Article

Taxonomy and Indicators for ESG Investments

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Abstract: Instead of the well-known three-pillar model of economic, social, and environmental sustainability, the shift in valuation paradigm to the sustainable realm needs a fundamental methodological and operational modification, with a focus on determining and describing metrics, criteria, and performance indicators that can be used to support Environmental, Social, Governance (ESG)-based valuation practices. As of now (2023), there is significant language and semantic heterogeneity in the indicators, standards, and operational methods to be used while conducting ESG assessments and analyses. The primary objective of this contribution is to analyze the current ESG criteria/indicators that can be found in relevant scientific publications. A scoping review of the recent ESG literature (2015–2023) as well as a content study of the reports from the most influential worldwide rating agencies—which are now utilized as models in the usage of criteria, indicators, and ESG metric applications—have been both carried out. A total of 182 indicators (78 environmental, 64 social, and 40 governance) have been gathered as a result of the investigation. In the endeavor to design and apply ESG-focused valuation and analytical practice, sets of Key Performance Indicators for the three dimensions have been found using cluster analysis and text mining, and a reference taxonomy has been provided based on them.

Keywords: ESG investments; taxonomy; indicator sets; scoping analysis; cluster analysis; text mining

1. Introduction

Economic, social, and environmental sustainability have traditionally been the purview of international policy organizations. Recently, interest in this topic has increased in European programming and project development [1,2]. The need to include three-dimensional issues (economic, social, and environmental) in the systematization of global governance policies may be traced back to the United States' contribution in 2015. The United Nations (UN) General Assembly adopts the 2030 Agenda for Sustainable Development, which includes 17 Sustainable Development Goals (SDGs). The proposed program establishes a global imperative for the 197 countries of the UN to struggle against, and effectively reduce, poverty, climate change, and human rights damages through essential goods and services provisions for people [3,4].

The emphasis on sustainable development and defense at the sub-local level is recurring at the organizational and managerial levels of the most circumscribed territorial-production units. Businesses operating in a certain jurisdiction, for example, must commit to incorporate Environmental, Social, and Governance (ESG) factors into their operational chart [5].

ESG is an abbreviation that stands for the examination of sustainability in three ways: ecologically, socially, and in connection to governance aspects. The sociality of an organization must be defined in terms of the impact of its actions on the community with which it interacts; the organization's governance profile must be related to good business practices and

economics while taking general equity and transparency in decision making into account [6]. The European Commission developed and is implementing a reference taxonomy for each dimension with the goal of defining sustainability and enabling effective measurement [7].

Starting in 2024, big corporations and publicly listed firms must create an annual sustainability report that outlines possible contributions under the heading ESG through the use of Socially Responsible Investment (SRI) [8,9]. SRIs, which are described as procedures that include societal considerations and "worries" in investing decisions, have grown in popularity in the latter few decades of the 20th century [10–12]. There is a lack of a uniform definition of SRI in scientific literature; therefore, it may be utilized for ESG analysis at the level of a single firm rather than simply one. In general, SRIs are considered as types of investment that, in addition to focusing on an economic and financial return, are entrusted with providing forms of added value for society [13].

The SRI investment advice takes into account the production sector in which the investments are embedded and the relative importance of that sector to the underlying firms from an environmental, social, and governance (ESG) standpoint. SRIs are deemed unsuitable in activities that could harm the environment or society (for instance, but not exclusively, the production of tobacco, alcohol, and weapons); the production of clean energy, reducing pollution, and reducing carbon emissions are areas where SRIs add the most value to businesses; they also assume structural importance for businesses that aim to improve their own ESG performance in order to increase their international competitiveness. According to studies referenced in the literature, including ESG aspects into an organization's operations enhances investor interest and contributes to long-term value development [14,15].

Increased legislative attention on this topic is helping to raise understanding about the need of achieving ESG goals, including in the finance sector. This enhancing legislative significance is rippling across the investment sector, offering new value-added aspects to consider in economic analysis and valuation. In response to the challenge of integrating diverse parameters to aid with assessment activities in a sustainable way, the most widely used methodologies and instruments in the appropriate field of analysis may be monitored in each sustainable area. Each of them has separate functioning qualities and is based on various accounting domain indications. The heterogeneity under the operating light directs reflection on the most concrete path to take for concurrently addressing the ESG element inside the same decision-frame system [16–18]. What methods and tools are more appropriate than others for measuring environmental, social, and governance sustainability in business-rating exercises? What are the metrics that should be used to economically account for the effects of an organization's activities on sociality, the environment, and governance?

Today (2023), ESG rating organizations examine manufacturing businesses' sustainability performance, with the purpose of delivering a thorough and analytical assessment of ESG performance levels for every firm working on site [19,20]. Rating agencies conduct ESG assessments using publicly available information, such as company reports, websites, and open-source databases (indirect methods), or by distributing questionnaires to the company's direct employees (direct methods) [21]. The information gathered serves as a foundation for identifying, and therefore setting up, relevant criteria and/or indicators for expressing qualitatively and quantitatively the three aspects of ESG sustainability in enterprises working across a dependable production industry [21].

