UNIVERSITÀ DI TORINO

ISSN 2704-9906

EJSICE

Volume 4, Issue 1
April 2023

European Journal of Social Impact and Circular Economy

A Journal dedicated to the investigation and innovative research in Social Impact and Circular Economy fields.

Fully open access and available online at
http://www.ojs.unito.it/index.php/ejsice/

Aims and Scope

The European Journal of Social Impact and Circular Economy (EJSICE) is an online open-access journal published by the University of Turin. The Journal publishes quarterly (every four months) articles that contribute to the development of both theory and practice of research methods used throughout the field of social impact and circular economy. The readers of this Journal are mainly researchers, academics, PhD students and other practitioners.

Publisher

UNIVERSITÀ DI TORINO

Publisher

UNIVERSITÀ DI TORINO

Publisher

UNIVERSITÀ DI TORINO

Indexing

- BASE
- CABI
- DOAJ
- INDEX COPERNICUS
- PKP INDEX
- EBSCO DISCOVERY SERVICE
- SCIENTIFIC JOURNAL FOR ANVUR (i.e., the Italian National Agency for the Evaluation of Universities and Research Institutes) in both AREA 13 - Economic and statistical sciences and AREA 14 - Political and social sciences.

Publisher

UNIVERSITÀ DI TORINO

European Journal of Social Impact and Circular Economy

Micro-level measurement of the circularity of organizations: the Italian innovative standardized approach applied to a public sector case study

Paola Vola[1], Giorgio Cantino[2], Lorenzo Gelmini[3*]

[1] Contact Author University of Piemonte Orientale, Via del Duomo, 6, 13100 Vercelli (Italy)
paola.vola@uniupo.it

[2] University of Piemonte Orientale, Via del Duomo, 6, 13100 Vercelli (Italy)
giorgio.cantino@uniupo.it

[3*] University of Piemonte Orientale, Via del Duomo, 6, 13100 Vercelli (Italy)
lorenzo.gelmini@uniupo.it

Received: 22/11/2022
Accepted for publication: 16/04/2023
Published: 21/04/2023

Abstract

This study analyses the implementation of a circularity measurement methodology at the University of Piemonte Orientale (UPO) in the early stages of the development of the UNI1608856 project "Measuring circularity - Methods and indicators for measuring circular processes in organisations, the first attempt to assess an organisation's circularity under a standardized framework in an Italian University. The single-case study examines the organisation's framework implementation, followed by an in-depth discussion of the phenomenon under study. The circularity measurement metrics applied to the UPO case have been extracted from a draft standard prepared by the Italian standardization body (UNI). The UPO case study considers the draft's general propositions with a focus on the metrics related to the management of human resources, assets, policy, and sustainability. Some useful insights emerge from the critical analysis of the norm proposal, both regarding adopting different types of measures and implementing the circularity measurement in terms of the organisation's readiness to collect data for the metrics. As this study deals with a new framework applied to a public Organisation, several issues come to light. The first implementation of UNI1608856 allows discussion of the effective measurement of circularity at the micro level and how an organisation's managerial processes need to evolve to provide the data required to measure circularity.

Keywords: Circular economy, Circularity measurement, Metrics, Standards, Public organizations, Lifecycle

1. Introduction

The circular economy (CE) is a system approach that can replace linear industrial operating models with cyclical, closed-loop production systems based on the no-waste principle in nature, thus dissociating economic growth practices from using and exploiting natural resources (UNEP, 2006; EMF a, 2013; BSI, 2017; Ilic *et al*., 2018).

With the CE concept gaining traction in the last decade, companies and policymakers started directing their attention to what is seemingly a promising tool to foster sustainable development (Jia *et al*., 2020), underlining the importance of CE transition. As a result, an increasing number of scholars and practitioners have focused on the progress of CE initiatives, and hence the development of circularity measurement tools. Despite the growing interest in CE assessment methods, the lack of a standardized approach, a commonly agreed scientific basis, and the low applicability of these methods in organizational realities are often cited as fundamental barriers to their uptake (Saidani *et al*., 2019; Franco *et al*., 2021).

CE transition currently concerns only a small fraction of organizations able to explicitly address CE in their business processes. For these reasons, extensive literature reviews on the approaches, methods, and tools to assess CE point to the potential usefulness of a more holistic measurement framework/method (Sassanelli *et al*., 2019; Walzberg *et al*., 2021; Roos Lindgreen, Salomone & Reyes, 2020).

Given these shortcomings in CE assessments, the goal of our study is to analyse the implementation of an innovative approach to standardizing the circularity measurement of organizations that UNI/CT 057 – the technical commission of the Italian body for standardization (UNI) – proposed within the specific context of a public Organisation, the University of Piemonte Orientale. Moreover, the case study aims to identify the potential limitations of the metrics of the standard and the managerial difficulties in applying the standard itself.

In this study, we analyse the implementation of the methodology drafted in the early stages of the development of the UNI1608856 project "Measuring circularity - Methods and indicators for measuring circular processes in organizations" by the University of Piemonte Orientale. This innovative approach is a first attempt to assess an organization's circularity in view of the development of an international standard for measuring the circular economy[1].

The objective of this study is to critically discuss the framework of the methodology formulated within the UNI1608856 project and its implementation in a public Organisation from a managerial perspective. Topics like the relevance of the proposed indicators list and data availability for application to the case study are fundamental for the definition of the methodology and need to be investigated. Specifically, we focus on the micro-level of Organisation circularity, focusing on improving the environmental performance of a particular Organization (through different initiatives such as resources consumption reduction, waste management, etc.).

The remainder of the paper is organized as follows. After this brief introduction, we review the literature to assess the circular economy measurement concept. The third section describes the research design and methodology adopted. Section 4 presents the findings from our case study, Section 5 discusses the results, and the last section offers some conclusions, limitations, and future research avenues.

2. Literature review

Measuring circularity: a debated topic

The EU CE program (EU COM2015) explains that prolonging the value chain of products and services in the economy will generate a sustainable economic system that will benefit organizations, citizens, and the environment.

Due to the importance of achieving sustainability, the CE concept has in recent years garnered the increasing attention of governments, regulatory bodies, organizations, citizens, and scholars.

The CE systemic approach is aimed at expanding the lifecycle of materials, design out waste, increase resource efficiency, and achieve a better balance between different critical issues regarding economic growth, environmental protection, and social wellbeing. A particularly interesting aspect of the circular economy concept is its compatibility and consistency with sustainable development through its three associated pillars. Indeed, CE directly aims for not only economic benefits (e.g., value creation

[1] ISO 59020 "Circular Economy – Measuring and assessing circularity" – CD stage.

and savings by reducing raw materials), but also environmental benefits (e.g., impact reduction), and indirectly, social benefits (e.g., job creation) (MGI, 2015; Accenture Strategy, 2015).

Therefore, under the United Nations 2030 Agenda, a significant number of the Sustainable Development Goals (SDGs) relate to CE practices (Schroeder, Anggraeni & Weber, 2019; Rodriguez-Anton *et al*., 2019; Netherlands Enterprise Agency, 2020). Organizations and collectives are increasingly willing to move towards a more circular and sustainable economic and business model as a means of achieving commercial differentiation, competitive advantage, and potential growth with economic spillovers.

However, the Circularity Gap Report 2020 underlines that the world is only 8.6% circular, meaning that only this small percentage of all minerals, fossil fuels, metals, and biomasses are cycled back (CGRi, 2020).

While there is currently no standard CE definition, the different definitions proposed or established by major organizations and academics have much in common, tending to formalize and converge towards the same paradigm (Carencotte *et al*., 2012).

In short, the CE concept is aimed at systematically maintaining the highest value and use of products and components during their lifecycle through changing the linear loop of material flows (take-make-dispose) to a circular loop (take-make-reuse) (Franco, Almeida & Calili, 2021).

Cui and Zhang (2018) provided an extensive literature review about CE demonstrating the growing interest for the topic.

CIRAIG (2015) performed an extensive literature review and inventory of key circular economy definitions, all of which oppose the linear "make-take-waste" model. In addition, CE implies better resource management throughout the lifecycle of systems, characterized by closed loops, promoting maintenance, reuse, remanufacturing, and recycling.

The most popular definition that the Ellen MacArthur Foundation proposed is that CE includes five fundamental characteristics (design out waste, build resilience through diversity, work towards energy from renewable sources, think in systems, think in cascades), and four building blocks (circular product design, innovative business model, reverse cycles, enablers and system conditions) (EMF a, b, 2013). Moreover, the Ellen MacArthur Foundation butterfly circular economy model is one of the most acknowledged and used in businesses and academic circles (Lieder & Rashid, 2016).

Nevertheless, other studies have defined CE strategies and proposed useful frameworks (e.g., King *et al*., 2006; Jawahir & Dillon, 2007; Allwood *et al*., 2011; EMF, 2013a, 2013b, 2014; Bakker *et al*., 2014a; 2014b; Sihvonen & Ritola, 2015; Willskytt *et al*., 2016; Potting *et al*., 2017; 2018; Reike *et al*., 2018). For instance, the framework of Potting *et al*. (2017) contains a set of R-strategies, grouped around three main circularity strategies: (i) smarter product use and manufacture; (ii) extended lifespan of products and their parts; (iii) the useful application of materials. The ten R-strategies are: (i) refuse (R0); rethink (R1); reduce (R2); re-use (R3); repair (R4); refurbish (R5); remanufacture (R6); repurpose (R7); recycle (R8); and recovery (R9). Furthermore, the priority order indicates that smarter product manufacture and use (R0–R2) are preferable to product lifespan extension (R3–R7). The lowest priorities are material recycling and energy recovery from incineration and anaerobic digestion (R8–R9).

In particular, system thinking is fundamental in the circular economy paradigm. Indeed, according to Balanay and Halog (2016), it is central because designing out waste and closing the loop requires a holistic understanding, wide acceptance, and the success of circularity interventions.

The International Organization for Standardization (ISO) has enriched the international debate on CE by proposing four new norms to promote and accelerate the standardization of the circular economy. Specifically, the aim is to provide a mainframe in which circularity can be measured, intended as the groundwork for future agreements between governments, companies, and society in general. The new ISO standards imply developing indicators that measure the circularity of manufacturing processes, with the goal of reducing their environmental footprint.

According to ISO 59004 (Circular Economy – Framework and Principles for Implementation), a circular economy system uses a systemic approach to maintain a circular flow of resources by regenerating, retaining, or adding to their value while contributing to sustainable development.

In this study, we adopt the ISO framework since it contains a well-defined concept of circularity measurement as the collection, calculation, and compilation of information and/or data to determine circularity performance.

In this context, CE transitions require the ability to measure and evaluate circularity performance progress (Ruggieri *et al*., 2016; Ghisellini, Cialani & Ulgiati, 2016; Kirchherr, Reike & Hekkert, 2017; Potting *et al*., 2017; Saidani *et al*., 2019). The quantification of the circular economy and sustainability is a relevant aspect at different levels of application: (i) companies need to evaluate and improve the environmental, economic, and social impact of their products and processes; (ii) financial

bodies must have quantitative information about the potential and risks of the different initiatives to select the optimal opportunity; and (iii) policymakers must be guided toward a coherent definition of strategies at the regional, national, and international level, setting realistic targets, and measuring their effectiveness.

Some authors underlined the need of studies applied to the public sector organizations, in light of the scarcity of research focused on the implementation of CE practices and strategies in this organizational context (Klein, Ramos & Deutz, 2020).

However, the lack of comprehensive and robust approaches to quantify the circular economy makes it challenging to apply quantitative methods and indicators in different contexts and compare the results, with the risk of limiting the practical implementation of circular initiatives due to their unknown and/or unclear potential and contribution.

The CE implementation process can benefit from technology, since it plays as fundamental factor in increasing new practices and leading to more significant environmental development (Massaro et al., 2021). Moreover, the use of technology concerns not only the ability to reduce resources but also the capability to manage information thus increasing the CE's impact.

Circularity metrics description

While there is broad consensus on the need for appropriate methodological approaches to monitor and evaluate the implementation of circularity strategies in business contexts, studies of indicators measuring the adoption of multiple CE strategies are still in the embryonic stage (An, Maarten & Veronique, 2018; Janik & Ryszko, 2019; Saidani *et al*., 2019).

Indeed, measuring and assessing circularity is a complex process comprising several steps and their iteration. ISO illustrates the process in Figure 1.

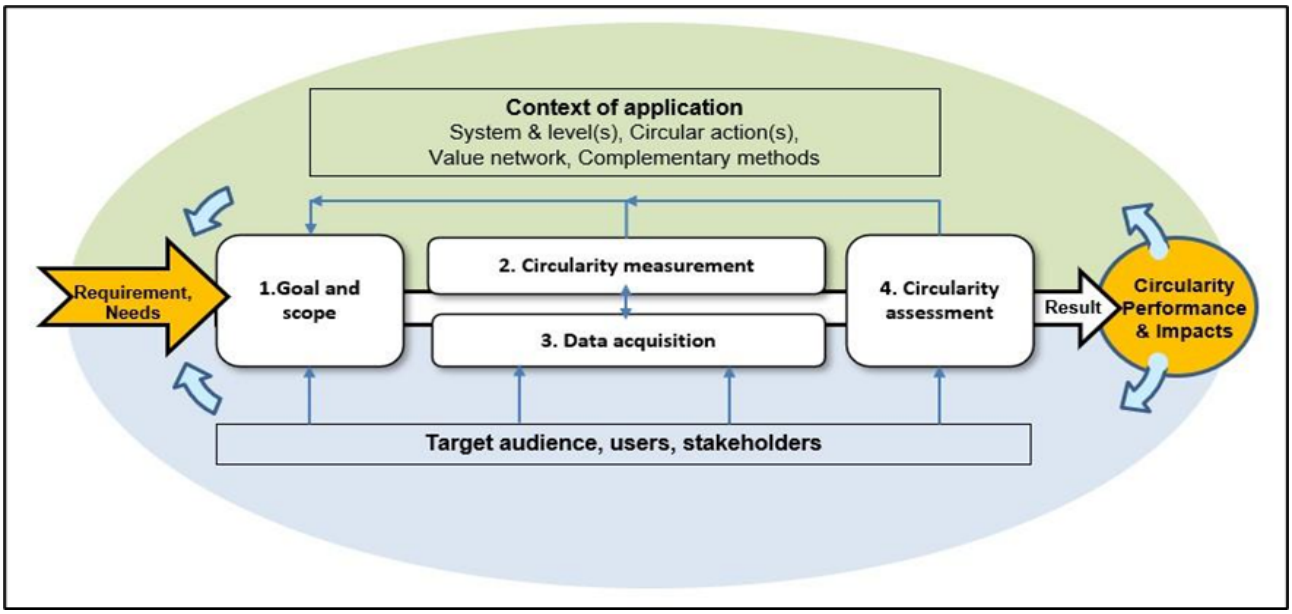


Figure 1. ISO framework for measuring and assessing circularity
(Source: ISO Standard 59020)

The interest in these metrics lies in their ability to summarize and distil the great complexity of environmental dynamics and provide more comprehensive information. Practitioners and scholars (e.g., Balanay & Halog, 2016; Saidani *et al*., 2017; Franco, Almeida & Calili, 2021) have proposed different levels of CE measurement: micro, meso, and macro.

The micro level comprises products, companies, and consumers. The meso level refers to developing an eco-industrial network that benefits regional production systems and the environment. The macro level means circular economy development in global, national, regional, or local contexts. In particular, at the micro level, the CE paradigm introduces a new perspective to look at business ecosystems. In this regard, organizations must prepare for CE transition based on their circularity performance insights, thus needing measurement frameworks to assess their circularity from a transition perspective.

Studies on indicators to measure the adoption of multiple CE strategies in organizations are still in their infancy (An, Maarten & Veronique, 2018; Janik & Ryszko, 2019; Saidani *et al*., 2019). In addition, existing guidelines and standards developed for businesses have been criticized for lacking monitoring C-indicators that link the circular economy with sustainability (Pauliuk, 2018; BSI, 2017). Moreover, a number of studies (e.g., An, Maarten & Veronique, 2018; Saidani *et al*., 2019; Iacovidou *et al*., 2017; Corona *et al*., 2019; Moraga *et al*., 2019; Potting *et al*., 2017, 2018) record the absence of standard indicators to track circularity progress within organizations, leading to misunderstandings and contradictions in implementing CE transition.

Very few indicators capture the effect of strategies concerning smarter product use and manufacture or extending the lifespan of products. Another concern is that, in general, C- indicators focus primarily on physical parameters. Social and environmental indicators are less well-defined and less frequently included in circularity performance measurement frameworks. The same is true for measuring the progress of implementing high-level circularity strategies (An, Maarten & Veronique, 2018; Saidani *et al*., 2019; Moraga *et al*., 2019; Kristensen & Mosgaard, 2020; Rincón-Moreno *et al*., 2021). In the words of Moraga *et al*. (2019, p. 460), "Most indicators focus on the preservation of materials. Strategies focusing on materials, especially recycling, are well-developed, but they are some of the existing options to promote CE recycling even being essential to the economy is not the only aspect of a sustainable CE".

In this regard, Potting *et al*. (2017) also point to the strong focus on recycling. Even so, a more ambitious CE transition towards the significant reduction of resources, material consumption, and waste generation will be based on high-circularity R-strategies.

Ghisellini, Cialani and Ulgiati (2016) underline that the most indicators concern the macro (national) and meso (inter-firm) level, with few metrics at the micro level. Moreover, the circular economy evaluations at the micro level are based on cleaner production and green consumption, which is not a full circular economy approach (Geng *et al*., 2012). As such, this approach could lead to indicators claiming to be of circular economy type at the micro level but without encompassing the overall complexity of the circular economy and all possible end-of-life options to close the loop.

