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Development of a decision-making framework addressed to SMEs and consultants to support the assessment, adoption and implementation of corporate sustainability

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A mamma, papà,
sorelle, cognati,
nipotoni e nipotine

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ABSTRACT

Sustainability concepts applied to organizations have recently come under the spotlight, as internal and external stakeholders are increasingly aware of these issues and push companies to implement sustainable principles and strategies in their business models.

In order to address this phenomenon, several tools have been developed to assist organizations in assessing sustainability and in the transition towards the implementation of these new principles. However, the lack of shared procedures, along with the proliferation of new practices, often not standardized, have led to uncertainties in selecting the most suitable tool or methodology to use.

This thesis aims at identifying and systematizing the most consolidated key processes and tools for evaluating, adopting, and implementing the concepts of integrated sustainability (environmental, social and economic/governance) within companies, then creating a logical tool, identified as a modular decision-making framework, that contains this information and allows companies or consultants to evaluate and implement their process of sustainable development.

Specifically, this dissertation will be divided into 4 parts. Firstly, the issues inherent to corporate sustainability will be explored. In particular, it will deal with integrated sustainability, available standards (environmental, social, economic, and integrated) such as ISO and BSI, certifications (e.g., B Corp), reporting tools (GRI, SASB, IR), rating tools (e.g., MSCI, SiRating, ecc) and frameworks (e.g., The Natural Step) that evaluate and implement corporate sustainability. This part will also discuss the uses and future developments of these tools, at national, European, and international level along with the needs that led to the development of the Framework presented in this thesis.

In the second part, the developed decision-making framework will be presented, first from the methodological point of view and then in its ICT implementation within a web-based tool. The decision-making framework aims at helping both business consultants – who support companies in the process of adopting and implementing sustainability–and companies willing to improve their corporate sustainability. In particular, the decision-making framework will help companies in following a flexible path for the evaluation of the material issues and the key externalities of the company, in the adoption and implementation of sustainability through a proactive approach and in the reporting the efforts spent towards sustainability. In the third part, the conceived Framework will be applied to a real case study, with the aim of verifying its functionality and potential problems. Lastly, the conclusions, the potentialities, the limitations, and the possible future improvements of the decision-making framework will be discussed.

RATIONALE AND GOALS

In recent decades, concepts such as sustainability and sustainable development applied to companies have become an integral part of society, governments, and private entities. This phenomenon has occurred because the society is increasingly aware of the problems inherent to the anthropogenic impacts, such as climate change, biodiversity loss, pollution, overexploitation etc. Indeed, the consequences deriving from these negative externalities are already well known as well as the needs to safeguard the planet, to protect ecosystems and preserve ecosystem functions (Landrum & Ohsowski, 2018; Parmar et al., 2010; Steffen et al., 2015).

The company has always been the holder of both moral and legal obligations towards the reference society. Today, however, stakeholders are increasingly asking organizations to consider the environmental, social, and economic impacts generated by their activities. Furthermore, they are pushing companies towards the implementation of more sustainable and socially responsible production systems. Requiring organizations to concretize processes of assessment, implementation and reporting of sustainable medium/long-term principles and strategies.

Under these pressures, organizations have begun to report and manage their environmental, social but also economic impacts, both positive and negative, to improve their sustainability and transparency (Engida et al., 2018; Hoffenson et al., 2013; Jiang et al., 2018).

This phenomenon, however, has led to the proliferation of various methodologies and tools that could guide companies in the processes of evaluation, implementation, and reporting of sustainability and thus in their strategic transition towards sustainable development.

However, the lack of standardised methodologies and tools for sustainability assessment is creating uncertainty regarding the most suitable tool or methodology to be used by companies to achieve sustainable practices. This uncertainty is present when selecting the category of "tools" to be implemented (standards, rating tools, framework, etc.) as well as when selecting the specific tool to be used within the identified category (e.g., MSCI, SiRating).

For this reason, the need and opportunity were seen to create a modular logical tool, namely a decision-making framework that would allow the structuring of a strategic guideline that could help both consultants and companies, through a proactive approach, in the assessment, implementation, and reporting of corporate sustainability.

This thesis work aims firstly to deepen, identify, and systematize the most consolidated key processes and tools for evaluating, adopting, and implementing the concepts of sustainability (environmental, social, economic, and integrated) within companies.

Subsequently, the specific goal of this dissertation consists in the development of a guideline, i.e., the decision-making framework.

The aim is to design a tool that can guide companies in a flexible, cyclical, continuous and proactive way, in the process of identifying a personalized, objective, and strategic path of sustainable development. This will be allowed using different tools and methodologies implemented within the guideline through a structured and logical roadmap.

In particular, the decision-making framework aims at helping companies: i) in the assessment of material issues and key externalities through a process of bilateral interaction with the main stakeholders, ii) in the adoption and implementation of sustainability through a proactive approach and ii) in reporting their non-financial externalities.

By applying the tool to a real case study, it will also be possible to verify the functionality and possible problems of the developed roadmap and methodology and the tools selected and implemented within the framework.

Particular attention will be paid to the potentials and criticalities of the morphological scheme, conceived, and implemented with the purpose of being an objective screening decision-making process for choosing the most suitable tool or standard for a company based on its requests and characteristics relating to sustainable development.

STRUCTURE

The thesis is divided into four distinct sections. Section I, developed in chapters 1, 2, 3, 4, defines the theoretical background behind this dissertation. The second section, composed of chapters 5, 6, establishes the conceptual development of the modular decision-making framework. Section III, divided into chapters 7, 8, composes the application of the tool to a real case study and finally, the last section presents the conclusions of the work.

Within the theoretical section, some topics and concepts are introduced to deepen the theme inherent to corporate sustainability. This part is divided into four descriptive chapters. Chapter 1, “Sustainable development and corporate sustainability” explains the concepts of sustainable development, corporate sustainability and the related challenges and potentials.

Chapter 2, "Corporate Sustainability Tools" discusses the various tools designed and developed for the assessment, implementation and non-financial reporting of corporate sustainability and their main characteristics are analysed in depth. In Chapter 3, "Commitments and Future Prospects", possible future developments regarding the methodologies and tools for corporate sustainability assessment are examined. In the last chapter of this section, "Reasons that Induced to the Creation of the Framework", the various reasons that led to the development of a decision-making framework are illustrated.

Within the second section, the developed decision-making framework is presented. Initially, within chapter 5, "The modular Framework", the theoretical processes that led to the logical design of the macrostructure of this decision-making framework are described and subsequently the whole structure is represented by means a flowchart. With the last chapter of this section, "IT Development of the Flexible Decision-Making Framework", the web implementation of the conceptual framework is finally briefly discussed.

In the third section, the case study application is presented. Specifically, in Chapter 7 "Introduction to the case study and contextualization of the test company", a description of the company that tested the conceptual tool is initially reported and subsequently the results deriving from the application of the framework to the case study are described. Chapter 8, "Potential and criticality of the Framework" presents the potentials and the problems encountered during the application of the tool. Finally, the thesis concludes with the chapter “Discussion and Conclusion” where the potentials, limitations, and possible future improvements for the research inherent to the decision-making framework are dealt with.

SECTION I: THEORETICAL BACKGROUND

In this first section, a review of the theoretical foundations of corporate sustainability will be discussed. In particular, a definition of this term, its development within the companies and the underlying pillars will be provided first. Then the various most significant tools and standards that have been designed to evaluate, implement, and report on integrated sustainability will be critically disserted.

Subsequently, prospects and commitments at the National, European, and International level will be dealt with, through an in-depth study of the Green Deal and the European Taxonomy.

Finally, the reasons that led to the development of a decision-making framework that guides and assists the implementation process of these concepts by companies will be illustrated.

CHAPTER 1: Sustainable development and corporate sustainability

Many of today's environmental and social challenges are the result of unsustainable economic and industrial development models (Asif & Searcy, 2014; Formentini & Taticchi, 2016) and are pushing companies towards more conscious management.

Citizens, increasingly aware of the anthropic impacts related to climate change, modification of biogeochemical flows and changes in the integrity of the biosphere with related social and moral consequences, which are mostly affecting the poorest classes and the future generations, are forcing companies to be more transparent and to properly consider the externalities of their operations (Landrum & Ohsowski, 2018; Parmar et al., 2010; Pope Francis, 2015; Steffen et al., 2015).

Organizations undergoing these pressures from different groups of both external and internal stakeholders are looking for ways to minimize and report the various negative environmental, social but also economic externalities, in order to improve their sustainability and transparency (Engida et al., 2018; Hoffenson et al., 2013; Jiang et al., 2018).

Over the last decade, concepts such as sustainable development and sustainability have increasingly become part of the collective of companies and the integration of these principles in key activities has led to a positive impact on the performance of the organizations (Grewal & Serafeim, 2020; Ioannis; Ioannou & Serafeim, 2019).

However, these concepts, on a global level, are not emphasized and structured in the same way. European companies, for example, are much more sensitive to environmental issues, while

American companies are more keen on social sustainability within the organization (del Mar Alonso-Almeida et al., 2014).

In the twentieth century, there was the game-changer that opened the way to the debate on sustainability between public opinion, national governments, and the business world, following the interest on the part of the international community in the effects that the development of human societies has on the environment. More precisely in 1983, the World Commission on Environment and Development (WCED) was established with the aim of outlining long-term strategies for achieving sustainable development for the years 2000 and later. This commission had the task of translating the concern about environmental problems into greater cooperation between the various countries, by also considering the close link between people, the environment and development. All this resulted in the document "Our common future" (World Commission for Environmental and Development, 1987), better known as the Brundtland Report, in which the concept of sustainable development is described for the first time as: "a development that satisfies present needs without compromising the possibility of future generations to satisfy their own" (World Commission for Environmental and Development, 1987).

Nowadays, sustainability for business is considered the paradigm of the 21st century. Indeed, in the last 10 years, investors have begun to pay increasingly attention to ESG (environmental, social and governance) performance such as information on corporate emissions, transparency, and worker safety, thus becoming today some of the important factors that are incorporated in the decision-making choice of investors and therefore of interest to the organizations themselves. The importance of addressing these aspects can be observed in the Deliveroo case, the worst debut ever on the London stock exchange. Due to various factors including the lack of ESG sustainability, especially for the social pillar, Deliveroo has seen its financial assessment decreased by about 30% (Financial Times, 2021; Garcia et al., 2016; Il Sole 24 Ore, 2021; Serafeim, 2020).

In 2018, 89% of the Global 500, the 500 largest corporate groups worldwide by revenue, committed themselves to emission reduction targets, with a percentage growth of + 59% compared to 2009 (Freiberg, D., Grewal, J. and Serafeim, 2020; Grewal & Serafeim, 2020).

Additionally, in 2019 more than 9,500 companies from 160 countries around the world began to arouse interest in implementing the concepts of sustainability as an essential part of their business (Freiberg, D., Grewal, J. and Serafeim, 2020; Grewal & Serafeim, 2020; Nunhes et al., 2020; United Nations Global Compact, 2021).

However, defining corporate sustainability is not easy, since there is not yet a single and standardized definition (Montiel & Delgado-Ceballos, 2014).

To this end, Figure 1.1 shows how the concepts of sustainable development and corporate sustainability are interconnected.

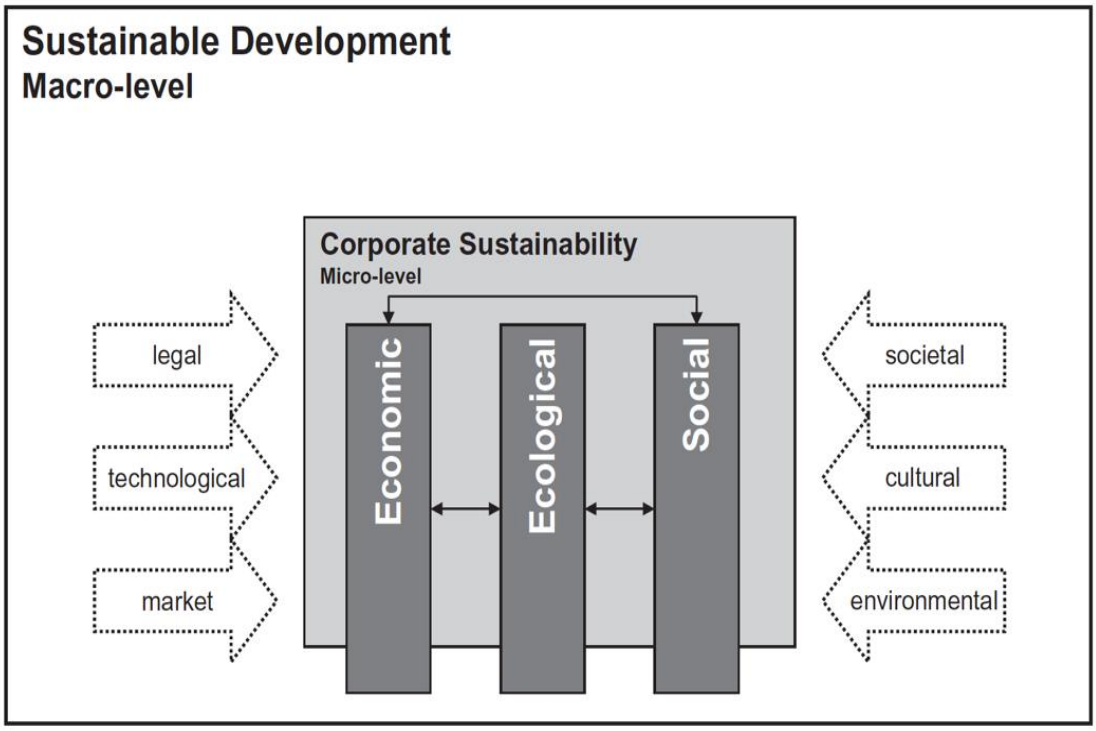

Figure 1.1: Interconnection between sustainable development and corporate sustainability (Baumgartner & Ebner, 2010)

Corporate sustainability can be defined as the application of sustainable development within organizations and how it is defined through the 3 pillars of the triple bottom line (TBL), social, environmental and economic, and deals with their balanced and integrated development (Baumgartner & Ebner, 2010; Joshi & Li, 2016; Moldavska & Welo, 2017; Montiel & Delgado-Ceballos, 2014; Nawaz & Koç, 2019; Nunhes et al., 2020; Roca & Searcy, 2012).

Through the definition of the Brundtland Commission (World Commission for Environmental and Development, 1987), therefore, a sustainable company can be defined as that organization that implements a long-term systemic vision within its borders, and that seeks to identify and manage externalities and associated risks, involving and communicating the results to interested parties, both internal and external, satisfying their current needs without compromising those of future stakeholders, also committing to use natural resources so that they are not depleted faster than regeneration rates (Holton et al., 2010; Joshi & Li, 2016; Nawaz & Koç, 2019).

To ensure the successful implementation of sustainability concepts, companies must make a substantial change in their "business as usual", starting to define new long-term strategies and operate in order to identify how to put into practice a focused vision on sustainability through a stakeholder engagement network, monitoring of externalities and non-financial evaluation of their processes, raising awareness that they are operating in a sensitive integrated system (Bocken et al., 2014; Busco et al., 2020; Eccles et al., 2014; Gonzalez-Perez & Leonard, 2015; Holton et al., 2010; Jolliet et al., 2016; Joshi & Li, 2016; Linnenluecke & Griffiths, 2010; Montiel & Delgado-Ceballos, 2014; Mura et al., 2018; Nunhes et al., 2020; Valente, 2012).

A company that has implemented the concepts of sustainability in a decisive and real way, not only has competitive advantages over other companies in terms of efficiency in the use of resources and reputation, but also it has greater resilience and resistance, as emerged from several studies carried out during the Covid-19 pandemic. Specifically, sustainable companies can more dynamically face the new challenges that the excessive exploitation of the planet and climate change are causing directly and indirectly (Birkin et al., 2020; Kaplan, 2020; KPMG, 2020; Sun, 2020).

Certainty, climate, environmental, social and health crises will become increasingly prevalent in the future. A 2012 survey by KPMG, one of the 4 most important consulting firms, identified 10 forcings, called mega-forces, schematically represented in Figure 1.2, which will have a dominant impact on the development of organizations over the next 20 years (KPMG, 2012).

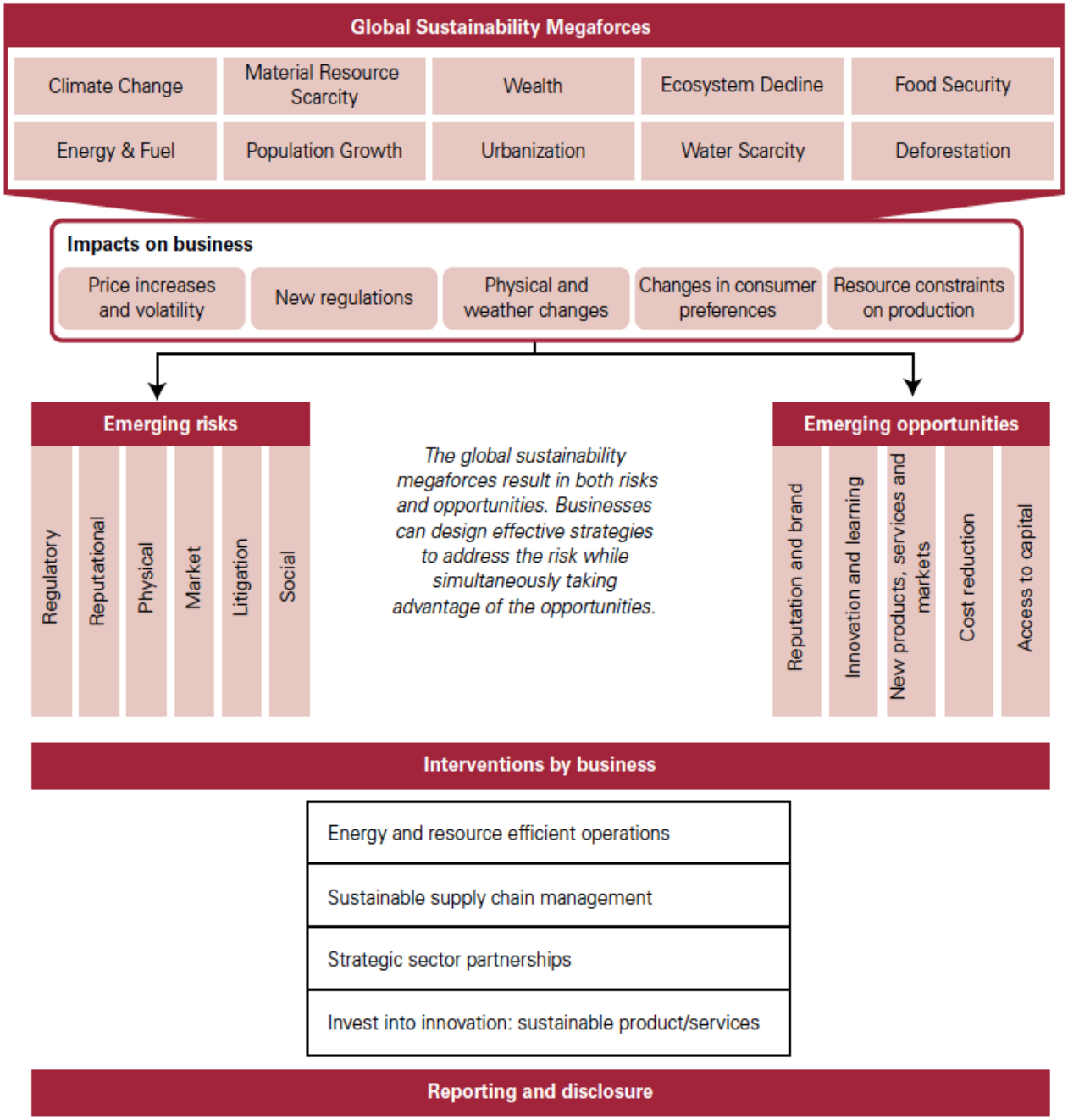

Figure 1.2: Mega forces connected to sustainability that will have an impact on company growth (KPMG, 2012)

CHAPTER 2: Corporate sustainability tools

In parallel with the development of concepts relating to corporate sustainability, various standardized methodologies and tools have been devised to evaluate, develop and report sustainability within organizations which can be grouped into 4 macro-areas (standards & certifications, non-financial reporting systems, rating tools and frameworks) as presented in Figure 2.1 (Gimenez et al., 2012; Moldavska & Welo, 2017; Siew, 2015).

The common point of these methods is the dialogue with the stakeholders and the measurement or management of corporate performance from a TBL/ESG[1] perspective, i.e. evaluating sustainability at an environmental, social, economic/governance or integrated level (Maas et al., 2016).

In the following paragraphs, a detailed description of the 4 macro-areas (i.e., standards & certifications, non-financial reporting systems, rating tools and frameworks) will be presented.

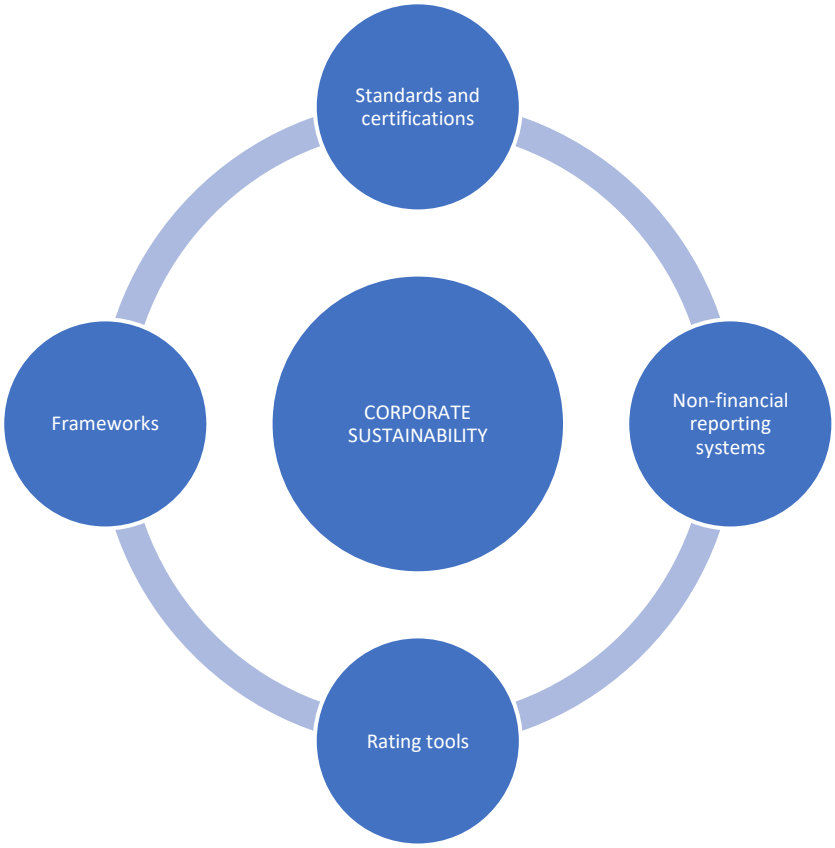

Figure 2.1: Methods for evaluating, implementing, and reporting corporate sustainability

[1] TBL: triple bottom line
ESG: environmental, social and governance

2.1. Standards and certifications

Sustainability, based on the integrated triple bottom line vision, is implemented, identified and verified within companies through the use of standardized management tools, such as, for example, the ISO 14001 environmental management system for environmental capital, the ISO 9001 quality management system for the economic one and the ISO 26000 corporate social responsibility standard for the social dimension, as reported in Figure 2.2, where some of the most important standards divided by type of capital are listed (Baumgartner, 2014; Engert et al., 2016; Gimenez et al., 2012; Grimm et al., 2016; Hahn, 2012; Holton et al., 2010; Jin & Bai, 2011; Moldavska & Welo, 2017; Nunhes et al., 2020; Siew, 2015).

The standards reported in Figure 2.2 are defined as management systems and guidelines for accounting the TBL sustainability issues. These deal with different sub-themes both separately, such as the management of environmental capital and the maintenance of its ecosystem properties or the management of stakeholders and multi-capitally, which integrate two or more dimensions of sustainability (ISO, 2021; Lozano & Huisingh, 2011; Nawaz & Koç, 2018; Nunhes et al., 2019, 2020).

TBL Focus Area(s)	Management Standard/Guideline/Regulation
Economic	- ISO 9001 Quality management system - ISO 44001 Collaborative business relationship management systems - ISO 37001 Anti-bribery management system - ISO 22301 Business continuity management system
Environmental	- ISO 14001 and EMAS—Environmental management system - ISO/DIS 24526 Water efficiency management systems - ISO 50001 Energy management system - ISO 14064 Carbon management system
Social	- ISO 45001 Occupational health and safety management system - ISO 18788 Management system for private security operations - SA 8000 Social Accountability
Economic, environmental and social	- ISO 19600 Compliance management system and AA1000AS Assurance standard - ISO 28001 Security management system for the supply chain - ISO/IEC 27001 Information security management system and ISO/IEC 2000-1 Service management system - ISO 30401 Human resource management—Knowledge management systems - ISO 31000 Risk management system - ISO 26000 Guidance on social responsibility - British BSI PAS 99; Danish DS 8001; Spanish UNE 66177; Australia/New Zealand AS/NZS4581 Integrated management system - BS 8900 Managing sustainable development

Figure 2.2: Some of the most important Standards with a focus on TBL divided by type of capital (Nunhes et al., 2020)

The proliferation of these standards is boosted by stakeholders, who are increasingly interested in how companies manage their negative externalities on the environment and society and how these are dealt with between different companies and industrial sectors (ISO, 2021). Already in 2010, about 15% of companies required their subcontractors to comply with sustainability standards, as well as to provide proof of their commitment through certifications such as ISO 14001, the environmental management system, as well as the less known EMAS, the European standard of eco-management and European level audit and SA8000, a management standard that encourages organizations to develop, maintain and apply sustainable social practices in the workplace (European Commission, 2021a; Grimm et al., 2016).

Today, however, many stakeholders are emphasising that companies implement sustainability standards without the real commitment of modifying their business model towards more sustainable practices, but only to obtain certifications expendable on the market to attract more clients. This is the case of organizations that use certifications derived from standards with the sole purpose of increasing their reputation with respect to competitors and therefore without a long-term strategy oriented towards sustainable development (Gianni et al., 2017; Nunhes et al., 2020; Witjes et al., 2017).

Despite this, scientific research demonstrates forms of effective sustainability implementation for these tools, in particular for ISO 14001, where some studies identify positive externalities also in the social and economic pillars due to, for example, both the increase in process efficiency and transparency on the market (Asif et al., 2013; Brammer et al., 2012; Curkovic & Sroufe, 2011; Daddi et al., 2011; Delmas et al., 2011; Maletic et al., 2015; Neves et al., 2017; Uhlaner et al., 2012; Upstill-Goddard et al., 2016).

2.1.1. B Corporation

In addition to the standardized methodologies reported in Figure 2.2, other tools providing sustainability certifications are starting to take hold, as the case of the B-corporation, one of the most recent and widespread labels/certifications related to corporate sustainability (B Corpation, 2021).

The B Corporation certification (B Corp) is a corporate certification which is issued to those entities that voluntarily and formally commit to the production, in an integrated way, both at spatial and temporal level, of advantages and social and environmental benefits while implementing economic capital and increasing and creating value (B Corporation, 2021b, 2021a).

Today, the B Corporation certified companies cover 150 industrial sectors divided into more than 70 countries worldwide. In the Italian landscape there are more than 100 companies that have the B Corp certification.

The first step to obtaining the B-Corp certification is to evaluate and provide information on how the company is implementing and increasing the value for the company through the B impact assessment, a tool that evaluates the impact of the company business model and which investigates how the organization interacts internally with employees and customers and externally with the community and the environment, providing a score between 0 and 200 at the end of the assessment. For all the companies that obtain the threshold score of 80 points, the certification is issued by B Lab, the certifying body for B-Corp companies (B Lab, 2019).

In Figure 2.3 it is possible to observe the numerical reference scale for B-Corp scores.

