to elaborate their reports.

An overview of the identified frameworks, specific to the construction and real estate sectors, is presented as follows:

Global Reporting Initiative (GRI)

GRI was established in 1997 in the United States by the non-profit organization CERES in response to the environmental harm caused by the 1989 Exxon Valdez oil spill, which also involved the UN environmental program [29]. The goal was to develop a standard global mechanism to hold firms accountable for environmental damage and to adhere to their responsibility to environmental conduct principles, which were later expanded to encompass social, economic, and governance issues [30].

According to the guidelines, a report should include the following areas: objectives and strategy; company profile; performance structure and management systems; GRI content index; and performance criteria (environmental, social, governance, and economic). The performance criteria are divided into "core" criteria, which aim to identify generally applicable criteria and material criteria for most corporations, and "additional" criteria, which refer to specific sectors [31]. GRI standards is a guideline that provides a series of voluntary disclosure indicators organized into three series: universal standards (GRI 1 and GRI 2, general disclosures; and GRI 3, material topics; sector standards (GRI 4); and topic standards, which go according to their list of material topics.

GRI is one of the most widely used reporting frameworks [32–34], and, according to [31], its relevance stems from various causes, including the escalating demand for social and environmental information.

GRI is the only one that provides a supplementary document with information specific to construction and real estate activities [17]. Additionally, the UNEP-FI [15] suggests that GRI for construction and real estate should be considered as the standard for sustainability disclosure. The Construction and Real Estate Sector Disclosures consists of a set of indicators all organizations in the Construction and Real Estate sector can use, covering key aspects of sustainability performance that are relevant to these economic sectors and which are not sufficiently covered in the G4 Guidelines [35].

Global Real Estate Sustainability Benchmark (GRESB)

GRESB stands for the global environmental, social, and governance (ESG) benchmark for financial markets, which is composed of an independent foundation and a benefit corporation. It is a mission-driven organization that facilitates the provision of ESG data to financial markets. GRESB is a framework that assesses the performance of individual assets or portfolios in the real estate and construction industry. The data used in the evaluation are self-reported, subjected to third-party validation, and, subsequently, are used to generate ESG benchmarks [36]. The benchmarking framework provides an industry-specific voluntary assessment tool for the construction and real estate sectors. It initially evaluated the performance of real estate commercial assets at the asset or company level and then created an infrastructure asset assessment [37]. The Real Estate assessment is divided into three components: management, performance, and development. The management component comprises data on risk management, investor involvement, and indicators that describe the organization's ESG strategy and leadership policies. Performance metrics cover a wide range of ESG factors on standing assets, such as governing building attributes, energy and water consumption, waste formation and divergence, and greenhouse gas emissions. Development data describes ESG attributes during construction, and both quantitative and qualitative data are collected. Green building certification accounts for approximately 10% of GRESB scoring under the performance category [37].

The second stage (refinement) is divided into three steps. In the first step, the indicators from both selected frameworks are merged, identifying overlaps and the source of each indicator. The second step consists of performing a compatibility check by identifying the indicators that are mandatory to report based on EU policies (CSRD Corporate Sustainability Reporting Directive EU 2022/2464) to ensure that the resulting framework is compliant with obligations in the European Union. The last step of the refinement stage consists of the classification of the indicators depending on which administrative level they impact. The three administrative levels proposed by [17] are corporate level, portfolio level, and asset level. The output from stages 1 and 2 is a set of pre-selected indicators, which are subsequently validated and refined by experts to produce a final selection of indicators.

European Sustainability Reporting Standards (ESRS)

The European Sustainability Reporting Standards (ESRS) represent a legislative proposition articulated by the European Commission through the Corporate Sustainability Reporting Directive (CSRD). This directive requires large and listed companies to produce elaborate reports, adhere to sustainability disclosure standards, and apply a double materiality perspective. This legislative initiative marks a significant advancement in propelling the transition toward a sustainable economic paradigm within the European Union [4]. The standards cover a diverse range of issues encompassing aspects of environmental, social, and governance dimensions. These considerations encompass but are not limited to issues such as climate change, biodiversity, and human rights.

The fact that the standards are methodically crafted with reference to the International Sustainability Standards Board (ISSB) and the Global Reporting Initiative (GRI) is relevant to the selection of indicators. This deliberate alignment is aimed at ensuring coherence and compatibility between global and EU standards; additionally, this alignment mitigates redundancy in reporting practices for companies, emphasizing the importance of a streamlined and harmonized approach in the pursuit of sustainable urban and social development.

The ESRS will be mandatory for use by the companies that are obliged by the Accounting Directive to report sustainability information, allowing comparability among companies across the EU using reliable information. The common standards are expected to help companies reduce, in the long term, the costs of the elaboration of sustainability reports, avoiding the use of multiple standards.

The standards adopt a double materiality perspective, necessitating companies to report on both their effects on people and the environment, as well as how social and environmental factors contribute to financial risks and opportunities for the company. The standards are divided into 12 sections that cover all sustainability issues and are divided into general requirements and disclosures, environmental, social, and governance. Environmental standards consider topics such as climate, pollution, and the use of resources; social standards consider information about the company's own workforce, workers in the value chain, and affected communities; and governance mainly considers business conduct data. All the standards and individual disclosure requirements are subject to a materiality assessment [4].

Do Not Significant Harm Envision Protocol DNSH

The "Do No Significant Harm Principle" is a concept that emerged as part of the European Sustainable Finance plan and holds a direct relationship with The European Union Taxonomy. The principle means not carrying out economic activities that harm any environmental objective, as defined by EU Regulation 2020/852 (EU Taxonomy). The European Taxonomy consists of criteria that define substantial contributions to the six EU environmental objectives that were presented with the DNSH: climate change mitigation, climate change adaptation, sustainable use and protection of water and marine resources, transition to a circular economy, pollution prevention and control, and protection and restoration of biodiversity and ecosystems. The taxonomy is a key policy initiative within the finance initiatives taking part in the EU [13].

The Envision protocol is the first independent rating system to evaluate sustainable infrastructure. It supports companies, designers, public administrations, and citizens in designing infrastructure projects. Envision was created by the Institute for Sustainable Infrastructure (ISI) in collaboration with the Zofnass program for sustainable infrastructure from Harvard University's Graduate School of Design. The Institute of Certification and Quality Branding Products and Services for Construction (ICMQ) introduced the Envision protocol in Italy and considers it the ideal tool to measure the alignment of construction projects with the DNSH objectives outlined in the National Recovery and Resilience Plan (PNRR). While DNSH principles focus solely on environmental impacts, the Envision protocol goes beyond by incorporating social and economic aspects encompassing the three dimensions of ESG criteria.

3. Results

3.1. Identification

The previously overviewed frameworks are presented in Table 1. They were examined to select ESG indicators relevant to the construction and real estate industries. GRI and GRESB indicators were combined to obtain a total of 169 indicators. These indicators were systematically classified into the three ESG dimensions (environmental, social, and governance).

Table 1. List of ESG frameworks.

Framework	Year	Country of Origin	Entity	Topic	Construction/Real Estate Specific	Scope	Number of Areas	Number of Indicators
GRI G4 Construction and Real Estate Sector Disclosures	1997	United States	GRI (Global Reporting Initiative)	Sustainability	YES	Any organization	40	89
GRESB Real Estate Standard and Reference Guide	2009	International	GRESB Global Real Estate Sustainability Benchmark	ESG	YES	Listed Companies	15	80

Each framework has its own hierarchical classification of ESG criteria. In the analysis, GRI serves as the baseline framework, where indicators common to both GRI and GRESB retain their GRI names. Indicators unique to GRESB are then allocated to the correspondent GRI categories. GRESB classifies indicators into three macro-categories: performance, management, and development and then indicates the E, S, and G allocation.