Although the operational objective of monitoring organizations may be definable in terms of mapping ESG performance in relation to a specific geographical environment, ratings are a subject of disagreement among academics and non-academics alike [22].

Berg et al. (2022) highlight three areas of disagreement to summarize the difficulties with ESG ratings: (1) Scope divergence, which occurs when several agencies use different criteria from the same information system to assess various ESG characteristics; (2) Measurement divergence, which refers to the variety of evaluation criteria used by ESG indicators to assess the same feature; and (3) Weight divergence, which refers to how differently each agency values certain indicators [23].

The lack of transparency surrounding the process used to determine an organization's ESG performance in accordance with the list of criteria and/or indicators used in the evaluation, as well as the weights assigned to the evaluation criteria that are taken into account in accountability operations, was identified by Windolph (2011) as the main problem across the ratings reign [24]. When findings are compared, the agencies' analysis of a wide range of firms using different evaluation criteria and procedures typically yields conflicting results [25]. Most of them show a clear preference for one or more ESG factors, giving different weights to each factor considered, and often giving preference to environmental factors over governance and social ones—which, as of 2023, remain largely unstudied and uncategorized—over the others [26].

Additionally, one of the important elements that indicates the ESG measurability discussion is the dependability of the data sources that rating agencies utilize to acquire information. This is owing to the chance that publicly accessible information regarding an organization's activities may be erroneous or inconsistent with the actual performance of those operations, resulting in rating agencies' evaluation inaccuracies [26].

The scenario as described thus far has drawn increasing attention to the unreliability of ESG factors related to economic-valuational contexts and performance analysis of corporate entities. The nature of the current work is introduced in a shaky context in order to provide a significant contribution to the Berg (2022) divergences by answering the following questions [23]:

(i)　What is the current state of knowledge on criteria and indicators for measuring the ESG aspects of a company in certain product sectors or investment forms associated with them?

(ii)　Is it possible to deduce a possible reference taxonomy, particularly for social and governance, from the definition of the criteria and indicators now proposed and used in the acronym ESG?

(iii)　What are the limitations and potentialities of standardizing ESG criteria and indicators in light of the structural characteristics of the target productive sector?

To provide answers to previously identified research questions, the authors intend to present a current snapshot of the indicators, criteria, and assessment methods used today (2023) in the field of ESG performance analysis in the production and investment sectors. The recognition work has been carried out by investigating the scientific literature of reference, so as to identify the ranking agencies that have received the most attention in the academic world for the criteria/indicators used and accounting metrics implemented in the valuation practice. In order to identify the Key-Performance Indicators (KPIs) ESG, a cluster analysis-text mining procedure was carried out among indicators of the same subject. A taxonomy is also provided for the three investigation areas (environmental, social, and governance).

The research is organized as follows: Section 2 contains the materials and methods used in the current work, specifically in Section 2.1 the taxonomy items at the European level, Section 2.2 an overview of the indicators tracked in the reference literature, and Section 2.3 the ESG accountability modes of the major international rating agencies to which the scientific literature refers for the type of criteria/indicators and ESG performance evaluation. In Section 3, the application of cluster analysis for the relevant ESG issue is reviewed, and the outcomes are shown as a potential example of taxonomy for the environmental, social and governance domains (Section 3.1) with integrating description (Section 3.2). The work's conclusions and future research pathways are discussed in Section 4.

2. Materials and Methods

The proposed work delivers a mapping of ESG criteria/indicators and reference taxonomies as a potential reference framework for sustainable valuation practises. This finding was achieved using a combination of scientific and gray research, with a focus on articles concerning ESG values with taxonomy reminders and the most often referenced and annotated reports from rating agencies in the worldwide context. The research path

based on the current contribution is depicted in Figure 1 with the steps proposed in the following sections: Section 2.1 (ESG taxonomy), Section 2.2 (ESG Performance indicators) and Section 2.3 (ESG accounting systems).
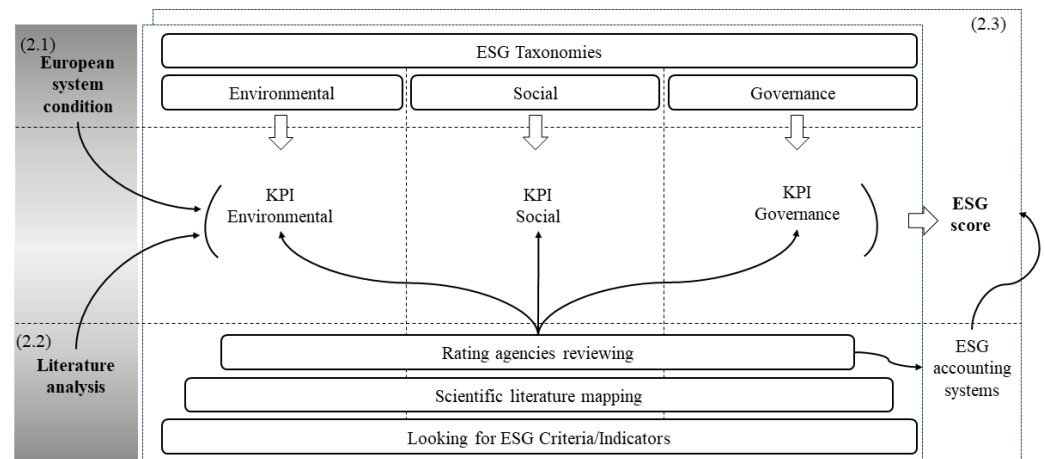

Figure 1. Research-route system.