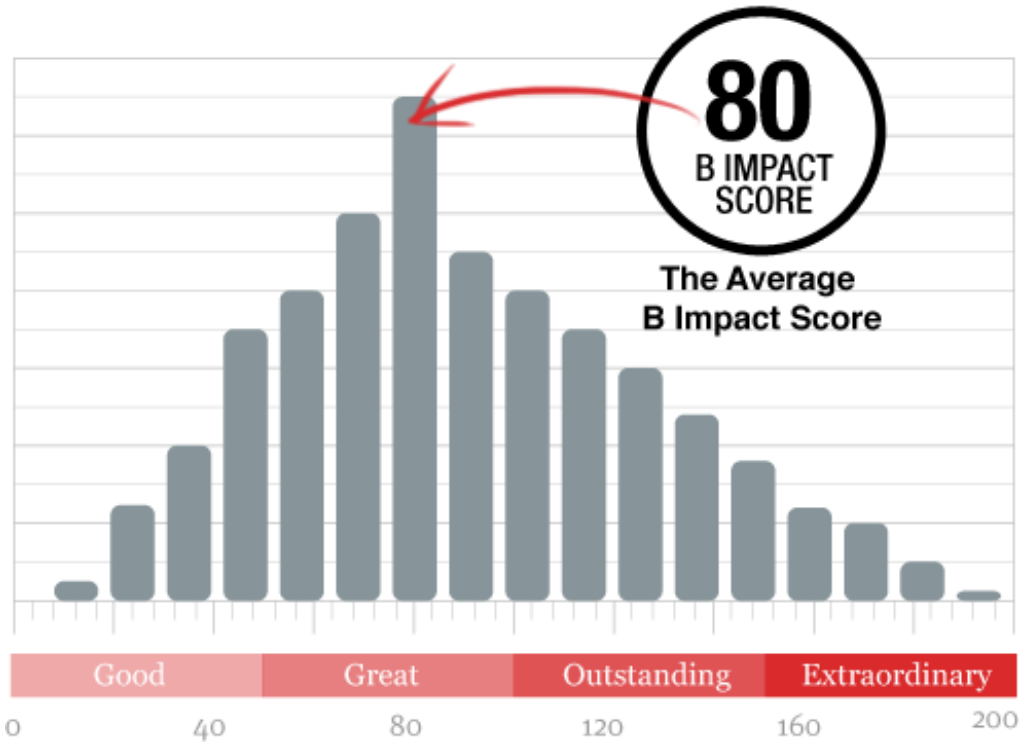

Figure 2.3: Numerical reference scale for B-Corp (B impact Assessment, 2021)

B-Lab also offers, through its own database, the possibility of comparing the various certified companies through an intra and inter-company benchmarking process, providing information on both how the organization is positioned compared to competing companies or other organization and how it has improved compared to its previous assessment. This process is similar to the Benchmarking process offered by ESG[2] rating companies and described in the chapter on Rating tools. The overall impact of the organization is calculated based on 4 impact areas: governance, workers, community, and environment. The sum of the score obtained for each impact areas creates the final score for the B-Corp (Figure 2.4) (B impact Assessment, 2021).

[2] ESG: environmental, social and governance

Figure 2.4: Example of Impact Report released by B-Lab (B impact Assessment, 2021)

Based on the principles of the B-Corp and in parallel with its implementation, a new legal form was introduced, first in the USA, and subsequently in Italy from 2016, which takes the name of Benefit Corporation, called in Italian "Società Benefit".

The Benefit Companies, today more than 500 in Italy, represent an evolution of the concept of standard company. They are for-profit companies that want to balance financial and non-financial interests when making decisions by working in an integrated way on the economic, social and environmental pillars (B Corporation, 2021c, 2021a; B Lab Europe, 2021).

2.2. Reporting tools

Recently, companies, also through the mediation of international organizations such as UN, GRI and SASB[3], have begun to report, with increasing frequency, their sustainability, in the face of the diffusion of specific regulations, especially in Europe, addressed to large companies (Sofian & Dumitru, 2017; Tschopp & Huefner, 2015).

Specifically, in 2014, following previous developments at Member States level, such as the French Grenelle Act of 2012 which introduced the reporting of both the social and environmental impacts and the commitment to the development of a sustainable community for the main national companies, the EU first approved and subsequently issued Directive 2014/95/EU, for mandatory non-financial reporting for companies larger than 500 employees (Cheng et al., 2014; Dienes et al., 2016; European Parliament, 2014; Simnett & Huggins, 2015; Villiers, 2014).

In Italy, the obligation for large national public interest entities[4] to draw up and publish a non-financial statement was introduced with Legislative Decree 254 of 12/30/16, implementing the "Barnier Directive", 2014/95/EU (Amelio et al., 2018).

In virtue of these pressures, including institutional ones, from 2012 to 2017 there was a worldwide increase of + 60% in sustainability reports, reaching 80% of the S&P 500 companies (Ioannis Ioannou & Serafeim, 2017). If only the world's largest companies are considered, this figure increases, reaching 90-95% (Ernst & Young, 2014; Ioannis Ioannou & Serafeim, 2017; King & Bartels, 2015; Landrum & Ohsowski, 2018; Tschopp & Huefner, 2015).

Non-financial reporting tools, which are non-mandatory methodologies, have the purpose of transparently communicating to the various stakeholders, through reports or dedicated pages on websites, the information and commitments of companies towards the implementation of sustainability. This is reported through various indicators, which evaluate the pillars from an ESG (economic, social and governance) or TBL (triple bottom line) perspective both quantitatively and qualitatively (Rupley et al., 2017; Siew, 2015).

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[3] UN: United Nations
GRI: Global Reporting Initiative
SASB: Sustainability Accounting Standards Board

[4] Italian companies issuing stock title admitted to trading on Italian and European Union regulated markets, banks, insurance companies, reinsurance companies with registered office in Italy and secondary offices in Italy of non-EU reinsurance companies with more than 500 employees who, at the balance sheet date, have exceeded at least one of the following two-dimensional limits: a) total balance sheet: € 20,000,000; b) total net revenues from sales and services: 40,000,000 euros.

Transparency is a key concept for non-financial reporting systems and, at the same time, the reporting tools are a vehicle for implementing more effectively a process that induces such transparency (Fernandez-Feijoo et al., 2014).

The motivation that drives companies to use these tools, although being mandatory for some, can be described through 6 key objectives (Crane & Glozer, 2016; Du et al., 2010; Landrum & Ohsowski, 2018):

1) building a network of relationships with stakeholders;
2) improvement of reputation;
3) communicate the commitments undertaken towards sustainable development;
4) change consumer behaviour with awareness campaigns;
5) communicate how the company undertakes stakeholder requests;
6) create a transparent corporate identity.

Two of the key themes that the various non-financial reporting tools have in common are stakeholder engagement and materiality assessed through maps or matrices. These are strategic tools that companies can use to define the risks and opportunities derived from sustainability (KPMG International, 2014).

Materiality, used previously within the financial reporting systems and now incorporated in the non-financial ones, is a changing concept in continuous evolution that leads to a lack of unified definition, the ISA (International Standard on Auditing) in fact, has abandoned the idea of providing a standard definition of materiality, while focusing on the general peculiarities of the concept, thus accepting that companies can define materiality in different ways (Edgley, 2014; Edgley et al., 2015; Lai et al., 2017).

Unlike materiality assessed in financial reporting, in the non-financial one, the most impacting negative externalities concerning environmental, social and economic sustainability are identified and evaluated and should be determined through both a broader social expectation and the influence of the company on suppliers (upstream) and customers (downstream) (CDP et al., 2016; Global Reporting Initiative, 2016a; KPMG International, 2014).

The company's material aspects are those relevant issues that should be prioritised, and which reflect the interests and needs, not only of the internal stakeholders of the company, but also of the

external ones. Additionally, a material aspect can be considered as such if it can affect the performance and reputation of the company in the long term (Hsu et al., 2013; Mio, 2013).

Furthermore, the material aspects also include externalities that in the short term may not be considered relevant to address, but which, if neglected, have the potential to become difficult to manage in the medium/long term, thus becoming critical and relevant (International Integrated Reporting Council, 2021).

Different tools can be used to assess the significance of the various externalities. For example, to define the priority aspects, companies have begun to involve the stakeholders in defining with them, at the ESG level, the relevant impacts/externalities, using maps o graphs representing the dimensions of interest/relevance (Eccles et al., 2012).

The three most used non-financial reporting systems or CSR (Corporate Social Responsibility Reporting) are GRI, SASB, IR[5] as reported in Table 2.1 along with their main characteristics. These systems are described in detail in the following paragraphs.

Table 2.1: Summary table of the most used non-financial reporting systems

	GRI	**SASB**	**IR**
Target	Stakeholders	Investors	Investors
Aims	Reporting of its own economic, environmental and/or social impacts, towards the goal of sustainable development	Communication to investors on issues relating to sustainability	Demonstrate to financial capital providers how an organization can create value over time
Standard	4 series: General 100, Specifications: Economic 200, Environmental 300, Social 400	77 Standards divided into 11 sectors	It does not require the representation of key performance indicators, nor the use of specific measurement methods, nor to report on individual aspects.
Materiality	The company undertakes to study and understand corporate externalities	Preliminary materiality matrix present on the website that allows to observe the main	The company must identify the relevant aspects (those that

[5] GRI: Global Reporting Initiative
SASB: Sustainability Accounting Standards Board
IR: Integrated Reporting

		impacts that the company and competing companies (same production sector) can cause	affect the creation of value)
Applicability	A sustainability report is created through standardized guidelines	Sustainability reports, integrated reports, websites, or annual shareholder reports	An IR can be drawn up as an independent document, section, distinctive of another report or other form of communication
Usability	Most used in the drafting of sustainability reports thanks to its approach. Older and more established	More recent and less consolidated	Overall, the absence of targeted standards that can be used makes this Framework difficult to implement
Use in 2015 within the reports (Ernst & Young & Boston College Centre, 2014; Landrum & Ohsowski, 2018)	86% (dropped from 95% in 2012)	11%	4%

2.2.1. Global Reporting Initiative

The Global Reporting Initiative, GRI, is the standard reporting format most used by companies to report, in an integrated and interconnected way, the non-financial externalities (environmental, social and economic), both positive and negative, and the company's commitments towards sustainable development (Christofi et al., 2012; Global Reporting Initiative, 2016a; James, 2015; Levy et al., 2010; Lueg et al., 2016; Marimon et al., 2012; Roca & Searcy, 2012).

The GRI Standards were designed with the aim of creating a guideline, which could have the same rigor as the financial report. Especially, the purpose was to devise a process, according to a standardized criterion, which would allow companies to clearly and uniquely identify a complete view of the various significant impacts (Ioannis Ioannou & Serafeim, 2017; Marimon et al., 2012) and to communicate them to stakeholders (internal and external).

Specifically, the GRI, try to provide an overall representation of the material issues and how they are managed, so as to be able to guarantee greater transparency and awareness about these aspects (Kılıç & Kuzey, 2018).

This mechanism allows stakeholders to make informed decisions about the use of services or the acquisition of assets and shareholders to transparently judge their investment (del Mar Alonso-Almeida et al., 2014).

Reporting non-financial externalities using the GRI standard should be performed through the application of the GRI Framework that identifies the contents to be included in the non-financial balance and the related indicators used to report the ESG[6] performance of an organization.

At the base of this standard, six key principles have been identified: reliability, clarity, balance, comparability, accuracy and timeliness (Fernandez-Feijoo et al., 2014).

Specifically, the GRI is made up of 4 series, 3 called Universal and one composed of the series relating to the various pillars of sustainability (economic, environmental, and social) as reported in Figure 2.5.

The three 100 series called Universal section consists of 3 subsections:

- GRI 101, Reporting Principles: this section is related to the essential requirements for reporting in compliance with GRI standards (Global Reporting Initiative, 2016a);

[6] ESG: environmental, social and governance

- GRI 102 General disclosure: guideline that provides information on how to draw up the report and define the profile and characteristics of the company and the process of involving interested parties (Global Reporting Initiative, 2016b);
- GRI 103 Management approach: provide information on what material topics are identified, the intensity and area of impact and how the individual material topics are managed (Global Reporting Initiative, 2016c).

The series relating to the various pillars of sustainability are divided as follows: economic (series 200), environmental (series 300) and social (series 400).

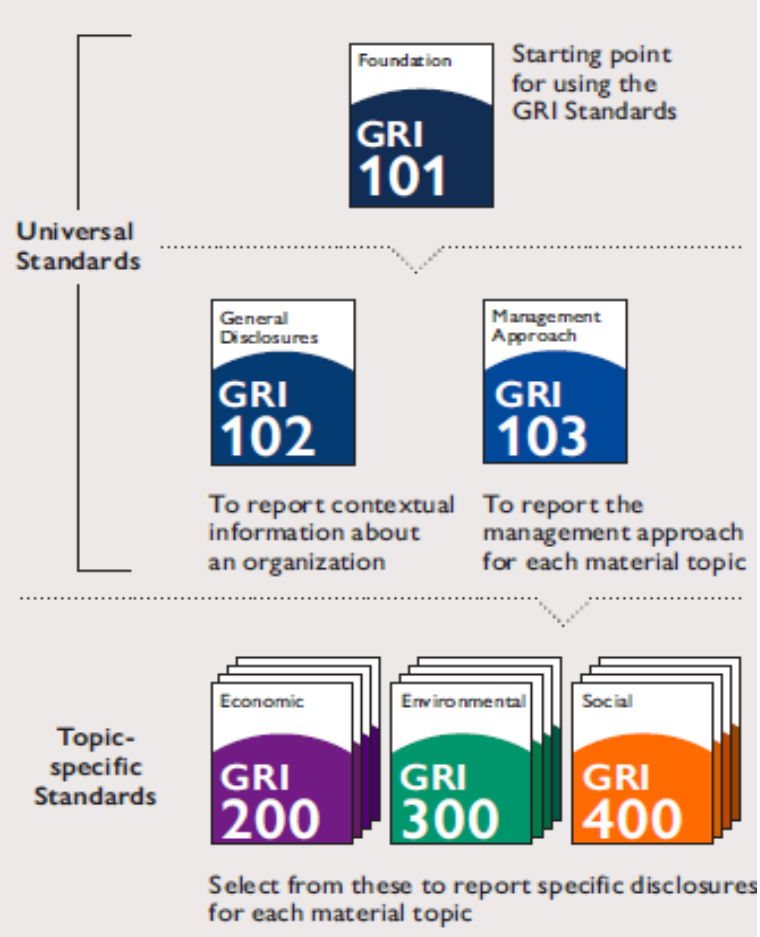


Figure 2.5: GRI series summary diagram (Global Reporting Initiative, 2016a)

One of the key themes of the Global Reporting Initiative, present within the 100 series, is the materiality, a moment in which an organization begins a concrete open discussion to define and understand its own particular situation (Global Reporting Initiative, 2016a).

For GRI, materiality is the cardinal principle that defines which aspects are relevant to internal and external stakeholders that are sufficiently important to make reporting essential, since not all material issues have the same importance.

GRI, to define the importance of a material issue, proposes the use, through the involvement of key stakeholders, of a map that defines the importance of externality (economic, social, or environmental) in the horizontal axis and the influence for stakeholders in the vertical one. The more significant a theme is, the more it will be placed during the impact assessment in the most extreme part of the graph, while the closer it will be to the intersection of the axes, the more it will not be important. An example of a materiality map drawn up through GRI is shown in Figure 2.6.

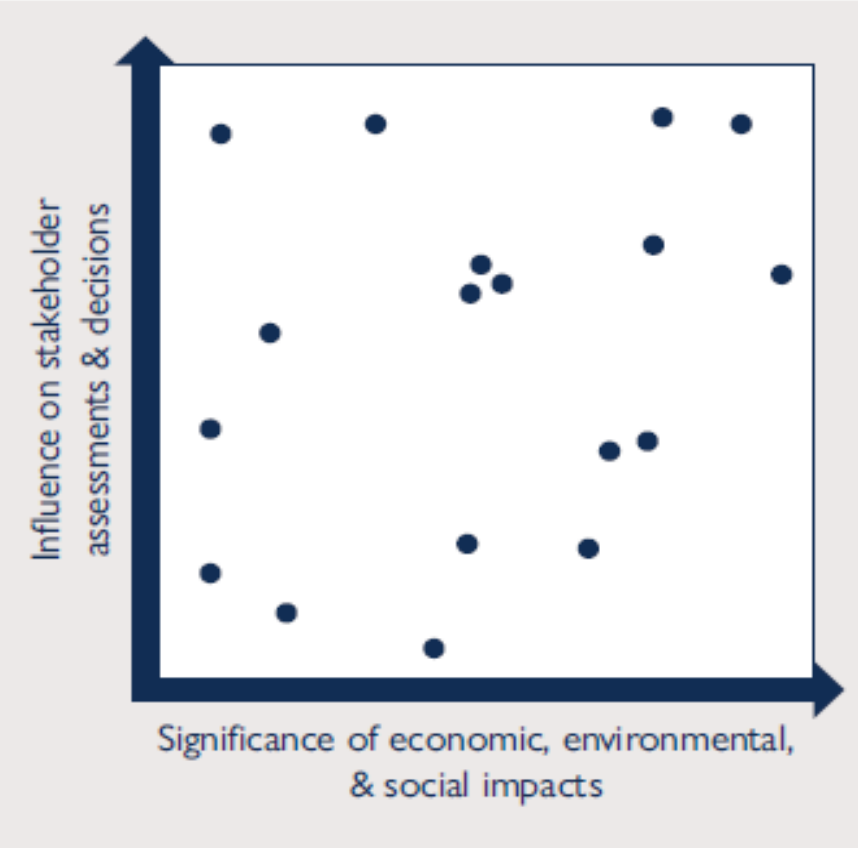


Figure 2.6: Materiality map according to GRI (Global Reporting Initiative, 2016a). The dots represent the different material aspects (economic, environmental, and social), resulting from the interpolation between the priority for the stakeholders and the significance for the company. The farther a dot is from the intersection of the axes, the more material it is.

In order to produce a report compliant with the Global Reporting Initiative a company must, first of all, apply the reporting principles (GRI 101) to define the contents of the report and to identify the material issues (environmental, social, economic) to be considered by developing the materiality map.

Once the material issues are identified, the specific standards to be applied can be selected according to the specific topic to assess (Global Reporting Initiative 2016a):

- GRI 200 for economic aspects (composed of series from 201 to 207);
- GRI 300 for environmental aspect (defined by series from 301 to 308);
- and GRI 400 for social aspect (consisting of series 401 to 419).

2.2.2. Sustainability Accounting Standards Board

In 2012 the Sustainability Accounting Standards Board (SASB), driven by the convincement that only the analysis of material non-financial aspects and the information related to them could determine the potential financial risks for a company, undertook the process of identifying a wide variability of risks related to financial issues. This led to the development of a system of standards, approved by a commission of various stakeholders in 2018, which allows the reporting of sustainability at the level of a single industrial sector and which is based on the principles of diversification and uniqueness of sustainability, i.e. supporting the hypothesis that each type of business has its own and unique sustainability profile (Busco et al., 2020; Rodriguez et al., 2017; Rupley et al., 2017).

SASB's goal is to devise, through the use of quantitative standards capable of identifying the externalities potentially relevant to long-term corporate performance, a reporting system for ESG (environmental, social and governance) issues, which can have the same reliability as financial reporting systems (Busco et al., 2020; SASB, 2021c).

The indicators of the Sustainability Accounting Standards Board characterize the set of opportunities and risks related to sustainable development that are likely to affect the business and company performance and therefore of probable importance for investors (SASB, 2021f).

A company that decides to use the SASB Standards to report its sustainability-related performance can independently determine which indicators are relevant and use them based on the material topics identified, and then select how to communicate the results obtained using any mechanism of existing disclosure (Rupley et al., 2017; SASB, 2021b).

SASB, as reported in Figure 2.7, defines 26 impact categories divided into 5 dimensions (environment, social capital, human capital, business model & innovation and leadership & governance) inherent to sustainability, effectively separating ESG into more precise and punctual sub-pillars (SASB, 2021e).

The environmental dimension includes all the externalities produced through the direct and indirect exploitation of non-renewable natural resources and which can have an impact on the performance and therefore on the financial condition of organizations.

The dimension defined as social within the ESG system is divided by SASB into two subsections. One external to the organization, called the social capital, which includes the management of interactions related to all those businesses located outside the company, such as the public sector, local communities, and governments and which intervenes, for example, in matters relating to human rights and equality gender. Instead, the second subsection, called Human capital, represents

the dimension of the internal problems of the organizations and includes the management of all human resources and intervenes in matters relating to the health, safety, and productivity of workers.

The last two dimensions identified by SASB, i.e., the business model & innovation and the leadership & governance, cover the economic sector of the ESG model.

The first aspect looks at how social issues, from the broader point of view of design, can be integrated with environmental issues to achieve long-term value increases.

The last pillar covers the strategic management of corporate issues that have the potential to conflict with the interests of stakeholders and which therefore could determine a problem with the business model. These issues can include the phenomena of bribery and corruption, anti-competitive and risk management.

Figure 2.7: Summary diagram of the 5 dimensions of sustainability and the 26 sub-categories (SASB, 2021e)

As previously introduced, according to SASB the importance of the 26th sub-categories, reported in Figure 2.7, changes in compliance with the different company sectors identified in Figure 2.8 to facilitate companies' understanding of their various potential externalities. Accordingly, the Sustainable Industry Classification System ™ (SICS) was created which is composed of 11 corporate macro-sectors and 77 subsections, as reported in Figure 2.8, that uses sustainability profiles to group similar companies on the basis of their sustainability-related risks and opportunities. This system is at the basis of the interactive materiality matrix that SASB provides to simplify the process of identifying the material topics and metrics. The provided materiality matrix can be used both by the various organizations and by investors, who can analyse the risks and opportunities of specific sustainability issues represented in Figure 2.7.

Figure 2.8: Composition of the Sustainable Industry Classification System (SICS) (SASB, 2018)

The materiality map created by SASB identifies the criticalities linked to sustainability, defining them at the level of probability of relevance for that particular industry sector that can influence both the financial conditions and the operating performance of the companies within one of the sectors defined by the SICS (SASB, 2021d).

As reported in Figure 2.9, the materiality map is a matrix that contains, in the second column on the left side, the 26 business issues divided according to the 5 dimensions of sustainability (first column on the left side) and in the first row the industrial sectors to which they belong. The map has different colours, from dark grey to white, based on the intensity of the material aspect, that is the probability that the environmental issue is relevant or not for that industrial sector.

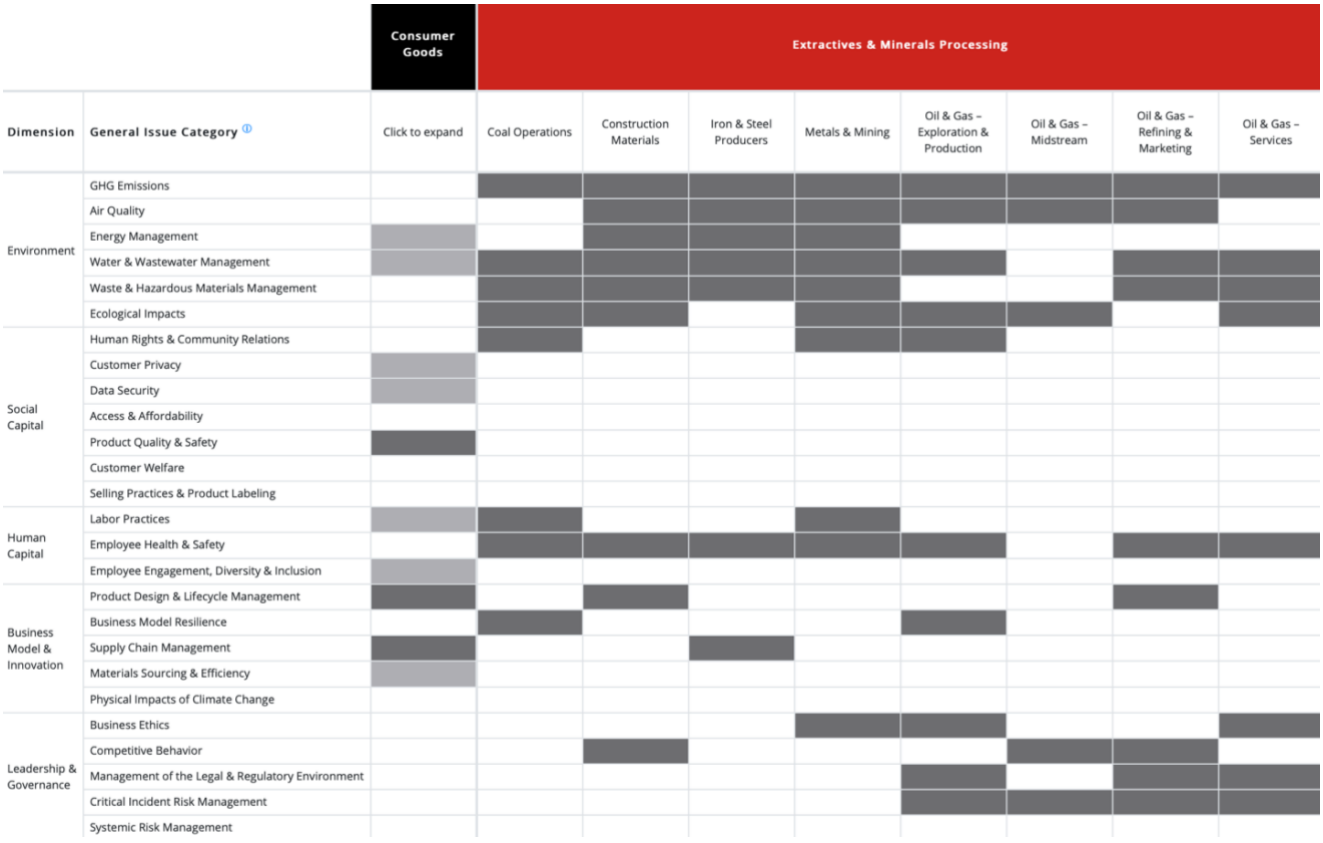


Figure 2.9: Materiality matrix example (SASB, 2021d)

2.2.3. Integrated Reporting

The sustainability reports discussed so far (i.e., GRI and SASB) are drawn up separately from the financial information. Due to this, in recent years, the need for an integrated system that would allow a comprehensive and concise vision of the main financial and non-financial material externalities that affect the performance and sustainability of a company has arisen (Atkins & Maroun, 2015; Kılıç & Kuzey, 2018; Robertson & Samy, 2015).

For this reason, in 2011, the International Integrated Reporting Council (IIRC) started the process of devising a Multidimensional Framework called Integrated Reporting (IR), that was finalised at the end of 2013 after several multi shareholder/stakeholder consultations.

The purpose of the framework is to integrate both financial and ESG (environmental, social and governance) information through holistic and synthetic reporting based on a multi-capital principle[7]. This simplified form of reporting may be able to define the most significant material aspects for the value creation process in the short, medium, and long term (Dumay et al., 2017; Edgley et al., 2015; M. Fasan, 2017; Marco Fasan & Mio, 2017; International Integrated Reporting Council (IIRC), 2013a; International Integrated Reporting Council, 2021; Magrassi & Raoli, 2018; PwC, 2016; Silvestri et al., 2017).

The IIRC believes that IR is an extension and evolution of current corporate reporting, arguing for two concepts. The first, that through integrated thinking, this reporting tool is able to incorporate a wider range of information than traditional reporting models. The second is that this framework, by means of integrated decision-making processes, allows companies to contribute positively and simultaneously to both sustainable development and financial growth (IIRC, 2014, 2016; International Integrated Reporting Council, 2021; Simnett & Huggins, 2015; Sofian & Dumitru, 2017).

South Africa was the first Nation to introduce the obligation for companies listed on the stock exchange, to provide information through integrated reporting using the "apply or explain"[8] approach (International Integrated Reporting Council (IIRC), 2013b; Kılıç & Kuzey, 2018; Simnett & Huggins, 2015).

[7] Multi-capital principle refers to the integrated sustainability assessment which includes the ESG (environmental, social and governance) pillars and the financial issues.

[8] It is the obligation to explain the reason for any renunciation of the application of the integrated report to the organization.