As shown in Figure 2, half of the indicators in GRI correspond to the social dimension, and it contains the least governance indicators, while GRESB is more balanced between the three dimensions. The social dimension is the most commonly represented one summarizing the indicators, followed by environmental and, finally, governance.

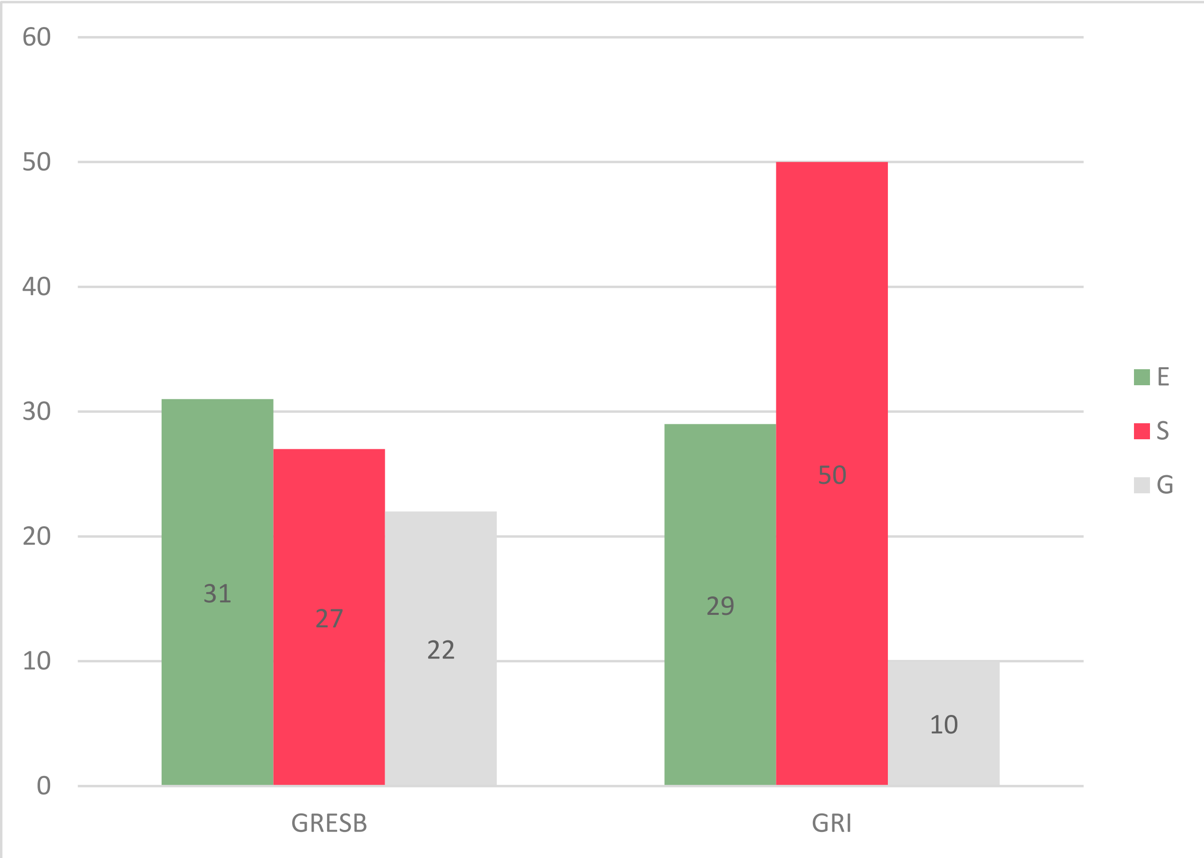

Figure 2. Distribution of dimensions per framework.

3.2. Refinement

The first step of the refinement phase consists in identifying overlaps between the indicators from the two frameworks. A total of 39 indicators overlapped, meaning they were included in both frameworks and had alignment in intent, elements, and criteria. Figure 3 shows the distribution of overlapped indicators, illustrating that most of the governance indicators are taken from GRESB, most social indicators are taken from GRI, and environmental indicators are balanced between GRI, GRESB, and overlapped indicators.

After merging the overlapped indicators, the result consists of a framework of 131 indicators, distributed in the dimensions and categories shown in Table 2, as follows: 53 environmental, 55 social, and 23 governance.

The second refinement step focuses on verifying the compatibility of the selected indicators with current and relevant European regulations. This compatibility check is based on the Corporate Sustainability Reporting Directive (CSRD) EU 2022/2464, which establishes the European Sustainability Reporting Standards (ESRS). As mentioned before, the ESRS outlines a set of mandatory disclosure indicators for large companies. This step is taken to compare the selected indicators against the ESRS to identify any gaps or redundancies and is shown in Figure 4. This will ensure the final framework aligns with EU regulatory requirements and avoids unnecessary reporting burdens for companies. This step successfully identified construction-specific indicators. These indicators are considered Key Performance Indicators (KPIs) as they are mandated by European Law.

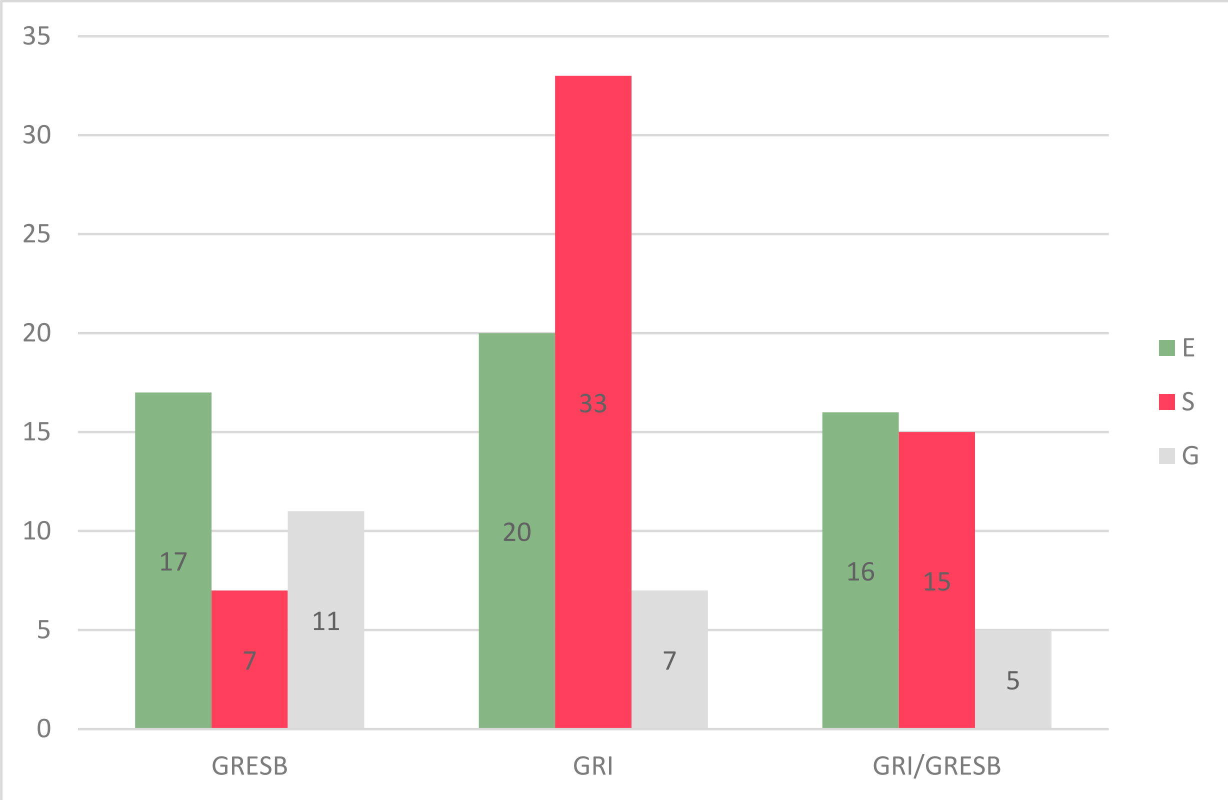

Figure 3. Distribution of overlapped indicators.