2.1. ESG Taxonomy

The European Union developed the Environmental Taxonomy Directive, which goes into effect on 13 August 2020, with the goal of developing a framework for identifying environmentally sustainable activities. This standard provides a possible point of reference to help harmonise ESG performance practises, making it easier for investors to compare the environmental performance of various businesses and manufacturing sectors. In the upcoming election (2023), the European Union's draught regulation focuses merely on environmental issues, despite advances in proposals for defining a code for social and governance issues. On an environmental level, the goals of achieving climate neutrality by 2050 established by the European Green Deal and the Paris Agreement need the involvement of private investments in economic activities. In this context, the EU's Environmental Taxonomy Directive is required since it provides a classification system for the most environmentally sustainable activities [27,28].

The European Taxonomy on the Environment provides six goals: (1) mitigation of climate change; (2) adaptation to climate change; (3) sustainable use and protection of freshwater and marine resources; (4) transition to a circular economy; (5) pollution prevention and control; (6) protection and restoration of biodiversity of ecosystems. An activity has to fulfil four requirements in order to be deemed environmentally sustainable: (1) it must positively and significantly contribute to at least one of the six primary objectives; (2) it must not significantly harm any of the other objectives; (3) it must be held accountable for adhering to minimal social safeguards (such as those required by Organisation for Cooperation and Development and United Nations guidelines); and (4) it needs to satisfy the technical selection criteria [29].

Aside from issues directly related to the environment, the first proposal for a Social and Governance Taxonomy was published on 12 August 2021 [30]. Based on the analysis of it, the sociality goal is to provide a definition of what constitutes a social investment and which activities contribute to its achievement. In the draft proposal, it is underlined that social taxonomy overlaps the environmental one for some structural aspects: (i) the identification of which social objectives to pursue; (ii) how to contribute to the achievement of one, or more, of the objectives defined in i; (iii) adherence to the principle of "not causing significant harm"; and (iv) ensuring technical fitting. For each goal, sub-goals are proposed that address more particular issues such as health and safety, medical assistance, housing, wages, equity, consumer-health, and community sustainability [30].

In addition, two goals for governance are proposed in the text as part of the environmental and social accounting. The first is to strengthen traditional corporate governance

sustainability aspects, with sub-goals such as assessing sustainability in the highest level of government; and transparency about sustainability goals. The latter concerns the improvement of the corporate governance, and the sub-objectives are as follows: anti-corruption measures; lobbying and responsible political leadership; transparent and non-aggressive fiscal planning; diversity among members of the administrative council; and representation of citizens in advisory boards [30].

2.2. ESG Key-Performance Indicators

The Environmental, Social, and Governance (ESG) Indicators are a collection of criteria and metrics used by investors, businesses, and organizations to assess the performance and impact in social, environmental, and governance field. For the purpose of establishing which indicators were referred to date, it is necessary to take into account quantitative and qualitative data that describe the non-financial capabilities of businesses [31] as well as the environmental, social, and governance sustainability strategies employed by companies [32]. The management of ecological emergencies is taken into consideration across the environmental sustainability assessment. Adherence to business management policies that minimise the impact of human action on the depletion of ecosystems is seen as a matter of social and moral importance and as a risk to the health of the planet. Dragomir, V.D. defines business environmental performance as the balance between the impact of an organization's actions on the natural environment [33]. This balance must be maintained across the whole supply chain and during the lifespan of the products and services that an organization provides. Similarly, the assessment of the social environment is based on an examination of the effects that businesses' activities have on society. The selection of quantitative criteria is a time-consuming process since the social impact is determined by the importance attached to certain issues such as relationships with the environment, employees, customers, suppliers, and the community overall. At least, governance refers to the adoption of good business practises and the observance of economic principles, as well as the rules and strategies that control the operation of a company. In the context of ESG assessment, governance is enhanced through the examination of several factors, including: adherence to the law, the implementation of anti-corruption policies; transparency; and the diversification of administrative personalities [34]. It is well acknowledged that governance is represented by fewer and more general indicators than that for social and environmental assessment of manufacturing sectors [35].

The indicator collection referred to across the ESG evaluations was identified by first reviewing academic literature in order to choose research undertaken in the field. The Scopus web-research tool was enhanced by adding the following code, which was used to keep track of 31 publications between 2015–2023: TITLE-ABS-KEY ("environmental, social, and governance") AND TITLE-ABS-KEY (criteria) AND TI-TLE-ABS-KEY (rating) AND (LIMIT-TO (OA, "all")) AND (LIMIT-TO (LAN-GUAGE, "English"). Lists of reference indicators for each ESG dimension are provided in just a few of these contributions [8,26,36]. Each one is examined in the content, and the rating services that the authors take into account while gathering ESG indicators are identified.