Despite considerable efforts in this regard, gaps are evident in current research concerning C-indicators for monitoring and assessing the progress of organizations towards a CE transition according to their circular strategic choices. Circularity measurement indicators are aimed at providing a value expressing how circular a system is, so that these measures enable assessing the circularity of an organization. These indicators have been developed by defining the main attribute of CE (e.g., recirculated materials in a product) to then assign it a scale ranging from 0 to 100%, representing the degree of circularity.

Our literature review identifies a variety of circularity indicators. For instance, the new product-level circularity metric of Linder, Sarasini and van Loon (2017) defines circularity as "the fraction of a product that comes from a used product" (p. 551). The authors argue that a circularity index should only be focused on the reuse of materials, while other values corresponding to the CE concept (such as environmental quality) should be measured with additional indicators. This argument indicates a divergence between their definition of circularity and the CE concept where circularity relates to only one of the CE goals (material reuse).

Other indicators, such as the Circ(T) and the Global Circularity Metric, are also based on a mono-dimension circularity concept, i.e., merely considering material recirculation, and covering only (and partially) the resource efficient CE goal. For instance, the Global Circularity Metric measures global economy circularity with "the share of cycled materials as part of the total material inputs into the global economy" (De Wit *et al*., 2018, p. 22), using data from input output statistics and projections from a computable general equilibrium model (Hatfield-Dodds *et al*., 2017). In turn, Circ(T) provides a relative measure of the cumulative mass of a material present in a system over a certain time interval in terms of an ideal reference case where the material is kept functional throughout the entire accounting period T (Pauliuk *et al*., 2017). Although the focus is only on material circularity, the developers of these last indicators agree that other goals, such as material saving, value retention, environment conservation, and climate mitigation, should also be considered.

The Circularity Index is based on material circulation, but includes the notion of quality in terms of the ratio of energy required for material recovery to energy required for primary production. This approach attempts to avoid the risk of achieving resource circularity by increasing energy use. The Material Circularity Indicator (MCI) that the Ellen MacArthur Foundation (EMF) and Granta Design developed is a micro-level index built on a more complex definition of product circularity expressed as "the extent to which linear flow has been minimized and restorative flow maximized for its component materials, and how long and intensively it is used compared to a similar industry-average product" (EMF, 2015, p. 19). Since this index does not

account for the environmental and socioeconomic risks of the analysed systems, additional indicators are proposed to cover the other CE goals.

Circular Economic Value (CEV) and Circular Economy Indicator Prototype (CEIP) both build on the MCI concept. CEV represents the system's circularity by accounting for reduced use of virgin materials, reduced output of waste, increased use of renewable energies, and increased energy output during end-of-life (EoL). The CEIP index is calculated by choosing predefined answers to a series of 15 questions on product design, manufacturing, commercialization, in-use, and EoL (Cayzer, Griffiths & Beghetto, 2017). Then, a final score (in %) is determined by aggregating the obtained scores for each answer.

Our literature review shows that CE measurement has some significant limitations in terms of the scale/level. In particular, the high diversity and fragmentation of approaches and metrics makes it difficult to compare the industrial applications in which such indicators and methods are used. This fragmentation has mainly two reasons. The first is related to the overall CE umbrella concept: hundreds of CE definitions exist, and the paradigm is developing without overall consensus regarding circular actions and aspects. This diversity in the theoretical background is reflected in the industrial adoption of CE, providing very specific case studies. Consequently, these idiosyncrasies also require a tailored assessment framework, challenging replication in other contexts. The second reason that determines CE assessment fragmentation at the same scale/level is the lack of standards.

The issues related to the aforementioned circularity measurement indicators highlight the need for a unique and validated reference (standard). Therefore, in 2020 UNI (the Italian standardization body), proposed a project aimed at developing a standardized approach with the aim of defining a set of metrics that organizations could apply at different micro and meso levels.

In this study, we analyse the implementation of the UNI1608856 project that the University of Piemonte Orientale proposed. This innovative approach is a first attempt to assess an Italian university's circularity under a standardized framework. Moreover, the case study aims to identify the potential limitations of the metrics of the draft standard and the managerial difficulties in applying the standard itself in order to improve the final standard.

3. Research design and methodology

Since our aim is to investigate a first adoption of the standard, we employ a single-case study methodology to analyse the organization's implementation process, providing an in-depth discussion of the phenomenon under study (Yin, 2017). This methodology is useful to transcend the local boundaries of the investigated case, capturing new layers of reality, and developing new, testable, and empirically valid theoretical and practical insights (Eisenhardt, 1989; Eisenhardt & Graebner, 2007).

As mentioned, the issues related to above mentioned circularity measurement indicators highlight the need for a unique and validated reference. Therefore, in 2019 the National Standardization Body, UNI, nominated a Technical Committee subdivided in five working groups with the aim to develop a norm for the "Evaluation of Circularity in the Organizations - Micro and Meso level". The Technical Committee was coordinated by the National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) and composed by several experts from academy, industry and national research bodies (e.g. the National Research Council). The goal was elaborating a standardized measurement approach that could be applied to a broad range of organizations (manufacturing companies, service organizations, public entities) at the different micro, meso, and macro levels.

The first draft of this norm is the so-called UNI1608856 project, later published as a technical norm titled UNI/TS 11820. In order to identify hot-spots and potential weakness for the practical application of the developed methodology, accordingly to the implementation of an interventionist approach (Grossi *et al.,* 2021), in 2021 UNI Technical Committee launched a call for volunteers for the preliminary application of the methodology. Considering the relevance to conduct a first attempt to measure the circularity level of a public Organisation at the micro level and the potential relevance of the findings in the improvement of the first draft of the UNI1608856 project norm, authors submitted the application of the case study of the University of Piemonte Orientale (UPO). UPO has locations in three cities (Alessandria, Novara, and Vercelli), around 15.000 students, and 7 (at that time, currently 8) departments that manage the teaching and research activities.

In more detail, UPO is a young university in northern Italy that runs along three cities and eight departments, organized both for logistical ease for students and to take advantage of specific potential of different locations.

More specifically, the departments are as follows: Law and Political, Economic and Social Sciences; Science and Technological Innovation; Pharmaceutical Sciences; Economics and Business Studies; Translational Medicine and Health Sciences; Medicine; Humanities; Sustainable Development and Ecological Transition

UPO has been accepted by the Technical Committee and UPO was enrolled in the list of contributors of the experimental phase of the UNI1608856 project (pilot study).

Methodology: Circularity measurement of organizations under UNI1608856

In response to the need for a unique and validated reference, the UNI Technical Committee CT/057 "Circular Economy" thus drafted a first version of the UNI1608856 project norm. This norm is highly significant as the first standardized framework for organizations to measure and assess circularity, and a reference in the development of a future international ISO 59020 standard[2].

The project defines a set of indicators to evaluate the level of circularity of a single/group of organizations. The measurement approach is based on a rating system that is neither linked to a sectoral benchmark nor a minimum level of circularity but only considers the actual level of circularity reached in respect of the maximum reference of 100 points. It also considers the opportunities to measure the circularity level over time.

The methodological approach is based on the so-called "lifecycle perspective", a holistic approach that aims at maintaining natural flows within systems to generate value for both the ecosystem and future generations. This theory is at the base of LCA (Life-Cycle Assessment), which is a standardized methodology to evaluate the environmental impacts of all the input and output flows of a process over its lifecycle. Specifically, the methodology identifies six main lifecycle stages: design, supply-chain, production, distribution chain and selling activities, use-phase and consumption, end-of-life.

The measurement methodology consists of a set of indicators that can be applied at the micro (single Organisation) and meso level (group of organizations, industrial and local clusters, municipalities, cities, districts). The macro level is not considered in the analysis, although a list of indicators currently applied to regions and countries is included in Appendix B[3]. The type of data to be collected and the definition of the so-called "system-boundaries" follow the standardized approach in Figure 2.

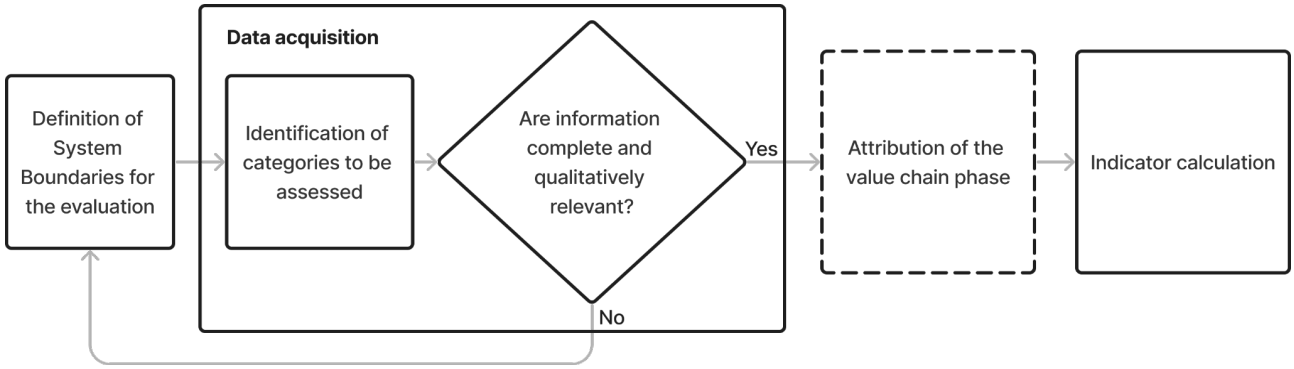


Figure 2. Flow diagram of the process of data acquisition
(Source: project UNI1608856, revision under final public inquiry)

Data acquisition first considers the elementary components needed to identify the primary data (e.g., input and output flows) to be collected using an effective and individual approach. The network of relevant stakeholders and processes involved in the assessment can be represented graphically, such as with a flow-diagram, in agreement with the LCA methodology.

Since the standardized approach to measuring circularity generally considers all private/public services, processes (bioprocesses included), and systems on two levels (micro and meso), it should be compliant with some measurement and

[2] ISO 59020 "Circular Economy – Measuring and Assessing Circularity" – CD stage

[3] UNI1608856 "Measuring Circularity – Methods and Indicators for Measuring Circular Processes in Organizations"

evaluation criteria. In particular, the nine criteria followed are applicability, coherence, compatibility, transparency, completeness, traceability, data reliability, spatial and temporal coverage, and systemic interdependencies. These criteria are then assessed with data-quality studies that characterize, for instance, data reproducibility, accuracy, precision, availability, representativeness, and so forth.

To evaluate all the different data describing the organization's circularity, three types of indicators are defined:

- Qualitative indicators = non-numerical factors that set the level of progression or positioning in respect of a target, namely qualitative data based on personal opinions.
- Quantitative indicators = numerical factors that determine the level of progression or positioning in respect of a target based on numerical and objective evaluations.
- Semi-quantitative indicators = qualitative evaluation based on a mix of qualitative and quantitative indicators.

These indicators are then grouped into six categories:

1) Management of materials and components
2) Management of energy resources
3) Management of waste and emissions
4) Management of logistics
5) Management of products/services
6) Management of human resources, assets, policy, and sustainability

According to the expected timeline shown in Figure 3, a preliminary set of 103 micro/meso indicators was defined. At the end of 2021, the CT/057 technical committee started a voluntary experimental phase of testing these indicators for applicability and validity, thus calling for volunteers to select a representative set of organizations, including manufacturing companies, service organizations, and public entities.

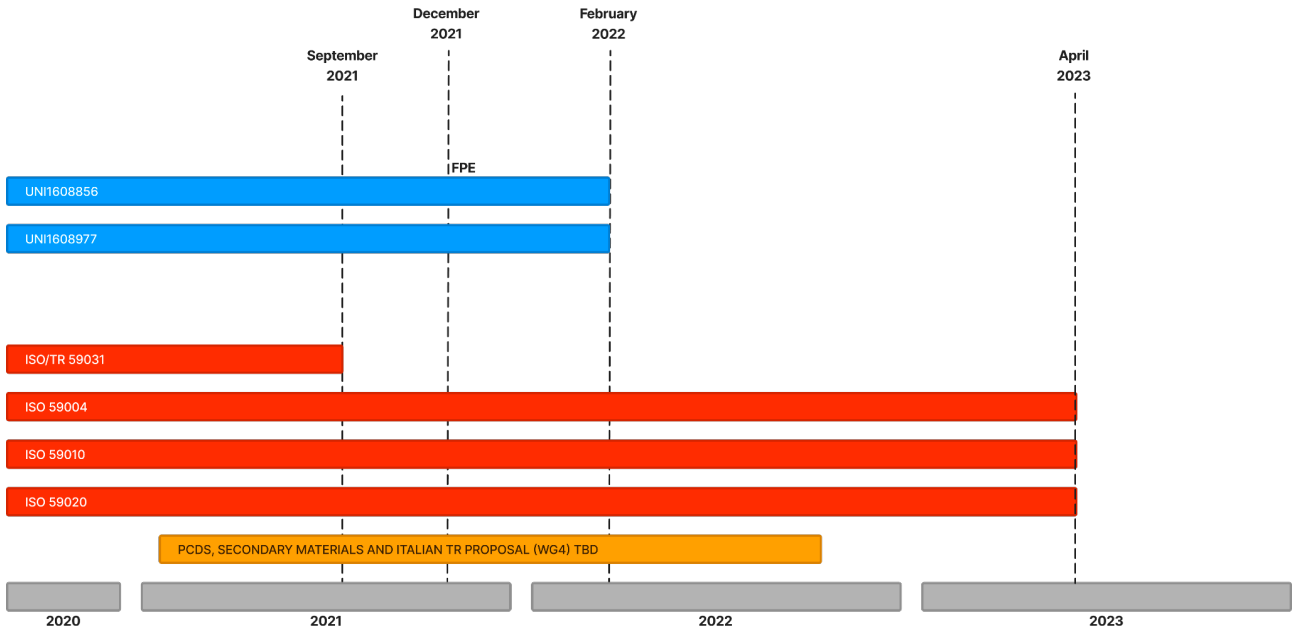


Figure 3. Timeline
(Source: UNI, Italian standardization body)

The findings allowed drafting a summary report for stakeholders and improve the methodology. The number of indicators utilized was then reduced to a set of 81, further classified as:

- Core indicators = indicators that are compulsory

- Specific indicators, if at least 50% are to be assessed
- Rewarding indicators = facultative indicators that if evaluated and different from zero lead to a higher final score[4].

These indicators are further described using additional information: progressive number, description, type of measurement (qualitative/quantitative/semi-quantitative), data-measurement unit (mass, energy, economy, ad hoc), datatype (input, output, internal), numerator and denominator for its evaluation (if present), further definitions, type of evaluation (related to a product and/or service), type of indicator (core/specific/rewarding). All these data are organized in the format of a table (as an example, see Table I).

Table I. Example of indicators for the "Human Resources, Assets, Policy, and Sustainability" category

	Description	**Type of measure**	**U.M.**	**Data type**	**Indicator calculation**		**Related definitions**	**Eval. type**	**Indicator type**
					Numerator	Denominator			
06. Indicators related to Human Resources, Assets, Policy and Sustainability									
65	Index of average energy efficiency of the organisation's buildings for civil use in (n) year Limits: Class A (100%) Class B-C (50%) Class D-F (25%) Class G (0%)	Semi-quantitative	Limits	Internal	Index of average energetic efficiency of the building for civil use in (n) year	-	Index of energy efficiency	P/S	1
68	Does the organisation disclose its sustainability and circularity performance (with a sustainability report, non-monetary declarations, etc.)?	Qualitative	Binary (Y/N)	Output	-	-	-	P/S	2
74	Investments in sustainable reconversion of assets in years (n), (n-1), (n-2) in respect of investments in sustainable reconversion of assets in years (n), (n-1), (n-2), and building new assets in years (n), (n-1), (n-2)	Quantitative	Economic	Internal	Investments in sustainable reconversion of assets in years (n), (n-1), (n-2)	(Investments in sustainable reconversion of assets in years (n), (n-1), (n-2)) + (Investments in building new assets in years (n), (n-1), (n-2))	Assets Reconversion of assets	P/S	2
Legend: Datatype: input, output, or internal Evaluation type: (S) Service, (P) Product, (P/S) Product/Service Indicator type: (1) Core, (2) Specific, (3) Rewarding									

Source: UNI1608856, revision under final public inquiry

Based on these indicators, the evaluation of products and services – separately or jointly – follows. Since this is a differential approach based on experimental data, organizations must define the expected focus *before* the actual data-analysis and

[4] UNI1608856, revision under public final inquiry

measurement phases. In fact, the three different calculation schemas to evaluate are manufacturing companies and service organizations, only manufacturing companies, and only service organizations, as reported in Table II.

Table II. Calculation schema for the evaluation of a service industry, as applied in the UPO case study.