Table 2. Number of indicators per category.

Categories	E	S	G	Total
Economic	3	8	4	15
Environment	50			50
Governance			7	7
Human rights		12		12
Labor practices and decent work		16		16
Marketing and labeling			6	6
Product responsibility		2		2
Society		17	6	23
Total indicators	53	55	23	131

The final step in the refinement process involves classifying the indicators into "administrative levels" (i.e., corporate level, portfolio level, and asset level) to define their scope of applicability and further define the boundaries of the resulting indicator framework.

Following the classification proposed by [17], the indicators are organized into three administrative levels to facilitate the data collection and flow of the indicators. The corporate level focuses on the organization's overall strategy, structure, and culture, emphasizing ethics, social equality, and socio-environmental justice. It includes elements such as company philosophy, company culture, strategic direction, corporate policy, and corporate strategic planning. The portfolio level addresses business strategy and portfolio management, ensuring alignment with the corporate sustainability strategy. The asset level focuses on individual building properties encompassing the development lifecycle, including planning, design, construction, occupancy, and recovery.

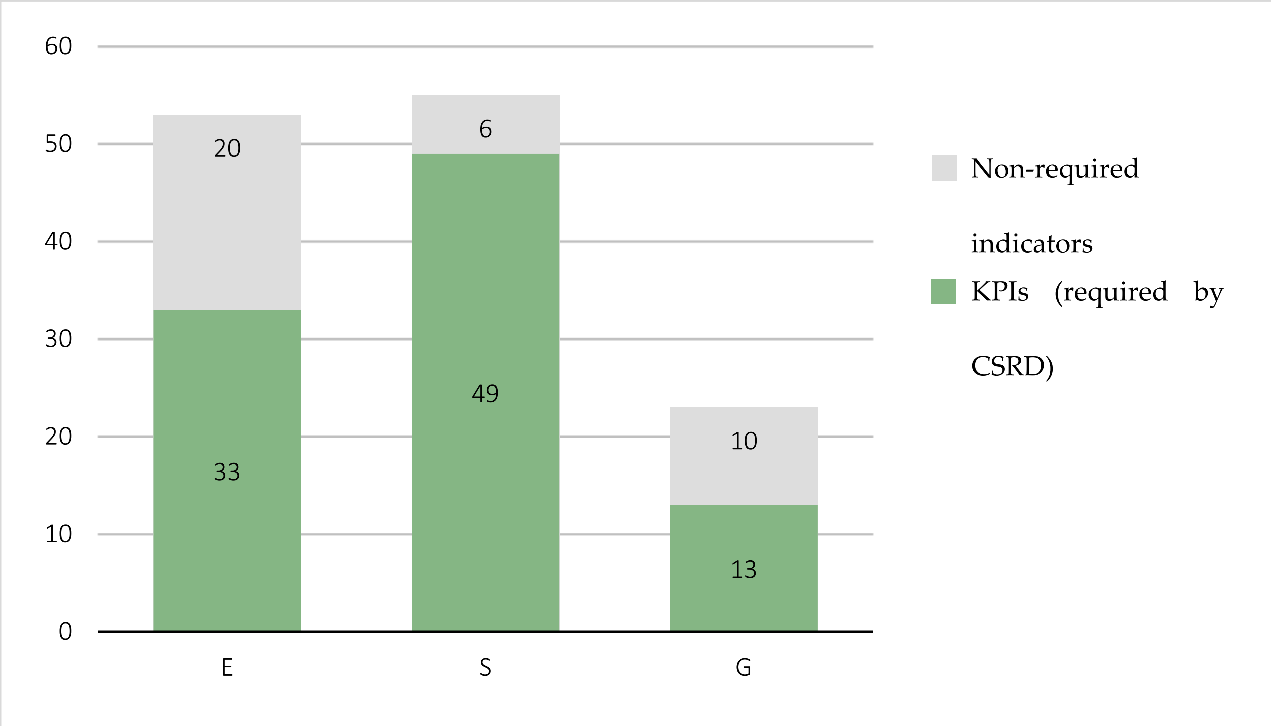

Figure 4. Identification of KPIs required by CSRD.

The classification results reveal that most indicators are assessed at the corporate level, reflecting their alignment with corporate strategy, policy, and management. Notably, most indicators at the corporate level fall under the social category. Environmental indicators are more evenly distributed across the three administrative levels, with most environmental aspects to be assessed in the buildings owned by the company, under construction, or part of the portfolio (Figure 5).

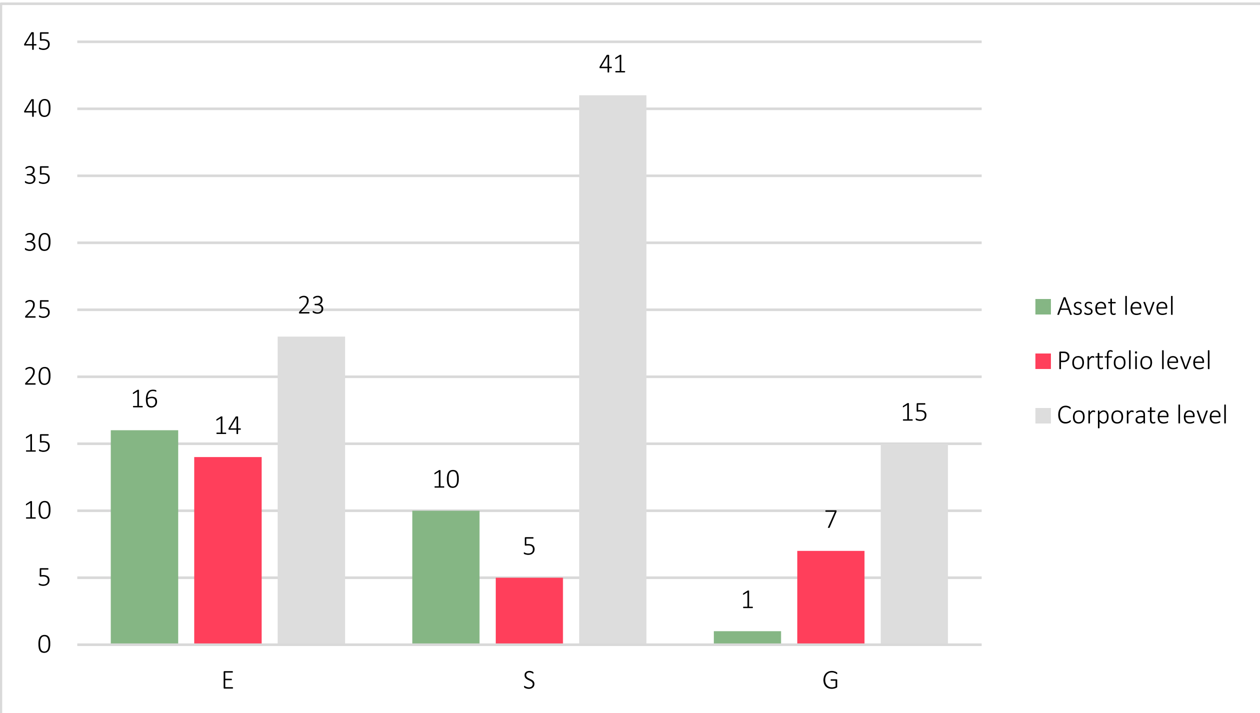

Figure 5. Distribution of indicators on administrative levels.