Muoz-Torres et al. (2019) cite eight rating agencies as being representative of the SRI market in terms of the number of nations and companies assessed. They conducted an analysis of the key ESG metrics to rank the environmental, social, and governance issues that rating agencies in their evaluations addressed [8]. Escrig-Olmedo et al. (2019) investigate an additional eight rating agencies to better understand how rating agencies' value criteria have developed over a ten-year period, from 2008 to 2018 [26]. Senadheera et al. (2021) explore the discrepancies in ESG indices established by different rating agencies. The authors, in particular, undertake an identification of indicators typical of the environmental sector, illustrating how there is a considerable disparity between the indicator panier employed by various suppliers [36].

The study of academic literature and detailed research on five rating agencies, all of which are regularly cited in research papers [6,8,36], allow for the establishment of certain considerations about the selection and interpretation of indicators used in the construction of ESG ratings [37]. The indicators are acquired from rating agencies using

various methodologies and may be the result of data from many sources [38]. The data are usually collected by interviews and/or questionnaires in areas where there is a lack of easily accessible information in order to gain the perspectives of those concerned about the specific problems under discussion. Companies provide information to rating agencies through a range of channels, such as company documents, websites, annual reports, reports, press releases, stock market filings, and so on. As a result, rating agencies choose indicators in a variety of strategies. It should be noted that in many circumstances, the material provided is poor, resulting in a lack of candour concerning the ESG metrics.

By scanning literature for reference, a collection of 182 indicators is established, including 78 related to the environment (Table S1 in the Supplementary File), 64 related to society (Table S2 in the Supplementary File), and 40 related to governance (Table S3 in the Supplementary File), as well as the references (Authors), citations for the rating agency (Rating Agencies), and lists of the Key-Performance Indicators (KPIs) with suggested codes for identification (Code), where the upper case letter is utilized according to the reference field (Environmental, Social, Governance) [39–43]. The latter are used in a text mining-cluster analysis procedure to identify the appropriate indicator domain (Cluster). The theoretical foundation for the taxonomy-proposal is provided at the start of Section 3 with an effective explanation of the cluster technique implemented.

A scatterplot analysis is used to examine the potential functional effect between the indicators gleaned from reading the key rating agencies' reports on ESG operations and those gained from examining scientific literature sources. The suggested indicators by the authors tracked in the literature of reference produced in part by the consultation of the apport by the rating agency, as shown by the scatterplot diagram for each ESG category from Figures 2–4. This is better seen in the scatter plot for the Environmental and Social KPIs, where the rating agencies' influence plotter is more readable due to its varied colour scheme, matching of the investigated authors, and proposed set of indicators for evaluating the ESG domain. A quantifiable, confined cluster of similarity, particularly within the Environmental scatterplot, highlights the major benefit of investigating the indicators that will be employed in this field of study in terms of univocity and non-replicability. Similarly, it is feasible to show the Social KPIs in the scatterplot. In contrast, the Governance scatterplot shows a different pattern. We read a distinct and uninfluenced input in the last section on the suggestion of appropriate indicators to help the assessment process in this area of study. Each agency's contribution seems distinct and consistent in supporting advancements in the accounting of governance domains, despite the fact that neither scientific representation of interest has any influence over the proposed action indicator.

Section 2.3 provides a quick overview of the rating agencies' operative philosophy in relation to their release of indicator sets in the ESG domain.
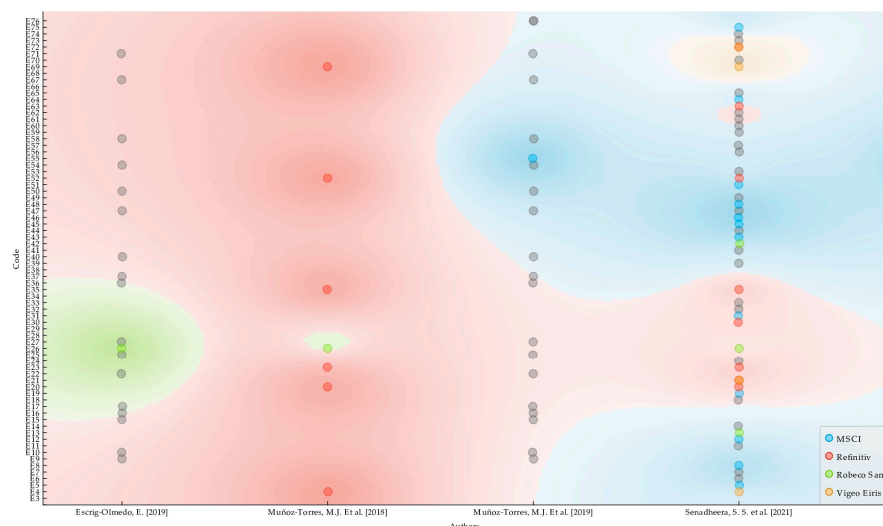

