

Assessing sustainable innovation: Towards the development of a self-diagnostic audit tool and its application to industrial activities

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ASSESSING SUSTAINABLE INNOVATION: TOWARDS THE DEVELOPMENT OF A SELF-DIAGNOSTIC AUDIT TOOL AND ITS APPLICATION TO INDUSTRIAL ACTIVITIES

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List of Abbreviations

EU: European Union

ESG: Environmental, Social, and Governance

SDGs: Sustainable Development Goals

LCA: Life Cycle Assessment

DEA: Data Envelopment Analysis

NFRD: Non-Financial Reporting Directive

CSRD: Corporate Sustainability Reporting Directive

ESRS: European Sustainability Reporting Standards

IoT: Internet of Things

SME: Small and Medium-sized Enterprise

SOI: Sustainability-Oriented Innovation

SRI: Sustainability-Related Innovation

CSMM: Corporate Sustainability Maturity Models

CMMI: Capability Maturity Model Integration

MSME: Micro, Small, and Medium-sized Enterprises

BMI: Business Model Innovation

IMM: Innovation Maturity Model

TBL: Triple Bottom Line

SMMM: Sustainability Maturity Model for MSMEs

OSR: Organisational Sustainability Readiness

B2B: Business-to-Business

B2C: Business-to-Consumer

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1. Introduction

In a global context characterised by the acceleration of environmental, social, and economic crises, sustainable innovation becomes a strategic imperative for organisational competitiveness and survival. The aggravation of climate change, natural resource depletion, biodiversity loss, increase in social disparities, and mounting pressure from increasingly conscious consumers are compelling companies to reconsider their economic models, production systems, and innovation strategies radically (Adams et al., 2016). In such a fast-changing world, the capacity to combine innovation with sustainability goals is emerging as a key discriminator for organisations that aspire to long-term success.

In response to such systemic challenges, both the international and the EU political agendas have been reshaped significantly to place sustainability at the heart of policy-making. The United Nations' 2030 Agenda (United Nations, 2015) and its 17 SDGs (United Nations, 2024) establish a broad framework, calling on states, businesses, and citizens to accelerate the transition to more equal, inclusive, and environmentally respectful development. At the European level, the European Commission put forward the European Green Deal in 2019, a long-term strategy to render Europe the world's first climate-neutral continent by 2050 (European Commission, 2019). Not only does this plan establish ambitious goals for reducing emissions, conserving natural resources, and transitioning to renewable energy, but it also demands systemic transformation across all economic sectors, thus fundamentally altering the context within which companies are run.

Alongside these broader policy developments, the European regulatory framework has also evolved to directly influence corporate behaviour. The 2014/95/EU Directive on the disclosure of non-financial information first established the necessity for environmental and social impact reporting, a move that has been further enforced through the 2022 CSRD adoption. The CSRD subjects a far larger number of companies to non-financial reporting requirements, mandating adherence to the ESRS. These regulatory developments echo a deep change in the business context in which transparency, social responsibility, and sustainable innovation are no longer philanthropic but strategic imperatives (Taliento et al., 2019).

Here, sustainable innovation is no longer just an image or differentiation lever. Rather, it is now a key driver of organisational performance and competitiveness. According to Taliento et al. (2019), the integration of ESG criteria into corporate strategies generates sustainable competitive advantages, improving organisational resilience and fostering medium- and long-term financial performance. Those companies that successfully integrate sustainability into their innovation processes will be in a stronger position to access sustainable finance markets, attract the best talent, address stakeholder demands, and preempt future regulatory currents.

Besides market and regulatory pressure, sustainable innovation needs to be put in the context of the most significant economic megatrends. The evolution of the economy towards sustainability has a direct connection with such megatrends as green digital innovation, the advent of Industry 4.0, the support for the circular economy, and the application of the European taxonomy of sustainable activities. As noted by Kiefer, Del Río González, and Carrillo-Hermosilla (2019), Industry 4.0 technologies such as the IoT, artificial intelligence, and sophisticated data analytics are being progressively incorporated into sustainable innovation agendas as a means of optimising resource utilisation, minimising emissions, and facilitating smarter, responsive production systems. Meanwhile, the shift to the circular economy, strongly advocated for in European policies, encourages companies to reconsider the generation of value based on product longevity, recycling, and valorisation of waste (Geissdoerfer et al., 2017).