Moreover, a holistic analysis of sustainability also considers the development lifecycle phase, since activities at each phase must align with sustainability strategies, human rights policies, sustainable processes, and environmental protection. This approach is essential to gain a better understanding of the interconnections between company policy, management practices, and asset-based certification methodologies [17]; indicators were classified according to the life cycle phase, where they must be assessed and reported.

The European framework Level(s) was selected as a reference, given its aim to standardize sustainability assessment in the built environment. The framework provides a comprehensive set of indicators for assessing sustainability performance across various dimensions concerning buildings in Europe [38]. The proposed framework presents a hierarchical structure aligned with the building life cycle phases: design, construction, and operation. To address the foundational aspects of ESG, a "Level 0" was introduced, representing the company policy administrative level. Within the Level(s) framework, each level provides a progressive scale of decision-making depth [39]. Consequently, when classifying the resulting indicators, it was found that one can be associated with multiple levels, reflecting the varying detail required in their implementation.

The distribution of indicators shown in Table 3, demonstrates that most of the governance indicators correspond to company policy, while a reduced number references the conceptualization, design, or construction phase of buildings. The social indicators follow a similar pattern to governance, except for being present at all levels. Finally, the environmental indicators are distributed more evenly across all levels.

Table 3. Distribution of indicators in life cycle phase "Levels".

	E	**S**	**G**
LEVEL 0: Company policy	28	42	19
LEVEL 1: Concept	28	8	8
LEVEL 2: Design	28	8	
LEVEL 3: Operation	19	8	

3.3. Validation

To validate and ensure the effectiveness and applicability of the framework, 16 experts from the construction industry were engaged in the final indicator selection process.

A third of the participants (33%) reported having more than five years of industry experience, while the remaining 67% were evenly distributed among 5 to 10 years, 10–20 years, and more than 20 years of experience. The most common role within the companies they work for is a sustainability consultant or sustainability expert, accounting for 66% of participants. Other roles include CEO assistant, business sustainability officer, commercial and marketing developer, and operations director. Given that the participants' profiles are closely related to sustainability, they were asked about their awareness of ESG prior to the workshop. All participants indicated that they were either aware of or already consider ESG issues in their companies. This stage of the methodology is designed to reduce the number of indicators of the framework or identify potential missing indicators, define the boundaries of the specific activity that the indicator is focused on (real estate/construction), and understand if the assessment or data collection for each indicator is feasible.

The framework's validation involved categorizing selected indicators based on their relevance to the construction and real estate sectors. This classification was informed by expert opinion and aimed to identify indicators applicable to both construction-specific and real estate-specific activities. The framework recognizes the complex interplay between these sectors, as highlighted by the Report on Sustainability Metrics [15], which emphasizes the influence of diverse business management factors on commercial property.

The first step of the validation process was developed through a survey, addressing a comprehensive set of indicators categorized into E, S, and G. The participants were asked to classify each indicator based on its applicability to construction or real estate activities and assessing its measurement difficulty (challenging, somewhat difficult, or easy) for data collection or calculation.

The results are described below:

- Environmental indicators analysis: the survey identified 29 environmental indicators relevant to both construction and real estate activities. These indicators generally focus on measuring environmental impacts, protection measures, and site selection requirements. Notably, indicator E.2 (risk assessment for standing investments portfolio) was deemed specific to real estate, while indicators E.4 (materials used), E.20 (emissions of ozone-depleting substances), and E.21 (nitrogen oxides, sulfur oxides, and other emissions) were categorized as construction-specific. In terms of assessment difficulty, four indicators were considered easy to measure. These include E.7 (energy consumption), E.14 (direct GHG emissions), E.31 (waste diverted from disposal), and E.40 (environmental screening of new suppliers). Conversely, indicators E.2 (risk assessments), E.19 (emissions intensity in new construction), and E.22 (net zero carbon design) were deemed more challenging to assess.
- Social indicators analysis: The survey identified 47 social indicators to be relevant to both construction and real estate activities. These indicators broadly encompass human rights policies and social impact assessments. Notably, indicators S.47 (tenant health and well-being program) and S.48 (tenant satisfaction survey) were specifically assigned to the real estate activity. In terms of assessment difficulty, nine indicators were considered easy to measure. These include S.7 (proportion of spending on local suppliers), S.15 (total number of incidents of discrimination and corrective actions taken), S.22 (total number and rates of new employee hires and employee turnover), S.32 (percentage of the organization operating in verified compliance with an internationally recognized health and safety management system), S.33 (average hours of training per year), S.35 (presence and extent of an entity's program for promoting employee health and well-being), S.36 (composition of governance bodies and breakdown of employees), S.41 (percentage of new suppliers that were screened using criteria for impacts on society), and S.44 (percentage of operations with implemented local community engagement). A total of 11 indicators were considered difficult to measure and are related to human rights violations, issues with labor practices, and impacts on society.
- Governance indicators analysis: The survey identified 12 indicators relevant to both construction and real estate activities. Only one indicator, G.13 (the total number of non-compliance incidents with regulations and voluntary codes), was deemed relevant solely to the construction industry. Notably, no indicators were identified as exclusively relevant to real estate activities. Regarding assessment difficulty, none of the indicators were classified as easy to measure. The remaining indicators were categorized as moderate to highly challenging in terms of assessment.

A workshop, designed to engage experts in reducing the number of non-mandatory indicators (39), aimed to identify the most relevant indicators beyond the scope of the ESRS. Through discussion and consensus, experts provided valuable insights on these additional indicators. Mirroring the survey structure, the workshop employed three separate rooms distributed according to the participants' expertise. The interphase of the workshop for the environmental board is shown in Figure 6.