Indicators	**Type**
04, 12, 17, 19, 20, 21, 22, 24, 65	Core
01, 02, 03, 05, 06, 09, 10, 11, 13, 14, 15, 16, 18, 26, 29, 30, 31, 33, 36, 38, 40, 41, 47, 48, 49, 50, 51, 52, 53, 58, 59, 60, 61, 62, 63, 64, 67, 68, 71, 72, 73, 74, 75, 76, 77, 81	Specific
42, 44, 66, 69, 70, 78, 79, 80	Rewarding

Source: UNI1608856, revision under final public inquiry

For each, the core, specific, and rewarding indicators are summed up separately and then divided by the relative number of indicators employed. This allows calculating the *general* level of circularity, while a further evaluation of each of the six categories of indicators enables assessing the *hotspots*. The mathematical model consists in a standardized procedure structured in the following steps:

-Be: c number of core indicators
s number of specific indicators
p number of rewarding indicators
-Be: $A \subset$ N ordered set A: $\{1, 2, ..., c\text{-}1, c\}$
$B \subset$ N ordered set B: $\{1, 2, ..., s\text{-}1, s\}$
$C \subset$ N ordered set C: $\{1, 2, ..., p\text{-}1, p\}$
-Be: $D \subseteq B \subset$ N the subset of B of specific indicators used, which must include at least 50% of elements of B set in ascending order.
D: $\{s_1, s_2, ..., s_t\}$
-Be: $E \subseteq C \subset$ N the subset of C of rewarding indicators used, which could be void or corresponds to C, then set in ascending order.
E: $\{p_1, p_2, ..., p_f\}$
-Be: a_i with $i \in A$ the core indicators $a_1, a_2, \ldots a_c$
b_j with $j \in D$ the specific indicators used $b_{s1}, b_{s2}, \ldots b_{st}$
c_k with $k \in E$ the rewarding indicators used $c_{p1}, c_{p2}, \ldots c_{pt}$

The level of circularity (LC) of an Organisation is defined as:

$$LC = \frac{\sum_{i=1}^{c} a_i + \sum_{j=s_1}^{s_t} b_j + \sum_{k=s_1}^{p_f} c_k}{c+t} \qquad if\ LC \leq 1 \text{ otherwise, } LC = 1$$

The result obtained consists in a numerical value (%) that assesses the organization's circularity level.
Thereafter, the Organisation can assess the conformity of the achieved level with respect to the level set by the norm. This assessment could be made by the Organisation itself (self-evaluation), by a second party as an interested client (consultant), or

by a third-party, thus an independent institution that works in compliance with UNI CEI EN ISO/IEC 17029. The requirements for this conformity evaluation are listed in detail in Appendix A[5].

The results obtained with the feasibility studies led to the final draft project proposal UNI 1608856 published online as a public inquiry.

4. Results: Project UNI1608856 implementation in UPO

As discussed, UNI1608856 enables overcoming the lack of precise metrics hindering the measurement of circularity of organizations at the micro level. The University of Piemonte Orientale (UPO) was among the organizations that participated in the experimental phase to test the norm's applicability. The university's participation is a first attempt to measure circularity in the public sector at the micro level. As such, the feasibility study conducted at UPO is an original case study aimed at implementing the innovative approach of UNI/TS 11820 in the public sector.

Among the six categories listed, the "Management of Human Resources, Assets, Policy, and Sustainability" was further investigated due to the general academic structure under public management. The set of indicators assessed for this category comprise 30 questions. As an example, Figure 4 shows the original indicators 81, 91, 105 and 106, as measured in the UPO case study.

[5] UNI1608856, revision under public final inquiry

081. Indicate: The Value Phase(s) and the Percentage, in the Other field, % Ratio of energy consumption, connected to energy efficiency: year n. -1, / analogous value of the year n. (%)
01 Design
02 Procurement
03 Production
04 Distribution and Sale
05 Usage / Consumption
06 End of life management
Other
091. Indicate: The Phase(s) of the Value and the Percentage, in the Other field, of Investments in asset conversion activities in year no. / Investments in asset conversion activities in year n + investments in new asset construction activities in year no. (This indicator aims to measure the ability to extend the useful life of assets - such as plants or buildings - instead of build new ones) (%)
01 Design
02 Procurement
03 Production
04 Distribution and Sale
05 Usage / Consumption
06 End of life management
Other
105. Indicate: The Phase(s) of the Value and with YES or NO in the Other field - The organization has drawn up and published the Report of Sustainability? [Based on internationally recognized certification schemes]
01 Design
02 Procurement
03 Production
04 Distribution and Sale
05 Usage / Consumption
06 End of life management
Other
106. Indicate: The Phase(s) of the Value and with YES or NO in the Other field - The organization has prepared and published the Balance of non-financial information? [ref. directive on non-financial information "NFRD" its amendments and additions and transposition into IT)
01 Design
02 Procurement
03 Production
04 Distribution and Sale
05 Usage / Consumption
06 End of life management
Other

Figure 4. Example of indicators for the "Management of Human Resources, Assets, Policy, and Sustainability" category (Source: Questionnaire for UNI1608856 early-stage revision)

In detail, 21/30 indicators are explicitly related to a specific lifecycle stage, namely use-phase and consumption (9/21), and 4/21 for other phases, such as design, supply-chain, and end-of-life, as shown in Figure 5.

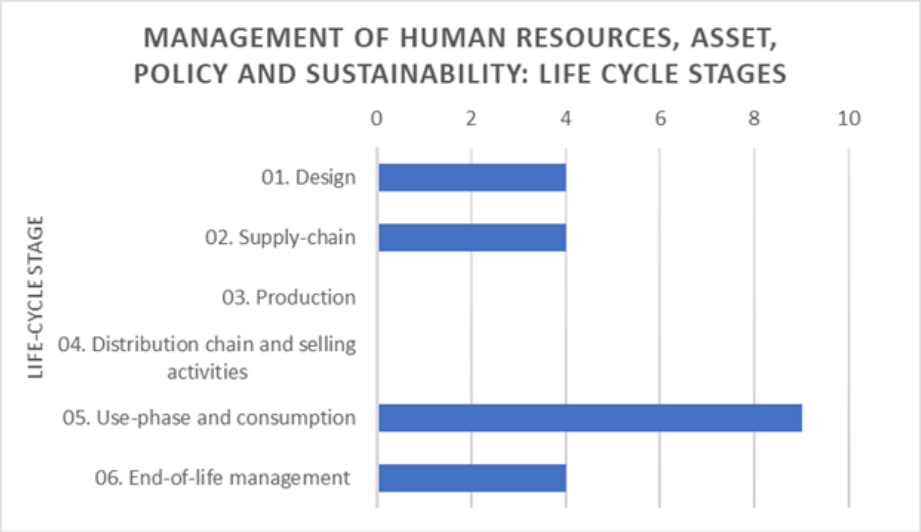


Figure 5. Lifecycle stages of the "Management of Human Resources, Assets, Policy and Sustainability" category (Source: Own elaboration)

Figure 6 shows that data were recorded for half the answers in this category.

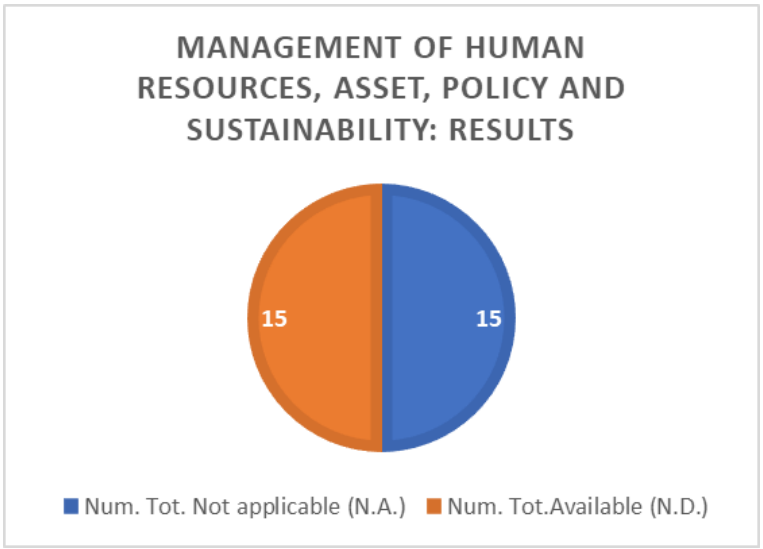


Figure 6. Results of the "Management of Human Resources, Assets, Policy, and Sustainability" category (Source: Own elaboration)

5. Discussion

The UNI1608856 project is a first proposal aimed at bridging several circularity measurement gaps outlined by scholars. Importantly, it provides a framework to measure the circularity of organizations, considering that scholars, such Ghisellini, Cialani and Ulgiati (2016), amongst others, lament the lack of circularity indicators at the micro level. Moreover, the framework is in line with initiatives dedicated to measuring circularity progress in organizations. Indeed, the methodology is based on metrics assessed at the organizational level with no reference to minimum scores but seeking desirable increases over time. This perspective is consistent with calls for indicators to measure progress in circularity (e.g., An, Maarten & Veronique, 2018; Saidani *et al*., 2019; Iacovidou *et al*., 2017; Corona *et al*., 2019; Moraga *et al*., 2019; Potting *et al*., 2017, 2018).

Moreover, the norm distinguishes the metrics proposed according to the type of activity conducted by organizations. Therefore, three different circularity calculation schemas are defined, respectively for manufacturing companies, service organizations, and manufacturing-service organizations.

This distinctive feature of the norm allows properly measuring circularity, since the determinants can vary greatly depending on the type of business.

Important to note is that for this case study, only half of the indicators proposed for the category under investigation were applicable (15 out of 30), indicating the need to discuss the metrics concerning the specific industry in which the organization operates.

Considering the applicable indicators, the results show that the data collected mostly concern the processing phases (out of the six main phases recommended). Specifically, most answers were recorded for the use-phase and the consumption lifecycle stage, and only a few for other phases.

Since UPO declared that data were unavailable ("N.D.") for many of the indicators analysed, it was impossible to obtain precise information. Indeed, the answers recorded referred to different measurement units (binary, limits, economic).

An obvious difficulty emerges: finding useful records that could be linked to the internal Organisation of information within UPO. In fact, data are not easy to access because they are gathered in many different archives. To overcome this issue, the data should be internally reorganized and better integrated with the related management activities. For example, data digitization could be enabled by the adoption of facility management systems.

Moreover, the answers related to the management of building stocks and assets highlighted a general lack of traceability concerning energy or organizational/functional interventions, likely because the collection of some data for traceability purposes is optional at the public level.

These considerations draw attention to the need to assess and evaluate the overall information system of the entire organization to find the right solutions to satisfy divergent needs, from accounting to procurement, to facility management. Some difficulties are also highlighted about human resources management. The results indicate a general need for knowledge of the circular economy principles at many levels, from education and the assignment of specific tasks to employees, to communication between stakeholders and students.

The results also show a general need for knowledge of international certification schemes for energy and environmental management (e.g., ISO 50001), as well as for sustainability reports and non-financial statements.

Therefore, a main recommendation is to include circular economy issues within the management of human resources, assets, policy, and sustainability at UPO. To ensure successful circular economy transitions, organizations require qualified staff with specific skills. In addition, education and training systems focused on circularity are critical in the human resource management.

6. Conclusions, limitations, and further research

Moving from the ISO Framework mentioned in the literature review, the UPO case study highlights some critical points with regard to the methodology proposed to measure circularity according to the UNI1608856 project. In view of similar problems emerging in other experimentations, some revisions were made to the first project of the norm. First, further categorizing the indicators as core/specific/rewarding, second, downgrading some from "core" to "rewarding", thus facultative, which allows slightly mitigating the problem of the consistent number of "not applicable" (N.A.) answers, as highlighted by the UPO case study.

Moreover, since the total number of indicators seemed ineffective, their number was reduced to a set of 81, further categorized with respect to "evaluation type", namely service, product, or product/service (see Table I). The distinction between evaluation type should be made *before* the actual data-analysis and measurement phase. In fact, when based on precise indicators, the description of products and/or services would be more detailed. For instance, in the revised norm, the number of indicators for the "Management of Human Resources, Assets, Policy, and Sustainability" category was reduced to 18, and further classified as core/specific/rewarding. Therefore, the original indicators reported in Figure 4 were re-elaborated as those in Table I, so the number 81 became 65 in the final revision, number 105 and 106 were merged in number 68, and the 91 was renamed as number 74.

However, the procedure described in the UNI1608856 project to measure the level of circularity of organizations is expected to be applied on a voluntary basis. The analysis of manufacturing companies and service organizations at the micro and meso level is likely to be up-scaled if some criteria are to be assessed on a mandatory basis. For instance, this would help identify benchmarks and hotspots in respect of different life stages and categories, thus gaining meaningful data to improve the circular economy also at the national level. Moreover, any activity of third-party evaluations of the conformity of results is highly recommended. This would set a proper basis to improve communications between stakeholders at the general level, as in the case of Type III environmental declarations (UNI EN ISO 14025:2010), for example. In fact, these provide objective and comparable data related to the environmental performance of products and services, without setting minimum levels, similarly to the scope of the UNI1608856 project with respect to the circular economy.

As concerns the research limitations, this study is based on a single case of the implementation of a working draft of a standard.

The results would benefit from measuring the circularity level of UPO once the UNI/TS 11820 norm is published. Furthermore, the application of the standard to other public organizations could highlight relevant hotspots useful for future revisions of the standard, as well as considerations derived from the implementation of the norm by different types of organizations. In this respect, in fact, UNI1608856 is applicable to all organizations and the case of UPO could, in general, foster useful insights.

References

Accenture Strategy (2015), "Gaining an edge: growth, innovation and customer value from the circular economy", available at https://www.accenture.com/us-en/insight-circular-economy-gaining-edge (accessed 20 April 2022).

Allwood, J.M., Ashby, M.F., Gutowski, T.G. and Worrell, E. (2011), "Material efficiency: a white paper", *Resources, Conservation and Recycling*, Vol. 55 No. 3, pp. 362-381.

An, V., Maarten, C. and Veronique, V.H. (2018), "Indicators for a circular economy", available at https://vlaanderen-circulair.be/en/summa-ce-centre/publications/indicators-for-a-circular-economy (accessed 20 April 2022).

Bakker, C., Wang, F., Huisman, J. and Den Hollander, M. (2014a), "Products that go round: exploring product life extension through design", *Journal of Cleaner Production*, Vol. 69, pp. 10-16.

Bakker, C.A., Den Hollander, M.C., Van Hinte, E. and Zijlstra, Y. (2014b), *Products that Last: Product Design for Circular Business Models.* TU Delft Library, Deft.

Balanay, R. and Halog, A. (2016), "Charting policy directions for mining's sustainability with circular economy", *Recycling*, Vol. 2, pp. 219–231.

BSI (2017), "Framework for implementing the principles of the circular economy in organizations - guide", available at https://www.thenbs.com/PublicationIndex/documents/details?Pub=BSI&DocID=317511 (accessed 20 April 2022).

Carencotte, F., Geldron, A., Villeneuve, J. and Gaboriau, H. (2012), "Economie circulaire et recyclage des métaux", *Geosciences*, Vol. 15, pp. 64–71.

Cayzer, S., Griffiths, P. and Beghetto, V. (2017), "Design of indicators for measuring product performance in the circular economy", *International Journal of Sustainable Engineering*, Vol. 10 No. 4-5, pp. 289-298.

CGRi (2020), "The circularity gap report 2020", available at https://www.circularity-gap.world/2020 (accessed 20 April 2022).

CIRAIG (2015), "Circular economy: a critical literature review of concepts", *Bibliothèque et Archives Nationales du Québec*, Quebec City, QC, Canada.

Corona, B., Shen, L., Reike, D., Carreón, J.R. and Worrell, E. (2019), "Towards sustainable development through the circular economy. A review and critical assessment on current circularity metrics", *Resources, Conservation and Recycling*, Vol. 151, pp. 104498.

Cui, T., & Zhang, J. (2018). Bibliometric and review of the research on circular economy through the evolution of Chinese public policy. Scientometrics, 116(2), 1013-1037.

De Wit, M., Hoogzaad, J., Ramkumar, S., Friedl, H. and Douma, A. (2018), "The circularity gap Report: an analysis of the circular state of the global economy", available at https://pacecircular.org/sites/default/files/2020-01/Circularity%20Gap%20Report%202018_0.pdf (accessed 20 April 2022).

Eisenhardt, K.M. (1989), "Building theories from case study research", *Academy of Management Review*, Vol. 14 No. 4, pp. 532-550.

Eisenhardt, K.M. and Graebner, M.E. (2007), "Theory building from cases: opportunities and challenges", *Academy of Management Journal*, Vol. 50, No. 1, pp. 25–32.

EMF (2013a), "Towards the circular economy Vol. 1: an economic and business rationale for an accelerated transition", available at https://ellenmacarthurfoundation.org/towards-the-circular-economy-vol-1-an-economic-and-business-rationale-for-an (accessed 20 April 2022).

EMF (2013b), "Towards the circular economy Vol. 2: opportunities for the consumer goods sector", available at https://emf.thirdlight.com/link/coj8yt1jogq8-hkhkq2/@/preview/1?o (accessed 20 April 2022).

EMF (2014), "Towards the circular economy Vol. 3: accelerating the scale-up across global supply chains", available at https://emf.thirdlight.com/link/t4gb0fs4knot-n8nz6f/@/preview/1?o (accessed 20 April 2022).

EMF (2015), "Material circularity indicator", available at https://ellenmacarthurfoundation.org/material-circularity-indicator (accessed 20 April 2022).

EU (2015), COM2015 "Closing the loop – an EU action plan for the circular economy", available at https://www.eea.europa.eu/policy-documents/com-2015-0614-final (accessed 20 April 2022).

Franco, N.G., Almeida, M.F.L. and Calili, R.F. (2021), "A strategic measurement framework to monitor and evaluate circularity performance in organizations from a transition perspective", *Sustainable Production and Consumption*, Vol. 27, 1165–1182.

Geng, Y., Fu, J., Sarkis, J. and Xue, B. (2012), "Towards a national circular economy indicator system in China: An evaluation and critical analysis", *Journal of Cleaner Production*, Vol. 23 No. 1, pp. 216–224.

Ghisellini, P., Cialani, C. and Ulgiati, S. (2016), "A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems", *Journal of Cleaner Production*, Vol. 114, pp. 11–32.