Subsequently, other companies from around the world, recognizing both internal and external benefits such as risk reduction and more accurate resource allocation, began publishing integrated reports on a voluntary basis, reaching 165 companies in 2017 (Eccles & Saltzman, 2011; Sofian & Dumitru, 2017).

IIRC has defined the integrated report through the identification of 7 guiding principles (strategic focus and orientation to the future, connectivity of information, relations with stakeholders, materiality, syntheticity, reliability and completeness, coherence and comparability) and 6 capitals, also called values, (financial, productive, intellectual, such as copyright and licensing, human, social and relational and natural, in the context of ecosystem services) as defined in Figure 2.10. However, there is no obligation for companies to follow this structure when reporting according to the IR and there are no obligations on the selection of the reporting system to be adopted, thus leaving the company to decide on the structure to be used, like for any other form of communication (International Integrated Reporting Council (IIRC), 2013b; International Integrated Reporting Council, 2021).

An integrated report defines, through both quantitative and qualitative indicators, such as KPIs[9], the journey that a company need to follow to generate value for the different capitals mentioned above over time, by considering the external environment, the methods and the external and internal influences that affect the company and that are influenced by the company itself and their relations with stakeholders (International Integrated Reporting Council (IIRC), 2013b).

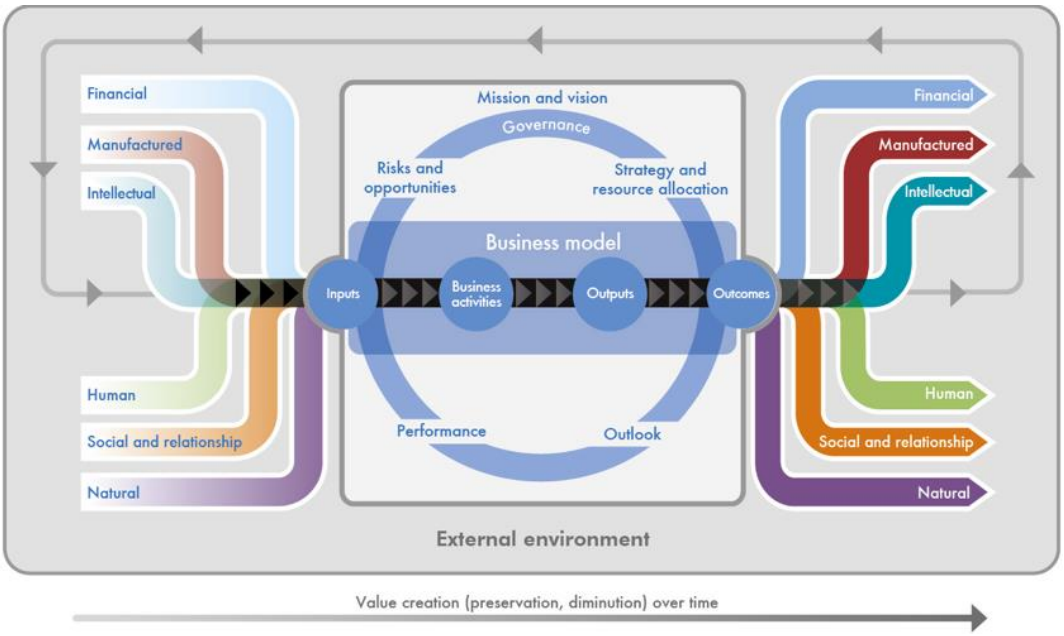


Figure 2.10: Value creation process according to IR (International Integrated Reporting Council (IIRC), 2013b)

[9] KPIs: key performance indicators

As in other reporting systems, materiality and its definition play a fundamental role within the integrated report, although this corporate reporting system does not identify its own methodology, allowing the company to choose the most suitable materiality map to follow.

According to the IIRC, there are some general guiding principles to determine materiality. In particular it is necessary to identify, in an integrated way, the key aspects, both positive and negative, including risks and opportunities, which can affect the creation of medium/long-term value of the company through active and regular stakeholders involvement (IIRC, 2014; International Integrated Reporting Council, 2021).

2.2.4. Future perspectives on reporting

The collaboration phenomena initiated in recent years by the most important organizations that provide non-financial reporting systems such as the CRD, Corporate Reporting Dialogue, which includes GRI, SASB, IIRC, CDP (Carbon Disclosure Project) and CDSB (Climate Disclosure Standards Board), are boosting the promotion of greater comparability and consistency within the market regarding these various new tools. Within these collaborations, attention is paid to supply shared communication materials, with respect to the impacts on sustainability including those that could provide risks and opportunities in the medium/long term. These shared materials could help, for example, interested parties such as investors, policymakers or civil society, to be able to receive information more easily understandable than nowadays where the lack of standardization of these tools is the cause of several difficulties (Corporate Reporting Dialogue, 2018).

To confirm this, GRI and SASB, in the first months of 2021, in the face of a collaboration started in 2020, have drawn up a practical guide that indicates how these two non-financial reporting systems can be used in an integrated and simultaneous way. This is performed by incorporating financial and sustainability information within a comprehensive and complete report so as to provide a holistic and practical approach to disclose the materiality of corporate performance (GRI, 2021a; SASB, 2020, 2021a).

Another interesting development, which will gain more and more value over the next few years, is the attempt to include the United Nations Sustainable Development Goals (SDGs) and associated indicators within the non-financial reports. These aspects are increasingly fundamental within the European Union and its member countries as a source of transparent information.

GRI and the United Nations Global Compact, after a collaboration with PwC[10] and SHIFT, the main competence centre on the United Nations Guiding Principles on human and business rights, have drawn up a practical guide based on the concepts of transparency and reliability and integrated sustainability (ESG). The guide has been designed to support companies in including the sustainable development objectives of the 2030 Agenda into their activities (GRI, 2021b; GRI et al., 2018).

[10] PwC: PricewaterhouseCoopers, one of the most important consulting companies belonging to the Big Four group

2.3. Rating tools

After the crisis that hit Lehman Brothers in 2008 and the financial crisis that began that year, it emerged that traditional models for measuring corporate performance and the associated risks were no longer sufficient (Lopatta & Kaspereit, 2014).

Faced with this, in recent years stakeholders and companies have begun to be aware and responsible, requesting increasingly information on corporate ESG aspects (Galbreath, 2013).

To respond to these new global criticalities and market demands, ESG rating agencies have been created, which integrate within the new models for evaluating and measuring performance with a view to integrated sustainability (environmental, social and economic) (Escrig-Olmedo et al., 2019; Olmedo et al., 2010; Veenstra & Ellemers, 2020).

The goal of these agencies is to identify business performance more accurately, in the principle of the concepts of resilience and resistance. Their pivotal mission is to try to provide information that makes it possible to clearly identify the current state of companies and its externalities ESG (Escrig-Olmedo et al., 2019; Olmedo et al., 2010; Veenstra & Ellemers, 2020).

Nowadays, various rating indices have been developed, which evaluate companies using different indicators, both qualitative and quantitative. These indices designed to assess the current sustainability of a company and to define its long-term sustainability, combine different extra-financial and sometimes financial information (Olmedo et al., 2010; Scalet & Kelly, 2010).

Indeed, rating companies use different methodologies to assess corporate sustainability. For example, according to the results of an assessment carried out on the 6 most important global rating companies (Berg et al., 2019), it emerged that 709 different indicators are used to cover 65 categories. These differences on how companies are assessed and on the categories of indicators that are used are causing difficulties in assessing sustainability and, consequently, also in managing the ESG performance of companies (Berg et al., 2019; Escrig-Olmedo et al., 2014, 2017; Muñoz-Torres et al., 2019; Pryshlakivsky & Searcy, 2017; Veenstra & Ellemers, 2020).

Although these tools differ on the type, the number of indicators and how they are used, there are 3 recurring aspects in the evaluation processes (Chatterji et al., 2016):

- indicators are selected and classified according to ESG aspects;
- these indicators aim to evaluate business practices, which are usually intrinsically complex;
- results are normalised by sector.

Some rating tools also adopt, as indicators, already existing methodologies such as the SASB indicator or the 17 Sustainable Development Goals (SDGs) defined by the UN in the 2030 Agenda. This is the case of SiRating, an Italian rating company that uses both the indicators defined by SASB and the SDGs to assess how the company contributes to sustainable development objectives (Nazioni Unite, 2019; SiRating, 2020).

The rating companies assign, through a questionnaire, a corporate sustainability performance score. This final score is represented by medals, scoring from 0 to 100 or alphabetical scales and can be used both for benchmarking[11] (intra and intercompany) and for the development of best practices (Escrig-Olmedo et al., 2019; Olmedo et al., 2010).

Indeed, through the evaluation of the questionnaires, a company may be able to identify those areas of sustainability that are not adequately monitored or assessed (e.g., lack of transparency concerning stakeholders as regards environmental externalities).

To provide a more detailed overview of the rating systems related to corporate sustainability issues, Table 2.2 and Table 2.3 report a brief description of some of the most important and well-known rating tools worldwide and in the European/Italian context, respectively.

Table 2.2: International ESG Rating Tools

	BLOOMBERG	**MSCI**	**DJSI (Dow Jones Sustainability Indices)**
Framework, standards, and pillars used	ESG e SASB	ESG	ESG
Results	0/100	AAA/C	0/100
Criteria	120 indicators divided into 3 pillars: environmental, social and governance	37 key ESG themes, divided into three pillars (environmental, social and governance) and ten themes	80/120 questions that deal with 100 ESG problems. The questions concern economic, environmental, and social governance

[11] Benchmarking inherent to ESG ratings is the practice of comparing the results of single scores or the overall scores obtained by a company with the scores obtained by other companies operating in the same production sector. Benchmarking can also be a practice carried out internally to evaluate the evolution of a company's results over time

Table 2.3: European ESG Rating Tools

	ECOVADIS	SI RATING	ECOMATE	EXSULTING
Framework, standards, and pillars used	GRI, UNGC e ISO26000	SASB, ESG	GRI, SASB, UNCG, ISO, CDSB	ISO standards and the main international guidelines on sustainability and social responsibility
Results	Medals	Medals, % of overall achievement, % of achievement divided by environmental, social and governance rating with relative average materiality, % of achievement of the 17 SDGs	0/100	Unique value, from 0 to no maximum value is specified
Criteria	7 indicator management aspects, through 21 sustainability criteria, divided into 4 themes: environment, work and human rights, ethics, and sustainable purchasing.	77 product sectors of SASB with relative materiality map. 26 indicators on environmental, social and governance (ESG) issues and its contribution to the 17 United Nations Sustainable Development Goals (SDGs)	Calculates the environmental, social and governance (ESG) performance of the business through 11 impact modules and over 70 sustainability issues	It consists of 2 sections, the first includes 36 statements on various issues related to sustainability divided into two sections (one dedicated to factors of uncertainty and another to those of resilience) to which the company must assign a score from 1 to 6. After completing the test and assigning a score to all 36 statements, the score related to the company will be sent (it is not separated for the type of company, from a standard value without identifying the different types of companies). The second, the Company Adjusted Index, is made up of 37 evaluation forms (one general and contextual and one for each factor of the index).

2.4. Frameworks

In recent years, to address the new global challenges inherent in sustainable development, decision-making frameworks have been devised from various sources, academic and non-academic. These tools can help companies through a multi-capital and often integrated ideology of sustainability, both in the evaluation and implementation processes of these new concepts within their business model and in the communication of the commitments undertaken with external stakeholders. These frameworks can also support companies in explaining how they incorporate economic, environmental and social externalities in the various long-term strategies (Amini & Bienstock, 2014; Baumgartner, 2014; Christen & Schmidt, 2012; Garcia et al., 2016; Nawaz & Koç, 2018).

These tools are generally non-standardized with high levels of heterogeneity in the structure and the contents, reflecting the enormous diversity and complexity of implementing the principles of corporate sustainability. For example, complex decision-making frameworks can be observed such as the Sustainability Management System Framework (SMSF), reported in Figure 2.11, which is based on the Deming cycle or PDCA model (Plan, Do, Check and Act) and on 6 key elements that allow bringing an organization towards a greater awareness of sustainability (Nawaz & Koç, 2018).

Up to easy-to-understand academic tools can be found as in the case of the Framework developed by Amini and Bienstock (2014). This framework identifies sustainability through a maturity matrix defined by 4 different levels of commitment divided into 5 dimensions of sustainability, including the time dimension (Amini & Bienstock, 2014).

The first 3 dimensions of this framework are related to factors internal to the organization (company focus, innovation, application, and communication of sustainability), while the other two look at external factors (externality and compliance stance). The dimension inherent to externalities includes all the impacts that negatively affect the economic, ecological-environmental, and social equity. The last dimension instead represents the commitment to a proactive approach to sustainability (Amini & Bienstock, 2014).

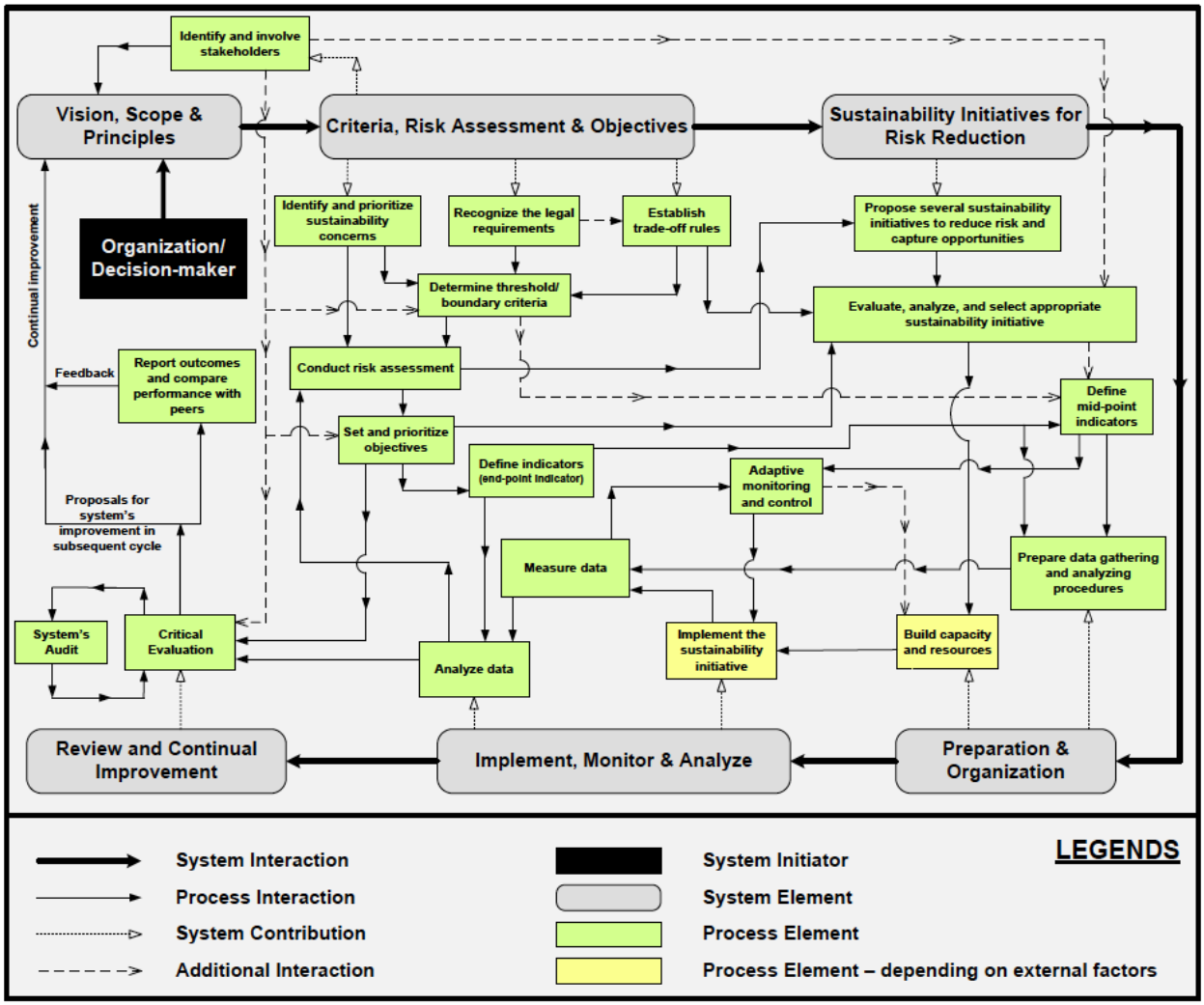


Figure 2.11: Flow chart inherent to the Sustainability Management System Framework (Nawaz & Koç, 2018)

The two frameworks just presented and developed by academia, are not yet used in real applications to evaluate corporate sustainability.

Therefore, in the next subsections, two of the most used and complete decision-making frameworks developed within complete guidelines will be briefly presented, in order to understand the structure and principles behind this new complex class of tools and to explain the different heterogeneity. These are the Strategic Sustainable Development Framework (FSSD) conceived by The Natural Step and the Managing Sustainable Development of Organizations Framework developed by the British Standards Institution.

2.4.1. FSSD - Framework for Strategic Sustainable Development, developed by the Natural Step

The Natural Step is an international non-profit association, currently present in 54 countries, founded in Sweden in 1989, following the publication, in 1987, of the Brundtland report, with the aim of implementing, through a methodology called Framework for Strategic Sustainable Development (FSSD), systemic corporate sustainability at a strategic level (Nathan, 2018; The Natural Step, 2021d).

The Natural Step's goal is to offer a proactive tool that allows companies, through the estimation of the most significant aspects/externalities, to translate the principles of sustainability. In particular, the framework aims to assess what has not contributed to the increase in unsustainability and to plan, through a decision-making process, the strategic management of compromises (Bratt, 2014; Broman & Robèrt, 2017; Missimer, 2015; Nathan, 2018; Thompson & Blume, 2010).

The Framework developed by The Natural Step bases its roots through a conceptual logical process aimed at implementing sustainable development. It consists of 5 assessment levels (Systems, Success, Strategic Guidelines, Actions and Tools). For each of them different methodologies, principles and approaches are available, to allow the FSDD to be considered a useful tool for successful strategic planning (The Natural Step, 2021a).

The Systems level assesses the direct and indirect interactions of the organization with external factors such as stakeholders, ecosystem functions and the resilience and resistance of environmental capital, with particular attention to the climatic regulation function. In this first macro-category, the key factor is the definition of the concept of sustainability through the illustration of the metaphor of the funnel that allows representing in a conceptual way the use by the company of resources and their availability, as well as their variation over time (Broman & Robèrt, 2017; The Natural Step, 2021a).

The funnel metaphor, represented in Figure 2.12 allows understanding when a business model is unsustainable (section B of the figure) and how this is evolving (section C of the figure).

The goal of The Natural Step is not to create a utopian future, but it is to make the company find a trade-off (section D of the figure) that allows a deceleration or an arrest of the continuation of unsustainability (Broman & Robèrt, 2017).

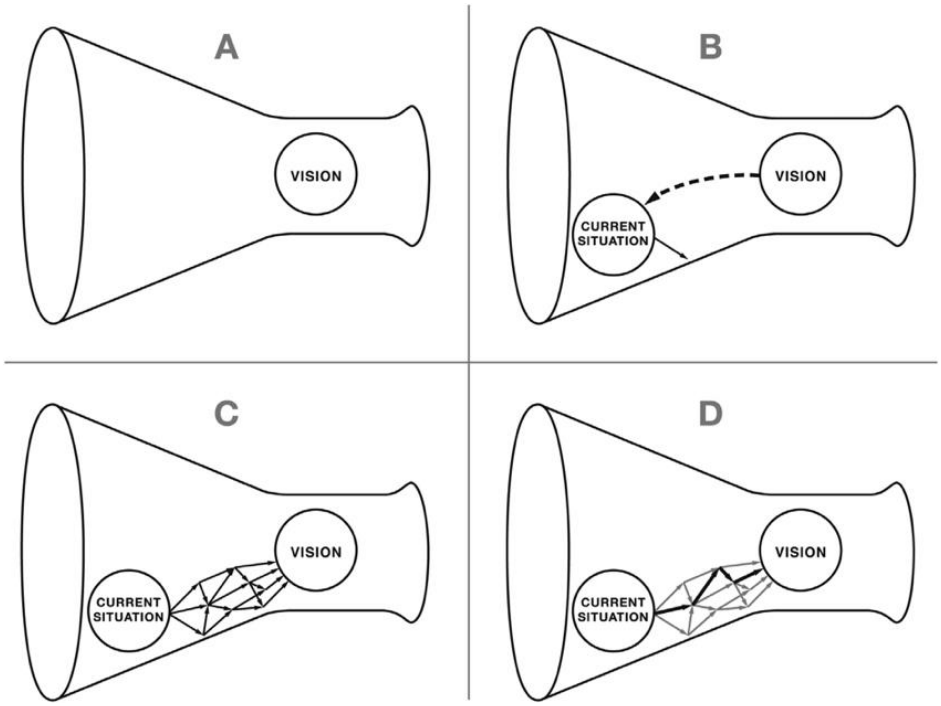


Figure 2.12: Visual development of the metaphorical conception of the funnel at the base of the FSSD (Broman & Robèrt, 2017)

The second level identified by the Framework is called **"Success"** and is divided in 4 principles of sustainability, also defined as system conditions, since they define the essential conditions that a company must satisfy to maintain or implement sustainability on the basis of the principle of cyclicality that aims to use resources in a fair, efficient and therefore sustainable way (The Natural Step, 2021b).

The first 3 principles (i) concentrations of resources, renewable and not extracted from the earth's crust, ii) concentrations of substances produced by anthropogenic activities such as xenobiotics and physical degradation of the earth and iii) deforestation or eutrophication caused by surface run-off of fertilizing chemicals affect the interactions between man and planet. Instead, the fourth principle identifies the achievement of a more sustainable society through the evaluation of human satisfaction (Broman & Robèrt, 2017).

Within **the third level**, called "**strategic guidelines**", the various strategic roadmaps that a company should follow to implement sustainability are defined. In this level, in particular, a process is illustrated that allows to modify the traditional business model "as usual" and to implement sustainability within companies and organizations through a strategic decision-making operational planning process divided into 4 key steps: i) awareness & vision, ii) baseline analysis, iii) creative

solutions and iv) decide on priorities, also referred to as the ABCD approach as reported in Figure 2.13. Although defined in a linear and consequential way, the ABCD approach is an interactive procedure that allows the continuous passage between steps in a non-prescriptive way (The Natural Step, 2021b).

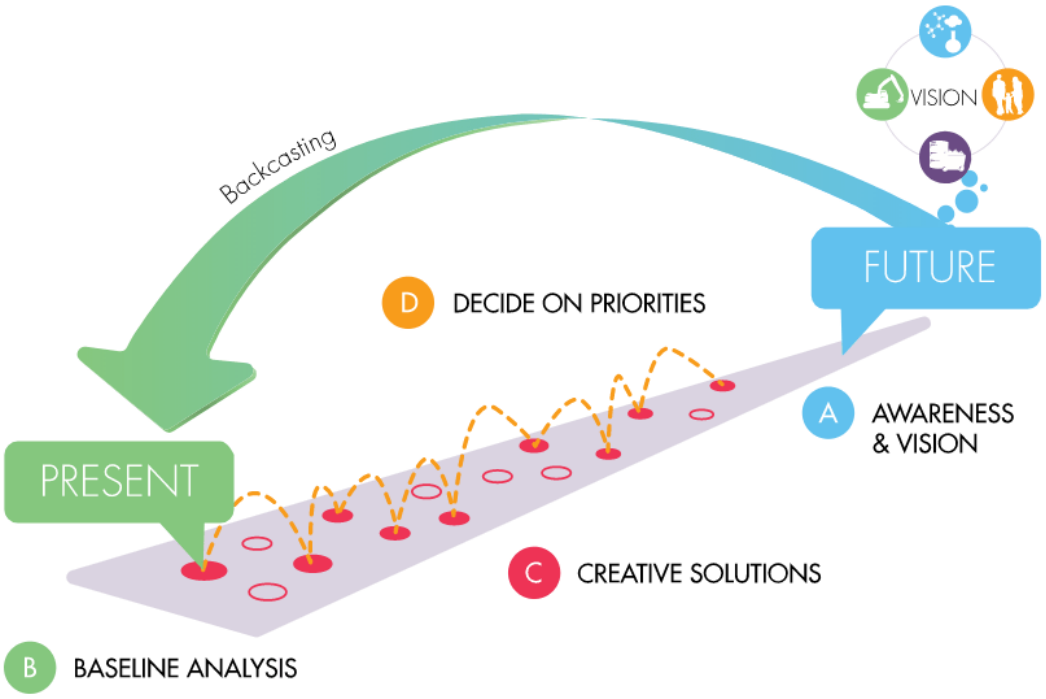


Figure 2.13: Sustainability implementation process through the A-B-C-D model developed by The Natural Step (The Natural Step, 2021b)

The first step, A, consists of identifying, through a discussion process, a possible vision of success, according to The Natural Step's 4 key principles of sustainability. Subsequently, the second point consists of a "gap analysis" between the current state of the company and the future vision of sustainability, thus allowing to define the material externalities, their effects on the business and the possible intervention strategies. Phase C defines the process of identifying a roadmap, by designing a more sustainable long-term vision, using the backcasting methodology (The Natural Step, 2021c).

The forecasting methodology defines the new stage of sustainability of the company simply by projecting current trends into the future, often causing a form of prescription and dependence on the pre-established roadmap, which does not comply with the planning of complex long-term systems (Broman & Robèrt, 2017). The backcasting, on the other hand, allows to identify cause-

effect relationships before they occur. This is obtained by defining first the future vision and only subsequently the current stage using a step-down process, back in time, that allows to connect the future vision with the current state of the company (Bratt, 2014; Missimer, 2015; Nathan, 2018).

In this way it is possible to identify the gap between the future vision derived from the implementation of sustainability and that of the current business model (Bratt, 2014; Missimer, 2015; Nathan, 2018).

In doing so, backcasting also allows identifying which specific actions are to be taken before implementing sustainable development actions. Organizations that adopt the backcasting methodology are able to implement interventions that allow the removal of the underlying sources of problems before they occur, rather than solving the various critical issues when they occur (Broman & Robèrt, 2017).

Subsequently in the last point, D, the companies identify the actions to be followed.

In **the fourth level** of the Framework called "**Actions**", the strategies identified in the previous phase through the ABCD approach just illustrated are concretely implemented, such as, for example, long-term internal policies that allow the gradual transition from the use of fossil sources with a high degree of greenhouse gas emissions to renewable energy sources (The Natural Step, 2021b).

Finally, in **the last "tools" level**, a process is identified that requires the company to search for methodologies that can help and guide it in the process of managing and implementing sustainability, such as through the adoption of management standards ISO (The Natural Step, 2021a).

2.4.2. BS8900 - Managing Sustainable Development of Organizations

The British Standards Institution, BSI has devised, within its Sustainable Development Management Standard (BS8900), a decision-making framework capable of implementing sustainable management (environmental, social, and economic) within organizations in an integrated and systemic way. The framework allows companies to continuously improve their performance regardless of the production sector or size, evaluating the commitment to sustainable development rather than the achievement of a specific result (British Standards Institution, 2013a).

The goal of BSI is to implement a critical thinking system within the company, encouraging the creation of a real commitment to sustainability and in parallel to define or increase transparency and trust with stakeholders (British Standards Institution, 2013a).

Unlike the more well-known standards, such as those of the International Organization for Standardization (ISO), the BS8900 standard does not prescribe the company to achieve performance criteria, nor it requires the identification of specific impact indicators. By supporting the principle that corporate sustainability is a complex, continuous and changing radical change.

Indeed, a moment in space and time in which an organization becomes sustainable cannot be clearly defined. Companies will therefore have both different materiality and different speed of improvement in relation to the various aspects inherent to corporate sustainability (British Standards Institution, 2013a).

Furthermore, the British Standards Institution is convinced that if the framework defines the path to follow in a prescriptive way, identifying exactly all the roadmaps, indicators or methodologies to be implemented, a company could mechanically follow the procedure defined by the standard, without a real commitment. As if it were following a simple checklist and producing, in fact, a possible application but without a real motivation. In doing so, an organization would not internalize the purpose and ideals of sustainable development and this would probably lead to an undersized sustainable development in the future (British Standards Institution, 2013a, 2013b).