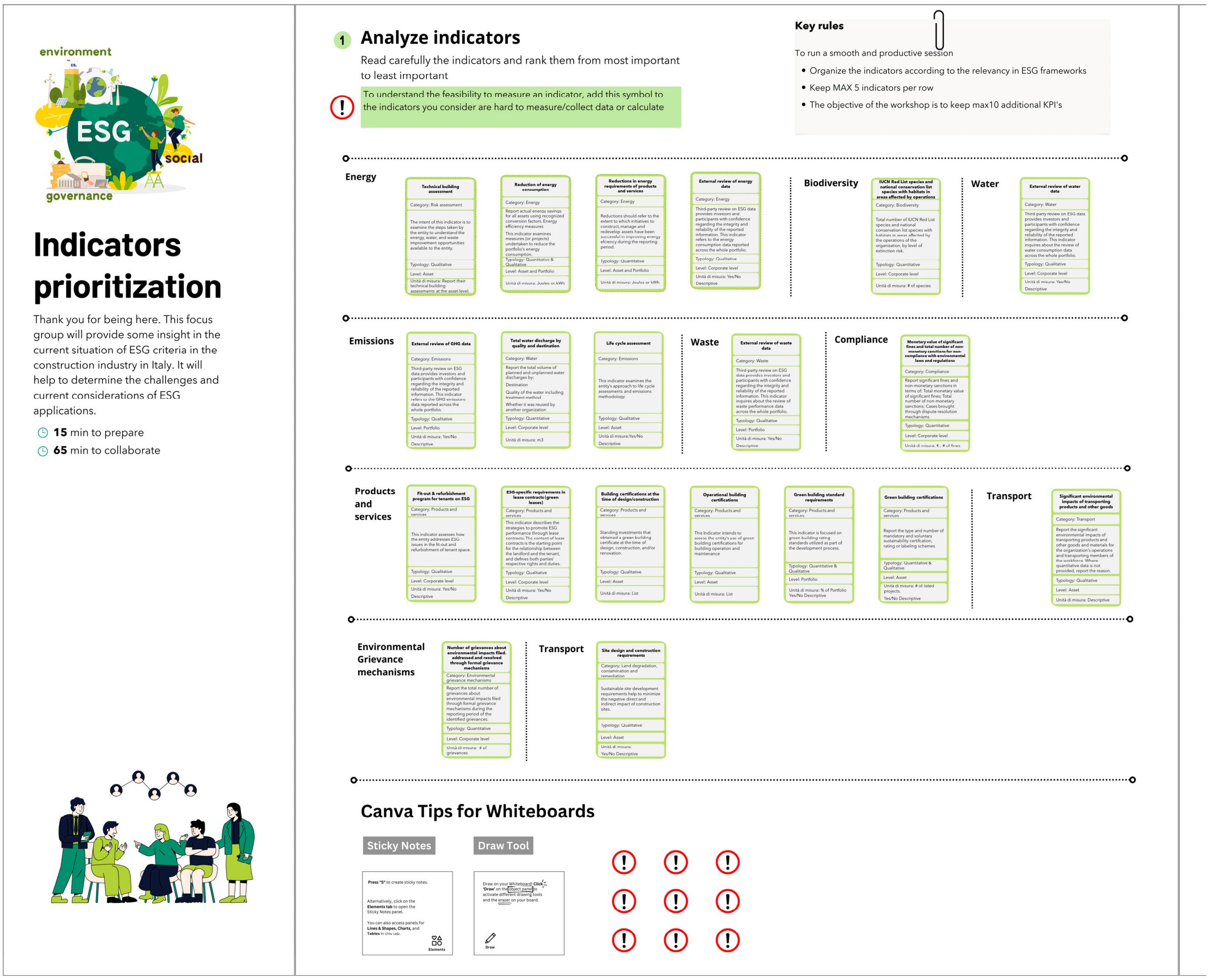

Figure 6. Interface of the workshop board for environmental indicators. The cards contained the caption "unità di misura" which translates to unit of measurement.

The environmental group represented the biggest challenge, considering time limitations, with 20 remaining indicators for expert evaluation. This resulted in a larger expert environmental group compared to the social (6 indicators) and governance (10 indicators) categories. After a first read of all the indicators, the participants were asked to sort a maximum of 10 indicators in a hierarchical ranking of relative importance on a matrix of 5 × 4. The participants were able to leave empty spaces between indicators, indicating that a specific indicator is x-times less important than the previous indicator.

To achieve the target of keeping a maximum of 10 indicators in the environmental category, the working group focused on merging those that measured similar aspects. Building certifications indicators, deemed highly important, were consolidated into a single indicator: "Green building certifications and standard requirements during the life cycle of the building" (E.35). Similarly, indicators related to energy consumption reduction were merged into "Reduction of energy consumption within the entire portfolio" (E.9). The same approach was applied to external review of environmental data (energy, GHG, water, and waste E.36), ESG programs for tenants, and non-compliance with environmental laws. Two indicators, "Technical building assessment" and "Total water discharge by quality and destination", were excluded due to their perceived lack of relevance. The results of the environmental indicators are shown in Figure 7.

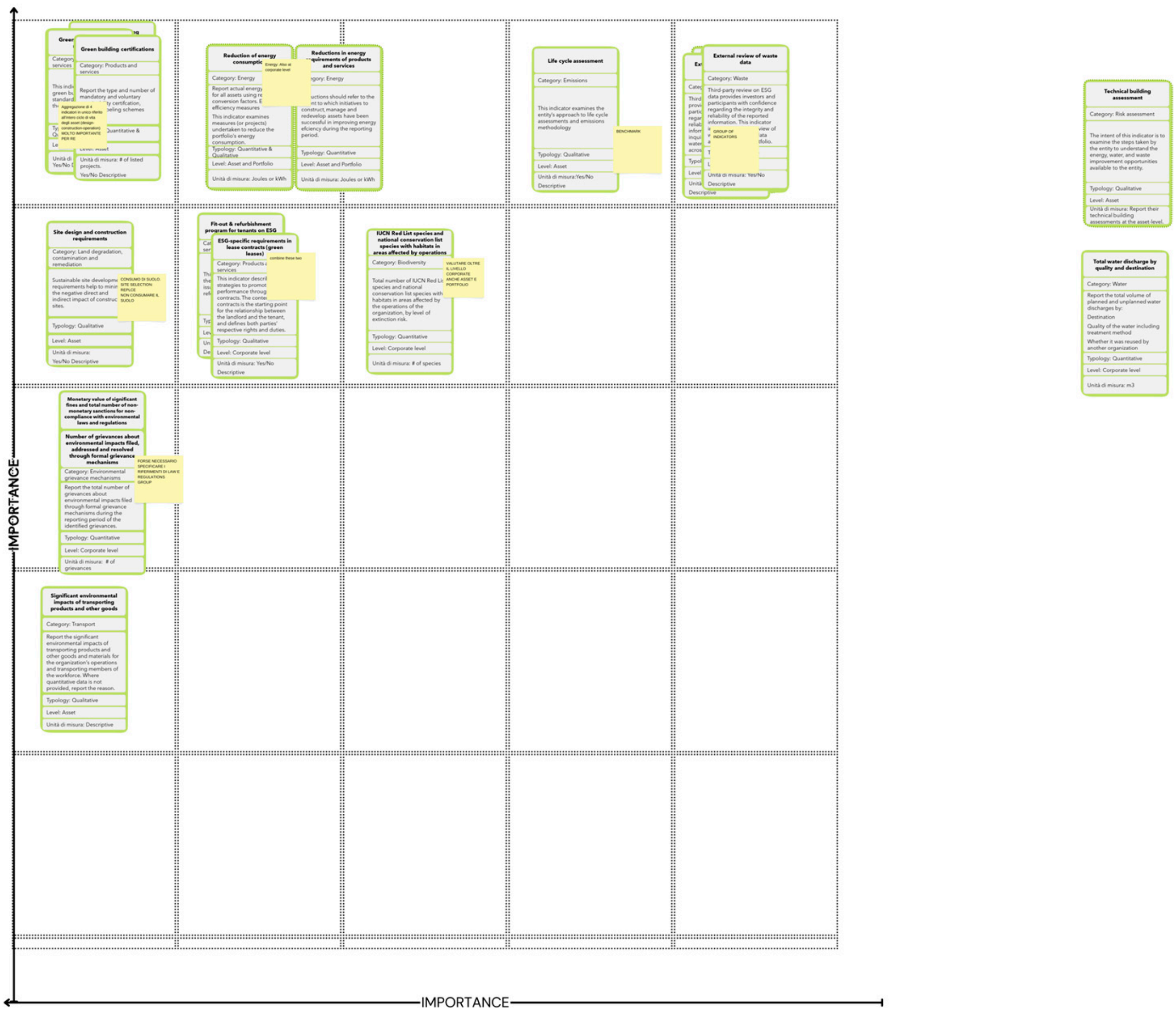

Figure 7. Final ranking of environmental indicators. The cards contained the caption "unità di misura" which translates to unit of measurement.

The experts' review process confirmed the relevance of all six remaining social indicators for the final framework. These indicators prioritize aspects like direct economic value generation and distribution (S.1), human rights training for security personnel (S.17), and fair wage practices (S.3). Additionally, they assess the inclusion of human rights clauses in significant contracts (S.13) and employee training on human rights policies (S.14). While all indicators apply to both construction and real estate activities, measuring human rights compliance within contracts (S.13) was identified as a potential challenge, considering the value chain in the construction industry. The experts emphasized the importance of considering local legal contexts when interpreting compliance-related indicators.