Grossi, G., Biancone, P. P., Secinaro, S., & Brescia, V. (2021). Dialogic accounting through popular reporting and digital platforms. Meditate Accountancy Research, 29(7), 75-93.

Hatfield-Dodds, S., Schandl, H., Newth, D., Obersteiner, M., Cai, Y., Baynes, T., ... and Havlik, P. (2017), "Assessing global resource use and greenhouse emissions to 2050, with ambitious resource efficiency and climate mitigation policies", *Journal of Cleaner Production*, Vol. 144, pp. 403-414.

Iacovidou, E., Velis, C.A., Purnell, P., Zwirner, O., Brown, A., Hahladakis, J., ... and Williams, P. T. (2017), "Metrics for optimising the multi-dimensional value of resources recovered from waste in a circular economy: a critical review", *Journal of Cleaner Production*, Vol. 166, pp. 910-938.

Ilic, D., Eriksson, O., Odlund, L., and Aberg, M. (2018), "No zero burden assumption in a circular economy", *Journal of Cleaner Production*, Vol. 182, pp. 352–362.

Janik, A. and Ryszko, A. (2019), "Circular economy in companies: an analysis of selected indicators from a managerial perspective", *Multidisciplinary Aspects of Production Engineering*, Vol. 2 No. 1, pp. 523-535.

Jawahir, I.S. and Dillon, O.W. (2007), "Sustainable manufacturing processes: new challenges for developing predictive models and optimization techniques", *Proceedings of the First International Conference on Sustainable Manufacturing.* Montreal, Canada.

Jia, F., Yin, S., Chen, L. and Chen, X. (2020), "The circular economy in the textile and apparel industry: a systematic literature review", *Journal of Cleaner Production*, Vol. 259, pp. 120728.

King, A.M., Burgess, S.C., Ijomah, W. and McMahon, C.A. (2006), "Reducing waste: repair, recondition, remanufacture or recycle?", *Sustainable Development*, Vol. 14 No. 4, pp. 257-267.

Kirchherr, J., Reike, D. and Hekkert, M. (2017), "Conceptualizing the circular economy: an analysis of 114 definitions", *Resources, Conservation and Recycling*, Vol. 127, pp. 221-232.

Klein, N., Ramos, T. B., & Deutz, P. (2020). Circular economy practices and strategies in public sector organizations: An integrative review. Sustainability, 12(10), 4181.

Kristensen, H.S. and Mosgaard, M.A. (2020), "A review of micro level indicators for a circular economy–moving away from the three dimensions of sustainability?", *Journal of Cleaner Production*, Vol. 243, pp. 118531.
Lieder, M. and Rashid, A. (2016), "Towards circular economy implementation: a comprehensive review in context of manufacturing industry *Journal of Cleaner Production*, Vol. 115, pp. 36–51.
Linder, M., Sarasini, S. and van Loon, P. (2017), "A metric for quantifying product-level circularity", *Journal of Industrial Ecology*, Vol. 21 No. 3, pp. 545-558.
Massaro, M., Secinaro, S., Dal Mas, F., Brescia, V., & Calandra, D. (2021). Industry 4.0 and circular economy: An exploratory analysis of academic and practitioners' perspectives. Business Strategy and the Environment, 30(2), 1213-1231.
MGI (2015), "Europe's circular economy opportunity", available at: https://www.mckinsey.com/business-functions/sustainability/our-insights/europes-circular-economy-opportunity (accessed 20 April 2022).
Moraga, G., Huysveld, S., Mathieux, F., Blengini, G.A., Alaerts, L., Van Acker, K., ... and Dewulf, J. (2019), "Circular economy indicators: what do they measure?", *Resources, Conservation and Recycling,* Vol. 146, pp. 452-461.
Netherlands Enterprise Agency (2020), "Circular Economy & SDGs: How circular economy practices help to achieve the sustainable development goals", available at https://circular economy.europa.eu/platform/sites/default/files/3228_brochure_sdg_-_hch_cmyk_a4_portrait_-_0520-012.pdf (accessed 20 April 2022).
Pauliuk, S. (2018), "Critical appraisal of the circular economy standard BS 8001: 2017 and a dashboard of quantitative system indicators for its implementation in organizations", *Resources, Conservation and Recycling*, Vol. 129, pp. 81-92.
Pauliuk, S., Kondo, Y., Nakamura, S. and Nakajima, K. (2017), "Regional distribution and losses of end-of-life steel throughout multiple product life cycles. Insights from the global multiregional MaTrace model", *Resources, Conservation and Recycling*, Vol. 116, pp. 84-93.
Potting, J., Hanemaaijer, A., Delahaye, R., Ganzevles, J., Hoekstra, R. and Lijzen, J. (2018), "Circular economy: what we want to know and can measure. Framework and baseline assessment for monitoring the progress of the circular economy in the Netherlands", *PBL Policy Report*, 3217.
Potting, J., Hekkert, M.P., Worrell, E. and Hanemaaijer, A. (2017), *Circular Economy: Measuring Innovation in the Product Chain* (No. 2544). PBL Publishers.
Reike, D., Vermeulen, W.J. and Witjes, S. (2018), "The circular economy: new or refurbished as CE 3.0? Exploring controversies in the conceptualization of the circular economy through a focus on history and resource value retention options", *Resources, Conservation and Recycling*, Vol. 135, pp. 246-264.
Rincón-Moreno, J., Ormazábal, M., Álvarez, M.J. and Jaca, C. (2021), "Advancing circular economy performance indicators and their application in Spanish companies", *Journal of Cleaner Production*, Vol. 279, pp. 123605.
Rodriguez-Anton, J.M., Rubio-Andrada, L., Celemín-Pedroche, M.S. and Alonso-Almeida, M.D.M. (2019), "Analysis of the relations between circular economy and sustainable development goals", *International Journal of Sustainable Development & World Ecology*, Vol. 26 No. 8, pp. 708–720.
Roos Lindgreen, E., Salomone, R. and Reyes, T. (2020), "A critical review of academic approaches, methods and tools to assess circular economy at the micro level", *Sustainability*, Vol. 12 No. 12, p. 4973.
Ruggieri, A., Braccini, A.M., Poponi, S. and Mosconi, E.M. (2016), "A meta-model of inter-organisational cooperation for the transition to a circular economy", *Sustainability*, Vol. 8 No 11, pp. 1153.
Saidani, M., Yannou, B., Leroy, Y. and Cluzel, F. (2017), "How to assess product performance in the circular economy? Proposed requirements for the design of a circularity measurement framework", *Recycling*, Vol. 2 No. 1, pp. 6.
Saidani, M., Yannou, B., Leroy, Y., Cluzel, F. and Kendall, A. (2019), "A taxonomy of circular economy indicators", *Journal of Cleaner Production*, Vol. 207, pp. 542-559.
Sassanelli, C., Rosa, P., Rocca, R. and Terzi, S. (2019), "Circular economy performance assessment methods: a systematic literature review", *Journal of Cleaner Production*, Vol. 229, pp. 440–453.
Schroeder, P., Anggraeni, K. and Weber, U. (2019), "The relevance of circular economy practices to the sustainable development goals", *Journal of Industrial Ecology*, Vol. 23 No. 1, pp. 77–95.
Sihvonen, S. and Ritola, T. (2015), "Conceptualizing ReX for aggregating end-of-life strategies in product development", *Procedia Cirp*, Vol. 29, pp. 639-644.
UNEP (2006), "Circular economy. An alternative model for economic development", available at https://www.yumpu.com/en/document/read/27541847/circular-economy-unep (accessed 20 April 2022).
Walzberg, J., Lonca, G., Hanes, R., Eberle, A., Carpenter, A. and Heath, G.A. (2021), "Do we need a new sustainability assessment method for the circular economy? A critical literature review", *Frontiers in Sustainability*, Vol. 1, pp. 620047.

Willskytt, S., Böckin, D., André, H., Ljunggren Söderman, M. and Tillman, A.M. (2016), "Framework for analysing resource-efficient solutions", available at https://publications.lib.chalmers.se/records/fulltext/245234/local_245234.pdf (accessed 20 April 2022).
Yin, R.K. (2017), *Case Study Research and Applications: Design and Methods*. Sage Publications, Los Angeles, CA.

European Journal of Social Impact and Circular Economy

Urban transformation: environmental issues, wicked problems, and transport development in the context of circular economy

Daneš Brzica[1*]

[1] Contact Author Institute of Economic Research, Slovak Academy of Sciences, Šancová 56, 81105 Bratislava (Slovakia) danes.brzica@gmail.com

Received: 16/09/2022
Accepted for publication: 10/02/2023
Published: 21/04/2023

Abstract

The paper brings some perspectives on new challenges for the synergy of urban transformation, environmental issues and transport development in the circular economy (CE) context. Considering that the number of studies on the given topics only pays attention to some selected areas, we bring a more comprehensive view of the current challenges for cities. The growing size of cities and population density are putting pressure on urban transport systems. As a result of the increasing intensity of traffic and economic activity, there is an increase in emissions in cities. Making decisions about changes in the city becomes more complex. The paper indicates the nature of "wicked" problems and obstacles in implementing the CE model in the context of sustainable transport/mobility development in big cities. It also demonstrates the situation in selected European cities regarding pollution and transport performance indicators. While the traditional city policy approach is predominantly based on the need to maintain the *status quo* and the reality of the city´s functioning is perceived as a routine matter, new approaches should work with challenges as opportunities for change towards greater efficiency and environmental sustainability and take into account new approaches to the governance of cities. One of the possible directions of urban development is using the CE in the context of the strategy of cities in the transport field. This could improve the situation within the goals of SDG 11. Solutions based on traditional approaches can cause disorders in the functioning of big cities, weaken their resilience and thus threaten their further development. In the future, the city leaders and other stakeholders will have to reevaluate traditional approaches to city governance in this area, as it can be assumed that an increasing number of "wicked" challenges will arise, which will need to be quickly/effectively resolved about the justified needs of city residents.

Keywords: governance; transport; cities; "wicked" problems; emissions; UN SDG 11 goals, circular economy

1. Introduction

Considering that the number of studies on the given topics only pays attention to some selected areas, we bring a more comprehensive view of the current challenges for cities. The growing size of cities and population density are putting pressure on urban transport systems. As a result of the increasing intensity of traffic and economic activity, there is an increase in emissions in cities. Making decisions about changes in the city becomes more complex. The paper brings some perspectives on new challenges for the synergy of urban transformation, environmental issues and transport development in

European Journal of Social Impact and Circular Economy - ISSN: 2704-9906
DOI: 10.13135/2704-9906/7040 Published by University of Turin http://www.ojs.unito.it/index.php/ejsice/index

the circular economy (CE) context. This involves overcoming many barriers. The present study viewed that (1) cities will represent residences for an ever-increasing share of the world's population; (2) urban transport will require the fulfilment of many conditions regarding the ecological sustainability of the urban environment, and (3) CE has the potential to contribute to solving new "wicked" challenges. "Cities generate a significant share of global GDP, consume significant energy resources and generate substantial volumes of waste and emissions. Urban areas are home to over 75% of the EU's population: creating around 70% of jobs and generating over 85% of the EU's GDP. Cities, responsible for about 80% of energy use, are essential for Europe's transformation to a climate neutral continent by 2050, as set out in the European Green Deal" (Eurocoties, 2020). Air pollution has escalated to hazardous levels in many cities. With the growth of a modern industrial sector and car ownership, but without enforceable pollution and vehicle emissions regulations, various toxic chemicals are released into the atmosphere in large cities (Knox and McCarthy, 2012). Among monitored pollutants belong not only particulate matter (PM_{10} and $PM_{2.5}$), but also nitrogen oxides (NO_x), Sulphur dioxide (SO_2), carbon monoxide (CO), total organic carbon (TOC), hydrogen chloride (HCl), and total dust (EPA, 2020).

The main obstacles to the development of transport in cities include economic, technical, organizational, environmental, informational, regulatory, infrastructural, and personnel. For example, in recent history, Citi Bank´s 100 bn USD Environmental Finance Goal was one of the initiatives in its Sustainable Progress Strategy. The strategy was organized into three pillars, and investment areas included renewable energy, green bonds, energy efficiency projects and green buildings, also sustainable transportation. Citi Bank´s share of environmental financing activities totalled 41.2 bn USD from 2014 through 2016 (Hoek, 2014). Sustainable transport is a significant component of sustainable urban development, and it seems that the CE can help address these challenges in this context. However, implementing changes – including support for the CE and the transport sector – may be threatened or slowed down by the nature of decision-making processes in complex entities such as large cities. The interests of various interest groups (stakeholders) are concentrated in large cities. Advocacy of these - often conflicting or significantly different - interests can slow down or completely stop decision-making processes. Wicked problems are specific forms of decision-making problems in complex entities. This paper aims to indicate the nature of "wicked" problems and obstacles in implementing the CE model in the context of transport/mobility development in big cities. It also demonstrates the situation in selected European cities regarding pollution and transport performance indicators.

2. Literature review

There is a wealth of literature related to the areas discussed here. This group includes works focused on (a) circular economy – e.g., COM (2015, 2018, 2019), Korhonen, Honkasalo and Seppälä (2018), Kautto and Lazarevic (2020), Milios (2017), Bocken, de Pauw, Bakker and van der Grinten (2016), Kirchherr, Reike and Hekkert (2017), Nylén and Salminen (2019), Ghisellini, Cialani and Ulgiati (2016) and COM (2015, 2018, 2019), but also works oriented (b) to wicked problems – e.g., Head (2022). Ghisellini et al. (2016) provide a very detailed overview of CE. For example, studies by Korhonen, Honkasalo and Seppälä (2018) and Kirchherr, Reike and Hekkert (2017) also deal with conceptual matters. Works focused on air pollution include, for example, EPA (2020). Hong et al. (2014) discussed challenges and opportunities for developing sustainable transportation systems (STSs) – in this case, for Beijing's capital. Johansson et al. (2016) discussed issues related to the paradigm shift from mobility to sustainable accessibility. However, only a few are simultaneously devoted to urban transformation, environmental issues, and transport development in the circular economy (CE) context. Nylén and Salminen (2019), for example, deal with how the circular economy discourse affects policymaking. A circular economy perspective embraces a systemic notion that things are designed to be reused as long as possible and then recaptured and repurposed when reuse is no longer possible (Bals, Tate and Ellram (2022). In terms of methodology, the CRA (Constructed Regional Advantage) approach mentioned in the work Asheim et al. (2006), "wicked" problems approach in public policy (Head, 2022, 2008) and MLG approach (multi-level governance) mentioned in the work Brzica et al. (2014) were used. Moser et al. (2012) and Head (2008) provide good insight into "wicked problems" issues. One of the documents (Eurocities, 2022) suggests that "additional efforts are needed by the Commission and member states to enhance the quality of emission estimation methods and to maintain their quality, especially for important and ever-present source sectors, like road transport (e.g., the HBEFa emission factor database)". Other works cover the area of (c) smart and sustainable cities – e.g., James Evans et al. (2019), Kenworthy, J. (2006), Haarstad (2017), Pereira et al. (2017), Tsun Lai and Cole (2022), Guenduez and Mergel (2022), Angelidou et al. (2022), and Przeybilovicz et al. (2022). Hikman and Banister (2014) seeks to develop achievable and low transport CO_2 emission futures in a range of international case studies, including in London, Delhi, and Auckland. The aim of

European Journal of Social Impact and Circular Economy - ISSN: 2704-9906
DOI: 10.13135/2704-9906/7040 Published by University of Turin http://www.ojs.unito.it/index.php/ejsice/index

their book is that the developed scenarios and the consideration of implementation and governance issues can help city management plan for and achieve attractive future travel behaviors at the city level. The work of Johansson et al. (2016) deals with the issue of transport and co-conceptual approaches. The authors note new methods in the shift from mobility to sustainable accessibility. According to them, to reach the climate objectives, there is a need for technical solutions in energy-efficient vehicles dependent on electricity and replacing fossil fuels with biofuels. These solutions, however, are – according to them - not enough. They also need to change direction in planning and developing society and infrastructure.

3. Methodology

The article is based on a methodological approach based on several steps: decomposition of the functioning system of large cities in terms of four investigated elements (traffic, pollution, CE and wicked problems). Other studies, which are focused on only some of the problems discussed here, mostly used a combination of quantitative data analysis and case studies. Some studies examine specific cities and towns (case studies) or segments (transport, air pollution). Some other studies deal with methodological issues and concepts (wicked problems, reflexivity, resilience, multilevel governance). When it comes to wicked problems, analyzing systemic issues is often applied. This research paper uses a set of methods. Methods, concepts and approaches such as qualitative/quantitative data analysis, participatory design, ideal-type transition pathway concept, multi-level governance concept, stakeholder-agency theory, holistic approach, constructed regional advantage concept and causal explanation are used. Causal explanation represents a partially useful approach in specific situations. However, various factors - in rather complex entities as cities are - often operate simultaneously to produce an observed effect. We tried to maintain internal validity - i.e., preventing the occurrence of sample selection bias (for cities) and information bias. Wicked problems have been identified in literature across various disciplines and policy domains (e.g., business, cybernetics, ecology, agriculture, urban design, energy, transportation, health, socio-economic sciences and political, administrative sciences) (Head, 2022). Like Kenworthy (2006), this paper provides critical responses to the challenge of changing the nature of urban development to a more ecological and sustainable model.