The pursuit of sustainable development for a company is defined within the Framework through 4 key pillars (inclusiveness, integrity, administration, and transparency).

These pillars, if correctly implemented, are able to increase the trust, credibility and transparency of the company and its activities concerning stakeholders and the community:

- inclusiveness: the inclusion of key stakeholders within the company's strategic planning and development;
- integrity: compliance with ethical rules of conduct that respect the laws in force;
- administration: responsible management of the various activities of the company;
- transparency: clear, simple, accurate, timely and complete communication process towards stakeholders to both positive and negative externalities for the ESG pillars (British Standards Institution, 2013a)**.**

The purpose of these pillars is to allow the company to strengthen transparency and involvement with both external and internal stakeholders.

Outside the company, these pillars attempt to demonstrate to stakeholders how it is operating responsibly and transparently in the short and long term at the level of the ESG pillars of sustainability. Internally instead, the focus of the pillars is to maintain and activate all internal relations with employees in a transparent way, to be able to have a bilateral dialogue, both bottom-up and top-down (British Standards Institution, 2013b, 2013a).

To define the sustainability assessment process, the framework has drawn up a descriptive and unique tool that allows monitoring the evolution, over time, of the company's maturity in addressing sustainability issues. This tool, called maturity matrix and presented in Figure 2.14. is useful for determining the position of an organization with respect to the path of sustainable development, for evaluating progress, clarifying future steps and combining the principles underlying sustainable management, also contributing to the risk identification process (British Standards Institution, 2013a, 2013b).

According to the principles of BSI, to obtain a more detailed overview of the actual state, a company should develop this matrix through the involvement of various strategic stakeholders (British Standards Institution, 2013b).

Principles	Practices	Stages of an organization's approach to sustainable development			
		Maturity			
Inclusivity					Additional plans and objectives to be determined by each organization may be added to the matrix.
Integrity					
Stewardship					
Transparency					
Additional principles applicable to each organization may be added to the matrix.					

Figure 2.14: Maturity matrix (British Standards Institution, 2013a)

CHAPTER 3: Commitments and future prospects

Over 2020, public institutions and private companies made enormous efforts towards sustainability. This includes the development of the European taxonomy for big companies on the financial market and the revision of the directive on the non-financial declaration, by including the SDGs impacts standards, the World Economic Forum, and the International Business Council.

In detail, the European Union has both issued, though the Green Deal, a sequence of policies and investments linked to sustainability to make Europe carbon-neutral and begun a process of creating a unified European taxonomy (i.e. a classification system establishing a list of environmentally sustainable economic activities) (European Commission, 2021b; SDG impact & UNDP, 2020).

The European taxonomy will push innovation towards more sustainable development over the next few years. The European taxonomy is an initiative included in the EU Regulation 2020/852, which sets itself the task of implementing a standardized classification framework relating to performance linked to sustainable development.

In particular, the goals are to be able to assist and guide the decisions of investors or companies proactively concerning the future but imminent ecological transition[12] (European Commission, 2021b). At the Italian level, the ecological transition will be one of the two great challenges of the new government which aims to implement the revolutionary green transition in the country, through funding from the Next Generation EU (Cosimi & Ameri, 2021; European Commission, 2021b).

The European taxonomy regulation will be applied to all financial market players and to large companies recognized as having non-financial disclosure obligations. According to the defined road map, by 2023 all targeted companies will have to start disclosing the first information in terms of taxonomy and ESG (European Commission, 2021b).

In line with this European taxonomy, to be considered sustainable, a company must implement at least one of the six strategic environmental objectives (i.e., i) adaptation of climate change, ii) mitigation of climate change, iii) sustainable use of both water and marine resources, iv) transition to a circular economy, v) control and prevention of polluting sources and vi) protection of ecosystem integrity through the protection of biodiversity) without damaging or impoverishing the other objectives. Furthermore, it will have to guarantee CAM (minimum environmental criteria) and the

[12] a concept that aims to centralize the importance of integration between ecosystems and of humanity through a future vision projected to 2030, and therefore towards an economic development that can minimize negative externalities on the environment

17 objectives (SDGs) of the United Nations (UN) (ASviS, 2020; EU Technical Expert Group on Sustainable Finance, 2019).

The EU has started the revision of the directive on the non-financial declaration as well, presenting different attention to two issues, linked to the materiality of the externalities of companies.

These two aspects investigated concern how the negative externalities generated by the social and environmental pillars can affect the economic/financial capital of organizations.

Specifically, the EU's goal is to structuring, by 2022, one or more European non-financial reporting standards, which allow evaluating these direct and indirect negative externalities (World Economic Forum, 2020).

The United Nations Procurement Division (UNPD) has released the SDGs impact standards, a series of management standards in line with the 17 SDGs[13] of the 2030 Agenda, dedicated to all organizations of public interest, such as NGOs, state and private, regardless of the production sector, geographical area or size, which proactively aim at sustainability (SDG impact & UNDP, 2020).

These standards have also been designed to be able, in the future, to be integrated with non-financial reporting, to support, through the implementation of the SDGs, the preparation of a complete and integrated report that can allow companies to report the opportunities or risks associated with sustainable development, the processes of increasing value and the various externalities and criticalities with respect to the achievement of the objectives of the 2030 Agenda (SDG impact & UNDP, 2020).

As far the private sector is concerned, private entities such as Deloitte, EY, KPMG, PwC[14] and the WEF (World Economic Forum), just to name a few, have focused on the pursuit of standardization of the various processes inherent to corporate sustainability (World Economic Forum, 2020).

Moreover, the IBC, the International Business Council, in collaboration with the Big Four[15], the 4 largest and most important consulting companies, confirming the lack of homogeneity, inconsistency and therefore the impossibility of benchmarking concerning non-financial reporting of the ESG aspects that cause a decrease in credibility towards stakeholders in the reporting of progress for sustainable development, has devised a series of material metrics. They are divided into 4 capitals (governance, people, planet and prosperity), in line with the 17 SDGs of the 2030

[13] SDGs: Sustainable Development Goals

[14] EY: Ernst & Young

KPMG: PricewaterhouseCoopers

[15] Deloitte, KPMG, EY and pwc

Agenda and ESG to create in the future a process that can lead to an increase in transparency regarding the reporting of these aspects and externalities in a clear, simple and integrated way (World Economic Forum, 2020).

CHAPTER 4: Reasons that Induced to the creation of the framework

As it was possible to deduce from the review just presented, currently, in the landscape of corporate sustainability, there is a lack of shared and standardized practices, both with regard to the methodologies and strategies used, and in the definition of the same pillars of sustainability.

Furthermore, also the proliferation, caused by different pressures both external and internal to organizations, of different tools that allow to evaluate, implement, and report corporate sustainability in a heterogeneous way is a rationale of great complexity.

These two problems, which work synergistically, cause indecision about the most suitable tool or methodology to be used and implemented by companies, at both inter and intra typological level, for the achievement of sustainable practices. Accordingly, this caused the need of developing a unique conceptual tool, subsequently called Decision-Making Framework. The goal was to devise a tool that could support, cyclically, continuously, and proactively, both consultants and companies in the process of evaluation and implementation of both these new methodologies and tools for sustainable development.

The rationale behind the Framework is to identify in a simple, linear, and transparent way, through a structured logical process such as a roadmap, how to evaluate, implement and report corporate sustainability in a way that is tailored to a specific company. This process relies on strong participation of key stakeholders both internal and external to the organization.

This process is allowed using the most consolidated tools and methods currently existing in the field of both corporate sustainable development and strategic decision-making.

In particular, the framework was conceived with the idea of being able to understand the maturity and materiality of an organization with respect to these aspects. Suggesting not only the most suitable type of methodology to be used among the different options but the different tools to be adopted as well, in line with the characteristics, needs, particularities and singularities of each company to implement sustainability.

SECTION II: CONCEPTUAL DEVELOPMENT OF THE MODULAR DECISION-MAKING FRAMEWORK

This second section illustrates the theoretical processes that led to the logical design of the macrostructure of the decision-making framework for corporate sustainability and its conceptual development. Especially, the 5 macro-phases, the flexible and modular maturity questionnaire at the base of the vertical navigation process consisting of 11 questions, the methodologies and tools defining the horizontal expansion and the checklists created to guide the transition from one phase to the next are identified and defined.

The development of a screening decision-making tool, called morphological scheme, which is one of the possible horizontal developments of phase II is also explored. Subsequently, all the general structure of the framework is presented in a single flowchart. At the end of this section, the implementation of the tool conceived in the form of an IT application is also summarized, which has allowed a simpler and more intuitive use, to verify both the functionality and the critical issues by applying it to a real case study that will be exposed in the next section (**SECTION III: FRAMEWORK APPLICATION THROUGH A CASE STUDY**).

CHAPTER 5: The modular decision-making framework

The decision-making framework was theorized taking the PDCA (plan, do, check and act) decision-making approach as a reference. It is composed of five sequential macro-phases defined so that each stage corresponds to a greater awareness of "maturity" on issues related to sustainability. The framework is also useful for defining a roadmap to implement sustainable development issues. The five sequential macro-phases are defined as follows:

- phase 0: understanding the principles of sustainability;
- phase I: defining the current position and the priorities of tomorrow;
- phase II: identification the interventions;
- phase III: measuring progress;
- phase IV: communicating and reporting.

The first two macro-phases allow first to assess the company's theoretical knowledge of these new concepts (phase 0), and then to identify the current state of sustainability and possible future scenarios through active stakeholder engagement (phase I).

In this latter phase, the environment is also incorporated as a primary stakeholder, thus expanding the traditional definition of stakeholders[16]. Incorporating the environment as a primary stakeholder means taking into consideration all potential direct and indirect environmental externalities during the stakeholder engagement process and the assessment of material aspects. Indeed, an over-exploited environment in which ecosystem services are impoverished leads to consequences for the organizations themselves and for all the other stakeholders.

Phase II, on the other hand, identifies, through objective decision-making processes, a series of interventions to be implemented in line with the specific needs and problems of a company.

Subsequently, phase III allows to locate and systematize the key indicators through a continuous monitoring plan to observe the evolution of sustainability over time.

Finally, phase IV first defines how to communicate the different improvements obtained step by step with the stakeholders and then distinguishes the most suitable reporting tool, certification, or ecolabel for external communication of the final results.

More specifically, as shown in Figure 5.1 and Figure 5.2, the framework is based on a multi-spatial process, defined by two dimensions, one vertical and one horizontal. The vertical dimension was defined on the basis of the flexible tool designed by BS8001[17] for issues relating to the circular economy (British Standards, 2017) and is composed of a questionnaire consisting of eleven questions divided into the five macro-phases described above. The horizontal dimension is composed of the individual methodologies and tools that act as a suggestion for completing a specific phase.

[16] Subjects, organizations, or individuals who are actively involved in a business activity, whose interest is positively or negatively influenced by the performance or result of the business. (Treccani, 2021)

[17] BS 8001 - Circular economy

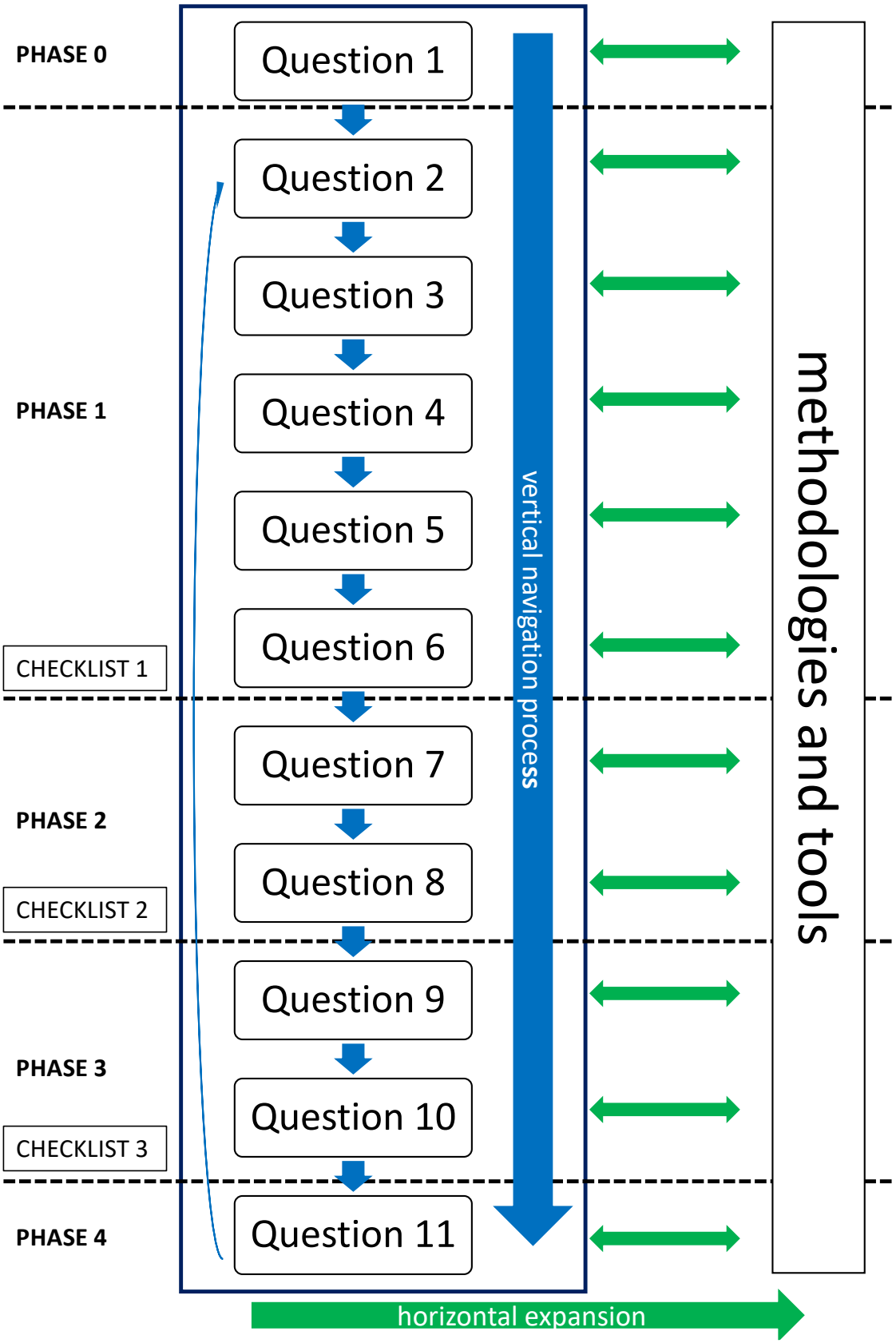


Figure 5.1: Simplified representation of the framework and its vertical and horizontal dimensions

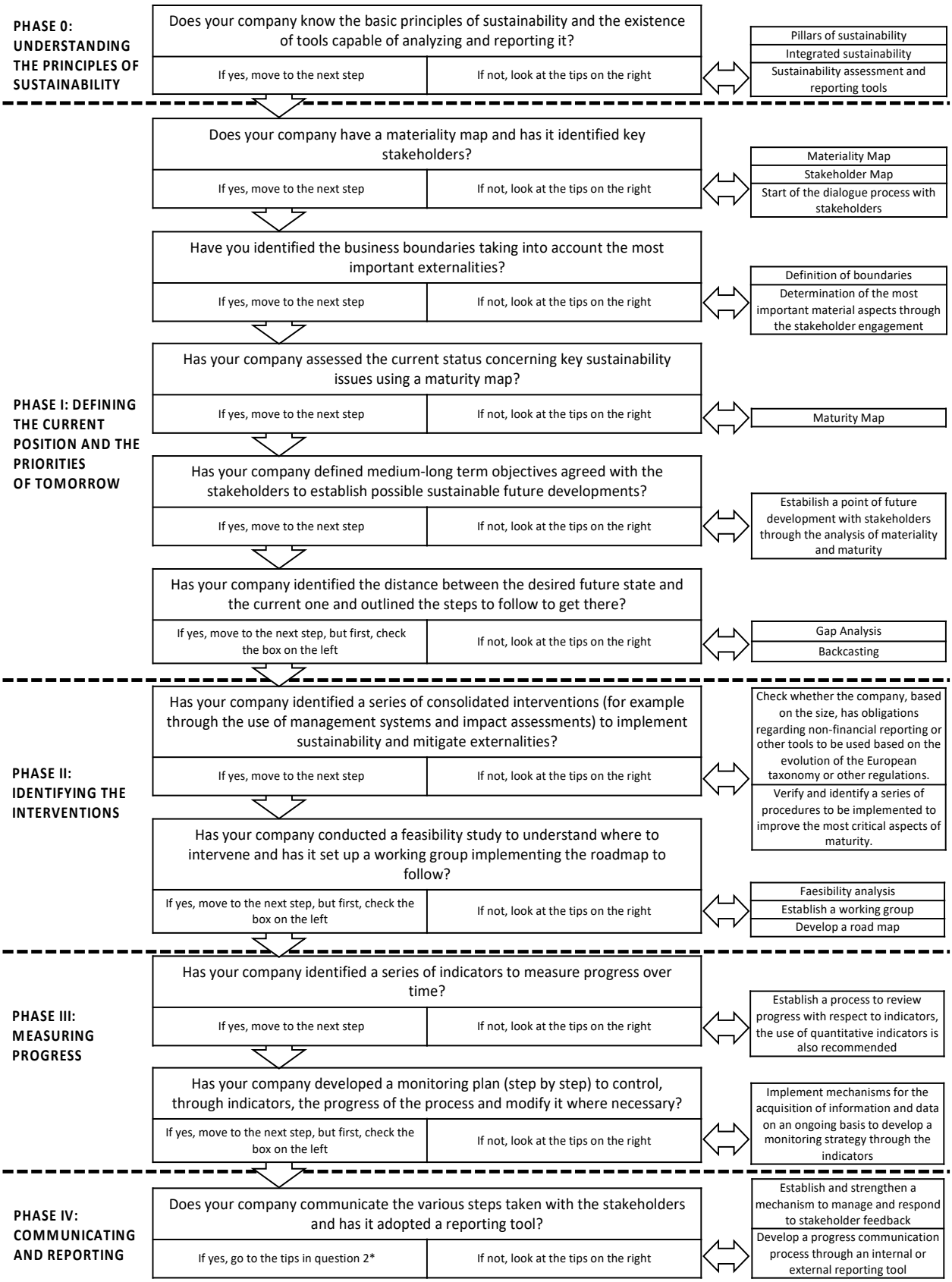


Figure 5.2: Flow chart representation of the questionnaire and its subdivision within the phases

Furthermore, as can be seen from Figure 5.1, the decision-making framework was conceived through a closed-loop process that guides an organization in a continuous effort to improve its integrated sustainability performance (understood as social, environmental, economic/governance performance), even when the organization has already completed all the steps defined within the framework.

The rationale behind it is that that sustainable development is not a point of arrival, but a pathway of continual, never-ending improvement to achieve the long-term goal of sustainability (i.e., a more sustainable world) (Gaziulusoy & Brezet, 2015; Zimek & Baumgartner, 2017).

In addition, further checklists, shown in Figure 5.3, have been implemented before moving from one phase to the next to have a second verification process and create a proactive tool that allows identifying problems and shortcomings before taking a deeper and more detailed step towards sustainable development.

These checklists have been designed for all companies that could answer “yes” to all the questions contained within a phase without consulting the methodologies suggested by the tool (horizontal dimension). If a company does not have one of the procedures or tools suggested in the verification phase, it is recommended to return to the first question of that phase and to view all the procedures or tools suggested, to fill and resolve any possible criticalities or gaps.

Specifically, 3 additional checklists have been devised and have been positioned between phase 1 and 2, phase 2 and 3 and phase 3 and 4, as reported in Figure 5.3. No checklist has been inserted in the transition between phase 0 and 1 since in that preliminary stage only theoretical knowledge on sustainability is required.

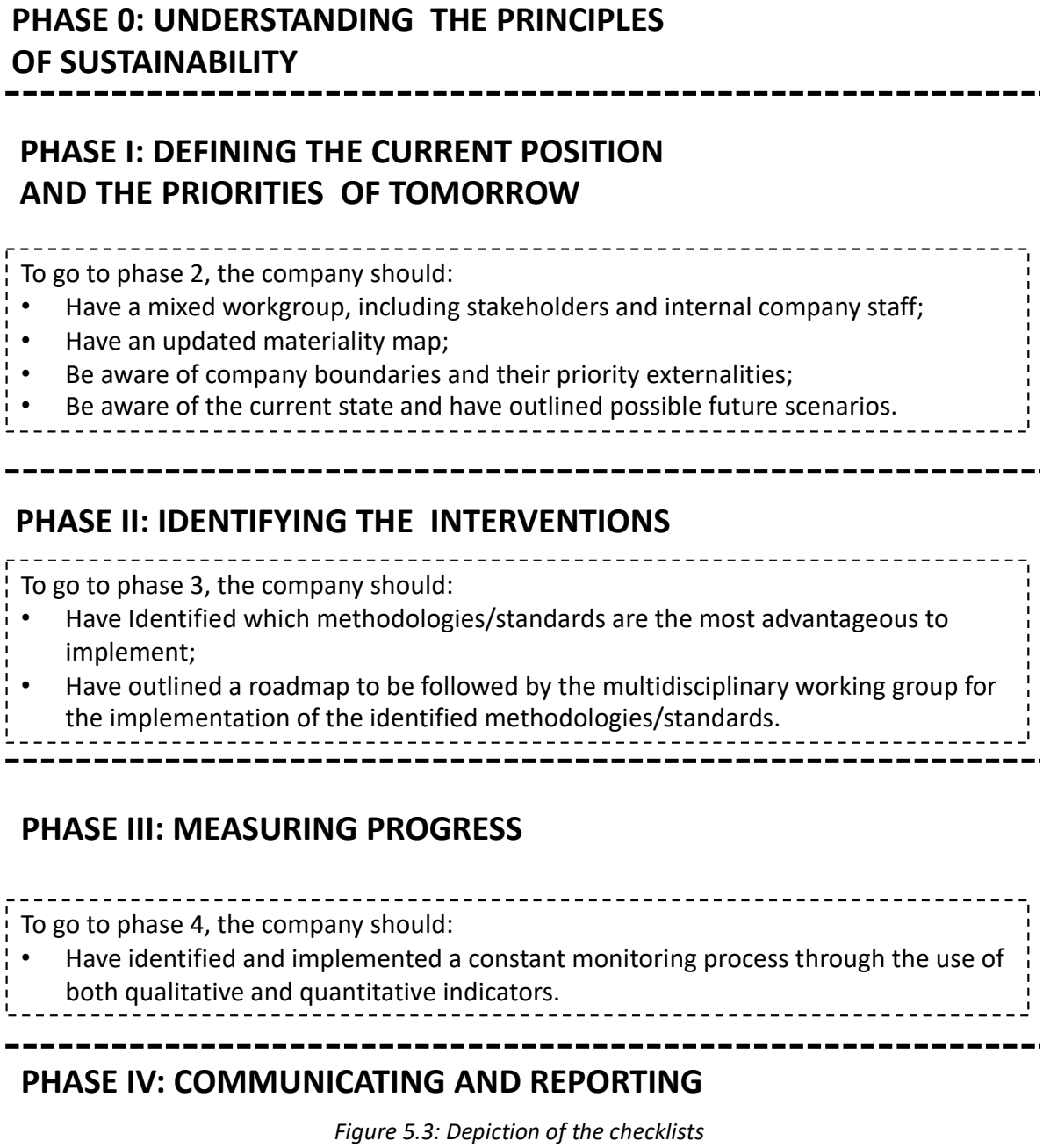


Figure 5.3: Depiction of the checklists

Lastly, within this framework, the sustainability has been defined as having at least three macro-dimensions composed of different micro-dimensions:

- environmental;
- social (social + human);
- governance (economic + governance + leadership).

This definition was conceived with the aim of obviating the lack of a standardized guideline regarding the creation of tools capable of evaluating, implementing, and reporting corporate sustainability, already reported in **SECTION I: THEORETICAL BACKGROUND**. Indeed, for example, reporting tools such as GRI and SASB [18]use different "dimensions / pillars".

Moreover, this pillar model also allows the use of ESG[19] impact standards and SDGs[20] both as indicators and as tools for assessing current sustainability and as components within the different forms of non-financial reporting if the European taxonomy or new EU directives standardize the various sustainability criteria for organizations in the future.

[18] GRI: Global Reporting Initiative
SASB: Sustainable Accounting Standards Board

[19] ESG: environmental, social and governance

[20] SDGs: Sustainable Development Goals

5.1. Phase 0: Understanding the principles of sustainability

The Phase 0 of the framework, called Understanding the Principles of Sustainability, was designed for all those companies which are a novice on sustainability issues.

Thanks to the first question of the questionnaire, represented in Figure 5.4, the framework is able to identify if a company has theoretical notions about sustainability issues. This is essential to be able to approach sustainable development consciously and strategically.

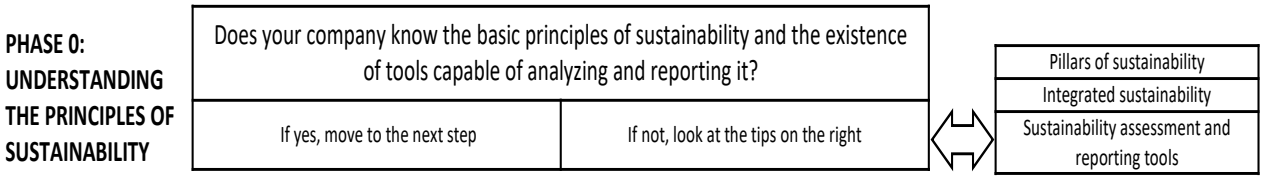


Figure 5.4: Flow chart representation of Phase 0 of the framework

Within this phase, a document[21] is available which provides a theoretical study of the peculiarities of corporate sustainability, of its pillars and their integrated view. Furthermore, the most used tools and standards to evaluate, implement and report integrated environmental, social, and economic sustainability (such as ISO, GRI, LCA[22], etc.) are presented and described, so that the company can become aware of the different opportunities and problems concerning their current business model. This Phase has been called Phase 0, as it was designed to be the foundation of the process, which allows institutions to be able to undertake a commitment to a more sustainable world, which requires a more conscious use of resources and a more equitable inter and intra-generational vision. Indeed, the framework was designed by arguing that a company is a piece of a synergistic, integrated and above all delicate ecosystem.

[21] This document consists of two sections. The first section briefly summarizes the concepts of sustainability and is present in **APPENDIX A: FIRST IN-DEPTH SECTION OF THE THEORETICAL NOTIONS DOCUMENT**. Instead, the second section is composed of the reworked information, present in Section I of this final dissertation.

[22] ISO: International Standards Organization
GRI: Global Reporting Initiative
LCA: Life Cycle Assessment

5.2. Phase I: Defining the current position and the priorities of tomorrow

This second phase, as can be seen in Figure 5.5, consists of five questions. It was designed with the aim of guiding a company in the processes of identifying and raising awareness of the current sustainability of its system and delineating, through a proactive approach in line with the principles of sustainable development, the possible future scenarios. The latter are defined based on strategies and actions to mitigate the most preponderant material aspects which cause corporate non-sustainability.

This part of the framework initially suggests to a company how to determine, using a materiality map, the potential externalities that make the business model unsustainable and therefore the fundamental resources to achieve medium/long-term success. It is recommended to use the pre-filled SASB[23] matrix as the first tool, since it gives a general overview of the categories and dimensions in which the externalities of companies operating in the same production sector can occur on the average.