While all indicators are applicable to both construction and real estate operations, assessing the extent of human rights adherence within contracts (indicator S.13) has been recognized as a potential difficulty. Experts emphasize the importance of considering regional legal frameworks when analyzing compliance-related indicators.

Regarding governance indicators, the experts eliminated three of the ten remaining indicators. The discussion underscored the importance of a robust governance structure within a company. The remaining indicators were organized to reflect the necessary steps for establishing this structure. Considering what is previously mentioned, all the indicators were determined relevant for both real estate and construction companies. The most relevant indicator was the existence of a committee or internal task force in charge of ESG components (G.19). The indicators following the hierarchy indicators are the statement of an ESG development strategy (G.9), ESG personnel performance targets (G.10), public commitment to ESG leadership standards (G.17), the inclusion of a senior decision maker on ESG and climate issues (G.18), ESG action disclosure (G.20), and ESG incident monitoring (G.15). The indicators considered non-relevant for the framework were related to product labeling, which is related mainly to correct marketing labeling and compliance with marketing regulations or voluntary codes and breeches in customer privacy. Additionally, the experts emphasized the importance of legal compliance as a foundational aspect of ESG disclosure, highlighting that the framework requires the identification of indicators that directly relate to compliance with national laws and regulations.

The assignment of indicators to a specific activity revealed a high degree of overlap between construction and real estate activities, with 106 indicators applicable to both construction and real estate activities. While most indicators align with company policy, a smaller subset is specific to either sector. Four indicators are exclusively relevant to real estate, while eight are specific to construction. For application in construction, 114 indicators must be considered, and 110 must be considered for real estate.

The resulting framework consists of 118 indicators distributed in 8 categories and 49 sub-categories. These indicators were developed through a comparison to European law and were revised and approved by industry experts. The complete list of indicators is provided in Supplementary Material (File S1).

3.4. Adaptation

To ensure practical applicability, the final step involved adapting the identified indicators to the specific context of the Italian construction sector. A crucial aspect of this adaptation process was to prioritize indicators that directly reference regulatory compliance and align with local policies.

In Italy, sustainability priorities extend beyond European regulations, encompassing the achievement of Sustainable Development Goals (SDGs), the green and energy transition, and the implementation of circular economy measures [19]. Within this context, building renovation emerges as a key strategy for achieving these goals [40]. As Italian authorities play a pivotal role in construction processes [23], the construction industry is increasingly recognized as a driver of sustainable development.

The adaptation process started by identifying which indicators from the final framework adhered to DNSH requirements. Among the 118 indicators, 19 were aligned with the DNSH principles (Table 4). These indicators primarily focus on environmental sustainability, hence the relationship with the EU Taxonomy, covering aspects such as energy efficiency, waste management, and pollution reduction. However, the social and governance indicators are underrepresented, with only two indicators categorized as social, and none linked to governance. This process facilitates the generation of ESG disclosure reports and prioritizes environmental implications in the initial phase of construction processes or considerations for investments. An individual indicator may contribute to multiple principles, considering that the EU Taxonomy and the DNSH principles are primarily focused on environmental impacts.

Table 4. List of prioritized indicators relevant to the Italian context.

ESG Allocation	Number	Categories	Sub-Categories	Indicator	Unit of Measurement	Qualitative Assessment	DNSH Requerement	DNSH Objective	Impact on Regulation 2020/852
E	E.1	Economic	Economic performance	Financial implications and other risks and opportunities due to climate change		Yes/No Descriptive	CR 2.2 Assess Climate Change Vulnerability CR 2.3 Evaluate Risk and Resilience	Climate change mitigation Sustainable use and protection of water fonts and marine resources Pollution prevention and reduction	Direct
	E.5	Environment	Materials	Percentage of materials used that are recycled input materials	% (Total recycled input materials used/total input materials used × 100)		RA 1.2 Use Recycled Materials	Climate change mitigation	Indirect
	E.8		Energy	Energy consumption outside of the organization	Joules or kWh		RA 2.3 Use Renewable Energy	Climate change mitigation	Direct
	E.9			Reduction of energy consumption in company and portfolio	Joules or kWh	Descriptive: Report energy efficiency measures	RA 2.1 Reduce Operational Energy Consumption RA 2.2 Reduce Construction Energy Comsumption	Climate change mitigation Transition to a circular economy	Indirect
	E.10			Building energy intensity	kWh/m^2/year; or kWh/person/year		RA 2.4 Commission and Monitor Energy Systems	Climate change mitigation	Indirect

Table 4. *Cont.*

ESG Allocation	Number	Categories	Sub-Categories	Indicator	Unit of Measurement	Qualitative Assessment	DNSH Requerement	DNSH Objective	Impact on Regulation 2020/852
E	E.11	Environment	Biodiversity	Significant impacts of activities, products, and services on biodiversity in protected areas and areas of high biodiversity value outside protected areas		Descriptive	NW 2.3 Reduce Pesticide and Fertilizer Impacts	Climate change mitigation Sustainable use and protection of water fonts and marine resources Pollution prevention and reduction Protection and restoration of biodiversity and ecosystems	Direct
	E.12			Habitats protected or restored		Descriptive	NW 1.1 Preserve Sites of High Ecological Value NW 3.4 Control Invasive Species NW 3.1 Enhance Functional Habitats	Protection and restoration of biodiversity and ecosystems	Direct
	E.17		Emissions	Reduction of GHG emissions	Ton CO_2 Equivalent		CR 1.2 Reduce Greenhouse Gas Emissions	Climate change mitigation	Direct
	E.20			Emissions of ozone-depleting substances (ODS)	Metric ton		CR 1.3 Reduce Air Pollutant Emissions	Pollution prevention and reduction	Direct
	E.22			Net zero carbon design and standards		Yes/No Descriptive	CR 1.1 Reduce Net Embodied Carbon	Climate change mitigation Transition to a circular economy	Direct

Table 4. *Cont.*

ESG Allocation	Number	Categories	Sub-Categories	Indicator	Unit of Measurement	Qualitative Assessment	DNSH Requerement	DNSH Objective	Impact on Regulation 2020/852
E	E.27	Environment	Water	Building water intensity	liters/person/year; or m^3/m^2/year		RA 3.2 Reduce Operational Water Consumption RA 3.3 Reduce Construction Water Consumption	Climate change mitigation Transition to a circular economy	Direct
	E.30		Waste	Waste generated	Metric ton	Yes/No Descriptive	RA 1.3 Reduce Operational Waste RA 1.4 Reduce Construction Waste	Climate change mitigation Transition to a circular economy	Indirect
	E.38		Transport	Significant environmental impacts of transporting products and other goods and materials for the organization's operations and transporting members of the workforce		Descriptive	QL 2.2 Encourage Sustainable Transportation	Climate change mitigation	Direct
	E.39		Environmental protection	Total environmental protection expenditures and investments by type	(EUR)	List	RA 1.5 Balance Earthowrk On Site	Climate change mitigation Transition to a circular economy Pollution prevention and reduction Protection and restoration of biodiversity and ecosystems	Direct