4. Results

4.1 Transport in big cities, "wicked" problems and circular economy

Urgency and the changing nature of the challenges are the basic parameters that characterize the current situation from the point of view of the management and governance of big cities. In this section, certain views on some important issues are presented. Two important aspects can be seen from the perspective of the traditional approach to the current challenges in the transport field. The (1) aspect is underestimating the importance/scope of these challenges, and (2) underestimating the nature of these challenges. However, both of them are crucial for timely and adequate solutions. In the traditional understanding, challenges are a problem that often needs to be solved according to the intensity with which it manifests themselves. Such an approach is not always suitable, especially because phenomena do not take place linearly in a complex world, and large-scale changes on the input side do not always bring large effects and vice versa. In addition, waiting for a situation where major positive/negative breakthroughs appear (e.g., an increase in pollution, traffic jams, new efficient solution) can mean that the situation is difficult to manage or requires much higher costs.

Several models exist - steady growth economy, de-growth, CE or sharing economy. These alternative ecological models challenge the economic growth model, encourage sustainable resource use, reduce waste, reuse and recycle, and nudge sustainable consumption models (Babacan, 2022). There is currently a wave of interest in transforming cities in the transport field about achieving a quality environment and safe transport network. New specifics characterizing the urban environment in terms of management and governance include, among others (OECD, 2006): • uncertainty; • specialization; • a number of actors; • interdependence; • multi-level decision-making; • time perspective, and political cycle. The CE in cities may assist in handling transport-related challenges (waste, lack of spare parts). Cities may assist in designing/supporting measures designed and optimized for reuse and re-construct. They may support set of policies easing nature-friendly and sustainable modes of sharing various transport means (not only person-to-person but also B2B) thus reducing resources needed to meet the needs of cities.

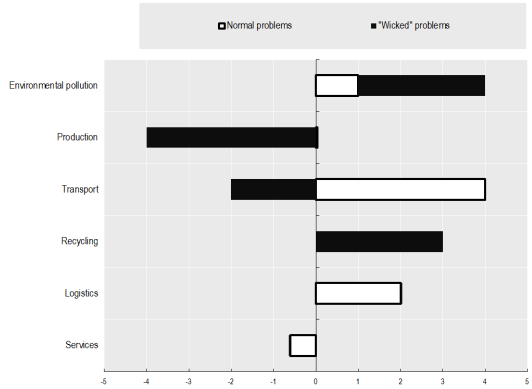
Kautto and Lazarevic (2020) point out that in connection with the circular economy, a significant challenge is " …the development and implementation of policies and regulatory instruments for accelerating the closing of material loops and phasing out unstainable systems and practices. Currently, numerous policy instruments have been adopted to promote more sustainable resource use. However, these are often scattered, weak and disproportionately divided along economic sectors.

European Journal of Social Impact and Circular Economy - ISSN: 2704-9906
DOI: 10.13135/2704-9906/7040 Published by University of Turin http://www.ojs.unito.it/index.php/ejsice/index

Thus, carefully prepared, consistent, coherent and credible policy mixes are needed." To realize this plan, however, it is necessary to cope with the very diverse structure of the number of actors and their interests at the level of urban systems. This diverse structure of actors and interests presents wicked problems. Kautto and Lazarevic also note the problem of reflexivity. According to them "The reflexivity failure is caused by the current lack of ability to monitor, anticipate and involve actors in processes of self-governance …. and to implement adaptive policy portfolios that can deal with uncertainty. Due to the long-term nature of transformational change, inherent uncertainties of innovation, and knowledge gaps, change requires continuous monitoring of the goals, and reflection on the direction of change."

The following Chart 1 shows a model of a modern view of contemporary challenges. In the case of this model, examples of the possible perception of the urgency of the solution and the nature of the challenges by top management are given. Of course, these are only fictitious values intended to document the possible range of problems.

Figure 1: Model view of current challenges



Notes: (1) negative values show a low degree of urgency of the need for a solution (2) positive values show a high degree of urgency of the need for a solution (3) the combination of colors indicating normal situations and "wicked" problems shows the expected ratio between the two components Source: Author´s elaboration

4.2 Performance of transport network and its impact on city environment

The CE Package, adopted by the European Parliament in 2018, sets new target level for the recycling of municipal waste (65% by 2035). While the traditional city policy approach is based on the need to maintain the *status quo* and the reality of city´s functioning is perceived as a routine matter, new approaches should work with challenges as opportunities for change in the direction of greater efficiency and environmental sustainability and take into account new approaches to the governance of cities (Brzica, 2022). One of the possible directions of development is the use of the CE in the context of the strategy of cities in the field of transport. This could substantially improve the situation within the goals of SDG 11. Table 1 shows the structure and description of the individual categories of indicators for the analyzed SDG 11 objectives. Graph 2 shows the situation for SDG 11 including transport as well as air pollution indicators (in this case $PM_{2.5}$)[1]. It provides a more detailed comparison of the position of selected European cities. Some Central European countries report very high degree of $PM_{2.5}$. Overview of primary pollutants in selected cities from January 27, 2023: the primary pollutant $PM_{2.5}$ prevails in these selected cities: Prague: 10.0 µg/m^3, Warsaw: 25.0 µg/m^3, Berlin 7.2 µg/m^3, Kosice 12.0 µg/m^3, Budapest 31.0 µg/m^3, Munich 6.9 µg/m^3, Brussels 3.0 µg/m^3, Paris 9.6 µg/m^3, Rome 30.0 µg/m^3, Bucharest 29.0 µg/m^3, Vienna 18.0 µg/m^3, and Bratislava 22.0 µg/m^3. Some cities show other primary pollutants: London (PM10) 27.0 µg/m^3 or Copenhagen (ozone) 41 µg/m^3. Contributing to pollution in some cities and countries (especially in Central and Eastern Europe) is the fact that the age of the cars in use is high, the modernization of the transport infrastructure is insufficient and the governance of the cities is not optimal.

[1] The environmental indicator $PM_{2.5}$ was used in terms of its significant impact on health, especially in big cities. Such pollution contributes to human mortality from respiratory, cardiovascular and other forms of diseases. The biggest cities are affected by the presence of substances of the $PM_{2.5}$ type.

European Journal of Social Impact and Circular Economy - ISSN: 2704-9906
DOI: 10.13135/2704-9906/7040 Published by University of Turin http://www.ojs.unito.it/index.php/ejsice/index

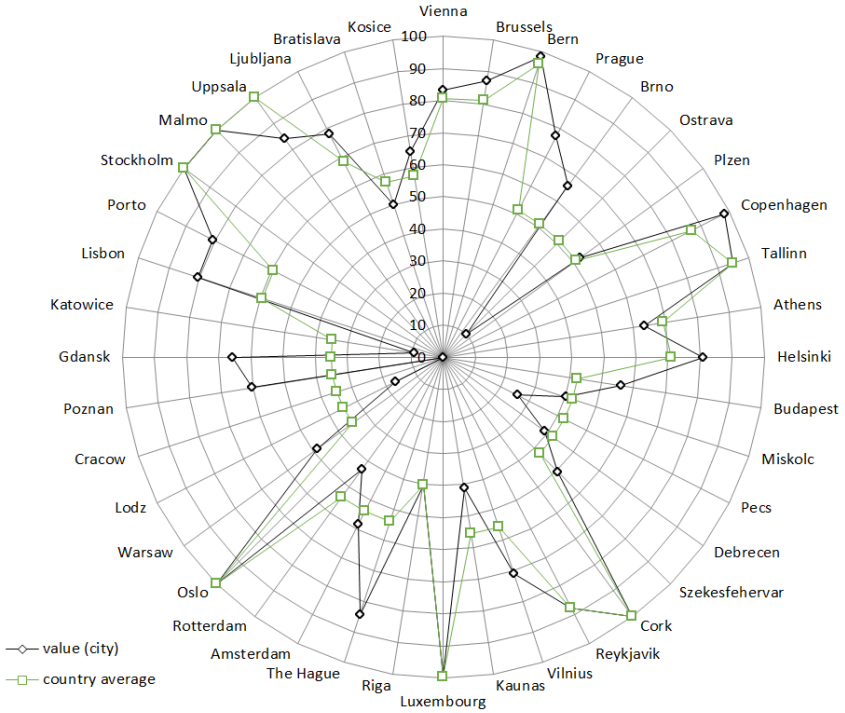
European Journal of Social Impact and Circular Economy

Table 1: Overview of selected indicators for SDG 11 "Sustainable cities and communities"

SDG goal	Indicator	Indicator - description
11.2	C110200a	Percentage of population satisfied with the quality of public transportation systems
11.2	C110201a	Performance of public transport network, ratio between accessibility and proximity to hospitals
11.2	C110201b	Performance of car transport network, ratio between accessibility and proximity to hospitals
11.3	C110301	Difference between built-up area growth rate and population growth rate (percentage points)
11.6	C110602	Exposure to $PM_{2.5}$ in µg/m³, population weighted (micrograms per cubic meter)
11.6	C110602a	Percentage of population satisfied with quality of air
11.6	C110602b	Percentage of people exposed to more than 10 µg/m³ (micrograms per cubic meter) of $PM_{2.5}$
11.7	C110701b	Percentage of population with access to at least one recreational opportunity (theatres, museums, cinemas, stadiums, or cultural attractions) within 15 minutes of cycling

Note: Indicators C110602 and C110602b, related to $PM_{2.5}$ secondary organic aerosol pollution, are highlighted. Graph 1 above also applies to this indicator. Omitted are indicators not related to transport, mobility and PM exposure (11.1, 11.3, 11.7a.). Source: Brzica (2022), modified, based on OECD data, 2020.

Figure 2. Position of selected capitals and countries for SDG 11 (SDG 11.1 - 11.7)



Note: Index is created from values of indicators for SDG 11.1 - 11.7. A higher number of points (obtained from aggregation of points from individual SDG 11 indicators) represent a better position of the city in terms of these indicators. See Tab. 1 for more details. SDG 11 is a "Sustainable Cities and Communities" category under the UN Program.
Source: Brzica (2022), Author's elaboration based on OECD data, 2020.

It is obvious that the top management of big cities must respond not only to air pollution, "normal" challenges in transport or modernization pressures, but also to the existence of another segment of challenges - the set of "wicked" challenges. Unlike the "normal" challenges, the "wicked" challenge set exhibits some specific characteristics. These need to be taken into account – including the case of CE in transport-related areas of large city functioning - when designing effective policies in the area of environmental changes, transport policy and the approach of producers. It can be assumed that the perception of various types of challenges (including the CE) will be different among representatives of industry, the public sphere and the

European Journal of Social Impact and Circular Economy - ISSN: 2704-9906
DOI: 10.13135/2704-9906/7040 Published by University of Turin http://www.ojs.unito.it/index.php/ejsice/index

management of individual big cities. While common problems appear mainly in conditions typical of stable states, "wicked" problems are typical for complex structures and unstable situations.

The circular economy and comprehensive modernization of the production capacities of cities can improve the situation. It seems important to create a complete chain "environment - modern production using CE - modern transport infrastructure with modern means of transport - effective governance with awareness of the need to solve wicked problems in related areas.

5. Discussion

Addressing the multitude of challenges that big cities face today in the environmental field is not an easy task. Nevertheless, the issue of the sustainability of the urban environment is becoming more relevant with increasing economic activity and technological changes. As the paper indicated, the existing challenges are serious not only in their content and scope, but also in the difficulty of finding solutions, as is the case of "wicked" challenges. Policy decision-making is structured through organisational processes that reflect historical institutional arrangements. Complex policy problems often involve conflicting interests and divergent perceptions among various stakeholder groups. Disagreements about problems and policies arise from many factors, including material interests, sociocultural values and political (dis)trust (Head, 2022). This fact further limits quick and effective solutions, especially regarding wicked problems.

The responsibility of city representatives is considerable. However, it is related not only to micro-management but especially to the conceptual planning of urban development and to the strategic orientation towards reducing the ecological burden. Effective multi-level city governance and the effort to solve “wicked” challenges also require city management to have the ability to find a consensus when solving important "wicked" challenges related to transport and environmental issues in big cities.

6. Conclusion

There are different approaches to emerging challenges. Solutions based on traditional approaches can cause upheavals in the functioning of big cities, weaken their resilience and thus threaten their further development. In the future, the city leaders and other stakeholders will have to reevaluate traditional approaches to city governance in this area, as it can be assumed that an increasing number of "wicked" challenges will arise, which will need to be quickly/effectively resolved about the justified needs of city residents. Compared to other works focused on some of the areas analyzed here, we tried to balance a set of key structures (for example, cities and transport systems) and processes (for example, air pollution, solving wicked problems, and governance processes). The holistic view of an integrated approach to the solution of urban ecology and transport in the circular economy context can be used for further research in several possible directions. Understandably, the holistic approach raises some doubts about the breadth of coverage, the depth of analysis (use of comparison), the choice of indicators, working with a time frame, and problems with the unification of approaches and definitions. The last point is quite complex due to the "fuzzy" boundaries of many dimensions addressed in the article. These are mainly the concepts of multi-level governance, wicked problems or the urban system. It is their exact characteristics that - due to their complexity – they run into the problem of precise and generally accepted definitions, and it is often possible to consider their characteristics as "fuzzy".

From the results of our study, it can be concluded that the situation in the large cities in our sample corresponds to the seriousness of the situation, as indicated in other publications. In contrast to more narrowly focused works, we bring an approach that should consider the complexity of the challenges regarding city transport requirements in terms of their growth and ecological burden (here, specifically, air pollution with $PM_{2.5}$ particles). We are trying to point out the effort through new approaches (both conceptual in the field of technology /CE/ as well as conceptual in the field of decision-making regarding difficult and complex situations /wicked problems/ to solve new challenges in the field of transport and related ecological burden. However, a quick and effective solution to a certain extent is hindered by increasingly complicated and complex relationships between growing groups of actors with different, often conflicting, interests.

Acknowledgements

The paper was developed with the support of the VEGA project No. 2/0111/21.

European Journal of Social Impact and Circular Economy - ISSN: 2704-9906
DOI: 10.13135/2704-9906/7040 Published by University of Turin http://www.ojs.unito.it/index.php/ejsice/index

References

Angelidou, M., Politis, C., Panori, A., Bakratsas, T. and Fellnhofer, K. (2022): Emerging Smart City, Transport and Energy Trends in Urban Settings: Results of a Pan-European Foresight Exercise with 120 Experts. Technological Forecasting and Social Change, 183, 121915. https://doi.org/10.1016/j.techfore.2022.121915.

Asheim, B., Cooke, P., Blažek, J., Annerstedt, J., Boschma, R., Brzica, D., Dahlstrand Lindholm, A., Del Castillo Hermosa, J., Laredo, P., Moula, M. and Piccaluga, A. (2006): Constructing regional advantage : principles - perspectives - policies [online]. Brussels: European Commission, 2006. <http://www.dime-eu.org/files/active/0/regional_advantage_FINAL.pdf>

Babacan, H. (2022): Conference Keynote - After COVID-19: Building Inclusive and Sustainable Economies for Resilience. Pp. 7 – 19. In: T.¬ Chaiechi, J. ¬Wood (Eds.) Community Empowerment, Sustainable Cities, and Transformative Economies. Springer, Singapore. ISBN 978-981-16-5259-2.

Bals, L., Tate, W. L. and Ellram, L. M. (2022): Introduction to Circular Economy Supply Chains: From Supply Chains to Value Systems. In: Bals, L., Tate, W. L., Ellram, L. M. (Eds.) Circular Economy Supply Chains: From Chains to Systems. ISBN: 978-1-83982-545-3. Emerald Publishing Limited, Bingley, pp. 3 – 27.

Bocken, N.M.P., de Pauw, I., Bakker, C. and van der Grinten, B. (2016): Product design and business model strategies for a circular economy. Journal of Industrial and Production Engineering, 33 (5), pp. 308 - 320.

Brzica, D. (2022): Governing Major Cities in the Context of New Environmental Challenges. Ekonomické Rozhľady – Economic Review, 50 (3), pp. 218 – 238.

Brzica, D., Wasziewicz, J. and Belof, M. (2014): Multi-level governance: a model not only for today, but also for tomorrow? In: Karabon, M. et al. Laboratories of multi-level governance: analysis of possibilities of implementing multi-level governance instruments in four chosen urban functional areas in the Czech Republic, Hungary, Poland and Slovakia. Wroclaw: The Society of Polish Town Planners, Green Press, pp. 9 -16.

CDP (2012): Measurement for Management - CDP Cities 2012 Global Report.

Clark, G. (2015): The making of a world city: London 1991 to 2021. John Wiley & Sons, Ltd. Chichester. ISBN 978-1-118-60974-3.

COM (2015): COM (2015) - 614 final. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on Closing the Loop – An EU Action Plan for the Circular Economy.

COM (2018): COM (2018) - 32 final. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of Regions on the Implementation of the Circular Economy Package: Options to Address the Interface between Chemicals, Products and Waste Legislation.

COM (2019): COM (2019) - 190 final. Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the implementation of the Circular Economy Action Plan.
DOI: 10.1080/13549839.2019.1624701.
economy. In: Brandão, M., Lazarevic, D. and Finnveden, G. (Eds.): Handbook of the Circular Economy. Edward Elgar Publishing, Cheltenham and Northampton, pp. 207 – 223. ISBN 978 1 78897 271 0.

EPA (2020): Dublin Waste to Energy (Site Visit Report). Environmental Protection Agency.

Eurocities (2020): Time to Empower Europe's Cities: EUROCITIES Position on the New Leipzig Charter. February 2020.

Eurocities (2022): Hope is in the air (quality): Eurocities position on the revision of the EU framework on air quality. April 2022. Eurocities.eu.

Ghisellini, P., Cialani, C. and Ulgiati, S. (2016): A Review on Circular Economy: The Expected Transition to a Balanced Interplay of Environmental and Economic Systems. Journal of Cleaner Production, 114, pp. 11 - 32.