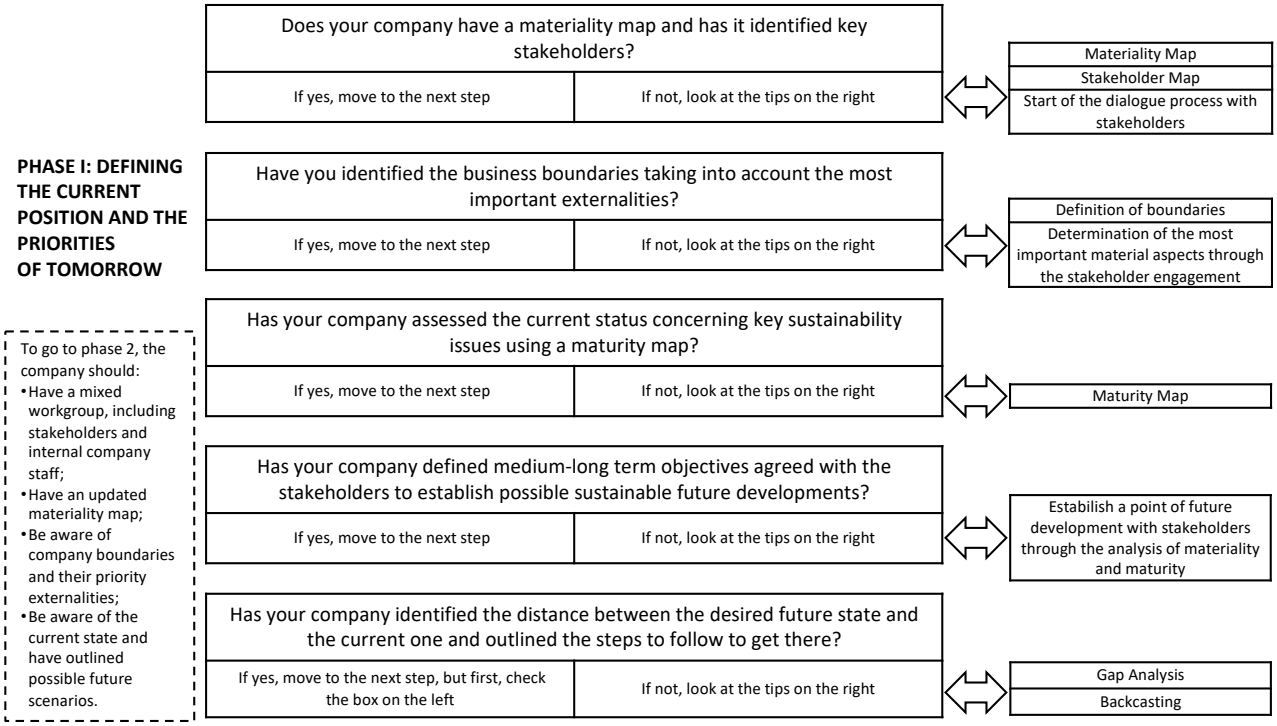


Figure 5.5: Flow chart representation of Phase I of the framework and of the first checklist

[23] SASB: Sustainable Accountability Standards Board

Once the various problems and general impacts are understood, the framework suggests identifying the main stakeholders, both internal and external, through the stakeholder map reported in Figure 5.6.

The stakeholder map allows defining the relationship of stakeholders with the organization and identifying the key ones, which could help during the subsequent process of identifying, through the realization of the materiality matrix defined by the GRI Standards, the specific and personal material aspects of a company.

In particular, a stakeholder map allows a company to implement the stakeholder analysis process simply and visually. Indeed, it is a moment in which an organization searches for possible key stakeholders for a particular and potential company externality linked to one of the pillars of sustainability to subsequently establish a continuous relationship based on interaction and the exchange of information and ideas (Dooms, 2019; Rahbek Gjerdrum Pedersen et al., 2013).

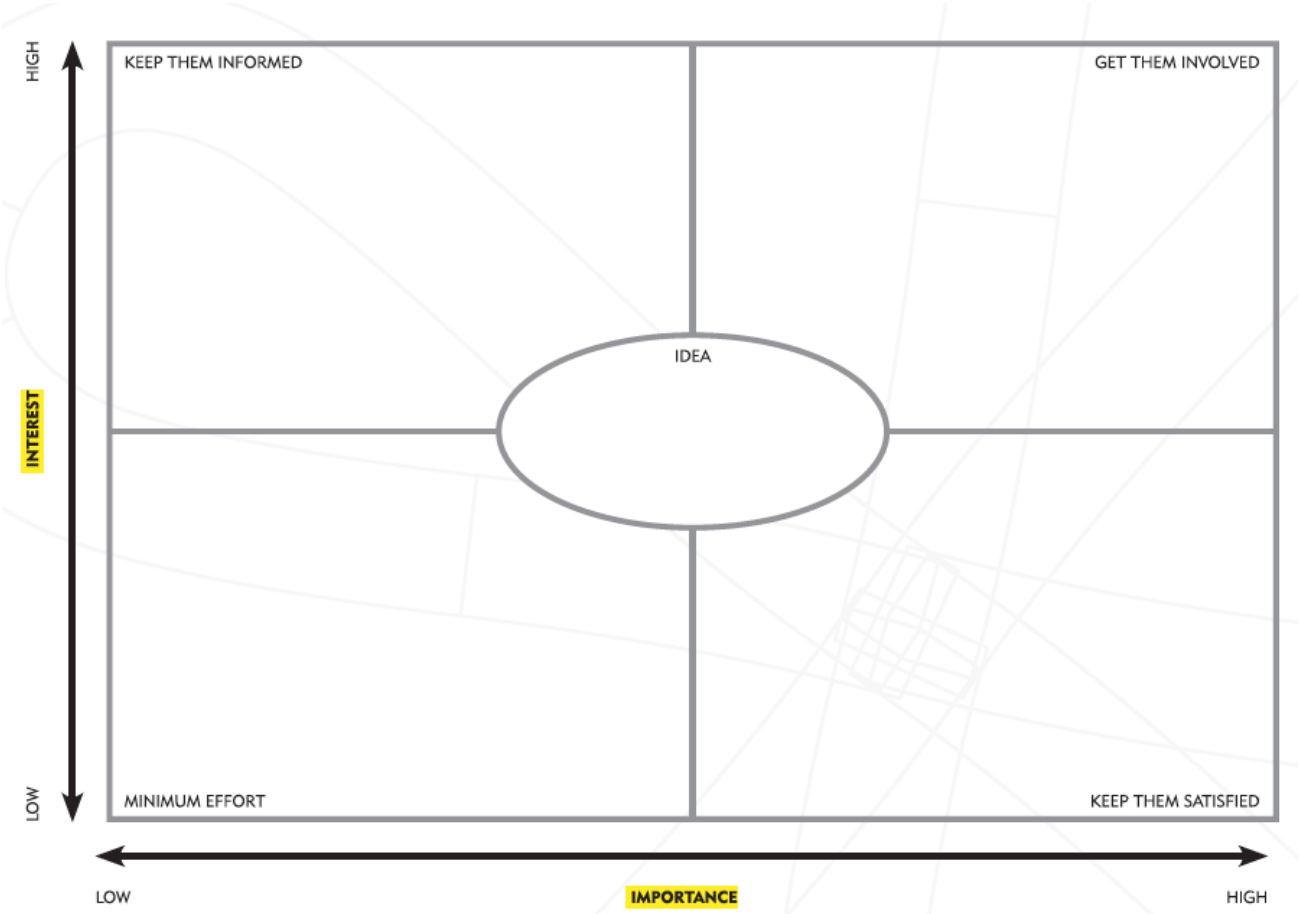


Figure 5.6 Example of stakeholder map (Carleton et al., 2011)

After the main stakeholders have been identified, an initial bilateral dialogue and interaction process starts. At this point, the decision-making framework suggests defining the company system to understand the boundaries of externalities, to be able to verify all the interested parties and identify, through a proactive process with double control, also the possible stakeholders that initially may have not been considered. This phase of defining the real boundaries of an organization was conceived considering that the business system should not be limited to the mere physical boundary of the organization, but should also be sought externally, based on the possible impacts of key externalities, developing the concept that an organization is part of an integrated complex ecosystem and as such influences and is influenced by it.

Then, through the active involvement of the interested parties, the framework suggests starting to determine which material aspects are most important for the internal and external key stakeholders based on the previously defined company boundaries and the different direct and indirect externalities.

Within this phase, the preparation of a Maturity Map is also suggested so that a company can acquire knowledge and awareness of its current position concerning other important factors for strategic and conscious sustainable development.

The framework suggests implementing a maturity map based on BS8900[24], to be able to include aspects such as transparency, integrity, inclusivity, stewardship etc.

The fourth step presented within this phase proposes to establish, through the active involvement of internal and external stakeholders, the possible future scenarios of sustainable development. The process described above is made possible through the evaluation of the matrices of materiality and maturity and the most relevant aspects and critics encountered. This includes trying to extrapolate the sectors with less developed and more critical or impacting materiality and identifying what could be the most important aspects through two possible screening mitigation scenarios, based on the externalities present in the different pillars, which are reported below:

i) reduce emissions by converting the energy mix used through more sustainable energies and evaluate the most energy-intensive production processes, through LCA and CF[25] which in turn support in the evaluation of how to intervene to reduce emissions;

[24] BS8900 - Managing sustainable development of organizations

[25] LCA: Life Cycle Assessment

CF: Carbon Footprint

ii) develop a company policy focused on raising awareness of staff about the aspects of circular economy and recycling, encouraging virtuous behaviours, such as sharing mobility.

Finally, once a company has defined the status and the various possible future horizons of intervention, the framework indicates to establish, through a gap analysis, the distance between the current state and the future one. By doing so, a company can define the real discrepancy concerning sustainable development and begin to proactively outline the ideal trajectories. This can be done by means of backcasting, that could be followed to decrease/mitigate the different externalities, identifying the cause-effect relationships before they occur, through a step-down process, back in time (Bratt, 2014; Missimer, 2015; Nathan, 2018).

5.2.1. First additional checklist

Although it is not a prescriptive phase, before passing from phase 1 to the next, the framework asks the company, through a first checklist, if it has a series of tools and methodologies to identify the current position concerning sustainability and possible future scenarios through active stakeholder involvement.

In particular, the checklist suggests:

- have a mixed working group, including stakeholders and internal staff of the company;
- have an updated materiality map;
- be aware of company boundaries and their priority externalities;
- be aware of the current state of sustainability and have outlined possible future scenarios.

5.3. Phase II: Identifying the interventions

This phase of the framework, as shown in Figure 5.7, consists of two questions designed through two key objectives that work synergistically one with the other. The first objective was the desire to convert all the materiality and maturity information of the previous phase and the various options for future screening development into concrete, objective actions.

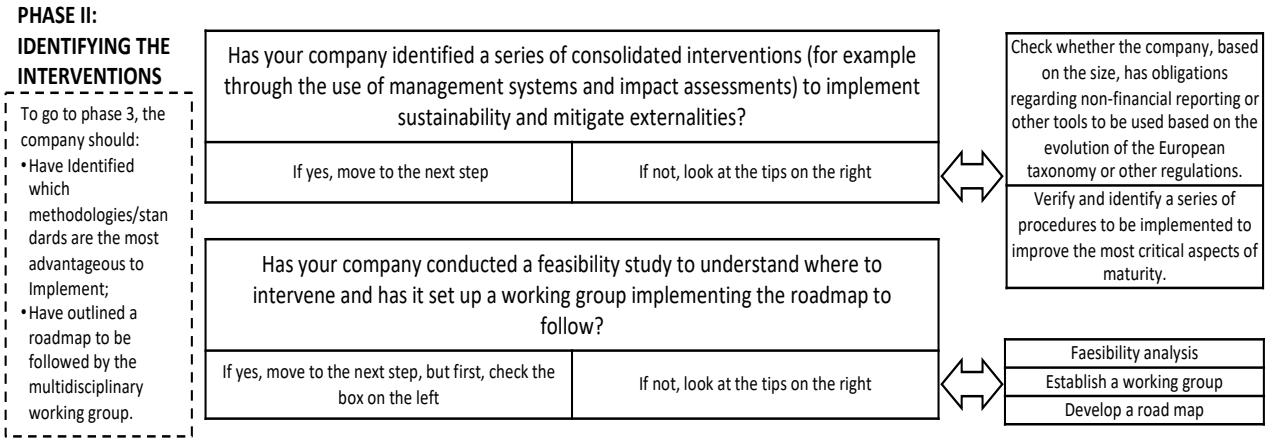


Figure 5.7: Flow chart representation of Phase II of the framework and of the second checklist

This would allow a company, through a scientific decision-making process, to highlight in a simple way the methodologies or tools which are suitable to implement the sustainability actions, based on its needs and peculiarities. The second objective was to introduce a process to understand, through decision analysis methodologies, such as multi-criteria analysis (MCDA)[26] or SWOT analysis[27], the best specific implementation strategy for a company.

As a first suggestion, organizations are required to verify, under a proactive and anticipatory attitude, whether there might be current or potential changes in national, European, and global directives. Paying particular attention to the European taxonomy and the New Green Deal, which could influence the decision-making choice to implement one methodology rather than another.

In the second step of the horizontal development, a decision support tool called morphological scheme was introduced and developed at a preliminary level.

[26] Strategic planning analysis used to compare alternatives based on quantitative criteria, expressed on a normalized scale, and then compared on the basis of a weight. In this way it is possible to draw up a ranking of the best options, among the different methodologies, standards or future visions, integrating the results of each criterion (Huang et al., 2011).

[27] Strategic planning analysis developed through a 2x2 matrix that allows a company to qualitatively identify the strengths, weaknesses, opportunities and threats for each of the individual methodologies, standards or future visions, so as to be able to select the one with the best trades -off (Sarsby, 2016).

The morphological scheme consists of an interactive matrix that allows to visualize, at the screening level, a series of standards and methodologies in line with the user needs. In section 5.3.1, the process of realization of the morphological scheme will be briefly summarized.

An example of application of the morphological scheme is present in Table 5.1 and Table 5.2. The compilation of the matrix is performed through the 5 steps in orange which allow to select the pillar to investigate, the complexity of the methodology, the external support required for the implementation of the methodology, the potential and consistency of provided results and the expected impacts derived from the communication of the results. Under the guidance of the blue explanation table, the morphological scheme suggests tools that can be applied in line with the user's requests.

From Table 5.1, it can be seen that the morphological scheme, based on the compilation of the orange table, suggests a Life Cycle Assessment or an ISO 14001 as methodologies in line with the needs of the company. By changing from 3 to 2 the inputs related to the complexity and resources required by the methodology, while keeping the other 3 columns unchanged, the morphological scheme suggests to use ISO 9001 and ISO 26000 or the methodology inherent to The Natural Step framework, as reported in Table 5.2.

Table 5.1: Example of morphological scheme compiled for the environmental pillar

PILLAR	COMPLEXITY + RESOURCES	EXTERNAL SUPPORT	POTENTIAL + CONSISTENCY OF RESULTS	COMMUNICATION
ENVIRONMENTAL	1 - Simple average amount of both input data and resources (personnel, time, information, etc.)	1 - External support strongly recommended but not essential	1 - Low-medium potential of the methodology	1 - Low-medium potential on image / external communication
SOCIAL	2 - Medium-high amount of both input data and resources (personnel, time, information, etc.)	2 - External support needed	2 - Medium-high potential of the methodology	2 - Medium-high impact on image / external communication
INTEGRATED	3 - High amount of both input data and resources (personnel, time, information, etc.)	3 - External support essential to apply the methodology / standard and strongly present	3 - High potential of the methodology	3 - High impact on image / external communication

PILLAR	COMPLEXITY + RESOURCES	EXTERNAL SUPPORT	POTENTIAL + CONSISTENCY OF RESULTS	COMMUNICATION
ENVIRONMENTAL	3	2	2	3

ENVIRONMENTAL	SOCIAL	INTEGRATED
LIFE CYCLE ASSESSMENT (LCA)		
ISO 14001 (ENVIRONMENTAL MANAGEMENT SYSTEM)		

Table 5.2: Example of a completed morphological scheme for the integrated pillar

PILLAR	COMPLEXITY + RESOURCES	EXTERNAL SUPPORT	POTENTIAL + CONSISTENCY OF RESULTS	COMMUNICATION
ENVIRONMENTAL	1 - Simple average amount of both input data and resources (personnel, time, information, etc.)	1 - External support strongly recommended but not essential	1 - Low-medium potential of the methodology	1 - Low-medium potential on image / external communication
SOCIAL	2 - Medium-high amount of both input data and resources (personnel, time, information, etc.)	2 - External support needed	2 - Medium-high potential of the methodology	2 - Medium-high impact on image / external communication
INTEGRATED	3 - High amount of both input data and resources (personnel, time, information, etc.)	3 - External support essential to apply the methodology / standard and strongly present	3 - High potential of the methodology	3 - High impact on image / external communication

PILLAR	COMPLEXITY + RESOURCES	EXTERNAL SUPPORT	POTENTIAL + CONSISTENCY OF RESULTS	COMMUNICATION
INTEGRATED	2	2	2	3

ENVIRONMENTAL	SOCIAL	INTEGRATED
		ISO 9001 (QUALITY MANAGEMENT SYSTEM)
		ISO 26000 (SOCIAL RESPONSABILITY)
		THE NATURAL STEP

The last part of the horizontal development present at this level suggests performing a feasibility decision-making analysis through two proposed methodologies, SWOT Analysis or MCDA. In this way, a company can determine the most suitable tool to implement, among those proposed during the screening phase by the morphological scheme, based on company's needs, priority material aspects and interest of the stakeholders.

Specifically, when a company has assessed the material and maturity aspects and compiled the morphological scheme, the latter will propose a series of methodologies and tools in line with company's needs. Indeed, for example, from Table 5.1 and Table 5.2, 5 methodologies and standards proposed by the morphological scheme can already be noted. Additional methodologies or standards suggested by sustainability experts during the evaluation phase of the material aspects can also be added. However, a company will not be able to develop all the methodologies and standards proposed in parallel and synchronously. For this reason, the framework suggests companies to evaluate with the stakeholders the different methodologies/standards or future visions proposed either at a qualitative and screening level through SWOT Analysis or at a quantitative and detailed level through MCDA. The goal is to be able to make a company understand through a complex and structured logical process which methodologies/standards or future visions could be with the best trade-off and which are therefore worth implementing first.

Subsequently, once the most suitable methodology to be implemented has been selected, the decision-making framework advises to draw up a restricted working group, composed of internal and external key stakeholders, which discusses the material aspect to mitigate. Finally, it is suggested to develop a roadmap divided into key steps. In particular, the framework requires a modification and a more accurate preparation of the backcasting analysis carried out in the previous phase, in order to be able to pursue the sustainable development established through a precautionary and proactive approach.

5.3.1 Development of the morphological scheme

Before discussing the construction of the morphological scheme, it is necessary to briefly define what this instrument consists of and its origins.

The morphological scheme, also called the "Zwicky box" in honor of its inventor, was originally proposed by the astrophysicist Fritz Zwicky for solving problems related to aerospace issues (F. Zwicky, 1967; Fritz Zwicky & Wilson, 1967).

Morphological analysis is a component of scientific decisional analysis inherent to complex issues and it is structured through a systemic logical process that leads to finding "organized solutions" (Ritchey, 2011).

Essentially, the Zwicky box is a matrix divided into parameters and attributes. This matrix contains and identifies a set of relationships and allows to arrive at different solutions thanks to the different row-column permutations. The parameters are the characteristics or functions provided for the solutions, which in the case of the matrix developed in the thesis are present in the first row of the matrix (pillar, complexity & resources, external support, potential & consistency of results and communication), while attributes are the single values that can characterize a parameter.

In the case, for example, of the parameter called "pillar", as can be observed in and Table 5.2, the attribute can be environmental, social or integrated.

Based on how a user fills in the morphological matrix, thus determining, for each parameter, a single attribute, the morphological scheme suggests a series of options in line with the pre-established permutations, as can be seen in Table 5.1 and Table 5.2.

The morphological scheme was created through a consultation, by mean of the questionnaire proposed in **APPENDIX B: SUSTAINABILITY METHODOLOGIES/STANDARDS QUESTIONNAIRE**, which requested information for 21 methodologies and standards relating to corporate, environmental, social, economic and integrated sustainability (reported in Table *0.1*).

More specifically, as reported in **APPENDIX B: SUSTAINABILITY METHODOLOGIES/STANDARDS QUESTIONNAIRE**, the following questions were asked for each methodology and standard:

- in which sector (pillar/thematic) of the sustainability assessment would you insert this methodology/standard;
- in applying this method, how do you evaluate its complexity also considering the temporal level?;
- in applying this methodology/standard, how essential do you think external support is for the company?;
- in applying this methodology/standard, how many resources (personnel, information, etc) do you think are necessary?;
- once this methodology/standard is applied, how would you describe the final information obtained?;
- once this methodology/standard has been applied, how would you describe the results obtained?;
- how would you describe the potential benefits obtained from implementing this methodology/standard? *(both internal and external);*
- How can the impact on image / communication deriving from the application of this methodology / standard be defined?

The questionnaire was submitted to 20 experts coming from public universities, research institution and private consultancy companies dealing with corporate sustainability.

The survey presented an overall response rate of 85%. The percentage response rate for each methodology is reported in Table *0.1* of **APPENDIX B: SUSTAINABILITY METHODOLOGIES/STANDARDS QUESTIONNAIRE**

The 21 methodologies and standards administered within the questionnaire to consultants were selected after:

- bibliographic search through Mendeley, Scopus and Google Scholar databases and search engines for all methodologies/standards;
- active comparison with environmental, social and integrated sustainability experts, operating both in public and private bodies, that supported the first phase of screening and an expansion of the methodologies and standards found through the previous phase of bibliographic search;
- active discussion with experts in sustainable strategic innovation.

Through the first screening analysis of the questionnaire results, it emerged that for three methodologies (ISO 28001 - security management system for the supply chain, ISO 44001 - collaborative business relations management system, and ISO 22301 - societal security, business continuity management system), there was no response.

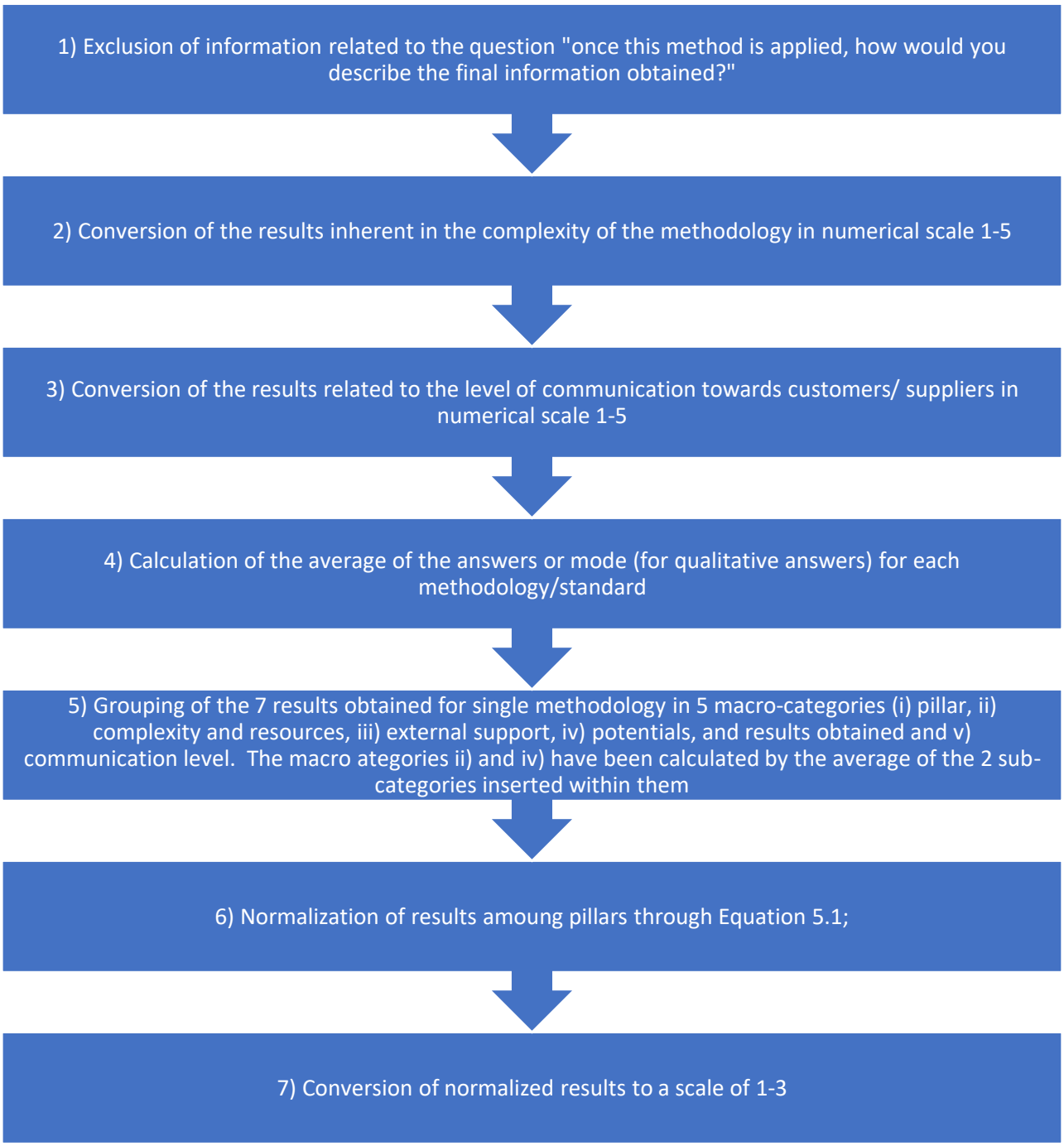
The remaining 18 methodologies were divided into 3 pillars based on the information obtained from the interviewees. Particular cases are related to the Benefit Corporation methodology, inserted into two pillars (social and integrated), as it emerged that the interviewees placed it equally within these two macro-areas of sustainability, and economic methodologies, which have been identified within the integrated pillar.

The final split consisted in:

- six methodologies in the Environmental pillar (LCA, carbon footprint, water footprint, ISO 14001, EMAS and ISO 50001);
- six methodologies in the Social pillar (SA8000, ISO 45001, SROI, theory of change, social footprint, benefit corporation;
- seven methodologies in the Integrated pillar (ISO 9001, AA1000, ISO 31000, BS8900, ISO 26000, The natural step and benefit corporation.

Table 5.3, briefly summarizes all the steps that were required to rank the results obtained from the questionnaire on a scale of 1 to 3, which is useful for simply defining the individual attributes of the 5 parameters that make up the morphological scheme. Subsequently, the motivations and purposes of the individual steps listed in Table 5.3 will be explained in more detail.

Table 5.3: Chronological representation of the steps performed for the normalisation of the results collected in the questionnaire and their final classification in a scale from 1 to 3



Initially, an analysis of the data was carried out across the overall responses, allowing for initial screening of the results. It came to light that all the different methodologies and standards presented mixed final information, both qualitative and quantitative. This led to the exclusion from the morphological scheme of the results inherent in this question[28], since it is not significant, being the same for all methodologies (mixed, i.e., both qualitative and quantitative) and therefore not providing useful information during the decision-making process.

Afterwards, there was a conversion of the results inherent to the complexity of the methodology, which was initially evaluated through the assignment of 4 classes values (simple, medium, complex, and other), to a scale from 1 to 5. This was done to allow a more rapid mathematical comparison with the results of the other questions which were collected in the scale between 1 and 5.

To obtain this conversion, first it was necessary to calculate the "modal value" of the answers related to complexity, then the obtained values were classified in the following 7 classes and finally a value between 1 and 5 was attributed to each of the 7 identified classes as described below:

- simple methodology = 1;
- both simple and medium methodology but tending to be simple = 1;
- both simple and medium methodology but tending to be of medium complexity = 2;
- average methodology = 2;
- both medium and complex methodology but tending to be medium = 3;
- both medium and complex methodology but tending to be complex = 4;
- complex methodology = 5.

[28] once this methodology/standard is applied, how would you describe the final information obtained?

As regards the question related to the level of communication towards customers/suppliers, a conversion from the initial decimal scale included in the questionnaire to a scale between 1 and 5 was carried out to standardize all the values according to the scale used for the other questions. Subsequently, there was also the need to calculate, for each of the answers obtained from the 18 methodologies, a mode (for qualitative results) and an arithmetic average (for quantitative ones), present in Table 5.4, to be able to have a limited number of values for each methodology/standard. Especially, for the "pillar" parameter, it was necessary to calculate the modal value and not the arithmetic mean, as it is made up of qualitative variables.