Table 4. *Cont.*

ESG Allocation	Number	Categories	Sub-Categories	Indicator	Unit of Measurement	Qualitative Assessment	DNSH Requerement	DNSH Objective	Impact on Regulation 2020/852
E	E.42	Environment	Land degradation, contamination and remediation	Land remediated and in need of remediation for the existing or intended land use, according to applicable legal destinations	m^2; ha		NW 3.3 Maintain Floodplain Functions NW 3.5 Protect Soil Health RA 3.1 Preserve Water Resources	Climate change adaptation Sustainable use and protection of water fonts and marine resources Protection and restoration of biodiversity and ecosystems	Indirect
	E.43			Site selection requirements		Yes/No Descriptive	NW 1.3 Preserve Prime Farmland CR 2.1 Avoid Unsuitable Development	Climate change mitigation Protection and restoration of biodiversity and ecosystems	Direct
	E.44			Site selection and construction requirements		Yes/No Descriptive	NW 1.4 Preserve Undeveloped Land NW 2.2 Manage Stormwater	Climate change mitigation Protection and restoration of biodiversity and ecosystems	Direct
S	S.8	Product responsibility	Customer health and safety	Percentage of significant product and service categories for which health and safety impacts are assessed for improvement	%		QL 1.2 Enhance Public Health and Safety	Pollution prevention and reduction	Indirect
	S.28	Labor practices and decent work	Occupational health and safety	Worker participation, consultation, and communication on occupational health and safety	%	Yes/No Descriptive	QL 1.3 Improve Construction Safety	Pollution prevention and reduction	Indirect

Regarding policy compliance, companies covered by the CSRD are mandated to report on all 95 required indicators. In the Italian context, an additional three indicators are mandatory due to national policies. Of the 95 ESRS-required indicators, 79 are not directly mandated by the DNSH principles.

In the final framework, indicators mandated by legal requirements in the Italian context are prioritized, ensuring alignment with both regulatory obligations and practical challenges. The indicators that are subject to Italian law correspond mainly to the social and governance categories and are shown in Table 5. Social indicators focus on compliance with human rights standards, while governance indicators address adherence to anti-corruption laws, conflict of interest regulations, and regulations concerning the provision of products and services.

Table 5. List of indicators related to policy compliance.

Code	Indicator	Policies
E.37	Monetary value of significant fines for non-compliance with environmental laws and regulations and number of grievances about environmental impacts.	• EU Directive 2004/35/CE on environmental liability. • Civil liability for pollution damage (Article 2043 of Italian Civil Code). • Green procurement: Law 221/2015 on environmental provisions to promote green economy measures and to contain excessive use of natural resources. • Law Decree 111/2019 on air quality (implementing Directive 2008/50/CE). • Criminal liability for environmental crimes (e.g., Decree 152/2006; Articles 452-bis ff. of the Italian Criminal Code). • Law Decree 36/2022 on the implementation of PNRR, which has, inter alia, introduced the National System for the Protection of Health from Environmental and Climatic Risks ("Sistema nazionale Prevenzione Salute dai rischi ambientali e climatici").
S.9	Total number of incidents of non-compliance with regulations and voluntary codes concerning the health and safety impacts of products and services during their life cycle, by type of outcomes	• Protection of workers' safety and health in the workplace (L.D 81/2008). • Determination and management of environmental noise (LD 19 August 2005, n.194). • Consolidated text of legislative and regulatory provisions on buildings (Presidential Decree 8 June 2001, n. 380) • Installation safety regulations (Law 5 March 1990, n 46) • General criteria for fire safety and emergency management during work hours (MD 10 March 1998)
S.32	Percentage of the organization operating in verified compliance with an internationally recognized health and safety management system	• OHSAS 18001 • AS8000
S.54	Monetary value of significant fines and total number of non-monetary sanctions for non-compliance with laws and regulations	• Obligation for companies to recruit disabled workers (Law 12 March 1999, n. 68). • Anti-discrimination legislation (Legislative Decree 9 July 2003, No. 215, 216; Legislative Decree 11 April 2006, No. 198). • Law 977/67 as amended by Law 345/1999 and Article 37 Constitution on the restriction on employing children of minor age. • Legislation on the elimination of violence and harassment in the workplace (Law 15 January 2021, No. 4). • Legislation concerning the obligation to guarantee equal salary to employees, complying with the criteria of the law, as well as national and company collective bargaining agreements (Italian Constitution). • Legislation concerning employees' right to carry out trade union activity (Italian Constitution, Law 20 May 1970, No. 300).

Table 5. *Cont.*

Code	Indicator	Policies
G.8	Compliance with laws and regulations	• Prohibition for directors to act in conflict of interest with the company (Article 2391 of the Italian Civil Code). • Requirement for companies owned or controlled by the Italian state to adopt anti-corruption models (Law 190/2012). • Legislative Decree 254/2016 ("Decree 254/2016") on the disclosure of non-financial information, which requires public-interest entities ("PIEs") to disclose sustainability information into the reporting cycle. (Adaptation of Directive 2014/95/EU in Italy). • Legislative Decree 147/2018 on the activity and supervision of pension funds. • Legislative Decree 49/2019 Italian laws implementing the Shareholder Rights Directive (2007/36/EC) and the Shareholder Rights Directive II ("SRD II")—EU/2017/828.
G.13	Total number of incidents of non-compliance with regulations and voluntary codes concerning marketing communications, including advertising, promotion, and sponsorship, by type of outcomes	• Code of Marketing Communication Self-Regulation Italy, 68th edition effective 9 February 2021 (Art. 27—financial and real estate transactions).
G.14	Monetary value of significant fines for non-compliance with laws and regulations concerning the provision and use of products and services	• Regulation (EU) 2019/2088 (Legislative Decree No. 254/16 in Italy)

For most companies in the construction and real estate sectors, activities are heavily regulated and subject to strict oversight under both national and international legal frameworks. Consequently, laws and regulations covering these activities are well defined within the sustainability regulatory system, considering not only their high environmental impact but also the risks they pose to society. Furthermore, adopting sustainable policies increases the likelihood of securing financing under the European context of sustainable finance.

4. Discussion

This study aimed to address the significant gap in the construction industry regarding the lack of a standardized ESG framework. By providing a systematic approach to identifying and refining relevant indicators, this research builds on existing voluntary ESG reporting frameworks, contextualized within current policy compliance. It highlights areas where the industry lags in standardization. While sustainability policies in the construction industry, such as the EU Taxonomy, prioritize environmental impacts, standardized corporate policies for ESG assessment and disclosure practices remain underdeveloped. Moreover, there is a notable lack of differentiation between indicators for construction and real estate activities, with most indicators being applicable to both sectors.

During the identification phase, reference frameworks were selected based on their relevance to the construction and real estate sectors. Despite their strengths, these frameworks showed limited overlap in their indicators, suggesting limited interoperability.

The resulting framework of 118 indicators, while comprehensive, presents challenges in terms of its complexity and difficulty of assessment, as noted by stakeholders during the workshop. To address these issues, boundaries were set to focus on specific sectors and administrative levels, thus reducing the number of indicators to be applied depending on the context. Additionally, each case should, in accordance with their legal context, identify material ESG issues based on each case study, i.e., asset, portfolio, or company, further reducing the number of indicators requiring assessment and disclosure.

Although current sustainability policies in the construction industry, such as the EU Taxonomy and the DNSH principles, largely emphasize environmental impacts, the framework reveals a greater prevalence of social indicators when aligned with European regulations. This finding reflects the roots of ESG in Corporate Social Responsibility principles. In the Italian regulatory context, the framework demonstrates a stronger alignment with governance obligations, emphasizing the diverse priorities within the ESG dimension.

The analysis of the workshop results reveals that while many indicators are shared across the construction and real estate sectors, there are clear distinctions and challenges in assessing sector-specific indicators. Environmental indicators show the most variation in relevance between sectors, while governance indicators tend to be more universally applicable but difficult to measure. Social indicators, though numerous, also highlight significant challenges in assessing sensitive issues like human rights and labor practices.