Industrial companies, especially, are confronted with deep structural changes. Not only must they change their processes and products, but they frequently must overthrow their entire business models, adopting service-oriented approaches ("servitization") or creating new types of collaboration in innovative change ecosystems (Lacy et al., 2020, Chapter 2). These fundamental changes highlight the increasing demand for firms to be provided with practical, multilevel instruments that are able to evaluate and manage their green innovation activities in a strategic and consistent way.

Despite this acknowledged significance, the literature continues to exhibit gaps in conceptualisation and measurement of sustainable innovation. Traditionally, empirical studies have touched mainly upon the environmental aspect of sustainability based on constructs like eco-innovation and green innovation (Rybczewska-Błażejowska, 2020; Mehmood et al., 2022). Though important to combat the environmental crisis, these strategies do not encompass in their agenda the social and economic dimensions of sustainable development, in spite of the holistic rationale offered by the triple bottom line model (People, Planet, Profit) formulated by Elkington (1997). Innovatively authentic sustainability will need to combine these three pillars in synergy, creating shared economic, social, and environmental value (Wilkerson & Trellevik, 2021; Afeltra et al., 2022).

To this difficulty, although a number of empirical researches validate that ESG integration can indeed improve corporate performance (Taliento et al., 2019), there is still a lot of complexity in measuring sustainable innovation in a holistic way. Current methods, including LCA or ecological efficiency models based on DEA, tend to comprehend environmental impacts at the cost of social and economic dimensions (Ding et al., 2021; García-Granero, et al., 2018). This drawback prevents the development of genuinely integrated evaluation tools.

In addition, existing tools are very technical, complicated, and not meant to be applied autonomously by industrial firms, especially SMEs. Performing a Life Cycle Assessment (Rybczewska-Błażejowska, 2020) or utilising DEA models in measuring innovation (Mehmood et al., 2022) takes a lot of experience, time, and effort, which are not available in most companies. Therefore, the spread of internal self-assessment processes is limited despite the fact that such processes are an important driver for ongoing improvement towards sustainability.

Another shortcoming is the failure to consider social impacts in innovation evaluations. Inclusion, health, safety, and territorial development are aspects that are rarely systematically integrated into evaluation frameworks (Taliento et al., 2019; Afeltra et al., 2022). A significant shortage also exists of evaluation frameworks offering a maturity model in progressive steps, which would not only assess companies' current adoption of sustainable innovation but also guide their incremental change efforts over time.

This thesis is a contribution to this wider academic and applied undertaking, with the objective of fulfilling a two-fold need: to address calls in the academic literature for an integrated and operational model of assessing sustainable innovation and to equip industrial firms with a practical tool for the self-evaluation and guidance of their sustainable innovation endeavours. In particular, the objective of the research is to formalise a model incorporating the three pillars of sustainable development through critical and selective review of recent literature, to develop a self-assessment tool following a maturity framework developed for industrial firms, and to test and validate the tool empirically with a sample of companies through qualitative gathering of feedback on its relevance, applicability, and potential for improvement.

This thesis is structured into six chapters, followed by a general conclusion. The first chapter offers an in-depth literature review aiming to clarify the key concepts related to innovation, sustainability, and their articulation while identifying the main models for assessing sustainable innovation developed

over recent years. The second chapter presents the theoretical foundations that guided the construction of the self-assessment tool, detailing the three conceptual axes retained and their operational translation. The third chapter describes the final model in its structure, dimensions, indicators, and scoring system, designed to be autonomously usable by industrial companies. The fourth chapter sets out the research methodology adopted, based on an abductive qualitative approach combining semi-structured interviews and thematic analysis. The fifth chapter presents the empirical results from the validation of the model with a panel of industrial companies through three successive waves of adjustments. Finally, the sixth chapter offers an analytical discussion of the model's contributions, its methodological limitations, practical recommendations, and future research perspectives. The general conclusion summarises the main findings of the research and highlights the theoretical and operational contributions of the work carried out.