Instead for the remaining 6 parameters (i) complexity, ii) external support, iii) resources, iv) achieved results, v) potentials obtained arising from implementation and vi) communication level) the average was calculated.

Table 5.4: Average/mode results obtained from the preliminary data analysis of the questionnaire

METHODOLOGY	PILLAR	COMPLEXITY	EXTERNAL SUPPORT	RESOURCES (PERSONNEL, INFORMATION, ETC)	ACHIEVED RESULTS	POTENTIALS OBTAINED ARISING FROM IMPLEMENTATION	COMMUNICATION LEVEL
LCA	ENVIRONMENTAL	4,000	4,706	3,882	4,294	4,353	3,853
CARBON FOOTPRINT		3,000	4,176	3,412	4,000	4,059	3,971
WATER FOOTPRINT		3,000	4,500	3,583	3,917	3,750	3,458
ISO 14001 (ENVIRONMENTAL MANAGEMENT SYSTEM)		3,000	4,417	3,750	4,083	4,250	3,917
EMAS (ECO-MANAGEMENT AND AUDIT SCHEME)		3,000	4,222	3,778	4,000	3,889	3,444
ISO 50001 (ENERGY MANAGEMENT SYSTEM)		5,000	5,000	3,000	4,000	5,000	3,500
SA8000 (SOCIAL ACCOUNTABILITY, CORPORATE SOCIAL RESPONSIBILITY)	SOCIAL	3,000	3,857	3,429	3,429	3,571	3,500
ISO 45001 (OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEMS)		2,000	4,250	3,500	3,750	3,750	3,625
SROI (SOCIAL RETURN ON INVESTMENT)		4,000	4,333	3,000	3,667	4,333	4,250
THEORY OF CHANGE		1,000	3,750	3,500	3,500	4,000	3,000
SOCIAL FOOTPRINT		4,000	4,000	4,000	4,000	4,000	3,250

METHODOLOGY	PILLAR	COMPLEXITY	EXTERNAL SUPPORT	RESOURCES (PERSONNEL, INFORMATION, ETC)	ACHIEVED RESULTS	POTENTIALS OBTAINED ARISING FROM IMPLEMENTATION	COMMUNICATION LEVEL
BENEFIT CORPORATION	INTEGRATED / SOCIAL	3,000	3,800	3,500	3,400	4,300	4,050
ISO 9001 (QUALITY MANAGEMENT SYSTEM)	INTEGRATED	2,000	3,625	3,375	3,875	3,625	3,125
AA1000 (ACCOUNTABILITY)		2,000	4,250	3,000	3,500	3,500	2,375
ISO 31000 (RISK MANAGEMENT SYSTEM)		2,000	5,000	4,000	4,000	4,000	4,000
BS8900 (SUSTAINABLE DEVELOPMENT MANAGEMENT OF ORGANIZATIONS)		2,000	3,000	2,000	3,000	3,000	2,000
ISO 26000 (GUIDE TO SOCIAL RESPONSIBILITY)		1,000	4,000	3,500	4,000	4,000	2,750
THE NATURAL STEP		2,000	4,000	3,400	3,600	4,400	3,000

Furthermore, to make the morphological scheme simpler and more intuitive during compilation, it was evaluated, due to the large number of permutations possible in a 7-parameter matrix, to group the results obtained into 5 categories (i) pillar, ii) complexity and resources, iii) external support, iv) potentials and results obtained and v) communication level).

The process that led to the definition of the new 5 parameters is schematized in Figure 5.8.

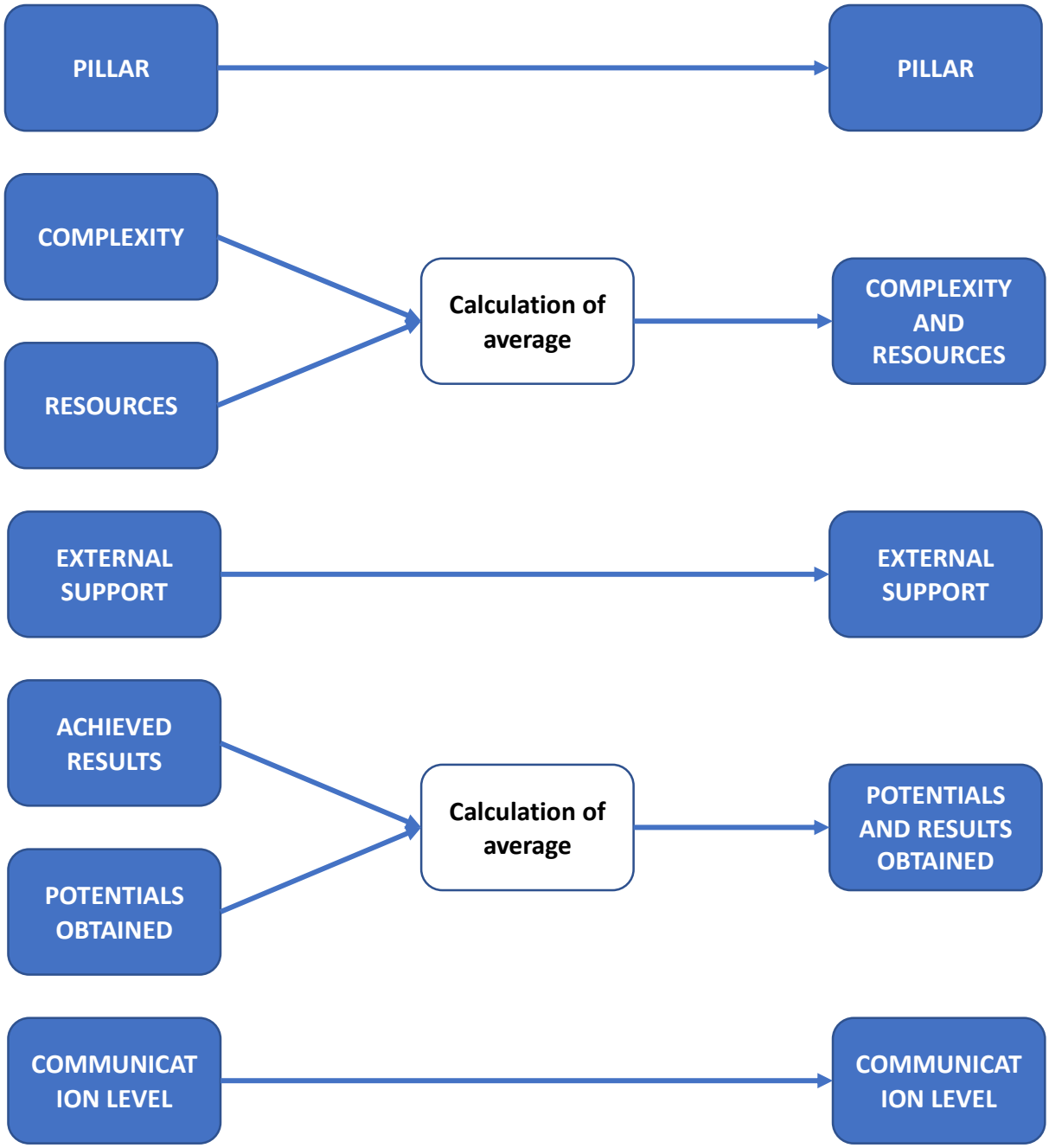


Figure 5.8: Schematization of the pillar grouping process

Subsequently, the quantitative results of the categories ii) complexity and resources, iii) external support, iv) potentials and results obtained and v) communication level, were normalized within each pillar on a scale 0-1, through Equation 5.1, as represented below.

Equation 5.1: Normalization

$$\bar{x}_i = \frac{x_i - x_{min}}{x_{max} - x_{min}}$$

$\bar{x}_i = mean\ of\ the\ parameter$
$x_i = i\ th\ value\ of\ a\ category\ to\ normalize$
$x_{min} = lower\ value\ of\ that\ category$
$x_{max} = highest\ value\ of\ that\ category$

The 4 categories along with the related normalized data on a scale (0-1) divided for each pillar, are presented in Table 5.5.

This choice of normalising among pillars was due, as can be seen from Table 5.5, to the lower average complexity of the methodologies and standards inherent to the social and integrated pillar compared to those of the tools present in the environmental one. Through a separate normalization by pillar, it was possible to observe a better distribution of the results which, by means a unique normalization, would have become squashed and would not have allowed a simple visualization of the results. Furthermore, during this phase, attention was paid to the normalization of the Benefit Corporation methodology present in both the social and integrated pillars.

Table 5.5: Average results normalized on a 0-1 scale, obtained after combining the results relating to complexity and resources and potentials and results obtained

METHODOLOGY	PILLAR	COMPLEXITY AND RESOURCES	EXTERNAL SUPPORT	POTENTIALS AND RESULTS OBTAINED	COMMUNICATION LEVEL
LCA	ENVIRONMENTAL	0,7500	0,6429	0,7412	0,7764
CARBON FOOTPRINT		0,2333	0,0000	0,2339	1,0000
WATER FOOTPRINT		0,3306	0,3929	0,0000	0,0264
ISO 14001 (ENVIRONMENTAL MANAGEMENT SYSTEM)		0,4250	0,2917	0,4208	0,8975
EMAS (ECO-MANAGEMENT AND AUDIT SCHEME)		0,4407	0,0556	0,1659	0,0000
ISO 50001 (ENERGY MANAGEMENT SYSTEM)		0,5000	1,0000	0,6104	0,1056

METHODOLOGY	PILLAR	COMPLEXITY AND RESOURCES	EXTERNAL SUPPORT	POTENTIALS AND RESULTS OBTAINED	COMMUNICATION LEVEL
SA8000 (SOCIAL ACCOUNTABILITY, CORPORATE SOCIAL RESPONSIBILITY)	SOCIAL	0,5476	0,1837	0,0238	0,4000
ISO 45001 (OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEMS)		0,4167	0,8571	0,4089	0,5000
SROI (SOCIAL RETURN ON INVESTMENT)		0,5000	1,0000	0,7222	1,0000
THEORY OF CHANGE		0,2500	0,0000	0,3646	0,0000
SOCIAL FOOTPRINT		1,0000	0,4286	0,7813	0,2000
BENEFIT CORPORATION		0,5833	0,0857	0,4781	0,8400
ISO 9001 (QUALITY MANAGEMENT SYSTEM)	INTEGRATED	0,5938	0,3125	0,5938	0,6875
AA1000 (ACCOUNTABILITY)		0,5000	0,6250	0,5625	0,5000
ISO 31000 (RISK MANAGEMENT SYSTEM)		0,7500	1,0000	1,0000	1,0000
BS8900 (SUSTAINABLE DEVELOPMENT MANAGEMENT OF ORGANIZATIONS)		0,2500	0,0000	0,0000	0,0000

METHODOLOGY	PILLAR	COMPLEXITY AND RESOURCES	EXTERNAL SUPPORT	POTENTIALS AND RESULTS OBTAINED	COMMUNICATION LEVEL
ISO 26000 (GUIDE TO SOCIAL RESPONSIBILITY)		0,3750	0,5000	0,7500	0,7500
THE NATURAL STEP		0,6000	0,5000	0,5500	0,7000
BENEFIT CORPORATION		0,8750	0,4000	0,4000	0,7500

Following, as can be seen from Table 5.6 as well, the normalized values have been classified into 3 classes:

- value 1 to all data belonging to the range 0-0.333
- value 2 all data belonging to the range 0.3331-0.666
- value 3 all data greater than 0.6661.

This operation allows a simpler compilation by the user, who selecting for each category a level on a scale from 1 to 3, as shown in the Table 5.1 and Table 5.2, will obtain a list of methodologies and standards corresponding to that permutation.

Table 5.6: Results normalized and subsequently reported on a numerical scale from 1 to 3

METHODOLOGY	PILLAR	COMPLEXITY AND RESOURCES	EXTERNAL SUPPORT	POTENTIALS AND RESULTS OBTAINED	COMMUNICATION LEVEL
LCA	ENVIRONMENTAL	3	3	3	2
CARBON FOOTPRINT		1	1	2	3
WATER FOOTPRINT		1	2	1	1
ISO 14001 (ENVIRONMENTAL MANAGEMENT SYSTEM)		2	2	2	3
EMAS (ECO-MANAGEMENT AND AUDIT SCHEME)		2	1	1	1
ISO 50001 (ENERGY MANAGEMENT SYSTEM)		3	3	3	2
SA8000 (SOCIAL ACCOUNTABILITY, CORPORATE SOCIAL RESPONSIBILITY)	SOCIAL	2	1	1	2
ISO 45001 (OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEMS)		2	3	2	2
SROI (SOCIAL RETURN ON INVESTMENT)		2	3	3	3
THEORY OF CHANGE		1	1	2	1
SOCIAL FOOTPRINT		3	2	3	1

METHODOLOGY	PILLAR	COMPLEXITY AND RESOURCES	EXTERNAL SUPPORT	POTENTIALS AND RESULTS OBTAINED	COMMUNICATION LEVEL
BENEFIT CORPORATION		2	1	2	3
ISO 9001 (QUALITY MANAGEMENT SYSTEM)	INTEGRATED	2	1	2	2
AA1000 (ACCOUNTABILITY)		1	3	2	1
ISO 31000 (RISK MANAGEMENT SYSTEM)		3	1	1	3
BS8900 (SUSTAINABLE DEVELOPMENT MANAGEMENT OF ORGANIZATIONS)		1	1	1	1
ISO 26000 (GUIDE TO SOCIAL RESPONSIBILITY)		1	2	3	3
THE NATURAL STEP		2	2	2	2
BENEFIT CORPORATION		3	2	1	3

Finally, the results, presented in Table 5.6, have been inserted into an Excel matrix (Table 5.1 and Table 5.2) which, through the function = + IF (AND) and the filter function, can be filled in by the user interactively, showing the methodologies belonging to the selected permutation.

Furthermore, a particular feature of the morphological scheme is that the + IF (AND) function has been constructed through logical comparisons (<, = and>). This made it possible to insert the various methodologies / standards within pre-established ranges, represented in Table 5.7.

As can be seen from Table 5.7., the complexity & resources, and external support parameters have the sign >=, while the potentials & results obtained, and communication level parameters have the sing <=.

This choice was made because a company for the first two parameters will be willing to display all the methodologies and standards with "complexity" greater or equal to the one selected, while for the other two, inversely, it will be willing to display all the methodologies and standards with less or equal "difficulty" than the one selected.

Table 5.7: Logical comparisons inserted inside the function + IF (AND)

METHODOLOGY	PILLAR	COMPLEXITY AND RESOURCES	EXTERNAL SUPPORT	POTENTIALS AND RESULTS OBTAINED	COMMUNICATION LEVEL
LCA	ENVIRONMENTAL	>=3	>=3	<=3	<=2
CARBON FOOTPRINT		>=1	>=1	<=2	<=3
WATER FOOTPRINT		>=1	>=2	<=1	<=1
ISO 14001 (ENVIRONMENTAL MANAGEMENT SYSTEM)		>=2	>=2	<=2	<=3
EMAS (ECO-MANAGEMENT AND AUDIT SCHEME)		>=2	>=1	<=1	<=1
ISO 50001 (ENERGY MANAGEMENT SYSTEM)		>=3	>=3	<=3	<=2
SA8000 (SOCIAL ACCOUNTABILITY, CORPORATE SOCIAL RESPONSIBILITY)	SOCIAL	>=2	>=1	<=1	<=2
ISO 45001 (OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEMS)		>=2	>=3	<=2	<=2
SROI (SOCIAL RETURN ON INVESTMENT)		>=2	>=3	<=3	<=3
THEORY OF CHANGE		>=1	>=1	<=2	<=1
SOCIAL FOOTPRINT		>=3	>=2	<=3	<=1

METHODOLOGY	PILLAR	COMPLEXITY AND RESOURCES	EXTERNAL SUPPORT	POTENTIALS AND RESULTS OBTAINED	COMMUNICATION LEVEL
BENEFIT CORPORATION		>=2	>=1	<=2	<=3
ISO 9001 (QUALITY MANAGEMENT SYSTEM)	INTEGRATED	>=2	>=1	<=2	<=2
AA1000 (ACCOUNTABILITY)		>=1	>=3	<=2	<=1
ISO 31000 (RISK MANAGEMENT SYSTEM)		>=3	>=1	<=1	<=3
BS8900 (SUSTAINABLE DEVELOPMENT MANAGEMENT OF ORGANIZATIONS)		>=1	>=1	<=1	<=1
ISO 26000 (GUIDE TO SOCIAL RESPONSIBILITY)		>=1	>=2	<=3	<=3
THE NATURAL STEP		>=2	>=2	<=2	<=2
BENEFIT CORPORATION		>=3	>=2	<=1	<=3

In addition, a blue Table 5.8 was created to guide a company during the compilation, which contains a guideline of the different values to be attributed to the morphological scheme.

Table 5.8: Guide table for the compilation of the morphological scheme

PILLAR	COMPLEXITY + RESOURCES	EXTERNAL SUPPORT	POTENTIAL + CONSISTENCY OF RESULTS	COMMUNICATION
ENVIRONMENTAL	1 - Simple average amount of both input data and resources (personnel, time, information, etc.)	1 - External support strongly recommended but not essential	1 - Low-medium potential of the methodology	1 - Low-medium potential on image / external communication
SOCIAL	2 - Medium-high amount of both input data and resources (personnel, time, information, etc.)	2 - External support needed	2 - Medium-high potential of the methodology	2 - Medium-high impact on image / external communication
INTEGRATED	3 - High amount of both input data and resources (personnel, time, information, etc.)	3 - External support essential to apply the methodology / standard and strongly present	3 - High potential of the methodology	3 - High impact on image / external communication

5.3.2. Second additional checklist

To pass to phase 3, the company is initially asked to confirm that it has identified, through a scientific and reproducible decision-making process, the best procedure/methodology to be implemented. This task should be based on the material aspects most predominant in the interests and pressures of the internal and external priority stakeholders. Subsequently, the checklist requires to have outlined a roadmap which is developed by the multidisciplinary working group that is also in charge of following the indications of the roadmap. The multidisciplinary working group will also be involved in the following phase 3 to identify which indicators can be used.

To sum up, the second additional checklist asks to confirm:

- to have identified which methodologies/standards are the most advantageous to implement sustainable development;
- to have outlined a roadmap to be followed by the multidisciplinary working group for the implementation of the identified methodologies/standards.

5.4. Phase III: Measuring progress

This phase has been defined so that a company can become aware of how to evaluate and measure the evolution of its sustainability over time, using key indicators with a precautionary approach. This allows to interrupt and modify the process in an early stage if this does not go in the predetermined direction or if there are unforeseen problems.

Specifically, within this phase quantitative and qualitative indicators (KPIs[29]) are suggested, in line with the pre-established roadmap. The indicators to use can be selected among those suggested by GRI and SASB[30] impact standard or within the 17 objectives of the 2030 Agenda. These last are increasingly important objectives also used as a basis for various indicators implemented within some national and international rating tools for both companies and universities as in the case of THE Impact Rankings (Times Higher Education, 2021).

Subsequently, the framework recommends, as the last horizontal development of this phase, to implement processes for the acquisition of information and data on an ongoing basis by developing a monitoring strategy based on the indicators identified in the previous step. This allows companies to be able to carry out timely step-by-step assessments during the pursuit of sustainability.

[29] KPIs: key performance indicators

[30] GRI: Global Reporting Initiative

SASB: Sustainability Accounting Standards Board

A graphical brief representation of this phase can be seen in Figure 5.9

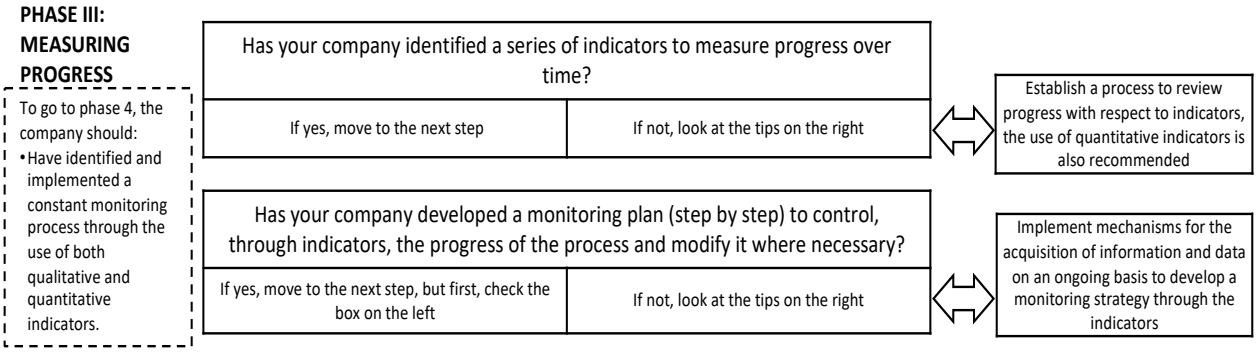


Figure 5.9: Flow chart representation of Phase III of the Framework and of the third checklist

5.4.1. Third additional checklist

To move on to the final phase of the framework, a company is advised to have identified and implemented a constant monitoring process using both qualitative and quantitative indicators to have a tool capable of viewing progress and different issues as the sustainability implementation process develops.

If the company has these indicators, then the sustainability implementation process can begin as there are several tools that can monitor the process continuously and proactively.

Specifically, the checklist suggests:

- To have identified and implemented a constant monitoring process using both qualitative and quantitative indicators.

5.5. Phase IV: Communicating and reporting

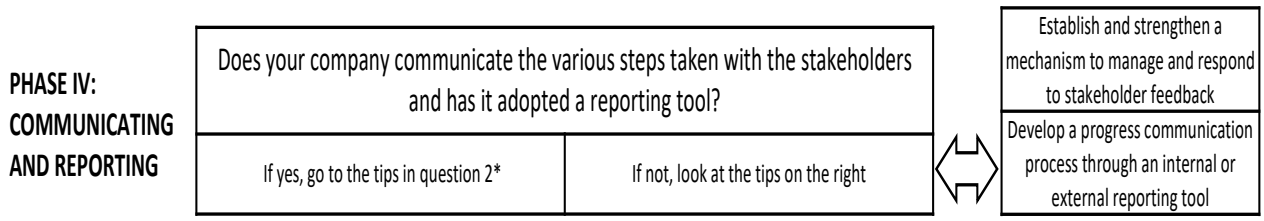
The final phase has been defined so that an organization can be transparent with respect to the various stakeholders, involving them during all phases of the process and not only at the end of them. This involvement should occur through bilateral dialogue and reciprocal exchange and not as a simple form of unilateral communication of results.

As a first horizontal development, as can be seen in

Figure 5.10., the framework suggests establishing and strengthening a method for continuously communicating with the various interested parties and responding to their feedback, in order to demonstrate to be transparent and open to discussion. This process is very important because a company can both demonstrate its real commitment step by step towards the implementation of sustainability and understand through constant dialogue with stakeholders some relevant critical issues or potential not considered.

Subsequently, the framework recommends developing a communication process on the progress achieved by using internal or external reporting tools such as GRI, SASB, IR[31], Ecolabel, or certifications. This form of communication can then be included in specific reports or on company websites. A summary flowchart of this phase is represented in

Figure 5.10.



*Once the questionnaire is completed, the framework recommends returning to PHASE I (Question 2) and starting over the sustainability implementation process by updating the materiality map, since sustainable development is a process of continuous and endless improvement.

Figure 5.10: Flow chart representation of Phase IV of the Framework

[31] IR: Integrated Reporting

As shown in Figure 5.10, once the questionnaire is completed, the framework recommends returning to PHASE I (Question 2) and starting over the sustainability implementation process by updating the materiality map, since sustainable development is a process of continuous and endless improvement.

Indeed, at the end of the first cycle, if a company positively answers all questions, including the final one, or completes the roadmap, it will achieve greater awareness on how to identify and manage its material aspects of sustainability. The company is now ready to repeat the process, starting from the updating of the materiality map, being more critical and aware on the topic than when it started. In this way, the company can improve and optimize what has already been done, integrate other relevant aspects and set more ambitious sustainability objectives.

Furthermore, once an externality is mitigated, it will no longer be a preponderant material factor.

A company, therefore, by updating its materiality map will be able to understand the new externalities, caused by new external or internal pressures identified by stakeholders or new regulations. Moreover, the company can be able to understand whether the previous sustainability actions have managed to mitigate a specific impact related to a specific pillar of sustainability and understand if and how that material aspect has evolved.

5.6. Conceptual scheme of the framework

In this subsection the whole flowchart of the framework is reported, as can be seen by Figure 5.11. Specifically, it is possible to observe the conceptual structure, consisting of the 5 phases, the flexible questionnaire and the various suggestions that make up the horizontal development.

Furthermore, this scheme was used as the basis for ICT development, presented in CHAPTER 6: IT development of the decision-making framework

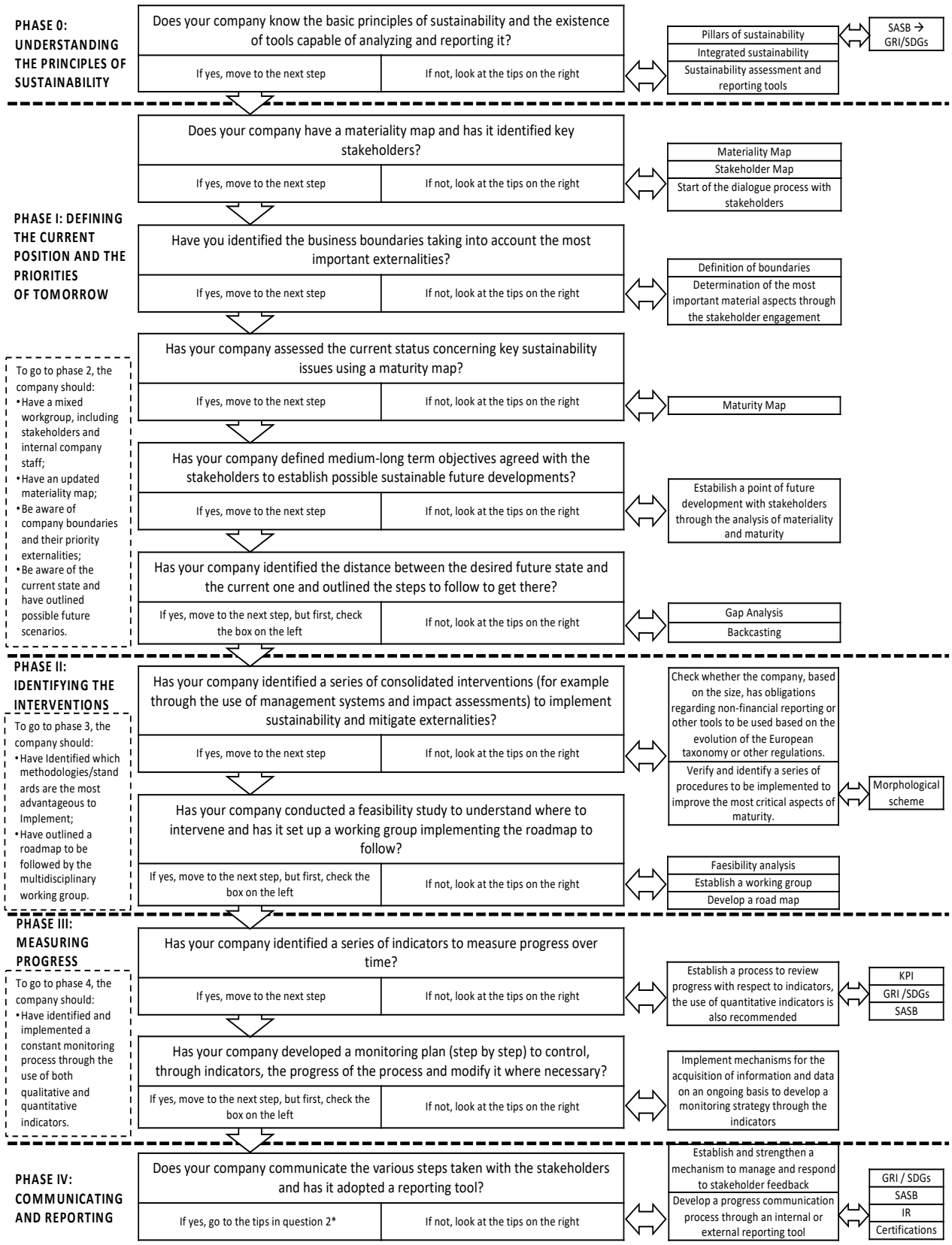


Figure 5.11: Framework represented below flow chart

The framework has been implemented by an ICT expert as a web application, available at https://sustainability-dashboard.greendecision.eu, which allowed a simpler application for the case study presented in the next section.