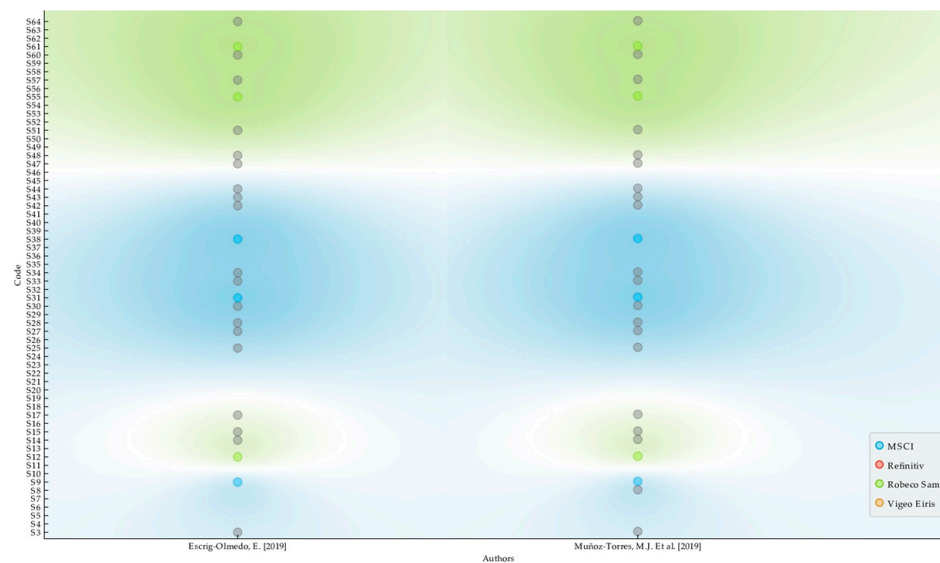**Figure 2.** Scatterplot of Environmental KPIs by scientific literature and rating agencies' proposal [8,26,36,44].

Figure 3. Scatterplot of Social KPIs by scientific literature and rating agencies' proposal [8,26].
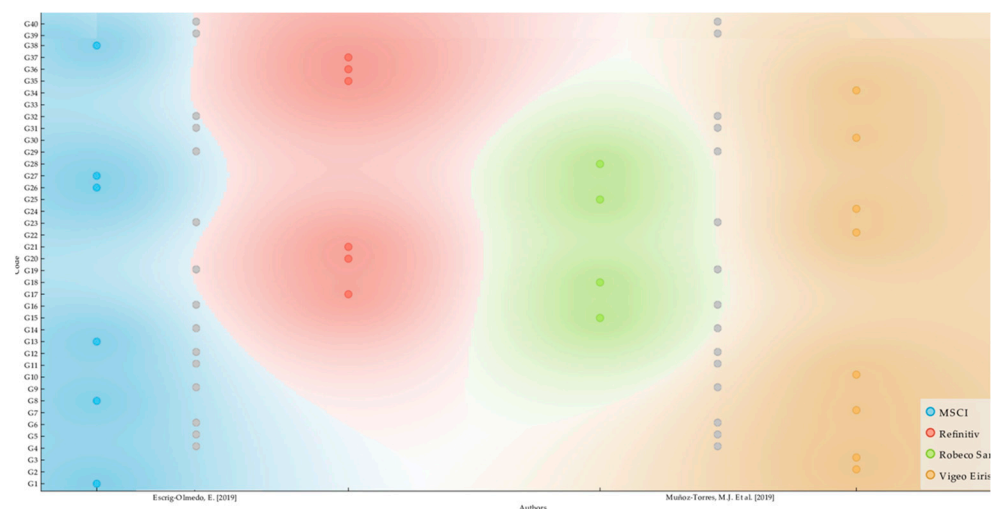

Figure 4. Scatterplot of Governance KPIs by scientific literature and rating agencies' proposal [8,26].

2.3. Systems of ESG Rating

The online documents from the rating agencies that are regarded as the best in the field's scientific literature have been examined in order to provide a synthesis of the indicators and methodologies used for ESG assessments. The rating agencies taken under consideration include (i) Refinitiv, (ii) Robeco SAM, (iii) Vi-geo-Eiris, and (iv) MSCI. The in-depth analysis that was conducted allowed for the identification of the differences between the various ESG providers and the debates surrounding such evaluations. Each of the rating agencies mentioned below provides information on the methodology used, respectively.

(i)　Refinitiv evaluates the ESG performance of 12,500 public and private companies operating on a worldwide scale, providing an ESG score based on data obtained from publicly available sources such as annual reports and company websites. Refinitiv considers over 630 metrics, with 186 being the most important per industry. The metrics are divided into ten categories: emissions, innovation, and resource utilization belong to the Environmental category; community, human rights, product responsibility, and labour force belong to the Social category; and finally, CSR strategy, management, and shareholders belong to the Governance class. Each category is subdivided into 25 topics, one by one. In general, the data gathered match topics that are grouped into ten categories, to which points are assigned that, when added together, determine

the values of the three ESG components. The ESG score is a weighted average of the scores in each category. The weight assigned to environmental and social pillars varies according to the subject of evaluation, as opposed to the weight assigned to the governance pillar, which is the same regardless of the subject of reference [39].