2. Literature review

This literature review explores the conceptual foundations and recent advancements in the assessment of sustainable innovation. Defined by the intertwining of environmental, social, and economic priorities within innovation processes, this approach reflects a broader shift toward corporate accountability and long-term resilience. The review first clarifies the core definitions of innovation and sustainability, then traces how their intersection shapes the notion of sustainable innovation. It continues by outlining the main typologies and strategic implications that emerge from this convergence. Emphasis is placed on theoretical frameworks and existing evaluation mechanisms such as maturity models, impact-based tools, and competency-driven approaches. By analysing these models, the review identifies both their contributions and their limitations, pointing to the fragmented nature of current methods. In response, the need for an integrated, field-adapted, and practically usable evaluation tool becomes clear. This theoretical grounding provides the necessary base for constructing a self-assessment model specifically designed to address the operational constraints faced by industrial organisations.

2.1 Defining innovation

2.1.1 Evolution of innovation concepts

The concept of innovation has evolved significantly over time, reflecting shifts in economic, technological, and social paradigms. Initially, innovation was primarily viewed through the lenses of economics and technology. Schumpeter (1952), one of the pioneers of the economic theory of innovation, perceived it as the development of new products, processes, markets, or organisational forms, inducing a dynamic of "creative destruction" that is favourable to the renewal of the economic fabric and to economic growth. Innovation is then, in this perspective, a stimulus to competitiveness and structural adaptation in a market economy.

Innovation has over time come to be understood as encompassing social, cultural, and systemic considerations. Rogers (2003) proposed a sociological approach, conceiving innovation as "an idea, practice, or object perceived as new by an individual or other unit of adoption", thus emphasising the significance of the diffusion process in social systems. Innovation in this view is not just technical newness but also perception, acceptance, and adoption within a social environment.

Within this continuity, the Oslo Manual (OECD & European Union, 2019) recommends a wide and functional description of innovation as "a new or significantly improved product or process that differs significantly from previous versions and has been introduced or implemented." Innovation is then not merely viewed as invention but also as the successful implementation of novelty, either technological, organisational, or commercial.

As a response to the increasing diversity of innovation types and functions, Singh and Aggarwal (2022) conducted a meta-analysis of 208 definitions from various academic fields. They arrived at a consolidated definition of innovation as "the operationalisation of creative potential, driven by commercial and/or social objectives, through the implementation of new and adaptive solutions that create value, leveraging emerging technologies or inventions, contributing to competitive advantage and fostering economic growth" (p. 1118). The multidimensional perspective positions innovation as a process that is at the same time creative, strategic, and of societal value.

Lastly, the systemic and interactive nature of innovation, as emphasised by Lundvall (2013), is now widely recognised. Innovation is no longer viewed as an isolated or purely technological act but rather as the result of dynamic interactions between diverse actors within evolving ecosystems shaped by knowledge, institutional frameworks, and regulatory structures (Edwards-Schachter, 2018).

2.1.2 Typologies of innovation

Innovation is not a singular event that manifests in a single way with the same implications for any organisation and society. The Oslo Manual (OECD & European Union, 2019) differentiates four broad types of innovation: product innovation, process innovation, organisational innovation, and marketing innovation.

Product innovation is the introduction of a good or service that is new or radically changed in its features, materials, or applications. Process innovation is the use of a new or significantly improved production or delivery process. Organisational innovation is the introduction of new organisational approaches in business activities, workplace organisation, or external relations with the aim of improving firm performance. Finally, marketing innovation involves the launch of innovative marketing practices, i.e., design, packaging, promotion, or price change (OECD & European Union, 2019).