The application which is based on the meteor framework has been programmed in TypeScript, an open-source language which is based on JavaScript by adding static type definitions.

Meteor is an open source full-stack platform for developing reactive web applications, allowing the web user interface to seamlessly reflect the underlying data, by updating and rendering the components when data changes. The Meteor structure is displayed in Figure 6.1 (Meteor, 2021).

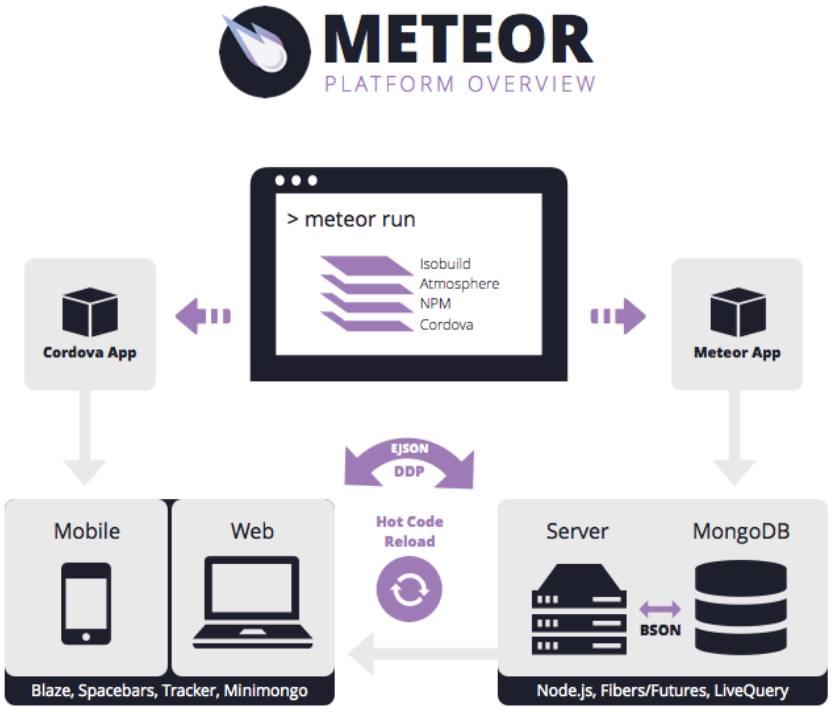


Figure 6.1: Meteor platform overview (ASTREA IT, 2018)

Responsiveness is defined by means to the Distributed Data Protocol, which propagates changes to the underlying data to different listeners allowing changes to appear directly and immediately to all connected users. Specifically, thanks to React (https://reactjs.org/, which is part of the framework) only the components displaying the portion of data which changes are updated, and not the whole web page.

The data is stored in a NoSQL database, MongoDB, on which the meteor framework is based.

Mongo is a NoSQL database, in which documents are grouped into collections that can also be heterogeneous (Mongo DB, 2021b, 2021a). Specifically, each document is stored in a JSON-like format, and documents fields can vary from document to document, while the data structure can be changed over time.

The interface of the Framework has been made simple and intuitive for the user, through the possibility of navigating within the tool by single phase. An example of the developed IT application is shown in the two figures below. In Figure 6.2 the navigation within phase 1 is represented, where the user had answered affirmatively to the first 3 questions of the Framework. In Figure 6.3 on the other hand, the horizontal development inherent to the last question present in phase 1 is represented.

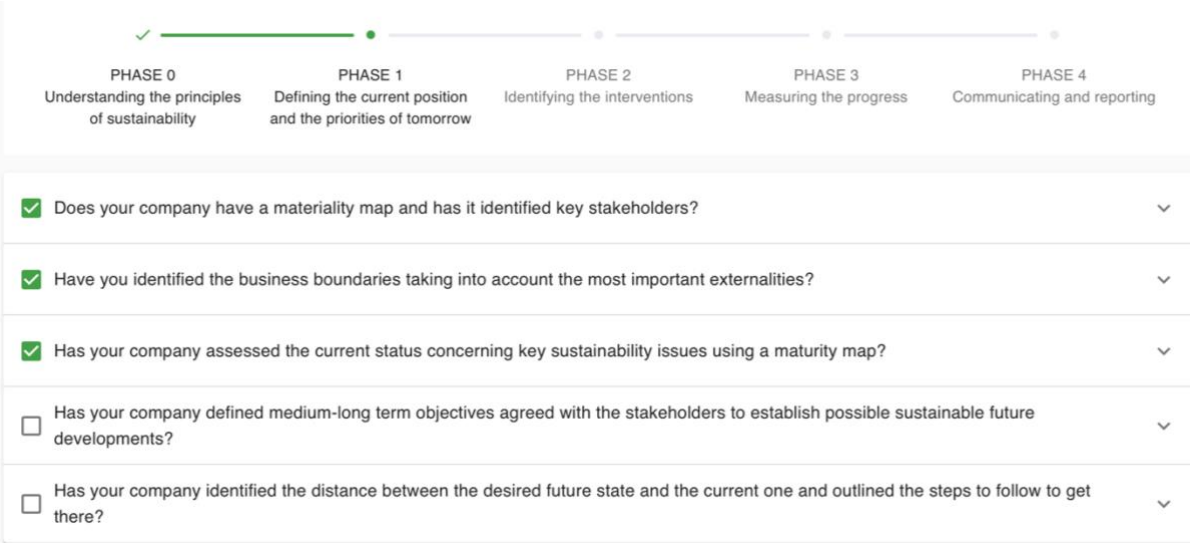


Figure 6.2: Example of Phase 1 of the Conceptual Framework

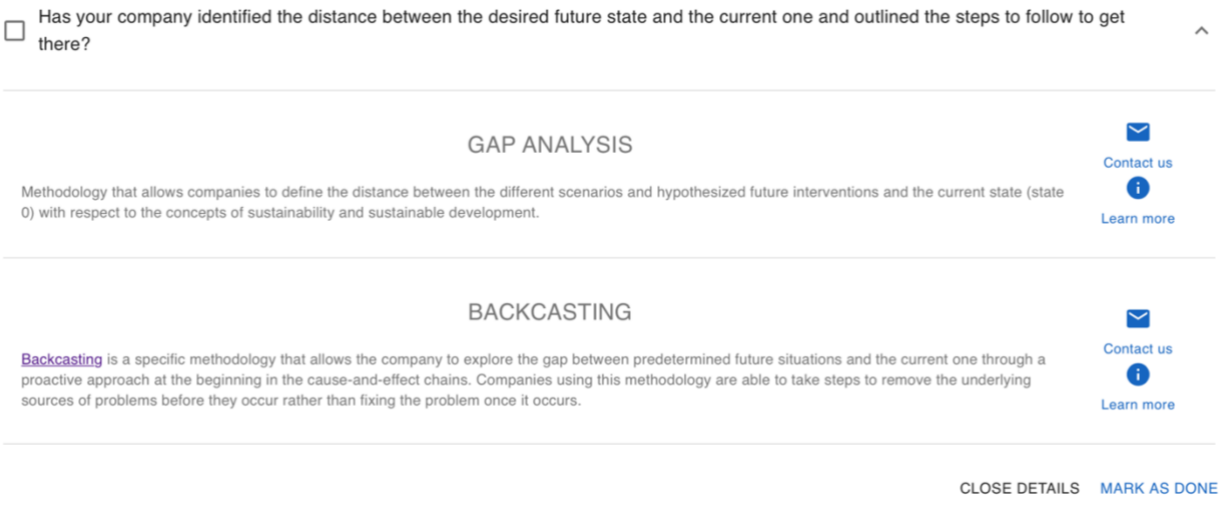


Figure 6.3: Example of horizontal development of Phase 1 of the Conceptual Framework

SECTION III: FRAMEWORK APPLICATION THROUGH A CASE STUDY

This third section reports the application of the developed framework to a real case study in order to understand the functionalities and the possible problems inherent to the designed logical structure and to the roadmap defined by the framework.

Initially, the SME which tested the framework is briefly presented. The application has been done in collaboration and with the contribution of GreenDecision and Strategy Innovation, two spin-offs companies of the Ca' Foscari University of Venice. These two companies are operating in the sustainability sector, with a focus on environmental issues in the case of GreenDecision and in the economic strategic sustainable development in the case of Strategy Innovation. These companies allowed to test the logical functioning of the framework, also reporting comments relating to its general structure and its usability both before the application of the framework with the case study and during the application.

The choice to test the decision-making framework through an external party was decided to allow understanding the possible problems and/or the need of additional functionalities by means of a third-party verification and to verify whether the decision-making framework could be used as a support tool for both consultants and companies. Furthermore, during the testing phase of the framework, there was also the possibility to actively support the consultants of Strategy Innovation and GreenDecision both in the evaluation of the material aspects and in the identification of some possible methodologies capable of evaluating and implementing the sustainability of the environmental pillar.

Specifically, this section provides a general overview on the characteristics of the case study, including the production sector and size. Then, the framework application process and the related results are described. This is provided by illustrating the vertical level of the framework in which the case study is positioned and the results of the flexible questionnaire. For each level, the horizontal development is represented by the different implemented methodologies and tools.

In particular, the following aspects are presented i) the material aspects (subchapter 7.1), ii) the extra-company boundaries (subchapter 7.1), iii) the initial maturity of the organization by means of the application of the maturity map (subchapter 7.2), iv) the preliminary process of stakeholder engagement (subchapter 7.3), v) the suggested methodologies at the screening level achieved using the morphological scheme (subchapter 7.4) and vi) the level reached throughout this first phase of application of the framework (subchapter 7.5). Finally, the potential and criticalities observed are exposed (CHAPTER 8: Potential and criticality of the framework).

CHAPTER 7: Introduction to the case study

With the aim of understanding the functionality of the corporate sustainable development roadmap defined by the decision-making framework, an SME has been selected to test this framework.

The company selected thanks to the contribution and involvement of Strategy Innovation, is a medium-sized Italian B2B[32] company, with 650 employees, 3 production sites and 6 proprietary brands. The company is operating in the production and supply of electronic and electromechanical components. Specifically, the worldwide sales network covers the areas relating to large and small household appliances (main business area), automotive, heating and ventilation (HVAC), gardening and outdoor and healthcare.

Throughout the first screening meeting, it was found that the company already had previous knowledge about sustainability, its pillars, and the tools capable of evaluating, implementing, and reporting corporate sustainability. It also proved to be socially committed within community of Verona province through various initiatives. Moreover, it emerged that as one of the main objectives of 2021 was a desire to draft a non-financial report using the GRI standard.

This information allowed to overcome Phase 0 “Understanding the principles of sustainability” and to advance to the Phase I of the framework “Defining the current position and the priorities of tomorrow”.

However, since the company did not have a materiality matrix, it stopped its journey at this level of the framework and entered the first horizontal development in order to start drawing up its materiality matrix. The level reached by the company during the first meeting and therefore its starting point is represented in Figure 7.1.

The next subsections represent the process of sustainability assessment and research of possible future developments undertaken with the company using the decision-making framework.

[32] B2B: business to business, trade between companies

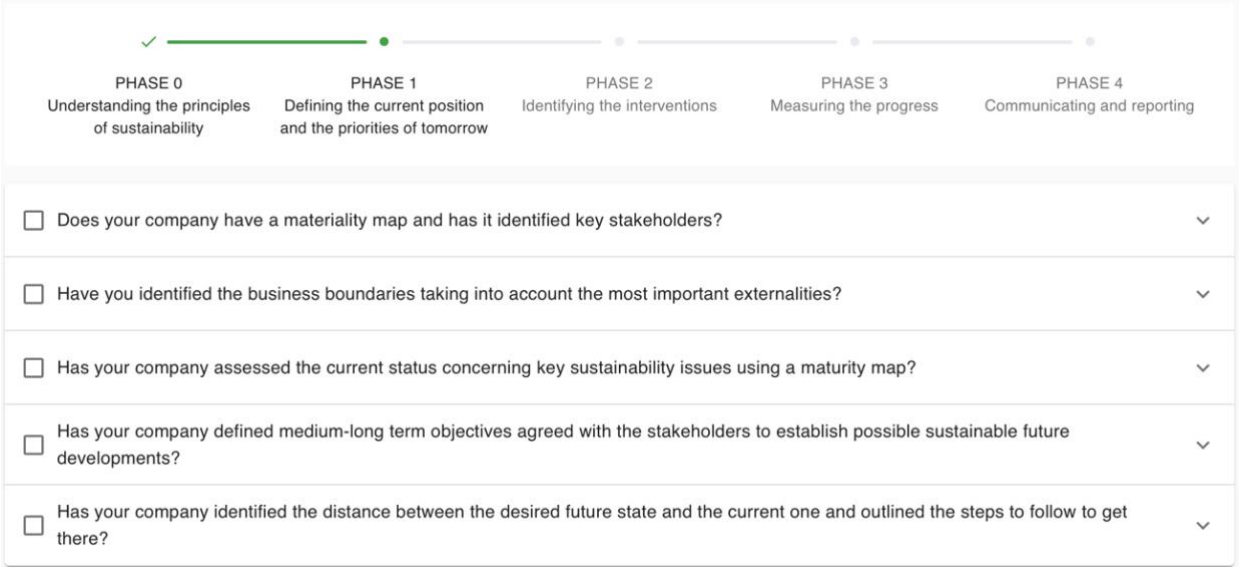


Figure 7.1: representation of the completed phase (phase 0) and the path required for the completion of phase I

7.1. Material aspects and definition of boundaries

This paragraph deals with the aspects related to the first and second questions in Figure 7.1. Initially, by means of an initial preliminary analysis deriving from the use of the pre-filled maturity matrix defined by SASB, present in Table 7.1, it was possible to verify the most important and preponderant material aspects for the company. Specifically, the priority aspects for companies operating in the same production sector of the company under assessment were examined first (Resource Transformation column)[33]. Then, the possible material aspects were assessed in more detail, inspecting the micro-category to which the case study belongs (Electrical & Electronic Equipment column).

From Table 7.1 it can be noted that the aspects inherent to the environmental and governance dimensions are the most potentially critical. In these categories, there are potentially priority externalities concerning energy management, waste management, product design & life cycle management, material sourcing & efficiency and business ethics (dark grey).

In addition, generally, externalities of medium relevance (light grey) can be seen as well, such as for example, GHG emissions, air quality and employee health & safety.

[33] the Resource Transformation macro-category is made up of 5 sub-categories (Aerospace & Defense, Chemicals, Containers & Packaging, Electrical & Electronic Equipment, and Industrial Machinery & Goods). The light grey colour is given by the average materiality value of these 5 sub-categories.

Table 7.1: Maturity matrix pre-filled by SASB for the production sector and the sub-category inherent to the case study

SASB Dimension	**REAL Dimension**	**General Issue Category**	**Resource Transformation**	**Electrical & Electronic Equipment**
Environment	**Environment**	GHG Emissions		
		Air Quality		
		Energy Management		
		Water & Wastewater Management		
		Waste & Hazardous Materials Management		
		Ecological Impacts		
Social Capital	**Social Capital**	Human Rights & Community Relations		
		Customer Privacy		
		Data Security		
		Access & Affordability		
		Product Quality & Safety		
		Customer Welfare		
		Selling Practices & Product Labeling		
Human Capital		Labor Practices		
		Employee Health & Safety		
		Employee Engagement,		
Business Model & Innovation	**Governance**	Product Design & Lifecycle Management		
		Business Model Resilience		
		Supply Chain Management		
		Materials Sourcing & Efficiency		
		Physical Impacts of Climate Change		
Leadership & Governance		Business Ethics		
		Competitive Behavior		
		Management of the Legal & Regulatory Environment		
		Critical Incident Risk Management		
		Systemic Risk Management		

Subsequently, after examining the "standard" material aspects proposed by the SASB materiality matrix and using them as a benchmark, the process of identifying the priority material aspects which are specific for the company began.

This allowed to start the first phase of research and consultation with the priority stakeholders.

Through a careful study carried out with consultants, 13 key material aspects have been identified and represented in Figure 7.2.These material aspects have been divided into the environmental, social and governance pillars, after a scrupulous evaluation and discussion with the company. As can be seen from Figure 7.2., some material aspects, that in the SASB matrix are present under the governance pillar, have been included in the environmental or social pillars (i.e., product design & life cycle management, supply chain management, materials sourcing & efficiency and business ethics). This was a choice of the multidisciplinary team, composed of economist, sociologist and environmental scientist, who felt, also evaluating all the potential indirect criticalities, that these aspects were a priority for other pillars.

From this evaluation of the priority aspects, it was verified that the case study was proactive about the search for possible externalities, especially related to environmental and social issues. Indeed, as can be seen from the specific material aspects of the company (Figure 7.2.), there has been a more in-depth research and evaluation which allowed the identification of additional material aspects compared to the material aspects suggested by SASB (see Table 7.1).

This first phase of preliminary assessment of the material aspects allowed to understand the real company boundaries. By doing so, it was also possible to identify in more detail the various priority stakeholders: foreign customers, Italian customers, distributors, service providers, component suppliers, public administration, private citizens of the Verona area, third sector and associations, company property, and all employees.

Table 7.2: Description of the 13 material aspects that emerged during the screening phase

Environmental	Social	Governance
Criticality[34] of the articles produced	Health and safety of workers	Communication, information on environmental and social sustainability issues
Waste, materials, resources, and energy	Social ecosystem	
Territorial natural ecosystem		Proactive and innovative partnership
Chemical safety of product	Well-being of the staff[35]	
Search for new, less impactful technologies	Business ethics and social value	National, European, and global directives
Eco-design of products		

[34] Criticality of the articles produced means the possible negative environmental externalities caused directly and indirectly during the production process.

[35] The well-being of workers is understood such as happiness, respect, non-discrimination, etc.

7.1.1. Interpretation of environmental materiality

Although the case study focused on the application of the whole framework, which has the objective of guiding a company in an integrated analysis including all the sustainability pillars, the writer of this thesis specifically contributed to the evaluation of the material aspects related to the environmental pillar, which are reported in Figure 7.2. Following the sustainability road map proposed by the framework, the writer of this thesis suggested possible methodologies that could evaluate in more detail the environmental impacts and the actions for implementing the company's sustainability. These suggestions have indirect effects, to some extent, also to the other pillars.

Albeit the discussion on methodologies or standards to be implemented is not included in the present level of the framework, the discussion between the company and the sustainability experts anticipated this assessment. This allowed to provide the company with possible creative and original solutions at the screening level that could be subsequently integrated with the results deriving from the use of the morphological scheme, present in subchapter 7.4.

Specifically, various complementary options have been identified and then suggested regarding the different environmental externalities encountered by the company along with the possible methodologies and standards that can be used to measure them.

As a first step, it was decided to suggest a Life Cycle Assessment (LCA) study of the corporate process at the screening level, through a cradle-to-the-gate[36] assessment. Then, it was suggested to perform an Eco-design LCA study comparing the flagship product to different alternatives produced with less impacting components. Such LCA study could be implemented through a search for more "sustainable" alternative raw materials or components and by means of proactive and innovative partnerships to be pursued in collaboration with universities.

LCA is an objective standardized methodology, regulated at the level of ISO 14040 and 14044, which allows quantifying direct and indirect emissions, resources, energy and environmental impacts throughout the life cycle of a product or service (Chomkhamsri et al., 2011; Wolf et al., 2010).

The life cycle indicates all the phases, of a product or process, which are there starting from the extraction of raw materials, up to the use of the product and its disposal. LCA studies can be divided into different categories, the most complete study is defined as cradle-to-cradle or closed-loop-production. It evaluates the impacts along the entire process from the extraction of raw materials to the end of life, including the avoided impact deriving from product recycling. Up to less complex

[36] type of LCA study that directly and indirectly evaluates the impacts from the resource extraction process to product packaging or at the end of a company's production process

analysis, gate-to-gate studies assess the impacts only within the company. This type of study allows understanding which are the production processes with the greatest criticalities and wastes, and it allows activating reuse and recycling paths for waste in line with efficiency and circularity.

Furthermore, LCA could help to understand the production processes that require more resources and that are more energy-consuming in order to identify possible options to minimize these externalities and to identify priorities for intervention.

Another potential of the two proposed LCA study options is the assessment of the impacts on health and the natural environment. Indeed, LCA allows both at the midpoint and endpoint[37] levels, to have an assessment of the impacts on human health and the ecosystem. Specifically, some of the midpoint indicators are very specific, providing information about freshwater and marine eutrophication, human carcinogenic and non-carcinogenic toxicity, land use, terrestrial, marine, and freshwater ecotoxicity just to name a few.

The natural ecosystem turned out to be one of the key elements of the materiality analysis.

In this sense, it could be possible to intervene directly by enhancing the territorial natural resources and activating virtuous paths in the use of renewable energy and the reduction of emissions. In order to apply these strategies, a methodology to be used in parallel to the LCA is the carbon footprint of the entire company system. This methodology is able to understand the different emissions of an organization and subsequently evaluate the strategies to be adopted.

Carbon footprint (CF) is a standardised methodology for quantifying the impacts resulting from greenhouse gas (GHG) emissions. The GHGs measured come from both direct and indirect emission and are converted into a single unit of measurement corresponding to the equivalent carbon dioxide (CO_2eq) (ISO, 2018; Pandey et al., 2011). One of the advantages that differentiate CF from the LCA methodology is its ability to be applied to the entire company organization.

[37] midpoint: mid-level impact indicators, identified by the Recipe calculation method. They consist of 18 indicators that assess the environmental impacts of a process or product.
endpoint: final impact indicators, identified by the Recipe calculation method. They consist of a clearer vision of the environmental impacts of a process or product by assessing the impact through 3 indicators: Human health, Ecosystems and Resources. These indicators are not formed by the simple sum of the midpoint level indicators.

Moreover, in order to have a proactive and anticipatory attitude towards upcoming international, European and national environmental regulations it was also proposed to activate an observatory on environmental issues.

This observatory will have the aim of actively dialogue on new possible future directives and could be managed by the corporate group that deals with sustainability (CSR manager and accountable employees), by the delegates of the public administration, by the third sector and be open to all the other stakeholders.

7.2. Maturity

This paragraph deals with the aspects related to the third question in Figure 7.1. Following the identification of i) the material aspects, ii) the main stakeholders, and iii) the company boundaries (as described in the previous sections), the first draft of maturity was defined, using the BS8900 maturity matrix, as suggested by the framework.

This process allowed defining the starting state of the company regarding the broader aspects of sustainability (not only ESG) useful for understanding the corporate identity and to make the company undertake a virtuous path towards sustainability, and to identify whether the commitments and efforts of the company were oriented towards transparent and real strategies of sustainable medium-long term development.

Specifically, to be able to define the initial state of the company, the issues relating to integrity, inclusivity, stewardship, and transparency were investigated. The maturity matrix also allowed understanding in more detail the position of the organization with respect to the social pillar, very often difficult to identify as reported by Missmer et al., (Missimer et al., 2010).

As can be seen from table Table 7.3, which summarizes the key issues of maturity, the case study has strong social commitments, which positively affects the social pillar. Indeed, it is possible to note, for example, various commitments on the part of the organization, both internal through a structured and shared code of ethics and external by means of various collaborations with Onlus and Cooperatives.

In particular, it was possible to observe the proactive attitude towards the new generations, by means of the collaboration with "ABC dello Sport", workshop of talents and school-work alternation programs as well as to help people in difficulty.

At the administration level, there is a CSR manager, at the head of a group of six people who seek to create shared value, generating a process of mutual exchange between the organization and the community. By the end of 2021, as previously reported, the company will draw up its first sustainability report through the GRI standards to increase its levels of transparency and involvement with the outside world.

Table 7.3: Schematic of the corporate maturity with respect to the pillars defined by BS 8900 parallel to the ESG pillars of sustainability

Principles	Current case study initiatives
Integrity	The organization actively collaborates with various entities such as: - "Amani Onlus", for the building schools, hospitals, and reception centres on the African continent. - "Exodus Community" for the recovery of drug addicts. - "Casa Dacia Foundation", operating in the integration of the Romanian community within the Veneto region. - "ABC dello Sport", for the development of the new generations thanks to sport and its principles and values.
Inclusivity	The company has activated active involvement processes through: - "Cooperativa Monteverde", which is responsible for supporting boys and girls with different abilities. - "Alternanza Scuola Lavoro", an internship program with the aim of bringing students closer to working realities. - "Workshop of Talents": training program, internal to the company, for non-employed people, with the aim of providing specialized technical skills for future inclusion in the world of work - Prisons of Verona and Arad: collaboration programs with inmates.
Stewardship	Within the organization, there is the presence of a CSR manager, actively involved within the board of directors. The team in charge of CSR and sustainability issues is made up of 6 people who actively involve all company staff, customers, and suppliers through a structured and shared code of ethics. With the aim of creating common value, to respond to social and local needs.
Transparency	By the end of 2021, the company wants to publish the first sustainability report following the non-financial reporting system of GRI.

7.3. Stakeholders' engagement

Once the priority stakeholders and the various externalities defined by the material aspects were identified, the company was asked to activate a process of confrontation with the stakeholders in order to be able to jointly define the various key material aspects and visions of the sustainable future, in line with the aspects related to the last two questions of phase I, present in Figure 7.1.

The stakeholder engagement phase was launched by requiring the active participation of priority stakeholders (internal and external to the organization). Specifically, the stakeholders to whom the request for participation was sent included foreign customers, Italian customers, distributors, service providers, component suppliers, public administration, private citizens of the Verona area, third sector and associations, property, and all employees. In addition to the request for participation, the materiality assessment was sent to these stakeholders in order to provide initial information on the work already carried out.

While waiting for responses and planning the meetings, it was decided, thanks to the flexibility of the roadmap defined by the framework, to start a screening process of the various future options, with the aim of providing some alternatives to be discussed in the future meetings with stakeholders.

In particular, in line with the backcasting methodology identified by the Natural Step, an internal consultation was launched to understand the ideal and utopian future vision of sustainability.

After completing this discussion process, it emerged that the current preliminary objective of the company, to be agreed with the key stakeholders, is to increase the well-being of both internal and external stakeholders and at the same time to minimize the environmental impacts and risks of their production processes. By means of this future "utopian" vision, it was, therefore, possible to understand the distance from the current state of the company to that specific objective.

Specifically, observing the 13 material aspects highlighted by the company at the screening level and the defined future vision, it can be assessed at a qualitative level that the objective set by the company in the long term is very far-sighted and distant from the current state. This will involve a long journey and several creative and original solutions to direct the company towards this future "utopian" vision.

7.4. Definition of methodologies

Following future “utopian” scenario, the company was asked to move on to the next phase of the framework called "identification of interventions", presented in Figure 7.2. The goal was to be able to assess future steps and to start at the screening level to think about laying the foundations for the continuation of the journey.