Guenduez, A. A., Mergel, I. (2022): The Role of Dynamic Managerial Capabilities and Organizational Readiness in Smart City Transformation, Cities, 129, 103791. https://doi.org/10.1016/j.cities.2022.103791.

Haarstad, H. (2017): Constructing the Sustainable City: Examining the Role of Sustainability in the 'Smart City' Discourse. Journal of Environmental Policy & Planning, 19:4, pp. 423 - 437, DOI: 10.1080/1523908X.2016.1245610

Head, B. W. (2008): Wicked Problems in Public Policy. Public Policy 3(2): pp. 101-118.

Head, B. W. (2022): Wicked Problems in Public Policy: Understanding and Responding to Complex Challenges. Palgrave Macmillan, Cham. The University of Queensland. ISBN 978-3-030-94580-0 (eBook), https://doi.org/10.1007/978-3-030-94580-0.

Hikman, R. and Banister, D. (2014): Transport, Climate Change and the City. Routledge Advances in Climate Change Research. Routledge, London and New York, 2014. ISBN: 978-0-415-66003-7.

Hoek, M. (2014): The Trillion Dollar Shift: Achieving the Sustainable Development Goals; Business for Good is Good Business. Routledge: London and New York. ISBN: 978-0-8153-6431-3.

Hong, Q., Dennis, E., Cregger, J., Wallace, R. and Zielinski, S..(2014): Challenges to and Opportunities for Developing Sustainable Transportation Systems in Beijing. Presentation to the Transportation Research Board 93rd Annual Meeting, Washington, DC.
https://doi.org/10.1016/j.ugj.2022.11.004.
https://epawebapp.epa.ie/licences/lic_eDMS/090151b2807727da.pdf.

James Evans, J., Karvonen, A., Luque-Ayala, A., Martin, Ch., McCormick, K., Rob Raven, R. and Voytenko Palgan, Y. (2019): Smart and sustainable cities? Pipedreams, practicalities and possibilities, Local Environment, 24:7, pp. 557-564.

Johansson, H., Sandvik, K. O., Zsidákovits, J., Łutzyk, G. (2016): A need for new methods in the paradigm shift from mobility to sustainable accessibility. Transportation Research Procedia 14, pp. 412 - 421. DOI: 10.1016/j.trpro.2016.05.093.

Kautto, P. and Lazarevic, D. (2020): Between a policy mix and a policy mess: policy instruments and instrumentation for the circular

European Journal of Social Impact and Circular Economy - ISSN: 2704-9906
DOI: 10.13135/2704-9906/7040 Published by University of Turin http://www.ojs.unito.it/index.php/ejsice/index

Kenworthy, J. (2006): The Eco-city:Ten Key Transport and Planning Dimensions for Sustainable City Development. Environment &
Kirchherr, J., Reike, D. and Hekkert, M. (2017): Conceptualizing the Circular Economy: An Analysis of 114 Definitions. Resources, Conservation and Recycling, 127, pp. 221–232.
Knox, Paul L., McCarthy, L. (Eds.) (2012): Urbanization : an introduction to urban geography. Boston, Pearson Education, Inc., ISBN 978-0-321-73643-7.
Korhonen, J., Honkasalo, A., and Seppälä, J. (2018): Circular economy: The concept and its limitations. Ecological Economics, 143, pp. 37 - 46.
Milios, L. (2017): Advancing to a circular economy: three essential ingredients for a comprehensive policy mix. Sustainability Science, 13 (3), pp. 1 - 18.
Moser, S., Williams, S. J. and Boesch, D. F. (2012): Wicked Challenges at Land's End: Managing Coastal Vulnerability Under Climate Change. October 2012. Annual Review of Environment and Resources 37(1):pp. 51–78. DOI: 10.1146/annurev-environ-021611-135158.
Nylén, E.-J.A., Salminen, J. M. (2019): How does the circular economy discourse affect policy-making? The case of streamlining waste utilisation in Finnish earthworks. Resources, Conservation and Recycling, 149 (June), pp. 532 -540.
OECD (2006): Territorial Reviews: Competitive Cities in the Global Economy. OECD: Paris. ISBN: 92-64-02708-4.
participation in the smart city: findings from an international comparative study. Local Government Studies, 48:1, pp. 23 47. https://www.tandfonline.com/doi/abs/10.1080/03003930.2020.1851204.
Pereira, G. V., Cunha, M. A., Lampoltshammer, T. J., Parycek, P. and Testa, M. G. (2017): Increasing Collaboration and Participation in Smart City Governance: A Cross-case Analysis of Smart City Initiatives. Information Technology for Development, 23:3, pp. 526 – 553. https://www.tandfonline.com/doi/abs/10.1080/02681102.2017.1353946.
Przeybilovicz, E., Cunha, M. A., Geertman, S., Leleux, Ch., Michels, A., Tomor, Z., Webster, W. R., Meijer, A. (2022): Citizen
Tsun Lai, C. M., Cole, A. (2022): Measuring Progress of Smart Cities: Indexing the Smart City Indices. Urban Governance, 44,
UN (2017): New Urban Agenda. 2017 United Nations. ISBN 978-92-1-132731-1. https://habitat3.org/the-new-urban-agenda.
Urbanization, Vol. 18 (1): pp. 67 - 85. DOI: 10.1177/0956247806063947.

European Journal of Social Impact and Circular Economy - ISSN: 2704-9906
DOI: 10.13135/2704-9906/7040 Published by University of Turin http://www.ojs.unito.it/index.php/ejsice/index

European Journal of Social Impact and Circular Economy

Social pillar score and the CSR Committee: An empirical analysis of corporate governance mechanisms

Adriana Bruno[1*], Matteo Pozzoli[2], Sabrina Pisano[3], Elbano De Nuccio[4]

[1 Contact Author] University of Naples Parthenope, via Generale Parisi 13, 80132, Napoli (Italy)
adriana.bruno@uniparthenope.it

[2] University of Naples Parthenope, via Generale Parisi 13, 80132, Napoli (Italy)
matteo.pozzoli@uniparthenope.it

[3] University of Naples Parthenope, via Generale Parisi 13, 80132, Napoli (Italy)
sabrina.pisano@uniparthenope.it

[4] LUM University – Giuseppe Degennaro, S.S 100 Km 18 - 70010 Casamassima, Bari (Italy)
denuccio@lum.it

Received: 22/02/2023
Accepted for publication: 20/04/2023
Published: 21/04/2023

Abstract

This empirical study on corporate governance mechanisms addresses the potential impact of the corporate social responsibility committee (CSRc) on the social pillar score (SP). Based on a sample of 457 listed European companies from the Refinitiv Thomson-Eikon database over a one-year period (2021), this paper examines the effect of a corporate social responsibility (CSR) committee and the moderating effect of gender diversity on the social pillar score. Our analysis shows that the more firms have CSR committees, the more likely they are to adopt "socially responsible policies and practices". In addition, female directors on the board positively moderate the previous relationship. Therefore, this research stresses that gender diversity and CSR committees significantly predict a firm's social initiatives. Thus, our findings show that CSR committees and gender diversity are socially sensitive variables. Finally, the analysis demonstrates a positive relation between firm size, board size, role duality, board independence variables, and the social pillar score.

Keywords: Social pillar; corporate and social responsibility; CSR committee; gender diversity

1. Introduction

Although there is yet to be a clear definition of the environmental, social and governance (ESG) approach (Li et al., 2021), it is quite sure that ESG focuses on three pillars: the environmental, social, and governance pillars. The social pillar includes health and safety, diversity and opportunity, training and development, employment quality, product responsibility, community, and human rights. (Marsat & Williams 2014). It also represents a major component of corporate reputation (Bruno A. et al. 2015).

Currently, stakeholders are focused on environmental, social and governance (ESG) behaviour and disclosures to prevent firm misconduct, obtain higher assurance of corporate reputation (Arayssi et al., 2020) and comprehend management plans to

European Journal of Social Impact and Circular Economy - ISSN: 2704-9906
DOI: 10.13135/2704-9906/7425 Published by University of Turin http://www.ojs.unito.it/index.php/ejsice/index

produce value in the medium and long term (Escrig-Olmedo *et al.*, 2010; Zumente and Bistrova, 2021). The main element of a profound change is good corporate governance, and scholars have recently concentrated their attention on seeking means that enhance the social performance of firms (Urmanaviciene A. 2020).

In this context, corporate boards (CBs) are key in corporate governance (John K. & Senbet L.W. 1998). They can considerably influence firms' engagement and disclosure of social activities in business reporting (Francoeur, C et al. 2019). Firms must have a strong social commitment to establish value-creating stakeholder relationships to build sustainability (Secinaro S. et al 2020). The linkage between companies and the community is specifically founded on the decisions made by the CB, which traditionally aligns the interests of stakeholders and shareholders with day-to-day managerial operations (Belkhir, 2009).

Accordingly, the sensitivity and qualitative characteristics of CB can (positively or negatively) impact CSR (Urmanaviciene A. & Udara S. A. (2020) and ESG performance. At present, academia and practitioners seem more attracted by environmental issues, while social and governance features appear less investigated (Leopizzi et al., 2020). Even if the social pillar (SP) should be interpreted by a more general approach that a company uses to act sustainably, it can also be separately addressed to consider how it promotes a better quality of life for all involved parties. The SP area involves human rights, gender equality and diversity, social assistance, educational programmes, investments, and involvement in social protection programs (Murphy, 2012).

This paper moves from the perspective that, thanks to the operation of CSR committees and a wider diversity on the board, a specialized focus on ESG issues can support policies in favour of more socially sustainable development within and outside the firm (Stevens, 2010).

This research explores whether the presence of CSR committees can enhance social performance and whether the combined presence of higher diversity and CSR committees can further support the sustainable development of practices in the SP area. This perspective has been generated by the expectation that a CSR committee pays particular attention to ESG features (Baraibar-Diez and Odriozola, 2019), and contextually, the combination of board diversity and CSR committee operations can produce a "leverage" effect.

In addition, women have different leadership styles because they are more concerned with organizational needs and focus on community welfare and service organizations (Arayssi et al., 2016). Women directors possess characteristics that are more aligned with social issues since they have more communal characteristics, such as being supportive, gentle, and emphatic (Monteiro *et al.*, 2022; Uyar et al., 2022). Consequently, women are more concerned with corporate social performance since they tend to address stakeholders' interests better. Women's presence in board rooms encourages firms to become socially responsible and adopt environmentally friendly practices (Arayssi et al., 2016).

Therefore, this research aims to show that the presence of CSR committees, combined with gender diversity, could support a new competitive environment for behaviour that can be addressed as socially responsible (René et al. 2021).

To achieve this objective, the paper is organized as follows: Section 2 presents a literature review of the relationship between the social pillar, CSR committees, and gender diversity. Section 3 details the dataset and methodology. Section 4 provides the results and discusses the influence of the different components of the social pillar. Section 5 concludes the paper.

2. Literature review

The literature investigates the global relationship between CSR and financial performance (Bird et al., 2007). Specifically, the literature on human capital reinforces the idea that social expenses on employees should be linked with financial goodwill because motivating employees should increase productivity (Becker 1962). Specifically, a study from Marsat & Williams, 2014, shows a strong positive relationship between the social pillar and firm value. Interestingly, in this paper, even if not all the components of the social pillar are positively related to the overall results of global financial goodwill, this finding is consistent with the idea that the social pillar is an intangible asset producing firm market value and taking part in corporate social responsibility (Scholtens 2006).

Most other studies are focused on the complete measure of CSR and its main components or more specific issues such as human capital, religiosity (Shahid A. et al., 2022), legitimation, behaviour, and a good reputation among local communities (Marsat, S., Williams, B., 2013). Other studies have focused on the link between stakeholder welfare (including the environment) and firm value. (Jiao 2010).

European Journal of Social Impact and Circular Economy - ISSN: 2704-9906
DOI: 10.13135/2704-9906/7425 Published by University of Turin http://www.ojs.unito.it/index.php/ejsice/index

Moreover, previous research examined board gender diversity (BGD), concluding that a CSR committee could also emphasize its effectiveness. BGD plays a crucial role in prioritising CSR-related issues (Eberhardt-Tot et al., 2019) and tends to improve responsible management and social performance. It has been shown that board gender diversity (i.e., the proportion of female directors) is positively associated with firms' social commitment to human rights, product responsibility, and, consequently, their contribution to firm sustainability (Beji *et al.*, 2021; Arayakarnkul P. et al. 2022).

Martínez-Ferrero et al. (2020) examine the effect of gender diversity and the moderating effect of the existence of a CSR committee. Specifically, this study aimed to improve the understanding of the factors determining a firm's affiliation with the United Nations Global Compact (UNGC) as the largest voluntary corporate responsibility initiative worldwide. The results suggest that female directors on the board significantly encourage the firm's affiliation with the UNGC and support the mediating effect of the existence of a CSR committee. Therefore, the positive impact of female directors on UNGC signatories appears to be mediated by the existence of a CSR committee.

However, a few studies (sectoral and limited to some specific period) have tried to investigate the opposite relationship between the existence of CSR committees on the social pillar and the moderating effect of board gender diversity. Specifically, Uyar et al. (2021) showed that CSR committees and BGD positively enhanced CSR performance. Govindan et al. (2021) show that firms operating in the logistics sector with a sustainability committee are more likely to have greater corporate social responsibility performance (both overall and social) in 2018 than those that do not. Therefore, these authors confirm that logistics companies listed on the stock exchange will likely disclose a broader range of CSR aspects within their reports, implying an impact from stakeholder pressures on their CSR practices.

The presence of a CSR committee also plays a significant role in improving corporate social performance strengths, even though it cannot reduce public concerns (Burke et al., 2019).

Other research found a positive relationship between CSR performance and the presence of a CSR committee. Specifically, Spitzeck (2009) found that companies with a CSR committee have better corporate sustainability performance in the Corporate Responsibility Index. These committees can successfully improve corporate social performance strengths.

Baraibar-Diez and Odriozola (2019) also analysed the influence of a CSR committee on CSR performance, specifically ESG performance in the UK, France, Germany, and Spain. They found that companies with a CSR committee have different ESG scores than firms without one. A CSR committee is related to better performance when considering the four scores (environmental, social, governance, and economic) and the four countries independently (except for economic scores in Spain).

The social pillar in the literature is mostly studied about environmental reporting and is not studied "per se" (Ashfaq, K. & Rui, Z. 2018). Studies focus on specific contexts such as Europe (Baraibar-Diez, E. & Odriozola, M.D. 2019) and Italy (Cucari et al. 2017). The literature has explored the relationship between a firm's social performance and reporting while also considering board gender diversity; however, these studies focused mainly on developed countries and paid less attention to emerging countries that require special consideration (Arayssi et al., 2020; Khwaja N. C.L. 2021; Yadav P. & Prashar A. 2022).

Other authors have concluded that board characteristics influence the presence of CSR committees. In detail, they found that independent directors promote the creation of specialized committees to make decisions related to CSR strategies. Moreover, in this specific situation, the CSR committee is a mediator between independent directors and the adoption of the Global Reporting Initiative – International Finance Corporation (GRI-IFC) strategy. (García-Sanchez et al. 2017),

A body of literature has documented a positive relationship between board gender diversity and sustainability performance (Uson et al. 2022) across a broad spectrum of sustainability indicators (Amran, A et al. 2014; Eberhardt-Toth, E. 2017). Other authors have considered culture in the relationship between corporate social performance and firm performance (Wei S. & Veenstra K. 2021). Moreover, other researchers confirm that 'structural' gender diversity is a significant predictor of a firm's environmental sustainability initiatives, so gender diversity is also a sustainability issue (Kassinis G. et al. 2016).

Regarding the social pillar in the national literature, we have discovered that some Italian authors have already shown that CB diversity, proxied by director independence (a demographic diversity in boards and gender diversity), affects corporate social performance (CSP). In this research, CSP concepts were presented, including those that evolved from the concept of corporate social responsibility (CSR), which is a static concept emphasizing accountability. At the same time, CSP is a bottom-line concept emphasizing sustainable outcomes (Veltri et al. 2020). The sample in this research is the most capitalized firms.

In this stream, apart from very specific points of view, our approach is innovative since we investigate the link between gender diversity and the social pillar related to CSR.

European Journal of Social Impact and Circular Economy - ISSN: 2704-9906
DOI: 10.13135/2704-9906/7425 Published by University of Turin http://www.ojs.unito.it/index.php/ejsice/index

3. Theoretical framework and hypothesis development

Stakeholder theory (Cummings, L. & Patel, C. 2009) and agency theory are common theories used to understand the link between corporate governance and sustainability performance. Specifically, stakeholder theory argues that it is important for companies to establish strong relations with stakeholders to maintain and improve corporate legitimacy; thus, according to this theory, effective corporate governance can convey to society that the firm is well managed and that the interests of stakeholders are considered (Michelon and Parbonetti, 2012). In contrast, agency theory predicts that companies protect investors and reduce agency conflicts by using control mechanisms, such as corporate governance structures (Jensen and Meckling, 1976).

From this perspective, CSR is crucial for fulfilling stakeholders' expectations (Khan et al., 2013). Drawing on stakeholder and agency theories, this study examines the association between a CSR committee and social pillar performance, adopting board gender diversity as a moderating variable.

Based on the findings illustrated in the literature review, this paper aims to test whether the presence of a CSR committee, as found in some previous research (Jorge 2020), is positively related to social and environmental performance. This should confirm that ESG issues deserve specialized attention and a dedicated workforce. More specifically, this research investigates whether the presence of a CSR committee can support the SP score.

Hp 1: The presence of a CSR committee positively influences the social pillar score.