(ii) RobecoSAM values 3500 of the world's largest companies on the stock exchange, based on a questionnaire tailored to each industry and based on financially relevant economic, environmental, and social factors. The RobecoSAM methodology requires the definition and application to 61 analysable sets of criteria, both general and specific to standard management practises, which account for 40–50% of the total weightage. In the scope of this study, only eight broad indicators common to all industries were considered, as documented in a methodological report made available by the agency online [40,41].

(iii) Vigeo-Eiris evaluates companies' ESG performance by assigning them a composite score out of 100 for all sustainability factors in a given industry. This evaluation is based on 38 criteria, which are divided into six categories: environment, human rights, human resources, community involvement, business behaviour, and corporate governance. The social evaluation is based on a maximum of 19 criteria and provides a panoramic view of an organization's ability to manage risks and opportunities in relation to the labour force that operates inside the organization and the community with which the organization interacts. Similarly, the Governance Assessment provides a rating of a company's ability to manage risks and opportunities related to two major topics: corporate governance and business ethics based on a maximum of seven criteria. Finally, the environmental assessment focuses on the company's ability to manage environmental issues from the standpoint of internal management, supply chain, and product security [42].

(iv) The MSCI is based on an examination of risks and financially advantageous opportunities for the company. The ESG accounting methodology is built on a seven-point scale and is based on a negarchical structure that divides the three pillars of environmental, social, and governance sustainability into ten categories. Climate change, natural capital, resource constraints, and environmental opportunities are the topics that pertain to the environmental realm. The topics that affect the social dominion are human capital, product responsibility, stakeholder positioning, and social prospects. Finally, the two topics that relate to the governance are the corporate governance and the corporate behaviour. These topics have been divided up into 33 ESG important concerns for the sake of the current research [43].

3. Cluster Analysis in Taxonomy-Proposal Perspective

3.1. Clustering Results

As mentioned in Section 2.2, a summary was completed using the indications gathered by looking into the rating agencies' reports. It was carried out by using a cluster analysis to arrange objects of a similar sort into groups (clusters) [45]. Particularly in the context of text mining, cluster analysis is a technique used to categorise similar texts, phrases, paragraphs, or terms based on their content [46]. It was chosen to do cluster analysis text mining on the indicator names. The titles of the indicators utilized in the ESG ratings are reported in the scientific publications and methodological materials of the five rating agencies studied. This process was used to discover clusters of Key Performance Indicators (KPIs) by studying and thoroughly analysing each of the indicators obtained. The indicators were grouped together based on name similarity or thematic affinity. An example of clustering in regard to the environment domain is presented to demonstrate how this was accomplished. "E10.Climate change", "E11.Climate change impacts", "E12.Climate change vulnerability", and "E13.Climate change strategy" indicators, in particular, may be clustered by name similarity into a KPI cluster named "Climate change". Similarly, according to thematic affinity, the indicators "E3.Atmospheric emissions", "E8.Carbon emissions", "E9.Carbon intensity/emissions", "E20.Emissions", and "E39.Low carbon approach" have been allocated to the same cluster. These indicators investigate the topic of

climate change, but no information is provided to comprehend which aspects are looked at and how they are measured. This method yielded ten environmental, nine social, and nine governance KPI clusters.

With a few exceptions, the methodology used allowed for the definition of a cluster in which at least two indicators could be grouped: the "Clean technology opportunities" indicator identified in the environment field and the "Brand management" indicator identified in the governance field. Following the research of the indicators, it was determined that these two indicators could not be assimilated to other indicators through assonance or thematic affinity. Figures S1–S3 in the Supplementary File depict the cluster organization of the indicators set for the three ESG domains.

The detected clusters were utilized to create a suggested ESG taxonomy. The suggested taxonomy tables in the Supplementary File, Table S4 to Environmental, Table S5 to Social, and Table S6 to Governance, show the relationships between taxonomy-item, cluster, and reference KPIs. A condensed table (Table 1) is then suggested, which just provides the taxonomy components for each ESG domain. The suggested taxonomy categories are described below. In light of the objectives of the work, it is appropriate to note that the environmental domain was initially based on the EU taxonomy. In a similar vein, no reference taxonomy related to social and governance has been modified. Consequently, the European Commission's initial draught of the social and governance topic has been taken into consideration.

Table 1. Proposed taxonomy roadmap.