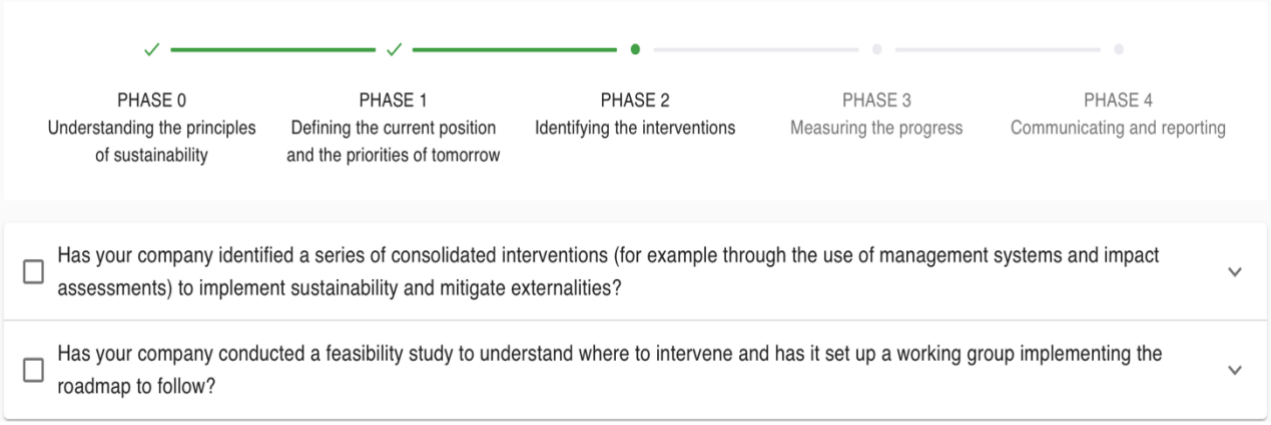


Figure 7.2: Representation of phase II of the framework

This choice was made to have further information to be delivered to the stakeholders, and to be able to apply and test the developed morphological scheme, a tool suggested as a horizontal development of the first question of phase II.

As can be seen from Table 7.4, Table 7.5 and Table 7.6, the company has decided to assign an average level (2) to the different parameters of the morphological scheme used to evaluate the different methodologies or standards suggested for the environmental, social and integrated pillars. In this screening and testing phase, an average value was selected for each parameter because the company and the consultants intended to observe possible options that could be implemented in parallel and synchronously in line with the integrated environmental and social sustainable development outlined with the future vision. For this reason, it was thought that an average level could be suitable for this purpose.

Indeed, probably, if the company had selected level 3 for every single parameter (excluding the "pillar" parameter), the suggested methodologies/standards could have been too demanding to be carried out in parallel with other methodologies.

Furthermore, the framework suggests that sustainable development is a long and continuous process, which must be implemented strategically in the long term and not in order to achieve a result in the short term.

As result, the tool suggested six possible future implementations to improve the environmental, social, and integrated sustainability of the company:

- ISO 14001 (Environmental Management System) for the environmental pillar;
- Benefit Corporation for the social pillar;
- ISO 9001 (Quality Management System), AA 1000 (Accountability), ISO 26000 (Social Responsibility) and The Natural Step for the integrated pillar.

These six results, together with the methodologies suggested after the evaluation of the material aspects, can be used as possible alternatives in the subsequent decision analysis (MCDA or SWOT analysis) with the aim of being able to interpret the most correct and suitable methodology to be used. Indeed, the morphological scheme is a decision support tool that provides indications that can be integrated with further methodologies/standards by the company or by consultants as in this case.

Specifically, the ISO 9001 standard was excluded from the selection since the case study was already certified according to the ISO9001: 2008 standards.

By focusing on the environmental pillar, the environmental management system ISO 14001 could be a standard to be used in parallel with the Life Cycle Assessment and Carbon footprint methodologies described in sub-chapter 7.1.1.

Indeed, ISO 14001 is an international standard, which can be used by any organization regardless of its business sector and which establishes the fundamental criteria for an Environmental Management System (EMS) (International Organization for Standardization, 2015, 2017).

The EMS represents a tool that allows an organization to comply with the regulations in force and to develop a self-control system that identifies and manages the present and future impacts of the company on the environment through a planned process that allows continuously improve its environmental performance (ISPRA, 2018).

In particular, the use of ISO 14001 guarantees company management, employees and external stakeholders that the relevant environmental aspects are characterized, measured and improved (International Organization for Standardization, 2015, 2017).

This standard has mainly two strengths:

- a systemic approach to the management of environmental aspects relating to corporate service processes;
- overcomes the limits and boundaries of mere legislative compliance.

Furthermore, as reported in SECTION I, in some studies concerning ISO 14001, positive externalities were also produced in the social pillar (Asif et al., 2013; Brammer et al., 2012; Curkovic & Sroufe, 2011; Daddi et al., 2011; Delmas et al., 2011; Maletic et al., 2015; Neves et al., 2017; Uhlaner et al., 2012; Upstill-Goddard et al., 2016).

This could indirectly implement the social pillar in an integrated and parallel way and thus advance the company with respect to its future vision.

Table 7.4: Results resulting from the application of the morphological scheme for the environmental pillar

PILLAR	COMPLEXITY + RESOURCES	EXTERNAL SUPPORT	POTENTIAL + CONSISTENCY OF RESULTS	COMMUNICATION
ENVIRONMENTAL	1 - Simple average amount of both input data and resources (personnel, time, information, etc.)	1 - External support strongly recommended but not essential	1 - Low-medium potential of the methodology	1 - Low-medium potential on image / external communication
SOCIAL	2 - Medium-high amount of both input data and resources (personnel, time, information, etc.)	2 - External support needed	2 - Medium-high potential of the methodology	2 - Medium-high impact on image / external communication
INTEGRATED	3 - High amount of both input data and resources (personnel, time, information, etc.)	3 - External support essential to apply the methodology / standard and strongly present	3 - High potential of the methodology	3 - High impact on image / external communication

PILLAR	COMPLEXITY + RESOURCES	EXTERNAL SUPPORT	POTENTIAL + CONSISTENCY OF RESULTS	COMMUNICATION
ENVIRONMENTAL	2	2	2	2

ENVIRONMENTAL	SOCIAL	INTEGRATED
ISO 14001 (ENVIRONMENTAL MANAGEMENT SYSTEM)		

Table 7.5: Results resulting from the application of the morphological scheme for the social pillar

PILLAR	COMPLEXITY + RESOURCES	EXTERNAL SUPPORT	POTENTIAL + CONSISTENCY OF RESULTS	COMMUNICATION
ENVIRONMENTAL	1 - Simple average amount of both input data and resources (personnel, time, information, etc.)	1 - External support strongly recommended but not essential	1 - Low-medium potential of the methodology	1 - Low-medium potential on image / external communication
SOCIAL	2 - Medium-high amount of both input data and resources (personnel, time, information, etc.)	2 - External support needed	2 - Medium-high potential of the methodology	2 - Medium-high impact on image / external communication
INTEGRATED	3 - High amount of both input data and resources (personnel, time, information, etc.)	3 - External support essential to apply the methodology / standard and strongly present	3 - High potential of the methodology	3 - High impact on image / external communication

PILLAR	COMPLEXITY + RESOURCES	EXTERNAL SUPPORT	POTENTIAL + CONSISTENCY OF RESULTS	COMMUNICATION
SOCIAL	2	2	2	2

ENVIRONMENTAL	SOCIAL	INTEGRATED
	BENEFIT CORPORATION	

Table 7.6: Results resulting from the application of the morphological scheme for the integrated pillar

PILLAR	COMPLEXITY + RESOURCES	EXTERNAL SUPPORT	POTENTIAL + CONSISTENCY OF RESULTS	COMMUNICATION
ENVIRONMENTAL	1 - Simple average amount of both input data and resources (personnel, time, information, etc.)	1 - External support strongly recommended but not essential	1 - Low-medium potential of the methodology	1 - Low-medium potential on image / external communication
SOCIAL	2 - Medium-high amount of both input data and resources (personnel, time, information, etc.)	2 - External support needed	2 - Medium-high potential of the methodology	2 - Medium-high impact on image / external communication
INTEGRATED	3 - High amount of both input data and resources (personnel, time, information, etc.)	3 - External support essential to apply the methodology / standard and strongly present	3 - High potential of the methodology	3 - High impact on image / external communication

PILLAR	COMPLEXITY + RESOURCES	EXTERNAL SUPPORT	POTENTIAL + CONSISTENCY OF RESULTS	COMMUNICATION
INTEGRATED	2	2	2	2

ENVIRONMENTAL	SOCIAL	INTEGRATED
		ISO 9001 (QUALITY MANAGEMENT SYSTEM) AA1000 (ACCOUNT ABILITY)
		ISO 26000 (SOCIAL RESPONSABILITY) THE NATURAL STEP

7.5. Level reached by the preliminary application of the framework

The preliminary application of the framework allowed, as detailed in Figure 7.3, the case study to mark the beginning of its first journey towards increasing awareness of its priority material aspects and in identifying possible future scenarios.

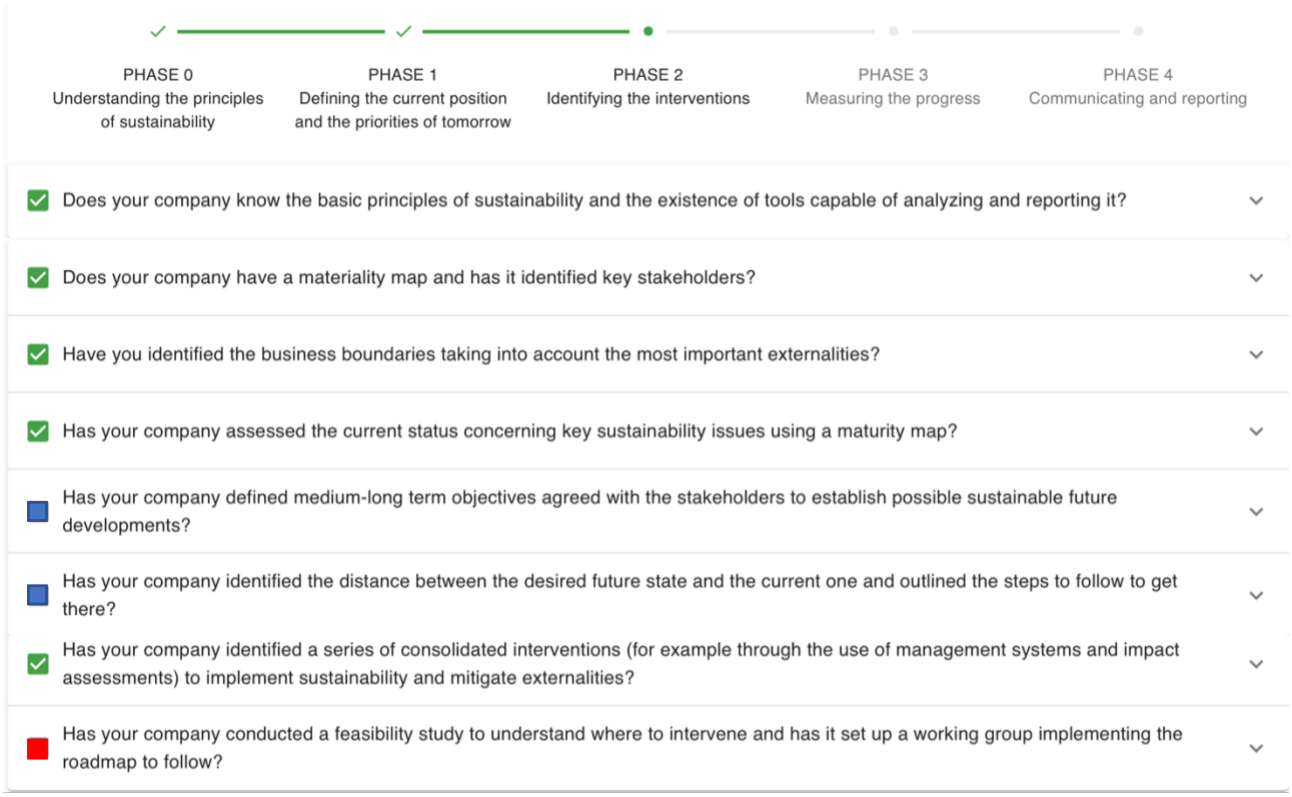


Figure 7.3: Level reached by the preliminary application of the framework. Green colour indicates completed procedures. The blue colour indicates that the procedures are awaiting approval and/or modification by the stakeholders. The red colour indicates the level not developed yet

Furthermore, currently, the company is in the process of discussion and dialogue with key stakeholders with respect to the first obtained results.

Specifically, the next objectives will initially be to finalize the material aspects and the future vision of sustainability through the participation of key stakeholders. Subsequently, the case study will have to define, using the backcasting methodology, the creative and customized solutions to achieve this vision. To define the individual creative solutions, the company will use, as a suggestion, the methodologies or standards that emerged throughout the evaluation of the material aspects and by the use of the morphological scheme.

Specifically, the company will evaluate through multi-criteria analysis (MCDA) or SWOT analysis which are the best methodologies/standards among those that emerged during this screening phase (assessment of the material aspects and morphological scheme) to be implemented.

CHAPTER 8: Potential and criticality of the framework

Through the preliminary application of the framework, although it was not tested to the end, it was possible to understand in more detail the various potentials and criticalities of the guideline defined by the framework, also thanks to the involvement of the sustainability consultants of the two spin-off companies.

First of all, starting to evaluate the framework at a general level, it was possible to observe that the modularity at the base of the phases can allow the framework to continuously update the horizontal and vertical development. This could allow, in the future, to modify and add questions, methodologies and tools within the framework. Modularity is a fundamental factor for the framework, making it responsive to future pressures with respect to the standardization of non-financial reporting and the European taxonomy.

Furthermore, thanks to the initial questionnaire, it was possible to find potential adaptability of the framework to different companies' characteristics. Specifically, an organization that has already an idea of future sustainability objectives and of the tools to be used to understand its current state will be sent to the most suitable level of the framework corresponding to its characteristics.

Finally, based on a cyclic questionnaire, the roadmap established by the framework allows a company to continue using the framework and continuously implement sustainability within its organization.

By carrying out a more detailed assessment and focusing the attention on the various suggestions included in the horizontal developments, it emerged that the integrated approach of i) viewing the standard material aspects for a company belonging to the same production sector and type according to the pre-filled matrix of SASB and ii) being able to draw up a list of material aspects specific for the company can allow a clearer understanding of what may be the material aspects that need to be assessed. Furthermore, this integrated approach just described is able to make the company an active actor in the identification of the various material aspects.

Parallel to the various found potentialities, some critical issues were noted that can be resolved and implemented in the future.

One of the most critical aspects concerns the morphological scheme. Currently, the defined parameters could make the company search for the methodology that requires less effort and resources (i.e., the one positioned at level 1 for most of or all the parameters), therefore with an incorrect approach to sustainability. For this reason, an assessment is under development with the

objective of modifying the various parameters and improving the structure and functionality of the morphological scheme.

In addition, during the testing phase, it emerged that both the consultants and the company, when defining in detail the backcasting at the screening level, requested to test the morphological scheme before having evaluated the different creative and customized solutions to achieve the future vision. Indeed, the consultants and the company have pointed out that once the “utopian” future vision of sustainability have been defined, before being able to research all the steps to follow, it would have been useful and interesting to use the morphological scheme to preliminary understand the possible available actions to achieve the future vision.

An interesting aspect found is that the company was able to freely navigate between the first and second phase to solve its doubts and search for the process that best suits its needs, switching between one question and the next continuously under the guidance of qualified personnel. Although this framework is designed to allow SMEs to independently implement its path towards sustainability, the support of an external consultant who can suggest and guide the identification of material aspects and possible alternatives can lead to a more efficient use of the framework.

DISCUSSIONS AND CONCLUSIONS

This thesis has allowed to understand the complex reality of corporate sustainability, which is the new paradigm of the 21st century. From the first section of this thesis, it was possible to initially observe the different tools currently existing that can guide companies in the processes of assessment, implementation, and reporting sustainability. Subsequently, it was possible to understand the intrinsic criticalities deriving from the non-standardized proliferation of instruments inherent to corporate sustainability. Although as emerged in CHAPTER 3: Commitments and future prospects, there is currently a concrete push towards a form of standardization promoted by public institutions and private companies, such as the initiatives concerning the European taxonomy or the revision of the directive on the non-financial declaration.

Subsequently, there was the possibility of observing the design and development of a modular decision-making framework that could act both as a guideline on corporate sustainable development and as a tool to understand how to approach sustainability objectively and concretely by implementing a long-term vision.

The developed decision-making framework, although still a work in progress, thanks to its modularity, adaptability, and the possibility of continuous updating, can be a useful tool to be used as a roadmap for both business consultants and companies to undertake the journey towards sustainable development.

Specifically, the flexible questionnaire based on eleven questions allows a company to easily enter the most suitable vertical level of the framework.

Through the synergy of vertical and horizontal development, the framework allows an organization to understand which most suitable methodologies or tools could be implemented to advance in a planned and strategic way towards a more sustainable future.

From the application of the case study and the related debate among the sustainability consultants, it was possible to observe how the roadmap defined by the framework can make companies follow a concrete and cyclical path.

In addition, the framework, thanks to the decision-making methodologies (morphological scheme, MCDA and SWOT Analysis) present within the identification phase of the interventions, allows to make companies understand the possible best strategies for implementing the future vision through an objective logical process.

Indeed, thanks to the integrated use of decision-making tools such as the morphological scheme, SWOT analysis and multi-criteria analysis, the framework could be able to accurately define the most suitable implementation methodologies.

Furthermore, throughout the case study, it was possible to suggest to the company the actions and methodologies to be implemented in order to intervene on the material aspects encountered. Specifically, the primary focus of this dissertation was to support the company and the sustainability consultants in the identification of the methodologies/standards and actions inherent to the environmental pillar, while the governance and social pillars were only partially and indirectly assessed.

To summarize, it was possible to notice how the developed Framework initially allows a company or consultant to understand the current state of sustainability and to think proactively and preventively about possible future scenarios. Subsequently, the framework allows to understand through objective decisional methodologies which could be the most suitable methodology for a company to be implemented to reach the predetermined future vision. Moreover, it also allows (phases not shown through the case study application) to identify a series of qualitative and quantitative indicators specific to the pre-established intervention and to create an active monitoring process to verify the real progress of the process to intervene promptly if the company is not progressing towards the pre-established future vision. Finally, the framework allows first to start the sustainability implementation process strategically and then to be able to communicate it externally.

In conclusion, although the framework is still in its infancy and needs several improvements, it can be a good starting point to develop a more complete and consistent support tool with respect to the assessment, implementation, and reporting of integrated corporate sustainability.

Limitations and future improvements for the research

One of the first limitations of this final dissertation, as discussed above, is that the framework was tested through the case study only up to phase II. This did not, therefore, allow to fully observe both the functioning of the instrument and additional problems that may not have emerged during the design and discussion phase with consultants and experts.

The implemented morphological scheme presents one of the highest limitations and controversies of this study. As it was found throughout the application, the morphological scheme can be improperly used by a company to verify the lowest commitment strategies, without therefore a real

push and participation towards sustainability. Indeed, this misuse could still create a possible implementation of sustainability, but most likely at a minimum level.

The framework was also tested at a preliminary level, without real stakeholder participation, thus stopping at the definition of the boundaries and priority stakeholders.

Furthermore, since the company is very present within the Verona area, it already had its own list of priority stakeholders. This, therefore, did not allow the use of the stakeholder map designed and inserted within the Framework, thus depriving the ability to understand if the type of stakeholder map inserted within the framework could be effective.

As future improvements, in addition to the completion of the roadmap defined by the framework to verify the possible non-emerged criticalities, it will be necessary to redefine the morphological scheme as objectively as possible. For example, this can be done by modifying the 5-input data so as to be able to request i) which pillar to investigate, ii) if the company wants a methodology inherent to the whole organization or only for a specific industrial process and iii) how much time does the company intend to invest in the implementation of this methodology/standard.

Another possible future improvement of the framework could be to expand the types of methodologies and standards present within the morphological scheme by requesting the related information through another questionnaire that should be open to more experts. Indeed, some methodologies and standards proposed in the questionnaire showed a low or no response rate which resulted in a less comprehensive assessment than the others.

In this case, the questionnaire should be modified by asking for information in a scale of 1-3 for all questions, to avoid additional normalizations and subsequent change of scale.

Furthermore, a possible future evolution of the framework could be to allow the company, through an iterative approach, to define the preliminary steps to reach the future vision by means the use of the morphological scheme and possibly to review them on the basis of how much the methodologies/standards available within the morphological scheme allow the company to achieve the pre-established future vision of sustainability.

Surely, an important aspect is to test the framework in other case studies by involving other sustainability experts. This additional test could support the identification of new issues to be solved and in the understanding of what other tools and methodologies could be included and how to modify the conceived roadmap.

In conclusion, the framework was tested in a company that is already very transparent and concretely projected towards sustainability and with the support of experts in sustainability.

To better understand the real potential or criticality of the framework, it would be useful to test it without the help of consultants and in a company that has limited knowledge of the aspects of sustainability.

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APPENDIX A: FIRST IN-DEPTH SECTION OF THE THEORETICAL NOTIONS DOCUMENT

A company, after having visited the first section of the document, presented in Figure 0.1, is able to access the second section by pressing "Learn more". This is the section presenting complete insights related to the pillars of sustainability, integrated sustainability, corporate sustainability, and tools. Moreover, in this first section there are links to the main web pages of the various tools and methodologies inherent to corporate sustainability.

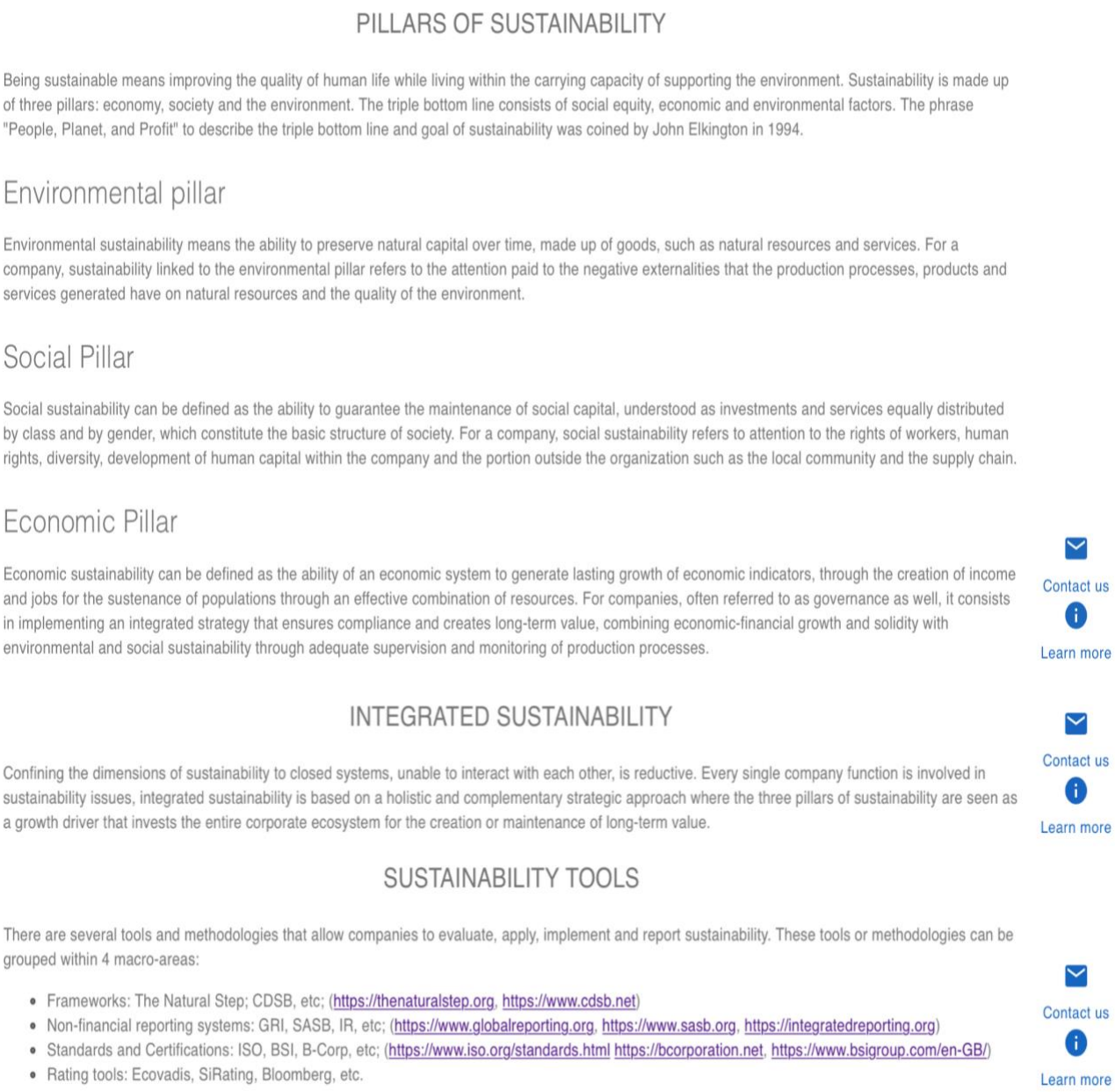

Figure 0.1: First section of the theoretical notions document

APPENDIX B: SUSTAINABILITY METHODOLOGIES/STANDARDS QUESTIONNAIRE

Personal informations

- First name*:
- Surname*:
- E-mail:
- Institution / Company:

For each single methodology, the following was required:

- Do you know and can you describe this methodology/standard?

For a negative answer the questionnaire passed to the next methodology/standard, for an affirmative answer the questionnaire proposed the following additional questions:

In which sector (pillar / thematic) of the sustainability assessment would you insert this methodology/standard?

- Environmental
- Social
- Economic
- Integrated

In applying this methodology/standard, how do you evaluate its complexity also considering the temporal level?

- Simple
- Medium
- Complex
- Other

In applying this methodology/standard, how essential do you think external support is for the company?

- 1 not essential
- 2
- 3
- 4

- 5 essential

In applying this methodology/standard, how many resources (personnel, information, etc) do you think are necessary?

- 1 few resources
- 2
- 3
- 4
- 5 many resources

Once this methodology/standard is applied, how would you describe the final information obtained?

- Qualitative
- Quantitative
- Mixed

Once this methodology/standard has been applied, how would you describe the results obtained?

- 1 approximate
- 2
- 3
- 4
- 5 accurate

How would you describe the potential benefits obtained from implementing this methodology/ standard?

both internal and external

- 1 none
- 2
- 3
- 4
- 5 high

How can the impact on image / communication deriving from the application of this methodology / standard be defined?
If the result can be spent on the market and has a lot of exposure, mark 10
If the result is not usable on the market and has no visibility, mark 0

- 0 Not important
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 Definitely important

At the end of the 21 methodologies / standards included in the questionnaire there was the presence of two further sections Additional consideration and Other.

Additional Considerations

Are there any further considerations about one or more proposed methodologies / standards?

- Yes
- No

Comment:

Other

Do you know any other methods that you consider important for the implementation of corporate sustainability not mentioned yet?

- Yep
- No

Which?

If you can, enter information such as: Pillar / Theme, Complexity and Potential Benefits

Table 0.1: Response rate for each standard/methodology

	% FEEDBACK
LCA	100%
CARBON FOOTPRINT	100%
WATER FOOTPRINT	71%
ISO 14001 (ENVIRONMENTAL MANAGEMENT SYSTEM)	71%
EMAS (ECO-MANAGEMENT AND AUDIT SCHEME)	53%
ISO 50001 (ENERGY MANAGEMENT SYSTEM)	6%
SA8000 (SOCIAL ACCOUNTABILITY, CORPORATE SOCIAL RESPONSIBILITY)	41%
ISO 45001 (OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEMS)	24%
SROI (SOCIAL RETURN ON INVESTMENT)	18%
THEORY OF CHANGE	24%
SOCIAL FOOTPRINT	59%
BENEFIT CORPORATION	12%
ISO 9001 (QUALITY MANAGEMENT SYSTEM)	47%
ISO 44001 (COLLABORATIVE BUSINESS RELATIONSHIP MANAGEMENT SYSTEM)	0%
ISO 22301 (SOCIETAL SECURITY, BUSINESS CONTINUITY MANAGEMENT SYSTEM)	0%
AA1000 (ACCOUNTABILITY)	24%
ISO 28001 (SECURITY MANAGEMENT SYSTEM FOR THE SUPPLY CHAIN)	0%
ISO 31000 (RISK MANAGEMENT SYSTEM)	6%
BS8900 (SUSTAINABLE DEVELOPMENT MANAGEMENT OF ORGANIZATIONS)	6%
ISO 26000 (GUIDE TO SOCIAL RESPONSIBILITY)	12%
THE NATURAL STEP	29%

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