Despite its contributions, this study has certain limitations. First, it focuses primarily on the Italian context, which may limit the generalizability of its findings to other regions with different regulatory and market dynamics. However, the framework, validated against European regulations, is adaptable to other EU countries during its implementation phase. Second, reliance on expert opinions in the workshop, though valuable, may introduce bias due to the subjective nature of expert perspectives and the small sample size. Lastly, further testing and validation through the application of the framework in different case studies and broader stakeholder engagement are needed to assess the framework's applicability.

Future research and policy efforts should focus on harmonizing methodologies for assessing and rating ESG indicators while establishing a clear hierarchy among them. Additionally, the construction sector must develop actionable and streamlined approaches to sustainability assessment, especially as global regulations around corporate carbon emissions and climate change become increasingly stringent. Addressing these challenges will not only enhance ESG disclosure practices but also strengthen the construction industry's contribution to global sustainability goals.

5. Conclusions and Future Developments

This study aimed to address the significant gap in the construction industry regarding the lack of a standardized ESG framework, providing a systematic approach to identifying and refining relevant indicators. It builds upon existing voluntary ESG reporting frameworks by contextualizing within current policy compliance, particularly identifying areas where the industry lags in standardization. The research contributes to the systematization of ESG indicators used in widely recognized benchmarks and contextualizes these indicators within the Italian construction industry. The identification of relevant indicators was conducted through a four-step approach. The first step involved a comprehensive review of existing ESG indicators frameworks, such as GRI and GRESB, to collect a wide range of indicators and metrics relevant to the industry. This analysis allowed the collection of an initial set of 278 indicators. The second step refined these indicators by merging overlapping metrics and contextualizing them according to the new European sustainability reporting legislation (CSRD) through a qualitative analysis of the definition and input data of each indicator. This process helped to reduce redundancy, resulting in the identification of 131 indicators and 95 KPIs categorized according to administrative level and life cycle stage.

The third step aimed to simplify the framework by reducing the number of non-required indicators to facilitate the measurement process and eliminate those indicators considered irrelevant via experts' opinions. The resulting framework consists of 118 indicators distributed in 8 categories and 49 sub-categories. Of these, 95 indicators are designated as KPIs, as they are mandated by European regulations, while 19 indicators are prioritized to specific requirements of the local context adaptation. The resulting framework is illustrated in Figure 8.

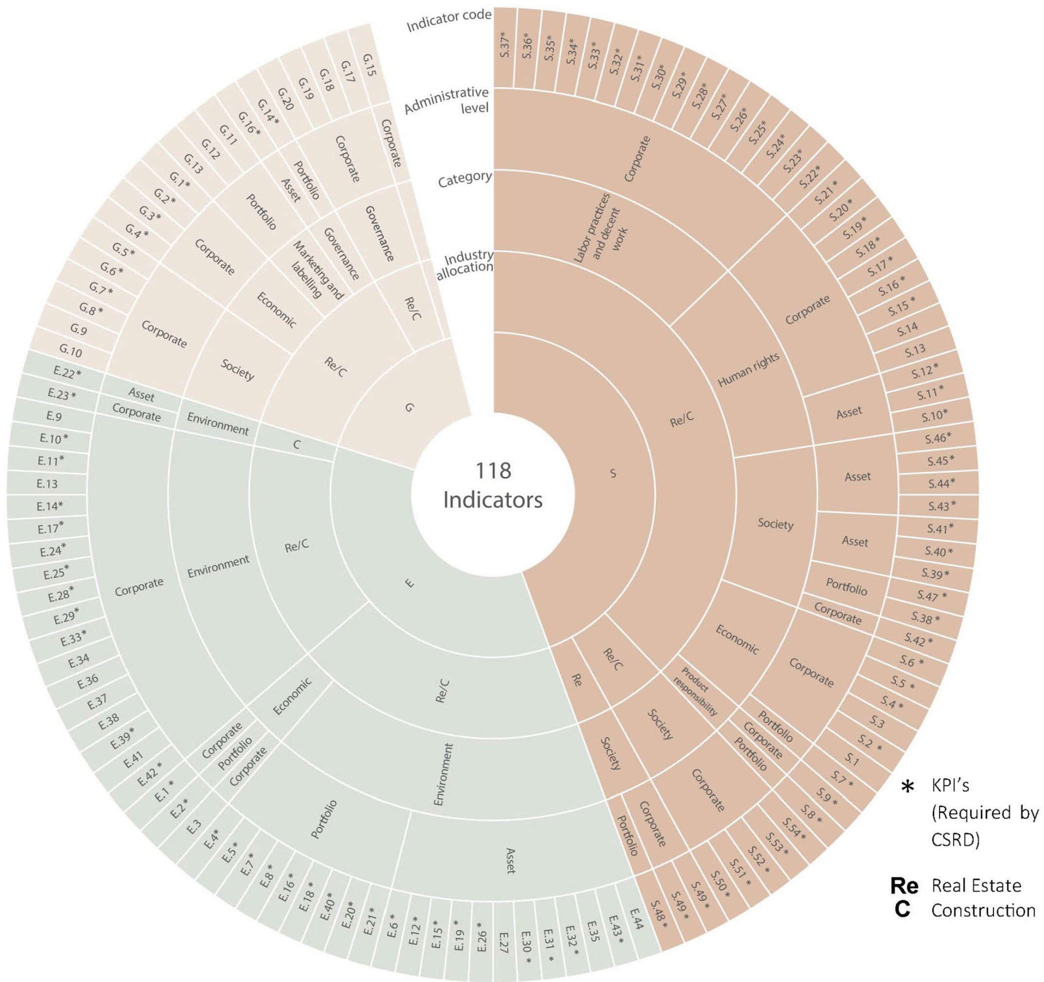

Figure 8. Final indicators framework.

This study highlights the effectiveness of participatory methods, particularly through structured workshops. The integration of participatory approaches at various steps of the process makes the assessment more inclusive and integrated to the needs and preferences of each economic sector. Engaging industry experts facilitated building consensus and ensured that the proposed frameworks address practical challenges and real sector-specific needs.

The resulting framework still presents challenges. The large number of indicators complicates the assessment process, making it both complex and resource-intensive. As noted by industry experts during the workshop, many indicators are difficult to measure and require specialized personnel for accurate assessment and disclosure, which complicates regulatory compliance and enforcement efforts.

Currently, sustainability policies in the construction industry predominantly focus on environmental impacts, such as seen in the EU Taxonomy, while there is a notable absence of standardized corporate policies addressing ESG-related accounting and reporting practices. Additionally, the distinction between indicators for construction or real estate activities was found to be minimal, as most indicators are relevant to both sectors. While ESG frameworks are more established in the real estate industry, where they assess investment viability and sustainability, these frameworks should be extended to encompass construction companies, harmonizing sustainability measures across both industries. These findings have significant implications for policymakers aiming to develop standardized frameworks specific to the construction industry, for defining expert panels to evaluate mandatory disclosures from companies, and for industry professionals who need guidelines to ensure compliance and alignment with existing frameworks. Beyond providing a foundation for future sector-specific policy development on ESG aspects, this framework provides companies with clear guidance on prioritizing key aspects to comply with regulatory requirements based on their context. Additionally, its adaptability to different EU countries enhances its practicality, serving as a standardized yet flexible tool to assess ESG in diverse contexts. Future developments should focus on harmonizing methodologies for assessing and rating ESG indicators and establishing a clear hierarchy among them. As global regulations concerning corporate carbon emissions and climate change become more stringent, the importance of ESG disclosure practices will continue to increase, underscoring the need for a more streamlined and actionable approach to sustainability assessment in the construction sector.

Supplementary Materials: The following supporting information can be downloaded at: Full indicators list. https://www.mdpi.com/article/10.3390/su17031341/s1, File S1: Complete list of indicators.

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