In contrast, we observed that some studies had illustrated the positive reaction that CB diversity could have on ESG performance with a moderating effect from the operation of a CSR committee (Martínez-Ferrero et al., 2020), even if there is no evidence of the opposite effect, that is, a positive impact of a CSR committee on ESG performance with a moderating effect from CB diversity. We based our hypothesis on the consideration that CB diversity can offer different points of view and support a more conscious decision-making process.

Hp 2: The level of board gender diversity positively moderates the relationship between the presence of a CSR committee and the social pillar score.

4. Methodology

4.1 Dataset

The sample comprises 457 European listed companies collected from the Refinitiv Thomson-Eikon, a database that several scholars have already applied to analyse CB characteristics in connection with ESG performance (Del Giudice & Rigamonti, 2020; Dorfleitner et al., 2020). The Refinitiv Thomson-Eikon database applies a consolidated methodology that attributes an ESG score to the investigated companies (Refinitiv, 2022). The analysis is organized by determining a complex score, articulated on the sum of the three single pillar scores.

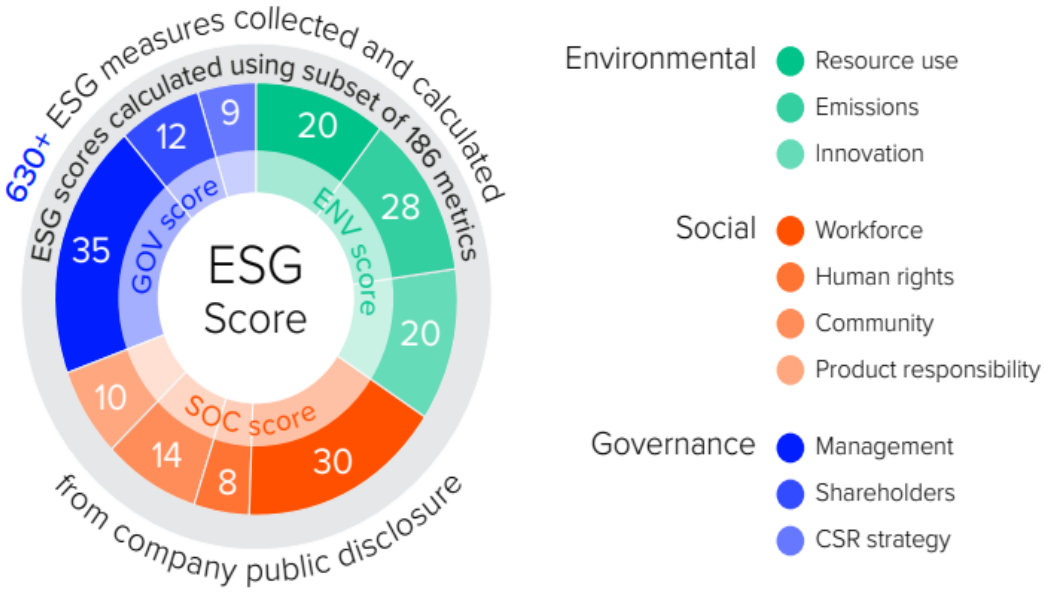
The choice of the European context arises from the "hard low approach" adopted here, i.e., ad hoc regulatory measures have been applied that aim at "imposing" the presence of women on boards. A further peculiarity that concerns Europe (Italy, Norway, Holland, France, Iceland, Belgium, Denmark, Greece, Slovenia, Austria, Spain, and Germany) is the different degree of effectiveness of the rules depending on whether they are companies with listed or publicly controlled shares. In this regard, the European Commission and the European Parliament have started harmonising the different gender equality approaches (Callegari et al. 2021).

Each pillar includes a few ESG themes, with the related data points evaluated as proxies of ESG magnitude per industry group. The themes for the social pillar are workforce, human rights, community, and product responsibility.

European Journal of Social Impact and Circular Economy - ISSN: 2704-9906
DOI: 10.13135/2704-9906/7425 Published by University of Turin http://www.ojs.unito.it/index.php/ejsice/index

European Journal of Social Impact and Circular Economy

Figure 1: The Refinitiv Thomson-Eikon methodology



Source: Author´s elaboration

The score is measured on 186 metrics (54 in the social pillar). The points are then weighted based on the industry sector in relation to the theme's importance in that specific context.

Table 1: ESG themes in the social pillar category

Pillars	Categories	Themes	Data points	Weight method
Social	Community	Equally important to all industry groups, hence a median weight of five is assigned to all		Equally important to all industry groups
	Human rights	Human rights	TR.PolicyHumanRights	Transparency weights
	Product responsibility	Responsible marketing	TR.PolicyResponsibleMarketing	Transparency weights
		Product quality	TR.ProductQualityMonitoring	Transparency weights
		Data privacy	TR.PolicyDataPrivacy	Transparency weights
	Workforce	Diversity and inclusion	TR.WomenEmployees	Quant industry median
		Career development and training	TR.AvgTrainingHours	Transparency weights
		Working conditions	TR.TradeUnionRep	Quant industry median
		Health and safety	TR.AnalyticLostDays	Transparency weights

Source: Author´s elaboration

The sample in this study comprises companies from the European economic area, as represented in the following table.

European Journal of Social Impact and Circular Economy - ISSN: 2704-9906
DOI: 10.13135/2704-9906/7425 Published by University of Turin http://www.ojs.unito.it/index.php/ejsice/index

Table 2: Country composition of the sample

	N° companies	%
Austria	15	*3,3%*
Belgium	14	*3,1%*
Cyprus	2	*0,4%*
Czech Republic	1	*0,2%*
Denmark	11	*2,4%*
Finland	37	*8,1%*
France	72	*15,8%*
Germany	86	*18,8%*
Greece	2	*0,4%*
Hungary	1	*0,2%*
Ireland	11	*2,4%*
Italy	44	*9,6%*
Luxembourg	3	*0,7%*
Malta	1	*0,2%*
Netherlands	22	*4,8%*
Poland	2	*0,4%*
Portugal	12	*2,6%*
Spain	34	*7,4%*
Sweden	87	*19,0%*
Total	**457**	***100,0%***

Source: Author´s elaboration

The European economic context has already been widely analysed in investigations of the impact of board characteristics on ESG performance (Martínez-Ferrero et al., 2021; Nicolò et al., 2021; Rossi et al., 2021; Gurol and Lagasio, 2022). The European Union has a strongly supportive attitude towards ESG issues, representing—especially since the beginning of the 2000s—a benchmark worldwide (EC, 2001; EU, 2011).

The industry composition is subsequently reproduced. The whole sample needs to consider the banking and financial services sector. We preferred to leave the financial sector out of the investigation, as some countries propose ad hoc legislation for board composition. Accordingly, we focused our attention on nonfinancial companies. Almost half of the companies belong to the "Manufacturing" sector (47%). The other half represented industry segments, such as "Information" (9.6%), "Real estate and rentals and leasing" (7.9%), "Utilities" and "Construction" (5.3%), "Professional, scientific, and technical services" and "Retail trade" (5%); the other sectors are more specialized, and each is below 5% of the sample.

European Journal of Social Impact and Circular Economy - ISSN: 2704-9906
DOI: 10.13135/2704-9906/7425 Published by University of Turin http://www.ojs.unito.it/index.php/ejsice/index

Table 3: Sector composition of the sample

TRBC Sector Name	Number of companies	%
Accommodation and Food Services	7	*1,5%*
Administrative and Support and Waste Management and Remediation Services	10	*2,2%*
Agriculture, Forestry, Fishing and Hunting	2	*0,4%*
Arts, Entertainment, and Recreation	4	*0,9%*
Construction	24	*5,3%*
Educational Services	1	*0,2%*
Health Care and Social Assistance	4	*0,9%*
Information	44	*9,6%*
Management of Companies and Enterprises	1	*0,2%*
Manufacturing	215	*47,0%*
Mining, Quarrying, and Oil and Gas Extraction	6	*1,3%*
Professional, Scientific, and Technical Services	23	*5,0%*
Real Estate and Rentals and Leasing	36	*7,9%*
Retail Trade	23	*5,0%*
Transportation and Warehousing	21	*4,6%*
Utilities	24	*5,3%*
Wholesale Trade	10	*2,2%*
Other Services (except Public Administration)	2	*0,4%*
Total	**457**	***100,00%***

Source: Author´s elaboration

We tested our hypotheses on 457 companies with a linear regression generated by Stata software. The final number of observations used in the regression analysis is 448, as the software identified the data of 10 companies as incomplete or inapplicable. All data refer to the 2021 period, representing our objective's most recent financial and nonfinancial information. Considering that we have considered a single period, the number of examined companies is equivalent to the number of applied observations.

4.2 Model specification and variables

Our dependent variable is Refinitiv's Social Pillar Score (*SocialScore*). This is a weighted score computed by Refinitiv for each company based on the social information recovered in the four social categories identified: workforce, human rights, community, and product responsibility.

Our dependent variable is the existence of a CSR committee (*CSRComm*). We measured this variable using a dummy equal to 1 when the company has a CSR committee within the board and 0 otherwise.

European Journal of Social Impact and Circular Economy - ISSN: 2704-9906
DOI: 10.13135/2704-9906/7425 Published by University of Turin http://www.ojs.unito.it/index.php/ejsice/index

Moreover, to test the moderating role of the presence of female directors in the relationship between CSR committees and the social pillar, we inserted an interaction term (*CSRCommxGenDiv*) into our regression. We obtained the interaction term by multiplying the *CSRComm* variable with board gender diversity (*GenDiv*).

We inserted different control variables in the regression to control for endogeneity and reduce possible bias. More specifically, we inserted both other CB and firm-specific characteristics as follows:

- Board size (*BoSize*) measured as the number of board members
- Role Duality (*RoleDual*) computed using a dummy equal to 1 when the CEO is also the chairman of the board and 0 otherwise
- Board Independence (*BoInd*) measured as the percentage of independent directors sitting on the board
- Board Meeting (*BoMeet*) computed as the number of meetings held during the year
- Firm Size (*Size*) computed as the natural logarithm of total assets
- Leverage (*Lev*) measured as the long-term debt divided by total assets
- Profitability (*Profit*) computed using the return on total assets

To test the hypotheses, we developed the following regressions:

$$SocialScore = \alpha + \beta_1 \text{CSRComm} + \beta_2 GenDiv + \beta_3 BoSize + \beta_4 RoleDual + \beta_5 BoInd + \beta_6 BoMeet + \beta_7 Size + \beta_8 Lev + \beta_9 \text{Profit} + \varepsilon \quad (1)$$

$$SocialScore = \alpha + \beta_1 \text{CSRComm} + \beta_2 GenDiv + \beta_3 CSRCommxGenDiv + \beta_4 BoSize + \beta_5 RoleDual + \beta_6 BoInd + \beta_7 BoMeet + \beta_8 Size + \beta_9 Lev + \beta_{10} \text{Profit} + \varepsilon \quad (2)$$

5. Results

5.1 Descriptive analysis

The following table reports the descriptive statistics of all the variables.

Table 4: Descriptive analysis

Variable	Obs	Mean	Std. Dev.	Min	Max
SocialScore	457	73.55954	15.43326	23.00668	98.22132
CSRComm	457	.9037199	.2952982	0	1
GenDiv	457	34.96473	11.7173	0	69.23077
BoSize	457	10.91466	4.112367	2	28
RoleDual	457	.2691466	.4440023	0	1
BoInd	457	59.19293	24.84083	0	100
BoMeet	449	11.00445	5.827887	3	56
Size	457	22.44632	1.60134	18.00879	26.99351
Lev	456	.2284475	.1356608	0	.9066298
Profit	457	.0510317	.0657023	-.2163655	.433664

Source: Author´s elaboration

The average Social Score recorded by sampled companies in 2021 is 73.55, revealing discreet attention to social issues. The minimum value is 23, and the maximum is 98.22.

A CSR committee is present in 90% of the sampled companies. The average percentage of women on the board is 34.96. Considering that the average board size is 10, previous data reveal that approximately 3 or 4 directors are women on average. A total of 26.91 companies have a CEO who is also the board's chairman. The average percentage of independent directors sitting on the board is higher than that of women and is almost equal to 60%. Finally, board members meet approximately once a month. Before performing the regression analysis, the next table shows the correlation between all the variables.

European Journal of Social Impact and Circular Economy - ISSN: 2704-9906
DOI: 10.13135/2704-9906/7425 Published by University of Turin http://www.ojs.unito.it/index.php/ejsice/index

Table 5: Correlation matrix

	SocialScore	BoSize	RoleDual	CSRComm	BoInd	BoMeet	GenDiv
SocialScore	1.0000						
BoSize	0.3459*	1.0000					
RoleDual	0.1520*	0.1411*	1.0000				
CSRComm	0.3378*	0.1919*	0.0643	1.0000			
BoInd	0.0687	-0.2542*	-0.1391*	0.0613	1.0000		
BoMeet	-0.1096*	-0.1874*	-0.0856	0.0067	0.1461*	1.0000	
GenDiv	0.1383*	0.0946*	0.1551*	0.1469*	0.0520	-0.0354	1.0000
Size	0.4985*	0.5429*	0.1416*	0.2412*	0.0695	-0.0657	0.1195*
Profit	0.0053	-0.1210*	0.0507	0.0403	0.0416	-0.1039*	0.0060
Lev	0.0080	0.0252	-0.0300	0.0543	0.0513	0.1395*	0.0119

	Size	Profit	Lev
Size	1.0000		
Profit	-0.0520	1.0000	
Lev	0.1267*	-0.2733*	1.0000

Note: *** p < 0.01, ** p < 0.05, * p < 0.1

Source: Author´s elaboration

Both *CSRComm* and *GenDiv* are positively correlated with *SocialScore*. Moreover, *BoSize*, *RoleDual* and *Size* are also positively correlated with *SocialScore*. *BoMeet*, instead, presents a negative correlation with *SocialScore.*

5.2 Regression results

The subsequent table shows the results of the regression analyses performed using Stata software.

Table 6: Regression Results (Dependent variable SocialScore)

Variables	Model 1	Model 2
CSRComm	11.5791***	3.804429
	(2.167769)	(5.307205)
GenDiv	.0372033	-.1894688
	(.0534431)	(.151023)
CSRComm*GenDiv		.2582784*
		(.1609875)
BoSize	.3392589*	.3601894*
	(.1924118)	(.1925096)
RoleDual	2.606915*	2.670899*
	(1.420351)	(1.418367)
BoInd	.0449805*	.0477557*
	(.02663)	(.0266385)
BoMeet	-.1623585	-.1637325
	(.1117212)	(.1115243)

European Journal of Social Impact and Circular Economy - ISSN: 2704-9906
DOI: 10.13135/2704-9906/7425 Published by University of Turin http://www.ojs.unito.it/index.php/ejsice/index

Size	3.659373***	3.571471***
	(.4813271)	(.4835786)
Profit	-1.238915	-1.277033
	(9.849703)	(9.832082)
Lev	-5.642679	-5.475304
	(4.753141)	(4.745771)
Constant	-24.3959***	-16.19662
	(9.487964)	(10.76189)
Observations	448	448
Adjusted R-Squared	0.3046***	0.3071***

Source: Author´s elaboration

Model 1 reports the results of the regression testing Hypothesis H_1 to understand the direct influence of *CSRComm* on *SocialScore*. It shows a positive and statistically significant association between the presence of a CSR committee and social pillar score ($\beta = 11.5791$, $p < 0.01$), meaning that the decision of the company to create a CSR committee within the board brings greater attention to the social aspects of sustainability. Concerning gender diversity, Model 1 shows no significant relationship between the presence of women sitting on the board and the social pillar score. Regarding the control variables, Model 1 also shows that board size, role duality, board independence and firm size positively and significantly influence the social pillar score.

Model 2 shows the findings of the regression developed to test Hypothesis H_2, that is, the moderating effect of *GenDiv* on the relationship between *CSRComm* and *SocialScore*. The coefficient of the interaction term *CSRComm*GenDiv* is positive and statistically significant ($\beta = .2582784$, $p < 0.1$), meaning that the presence of women sitting on the board positively moderates the relationship between the CSR committee and the social pillar score. In other words, companies with a greater number of female directors present a stronger positive relationship between the existence of a CSR committee and the social pillar score.

6. Discussion and conclusions

This paper focuses its attention on the impact that the presence of CSR committees can have and the moderating role of board gender diversity in pursuing social objectives. The disaggregation of the effect that these variables can have on social performance has allowed us to consider a specific aspect of the ESG approach that is critical for companies' financial and nonfinancial health: a shared vision and modus operandi that can determine a positive relationship with stakeholders and create a common strategic and operational perspective.

This motivation for this research derives from a gap in the research on the relationship between social performance and the related determinants that can be found in company governance.

In this context, the research concludes that the presence of a CSR committee contributes to greater efficacy in pursuing social matters. This supports the idea that ESG issues require a specialized structure to assist the board of directors with social issues. This conclusion appears consistent with a body of literature examining CSR and ESG more generally (Baraibar-Diez e Odriozola, 2019). Structured governance can improve the ESG approach of companies by enabling better control of delicate themes such as those included in the SP. It can consequently contribute to creating value in the medium and long term.

The research also stresses that the presence of board diversity supports SP performance. This work suggests that companies with a more diversified Board conduct aboard have better social performance. These results are also consistent with the previous literature (Alijifri K & Moustafa M., 2007) that has demonstrated how gender diversity enhances the tendency of corporate culture to integrate sustainability values (Jizi et al., 2022). It has been confirmed that the diversity of perspectives and sensitivity a company uses in decision-making is significant for stakeholders' engagement.

Moderation analysis shows that CSR committees and boards are not replacements for one another, as both benefit the corporate pursuit of social themes (Uyar et al., 2021).