Taxonomy		
Environmental	**Social**	**Governance**
Climate change management and reduction	Promoting community growth and inclusion	Business ethics and efficiency, risk mitigation, sustainable goals-achievement
Sustainable use and protection of water resources	Responsible marketing and investment practices	Prevention of hostile takeover bids
Diffusion of clean technologies to ensure the sustainable use of natural resources	Protection of and respect for consumer	Transparency in remuneration and tax planning
Waste management and recycling strategies	Promoting sustainable social development	Transparency on sustainability objectives and targets
Installation, maintenance and repair of renewable energy technologies	Ensuring respect for human rights	Principles and moral values in behavior and decision making
Planning, implementation, monitoring and improvement of practices and policies to reduce negative environmental impacts	IT security and data protection and privacy	Lobbying and responsible political engagement
Protection and restoration of biodiversity and ecosystems	Promoting equality and non-discrimination at work	Protect integrity by preventing corruptive phenomena
Optimization and efficiency of the production and distribution process of goods, products and services	Ensuring healthy and safe products and services	Diversity of board members
Pollution prevention and control	Promoting respectable work condition	Effective and transparent brand management
Integrating eco-efficiency practices into production processes (goods produced and services)		

3.2. Description of the ESG Taxonomy Elements

Ten categories make up the environmental pillar's taxonomy (Table S4 in the Supplementary File).

Five of the objectives listed in the EU taxonomy are connected to four of the identified categories: "Climate change management and mitigation", "Sustainable use and protection of water resources", "Protection and restoration of bio-diversity and ecosystems», and «Pollution prevention and control".

The "Diffusion of clean technologies to ensure the sustainable use of natural resources" is another category in the environmental sector that has been suggested. The clean technology indicator was clustered separately from other variables in order to avoid assimilation. This is because a number of topics exhibit the possibilities of clean technology. Controlling and lowering carbon emissions and perhaps limiting climate change need a shift to clean technology [47].

A few applications for clean technology include energy production, waste management, and water conservation. "Clean tech" refers to processes, products, and services that guarantee the sustainable use of natural resources while minimizing environmental impact.

The category "Waste management and recycling strategies" includes indicators that evaluate the proper handling of hazardous and mineral waste as well as indicators that show compliance with recycling and sustainable packaging practises.

Two other important challenges are environmental preservation and sustainable development brought on by the use of renewable energy sources [3]. As a result, a category produced from the cluster analysis is "Installation, maintenance, and repair of renewable energy technology", which comprises a set of indicators targeted at measuring enterprises' commitment to the use of renewable energy sources.

The category "Environmental Impact and Management" comprises a number of metrics that assess environmental impacts—positive or negative—and their appropriate management. A variety of procedures, plans, and regulations under environmental management are geared towards the wise and sustainable exploitation of natural resources.

A group of indicators are included in the category "Integration of eco-efficiency practises into production processes (goods produced and services)" that track a company's eco-efficiency. This is thought to be the capacity of an organization to maximise economic value or profitability while reducing environmental effects by technical and process modifications that lessen the excessive use of natural resources during the life cycle of the good or service.

Lastly, the category "Supply chain" includes all indicators that measure the effectiveness of a company's production process, from the sourcing of raw materials, through the development of goods, services or products, to their distribution to the end customer.

The taxonomy for the social pillar is divided into nine categories (Table S5 in the Supplementary File).

The "Promoting Community Growth and Inclusion" category contains metrics that assess the organization's dedication to programs and rules that work with and support the neighbourhood to foster an inclusive environment.

Another significant subject matter, "Promoting equality and non-discrimination in the workplace", is motivated by the idea of inclusion. Indicators for measures to promote diversity and inclusion fall under this category. The priority given to this topic is reflected by the fact that 33 percent of the 64 indicators gathered under the Social Pillar fall under the category of "Promoting decent work." A goal of international public policy is to provide adequate employment. One of the three goals to be sought in the proposed social taxonomy created by the European Commission [27], concentrating on individuals in their working life or as employees, is decent employment. The 2030 Agenda, which contains objectives to safeguard workers' rights under Goal 8 (Decent labour and economic growth), also addresses the issue in question.

The "Ensuring respect for human rights" is a category that includes indicators that pay attention to both the individuals involved in the supply chain and the final consumers of goods and services. In this instance, upholding and promoting human rights while considering how actions affect communities is the objective that needs to be pursued.

A group of indicators are gathered under the "Promoting sustainable social development" category with the goal of assessing how well sustainability principles are being followed across the supply chain for goods and services. Practises for social sustainability in the supply chain put a strong emphasis on the health and happiness of individuals while also taking into consideration suppliers, producers, customers, and society at large [48]. For instance, supply chain social sustainability practises include keeping an eye on suppliers to make sure they adhere to health and safety regulations, developing new products and services that ensure social well-being, and redesigning supply chains to include the community in the production process [49].

"Responsible marketing and investment practises" makes up the final category in the social taxonomy. This group of indicators introduces the problem of ethical corporate behavior as well as the problem of sustainable investment, concentrating not only on financial returns but also on sustainability in the areas of governance, social, and environmental conditions.

There are nine categories in the taxonomy of the governance pillar (Table S6 in the Supplementary File).

Corporate governance indicators are included in the first category, which is labelled "Business ethics and efficiency, risk mitigation, and sustainability goals" that means the collection of procedures, policies, and organizational frameworks that support a company's efficient operation [50]. This group of indicators is used to assess a company's performance in achieving its sustainability and business ethics goals, as well as the strategies used to accomplish so.

The indicators under the "Prevention of hostile takeover bids" category track the defences and strategies the board of directors and management have put in place to thwart or prevent hostile takeovers. These regulations are designed to prevent an outside party from taking control of the business against the wishes of the present management and board.