This typology can be discussed further on dimensions of novelty. That is how new the innovation is to the adopting firm. The Oslo Manual (OECD & European Union, 2019) proposes that innovations are "innovations which are previously unknown to the firm", "innovations previously unknown to the market", or "innovations previously unknown to the world", differing on dimensions of disruption and novelty.

In their qualitative synthesis of 208 innovation definitions, Singh and Aggarwal (2022) observe that innovation goes beyond the traditional categorisations. They highlight the growing prominence of non-technological types of innovation such as service innovation, business model innovation, and social innovation as key sources of competitive value and excellence. Service innovation entails creating new or enhanced services that are novel to user requirements. Business model innovation equates to new forms of value creation and value capture. Social innovation, on the other hand, responds to human needs by suggesting inclusive and sustainable solutions.

2.2 Defining sustainability

2.2.1 Evolution of sustainability concepts

The meaning of sustainability has not always been what it is today. At first, it mainly referred to the management of natural resources. One of the earliest examples comes from 18th-century forestry, where the idea of sustainable yield was introduced to make sure that timber could be harvested continuously without depleting forests over time (Kuhlman and Farrington, 2010).

This narrow approach started to shift in the 1970s. In 1972, the Club of Rome published *The Limits to Growth*, which had a major impact on how sustainability was perceived (Meadows et al., 1972). The report argued that constant economic and demographic growth was not compatible with the finite resources of the planet. It introduced the idea that the Earth had limits and that those limits had to be part of the discussion. From that moment, sustainability started to be seen as a global issue.

The Brundtland Report (World Commission on Environment and Development, 1987) gave the concept a new scope, it defined sustainable development as a form of progress that meets current needs without compromising the ability of future generations to meet their own (Kuhlman and Farrington, 2010; Vos, 2007). The idea of intergenerational fairness became central. The report also established a balance between economic, social, and environmental goals. Still, the definition has often been criticised. Many authors argue that it is too broad and too vague, allowing for very different interpretations depending on who is using it (Isil and Hernke, 2017).

During the 1990s, efforts were made to make sustainability more practical. One of the best-known contributions was the Triple Bottom Line, developed by Elkington. It presented sustainability as a balance between three dimensions: profit, people, and planet (Isil and Hernke, 2017). This framework helped businesses and institutions start measuring non-financial impacts. But it also attracted criticism for being too simplistic, especially in the way it deals with conflicts between economic goals and environmental or social ones (Kuhlman and Farrington, 2010).

In the years that followed, the academic debate focused more on how the concept keeps changing. Vos (2007) insisted on its ambiguity, calling it both flexible and at risk of losing meaning. Gehringer and Kowalski (2024) identified three main ways to represent it. The pillar model separates the economic, social, and environmental aspects. The nested model places the economy inside society, which itself depends on the environment. The systems view sees all three as constantly interacting in complex and evolving ways.

Even though sustainability is now used in global frameworks like the UN 2030 Agenda or the Sustainable Development Goals, it remains an evolving idea. Its content shifts with new scientific discoveries, policy debates, and changes in public expectations (Tseng et al., 2020; Kuhlman and Farrington, 2010).

2.2.2 The three pillars of sustainability

As explained in section 2.2.1, sustainability is commonly described through three core and interconnected areas: the environmental, social, and economic pillars. This structure, often called the "three-pillar model" or "triple bottom line" (Elkington, 1997), is widely used to give a concrete form to what sustainable development means in practice.

The environmental pillar relates to the preservation of ecosystems, the responsible use of resources, and the respect of ecological limits (Kuhlman and Farrington, 2010). It includes efforts to reduce greenhouse gas emissions, limit pollution, protect biodiversity, and promote land and water use that can be sustained over time. A system is considered environmentally sustainable when it can maintain its ecological functions while adapting to environmental pressures.