European Journal of Social Impact and Circular Economy - ISSN: 2704-9906
DOI: 10.13135/2704-9906/7425 Published by University of Turin http://www.ojs.unito.it/index.php/ejsice/index

This work confirms the adoption of agency theory and stakeholder theory. Companies that apply control mechanisms that can protect people directly or indirectly involved in company management reduce agency conflicts and enhance stakeholder relations.

There are many implications arising from this research. From a professional and practical point of view, companies should pay close attention to creating and managing CSR committees, especially if we consider that they are mostly voluntary bodies. These results reflect the importance of promoting these instruments to enhance company attitudes towards sustainability.

From an institutional perspective, regulators could consider amending their legislation, addressing the contribution provided by studies that demonstrate good practices and fair corporate behaviours. CSR committees can provide greater assurance to stakeholders, especially in those contexts where there is a need to provide greater certainty about the company's ethical behaviour. At the same time, technical bodies have some additional data on which to base their codes and requirements.

There are some limitations in this study. We considered only the European context. The enlargement of the sample could demonstrate if these results apply to other regional zones or are typical of only the European environment.

We also considered the composition of CSR committees and boards without investigating the skills of the component members. It seems that this variable can be crucial in analysing the collected data. It could highlight if the people involved are equally and highly qualified or if creating these conditions can always lead to better social performance.

Last, it must be stressed that the Thomson Reuters ESG data, even if largely applied in these studies, reflect only the firm's actual social improvements and not the company efforts produced to obtain social objectives. It could be interesting to reproduce this research by adopting other databases addressing ESG efforts, such as Bloomberg's ESG database, to test if the results are confirmed.

References

Alijifri K & Moustafa M., (2007) "The Impact of Corporate Governance Mechanisms on the Performance of UAE Firms: An Empirical Analysis", Journal of Economics and Administrative Sciences, Vol 23, n. 2, pp. 71-93, https://doi.org/10.1108/10264116200700008.

Amran, A.; Lee, S.P.; Devi, S.S. (2014), "The influence of governance structure and strategic corporate social responsibility toward sustainability reporting quality". Business Strategy Environmental, Vol 23, pp. 217–235. https://doi.org/10.1002/bse.1767

Arayakarnkul, P. Chatjuthamard, P. Treepongkarun S. (2022) "Board gender diversity, corporate social commitment and sustainability", Corporate Social Responsibility Environmental Management, Vol, 29, Issue 5, pp. 1706-1721. https://doi.org/10.1002/csr.2320

Arayssi, M., Dah, M. and Jizi, M. (2016), "Women on boards, sustainability reporting and firm performance", Sustainability Accounting, Management and Policy Journal, Vol. 7 No. 3, pp. 376-401. https://doi.org/10.1108/SAMPJ-07-2015-0055

Arayssi, M., Jizi, M. and Tabaja, H. (2020), "The impact of board composition on the level of ESG disclosures in GCC countries", Sustainability Accounting, Management and Policy Journal, Vol. 11 No. 1, pp. 137-161.https://doi.org/10.1108/SAMPJ-05-2018-0136

Ashfaq, K.; Rui, Z. (2018), "Revisiting the relationship between corporate governance and corporate social and environmental disclosure practices in Pakistan" Social Responsibility Journal, Vol 15, pp. 90–119. https://doi.org/10.1108/SRJ-01-2017-0001

Baraibar-Diez, E.; Odriozola, M.D. (2019)"CSR committees and their effect on ESG performance in UK, France, Germany and Spain" Sustainability, Vol 11, 5077. https://doi.org/10.3390/su11185077

Becker, G.S., (1962). "Investment in Human Capital: A Theoretical Analysis". Journal of Political Economy Vol 70, pp. 9-49 https://doi.org/10.1086/258724

Beji, R., Yousfi, O., Loukil, N., & Omri, A. (2021). "Board diversity and corporate social responsibility: Empirical evidence from France". Journal of Business Ethics, Vol 173, pp.133-155. https://doi.org/10.1007/s10551-020-04522-4

Bird, R., Hall, A.D., Momentè, F., Reggiani, F., (2007.) "What corporate social responsibility activities are valued by the market?" Journal of Business Ethics, Vol 76, pp. 189-206. https://doi.org/10.1007/s10551-006-9268-1

European Journal of Social Impact and Circular Economy - ISSN: 2704-9906
DOI: 10.13135/2704-9906/7425 Published by University of Turin http://www.ojs.unito.it/index.php/ejsice/index

Bruno A., Lombardi R., Mainolfi G., Moretta Tartaglione A., (2015) "Reaserch Perspective on Corporate Reputation and Company's Performance Measurement, "Management Control Journal", Vol 3. DOI: 10.3280/MACO2015-003004

Burke, J. J., Hoitash, R., & Hoitash, U. (2019). "The heterogeneity of board-level sustainability committees and corporate social performance". Journal of Business Ethics, Vol 154, pp. 1161–1186. DOI: 10.1007/s10551-017-3453-2

Callegari M., Desana E.R., Sarale M., (2021). "Speriamo che sia femmina: l'equilibrio fra i generi nelle società quotate e a controllo pubblico nell'esperienza italiana e comparata", Quaderni di Dipartimento di Giurisprudenza dell'Università di Torino, Vol. 21, Rubbettino Editore.

Cucari, N.; De Falco, S.E.; Orlando, B. (2017) "Diversity of board of directors and environmental social governance: Evidence from Italian listed companies" Corporate Social Responsibility Environmental Management, Vol 25, pp. 250–266. https://doi.org/10.1002/csr.1452

Cummings, L. and Patel, C. (2009), "Chapter 2 Stakeholder literature review", Cummings, L. and Patel, C. (Ed.) Managerial Attitudes toward a Stakeholder Prominence within a Southeast Asia Context (Studies in Managerial and Financial Accounting, Vol. 19), Emerald Group Publishing Limited, Bingley, pp. 17-51. https://doi.org/10.1108/S1479-3512(2009)0000019006

Dorfleitner, G., Kreuzer, C., Sparrer, C, (2020) "ESG controversies and controversial ESG: about silent saints and small sinners) ", Journal of Asset Management, Vol 21 Issue 5, pp. 393-412. DOI:10.1057/s41260-020-00178-x

Eberhardt-Toth, E. (2017) "Who should be on a board corporate social responsibility committee? Journal Cleaning Production, Vol 140, pp. 1926–1935. https://doi.org/10.1016/j.jclepro.2016.08.127

Eberhardt-Toth, E.; Caby, J.; Gendron, C.; Ramboarisata, L. (2019), "Determinants of the presence of CSR committees within European boards of directors". E. Responsib. Organ. Rev. Vol 14, pp. 33–49. https://doi.org/10.3917/ror.141.0033

EC (2001), Green paper (COM(2001)366) - Promoting a European framework for corporate social responsibility. Retrieved fromhttps://www.eumonitor.eu/9353000/1/j9vvik7m1c3gyxp/vikqhjet6py6

EU (2011), Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A renewed EU strategy 2011-14 for Corporate Social Responsibility. Brussels, Belgium: Author. Retrieved from https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0681:FIN:EN:PDF

Francoeur, C., Labelle, R., Balti, S. and Bouzaidi, S. (2019), "To what extent do gender diverse boards enhance corporate social performance?", Journal of Business Ethics, Vol. 155 No. 2, pp. 343-357. https://doi.org/10.1007/s10551-017-3529-z

Garcia, A. S., Mendes-Da-Silva, W., & Orsato, R. J. (2017) "Sensitive industries produce better ESG performance: Evidence from emerging markets" Journal of Cleaner Production, Vol 150, pp. 135-147 https://doi.org/10.1016/j.jclepro.2017.02.180

Gurol, B., & Lagasio, V. (2022). "Women board members' impact on ESG disclosure with environment and social dimensions: evidence from the European banking sector. Social Responsibility Journal. https://doi.org/10.1108/SRJ-08-2020-0308

Govindana K, Kilicc. M, Uyard A, Karamane A. S. (2021) "Drivers and value-relevance of CSR performance in the logistics sector: A cross-country firm-level investigation" International Journal of Production Economics, Vol 231. https://doi.org/10.1016/j.ijpe.2020.107835

John K, Senbet L. W., (1998) "Corporate governance and board effectiveness", Journal of Banking & Finance, Vol 22, Issue 4, pp. 371-403. https://doi.org/10.1016/S0378-4266(98)00005-3

Hussain, N., Rigoni U., & Orij, R. P. (2018) "Corporate Governance and Sustainability Performance: Analysis of triple bottom line performance". Journal of Business Ethics. Vol 149, pp. 411-432. https://doi.org/10.1007/s10551-016-3099-5

Jensen, M.C., Meckling, W.H., (1976). "Theory of the firm: managerial behavior, agency costs, and ownership structure. Economic Analysis of the Law Vol 3, Issue 4, pp. 305–360. https://doi.org/10.1002/9780470752135.ch17.

Jiao, Y., (2010)." Stakeholder welfare and firm value". Journal of Banking & Finance, Vol 34, pp. 2549- 2561 https://doi.org/10.1016/j.jbankfin.2010.04.013

Jizi, M., Nehme, R., & Melhem, C. (2022). "Board gender diversity and firms' social engagement in the Gulf Cooperation Council (GCC) countries". Equality, Diversity, and Inclusion: An International Journal, Vol 41Issue 2, pp. 186-206. https://doi.org/10.1108/EDI-02-2021-0041

Kassinis, G., Panayiotou A, Dimou A. Katsifaraki G. (2016) "Gender and Environmental Sustainability: A Longitudinal Analysis", Corporate Social Responsibility and environmental management, Vol 23, Issue 6, pp. 399-412. https://doi.org/10.1002/csr.1386

European Journal of Social Impact and Circular Economy - ISSN: 2704-9906
DOI: 10.13135/2704-9906/7425 Published by University of Turin http://www.ojs.unito.it/index.php/ejsice/index

Khan, A., Muttakin, M.B., Siddiqui, J., (2013). "Corporate governance and corporate social responsibility disclosures: evidence from an emerging economy". J. Bus. Ethics, Vol 114 Issue 2, pp. 207–223. https://doi.org/10.1007/s10551-012-1336-0.

Khwaja N. C.L. Voinea Z. Ali, Fawad R. Cosmin F., (2021), "Board Gender Diversity and Corporate Social Performance in Different Industry Groups: Evidence from China", Sustainability, Vol 13, Issue 6, https://doi.org/10.3390/su13063142.

Leopizzi, R., Iazzi, A., Venturelli, A., & Principale, S. (2020). "Nonfinancial risk disclosure: The "state of the art" of Italian companies". Corporate Social Responsibility and Environmental Management, Vol 27, Issue 1, pp. 358-368. https://doi.org/10.1002/csr.1810

Li, T. T., Wang, K., Sueyoshi, T., & Wang, D. D. (2021). "ESG: Research progress and future prospects". Sustainability, Vol 13, Issue 21, 11663. https://doi.org/10.3390/su132111663

Marsat, S., Williams, B., (2013). "CSR and Market Valuation: International Evidence". Bankers, Markets & Investors Vol., 123, pp. 29-42. https://dx.doi.org/10.2139/ssrn.1833581

Martínez-Ferrero J. Eryilmaz M. and Colakoglu N. (2020) "How Does Board Gender Diversity Influence the Likelihood of Becoming a UN Global Compact Signatory? The Mediating Effect of the CSR Committee", Sustainability Vol 12, Issue 10, 4329, pp- 1-19.

Marsat S., Williams B., (2014) "Does the Market Value Social Pillar?" http://ssrn.com/abstract=2419387

Martínez-Ferrero J., Lozano M.B., Vivas M. (2021) "The impact of board cultural diversity on a firm's commitment toward the sustainability issues of emerging countries: The mediating effect of a CSR committee". Corporate Social Responsibility and Environmental Management. Vol 28 Isue 2, pp. 675-685. https://doi.org/10.1002/csr.2080

Michelon, G., Parbonetti, A., (2012). "The effect of corporate governance on sustainability disclosure". J. Manag. Govern. Vol 16, Issue 3, pp. 477–509. https://doi.org/10.1007/s10997- 010-9160-3.

Monteiro, A. P., García-Sánchez, I. M., & Aibar-Guzmán, B. (2022). "Labour practice, decent work and human rights performance and reporting: The impact of women managers". Journal of Business ethics, Vol. 180, Issue 2, pp. 523-542. https://doi.org/10.1007/s10551-021-04913-1

Murphy K. (2012). "The social pillar of sustainable development: a literature review and framework for policy analysis, Sustainability: Science", Practice and Policy, Vol 8, Issue 1, pp.15-29, DOI: 10.1080/15487733.2012.11908081.

Nicolò G., Zampone G., Sannino G., de Iorio S. (2022) "Sustainable corporate governance, and non-financial disclosure in Europe: Does the gender diversity matter?" Journal of Applied Accounting Research, Vol 23 Issue 1, pp. 227-249. https://doi.org/10.1108/JAAR04-2021-0100

Refinitiv (2022), Environmental, Social and Governance scores. Retrieved https://www.refinitiv.com/content/dam/marketing/en_us/documents/methodology/refinitiv-esg-scores-methodology.pdf.

René P. O., Rehman S., Hashim K., Khan F., (2021) "Is CSR the new competitive environment for CEOs? The association between CEO turnover, corporate social responsibility and board gender diversity: Asian evidence", Corporate Social Responsibility and environmental management, Vol.28, Issue2, pp. 731-747. https://doi.org/10.1002/csr.2084

Rossi, M., Chouaibi, J., Chouaibi, S., Jilani, W., & Chouaibi, Y. (2021). Does a board characteristic moderate the relationship between CSR practices and financial performance? Evidence from European ESG firms. Journal of Risk and Financial Management, Vol 14, Issue 8, 354. https://doi.org/10.3390/jrfm14080354

Scholtens, B., (2006). "Finance as a Driver of Corporate Social Responsibility". Journal of Business Ethics, Vol 68, pp. 19-33. https://doi.org/10.1007/s10551-006-9037-1

Secinaro S., Brescia V., Calandra D., Buerahn Saiti, (2020) "Impact of climate change mitigation policies on corporate financial performance: Evidence-based on European publicly listed firms", Corporate Social Responsibility and Environmental Management, https://doi.org/10.1002/csr.1971.

Shahid A.U., Patel C., Peipei P. (2022) "Corporate social responsibility, intrinsic religiosity, and investment decisions" Journal of behavioural and experimental finance, Vol, 34, https://doi.org/10.1016/j.jbef.2022.100650

Spitzeck, H. (2009). "Organizational structures and processes: The development of governance structures for corporate responsibility". Corporate Governance International Journal of Business in Society. Vol 9 Issue 4, pp. 495-505. https://doi.org/10.1108/14720700910985034

Stevens, C. (2010). Are women the key to sustainable development. Sustainable development insights, Vol 3, Issue 11, pp. 1-8.

Uyar, A., Kilic, M., Koseoglu, M. A., Kuzey, C., & Karaman, A. S. (2020). "The link among board characteristics, corporate social responsibility performance, and financial performance: Evidence from the hospitality and tourism industry." Tourism Management Perspectives, Vol 35, 100714. https://doi.org/10.1016/j.tmp.2020.100714

European Journal of Social Impact and Circular Economy - ISSN: 2704-9906
DOI: 10.13135/2704-9906/7425 Published by University of Turin http://www.ojs.unito.it/index.php/ejsice/index

Uyar, A., Kuzey, C., Kilic, M., & Karaman, A. S. (2021). B"oard structure, financial performance, corporate social responsibility performance, CSR committee, and CEO duality: Disentangling the connection in healthcare". Corporate Social Responsibility and Environmental Management, Vol 28, Issue 6, pp. 1730-1748. https://doi.org/10.1002/csr.2141

Veltri S., Mazzotta R., Rubino F.E., (2021) "Board diversity and corporate social performance: Does the family firm status matter?" Corporate Social Responsibility Environmental Management, Vol 28, pp. 1664–1679. https://doi.org/10.1002/csr.2136

Wei S., Veenstra K., (2021) "The Moderating Effect of Cultural Values on the Relationship Between Corporate Social Performance and Firm Performance", Journal of Business Ethics, Vol 174, pp. 89–107 https://doi.org/10.1007/s10551-020-04555-9

Zumente, I., & Bistrova, J. (2021). "ESG importance for long-term shareholder value creation: Literature vs. practice". Journal of Open Innovation: Technology, Market, and Complexity, Vol 7, Issue 2, 127. https://doi.org/10.3390/joitmc7020127

Yadav, P. and Prashar, A. (2022), "Board gender diversity: implications for environment, social, and governance (ESG) performance of Indian firms", International Journal of Productivity and Performance Management, https://doi.org/10.1108/IJPPM-12-2021-0689.

Usón A.A,. Moneva J.M., Scarpellini S. (2022) "Sustainability accounting and the introduction of the circular economy principles in businesses", European Journal of Social Impact and Circular Economy Vol 3, n. 3. https://doi.org/10.13135/2704-9906/6817

Urmanaviciene A. Udara S. A. (2020) "The Effective Methods and Practices for Accelerating Social Entrepreneurship Through Corporate Social Responsibility", European Journal of Social Impact and Circular Economy, Vol 1, Issue 2, pp. 27-47. https://doi.org/10.13135/2704-9906/5085

Urmanaviciene A. (2020) "WISEs' Social Impact Measurement in the Baltic States", European Journal of Social Impact and Circular Economy, Vol 1, Issue 2, pp. 48-75. https://doi.org/10.13135/2704-9906/5091

European Journal of Social Impact and Circular Economy - ISSN: 2704-9906
DOI: 10.13135/2704-9906/7425 Published by University of Turin http://www.ojs.unito.it/index.php/ejsice/index