The category "Lobbying and responsible political engagement" is meant to track corporate lobbying, where lobbying is defined as a company's involvement in politics in a responsible manner in order to influence laws, regulations, and policy.

Indicators that evaluate a company's brand management are part of "Effective and transparent brand management" category. A sustainable strategy necessitates that the brand be connected to honest and open business practises.

An additional problem that has to be looked at in the context of sustainable development is the corruption. Inequality, poverty, environmental degradation, and other negative social and environmental outcomes are all directly related to the effects of corruption, fraud, and the use of bribes. In this situation, commercial corruption hampers efforts to achieve sustainable development objectives. These problems are measured using indicators that are part of the "Protect integrity by preventing corrupt phenomena" category.

Both social and governmental viability depend on inclusion and the absence of prejudice. As a result, these ideas must be used while choosing a board of directors for a corporation. The company's capacity to include and represent employees on the board is evaluated under the "Diversity of board members" category.

The indicators "Transparency on sustainability objectives and targets", "Principles and moral values in behaviour and decision making", and "Transparency in compensation and tax planning" cover matters whose management has an influence on both the social and environmental conditions. The goal of decent employment, which belongs to the social pillar, and transparency in compensation are strongly related. Similar indications of how businesses adhere to and commit to sustainability include corporate ethics and Corporate-Social-Responsibility (CSR) strategies [51,52].

4. Conclusions

The lack of unequivocal Environmental, Social, and Governance (ESG) parameters and specific international reference taxonomies to be used in common valuation practises determines the necessity of identifying potential ESG criteria and indicators to assess the sustainability of investments. The incorporation of ESG considerations in valuation practises for territorial

development initiatives contributes to the achievement of the United States' 17 sustainability goals, including those on energy consumption and circular economy.

The contribution provides a rationale systematization of ESG criteria and indicators used in rating, as well as an ESG taxonomy for structuring initiatives of multiple kinds by taking note of non-monetary variables. The framework and the underlying methodological apparatus provide a reference board for steering the ESG directives in consideration of the reference production sector, due to methodological reproducibility on various scales of analysis.

The identification of ESG criteria and indicators is carried out using a Double-Way (DW) method. The first DW is based on a comprehensive assessment of relevant scientific literature in order to assess the existence of pertinent ESG indicators, metrics, and taxonomies. The second DW focuses on the literature of interest for the collection of ESG criteria, indicators that international rating agencies operating in the ESG space take into account while auditing. The process of doing a scoping operation on the documents that the five research agencies made available allowed for the collection of 180 KPIs that were then organized into a few semantic-terminological clusters. The phase of defining a potential taxonomy for each ESG dimension was supported by the cluster eviction exercise.

The indicator analysis demonstrates a tight relationship between the pillars of governance, social equality, and the environment. Adopting suitable governance systems is critical for developing policies that address social and environmental challenges. In this regard, the proposed information system, which corresponds to the Supplementary Materials table, provides innovative indicators for sustaining sustainable financial investments as measured by ESG. Specifically, the tables proposed around the social and governance taxonomy serve as innovative analytical tools to consider for grading actions on investments pertaining to various production sectors. The taxonomy-items with the relevant criteria and performance indicators have a generality and wide range of aim.

To respect the research questions mentioned at the conclusion of the Introduction Section, the results gained address the concerns raised. Regarding the first, which concerns the restoration of the present state of applicable ESG indicators in the broader context, the Supplementary Materials Tables S1–S3 provide a logical mapping of the indicator typology used in the ESG rating sector. It is evident that they come in a variety of forms, some of which include intricate accounting and measuring systems. Regarding the second point, which is the proposal for a taxonomy based on the types of indicators that are currently in use, the tables in Supplementary Materials Tables S4–S6 that highlight this approach, particularly for the social and governance dimensions, emphasise the innovative contribution that the current study has to provide. One of the earliest tools to close the gap in the subject was provided through them. If nothing else, the possibility of utilizing the gathered indicators in conjunction with the suggested taxonomy might influence the direction of all evaluation procedures that use an ESG key across different productive sectors. In particular, the taxonomy tables and indicators can serve as useful tools as well as a reference for evaluating the prospective behaviour and/or performance status in ESG paradigms per economic sector. The task at hand involves choosing the right taxonomy items and comparable indicators based on the unique characteristics of the economic division. In light of this, the methodological apparatus has several limitations regarding the procedure for incorporating letter-collected indicators, namely, which criteria may be used to carry out such an operation, as well as the structure of the taxonomies for each ESG dimension.

The research phases will include the following: (i) an analysis of the collected clusters and indicators with regard to their respective measurability and integration in economic investment valuation models; (ii) spatial and temporal classification of the indicators and clusters proposed; and (iii) the provision of an analytical system for the identification ESG indicators with the type of product sector of interest.

KPI; Table S3: Governance KPI; Table S4: Environmental taxonomy and related indicators set; Table S5: Social taxonomy and related indicators set; Table S6: Governance taxonomy and related indicators set.

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