The social pillar focuses on people's well-being, equity, and access to essential rights and services. This includes education, health, employment, and the protection of vulnerable groups (Vos, 2007). Social sustainability also involves strengthening communities and ensuring that everyone can participate in society. Gehringer and Kowalski (2024) stress that social inclusion is necessary to make sure that economic growth and environmental measures benefit all groups fairly and not only a minority.

The economic pillar concerns the capacity to support economic activity over the long term without damaging the other two dimensions. It means maintaining productivity, encouraging innovation, and ensuring financial stability, but also avoiding overexploitation of natural resources or the deepening of social inequalities (Kuhlman and Farrington, 2010; Gehringer and Kowalski, 2024). Economic

sustainability requires a shift in how growth is approached, aiming for models that consider both environmental and social limits.

Although these three pillars are often treated separately, recent research insists on the strong links between them. In reality, none of the three can stand on its own. Progress in one area can be undermined by weakness in another. Sustainability needs to be approached in an integrated way, where environmental protection, social inclusion, and economic development are seen as part of the same system (Isil and Hernke, 2017). If one pillar is neglected, the balance cannot hold in the long run.

2.2.3 Weak vs. Strong sustainability

There is an important difference between the ideas of weak and strong sustainability in the larger discussion about sustainability. This difference has a big effect on how sustainability is pursued in practice (Kuhlman & Farrington, 2010; Vos, 2007). It has to do with how much natural capital can be replaced by human-made capital.

Weak sustainability assumes that different types of capital can be used in place of one another. From this point of view, using up natural resources is okay as long as it is balanced out by increases in other types of capital, like new technology, better infrastructure, or more knowledge (Soysa, 2022). This point of view says that economic growth and protecting the environment can go hand in hand if we make things more efficient and use new technologies instead of old ones. Weak sustainability supports a more flexible view of sustainability, which is in line with traditional economic ideas that put a lot of value on growth (Soysa, 2022).

In contrast, strong sustainability asserts that natural capital performs important ecological functions that human-made capital cannot fulfill. Biodiversity, climate stability, and ecosystem resilience are some components of the natural world that researchers consider irreplaceable and necessary for human survival (Galli & Losch, 2023; Soysa, 2022). From this perspective, sustainability means protecting essential environmental resources at all costs, regardless of technological or economic growth. Strong sustainability prioritises environmental protection over economic growth. It supports precautionary principles and emphasises that there are non-negotiable ecological thresholds (Soysa, 2022).

This difference has important effects on how things work. Kuhlman and Farrington (2010) point out that policies based on weak sustainability tend to focus on promoting eco-efficiency and green technologies. On the other hand, strong sustainability approaches often call for more radical changes, such as limiting resource use and changing the way people produce and consume goods. The planetary boundaries framework proposed by Rockström et al. (2009) is very similar to the ideas of strong sustainability. It sets limits on how much damage human activities can do to the environment before it becomes catastrophic.

The weak–strong sustainability dichotomy is easy to understand in theory, but it is still hard to put into practice. Many sustainability efforts use a mix of both paradigms, depending on the sector, resource, and societal priorities (Gehring & Kowalski, 2024). Still, it's important to know the difference between weak and strong sustainability in order to understand the different levels of ambition and restriction that sustainability strategies can have.

2.3 Defining sustainable innovation

2.3.1 From innovation to sustainable innovation

Innovation has been characterised throughout history as a driver of technological development and economic growth that was frequently pursued without primary consideration of its environmental or social consequences (Adams et al., 2016). Nevertheless, the growing public awareness of global issues such as climate change, scarcity of resources and social disparity has led to a revision of the notion of innovation goals.

In reaction, innovation and sustainability have become increasingly intertwined, and the idea of “sustainable innovation” has emerged, explicitly interlinking the dimensions of economic feasibility, environmental stewardship, and social development (Boons & Lüdeke-Freund, 2013). This multidimensional understanding assumes that maximum efficiency is no longer solely driving the process but that sustainable innovation is a strategic instrument to analyse and try to solve complex, interconnected issues with which present-day societal actors are confronted.

With this, sustainable innovation represents a transition from a restricted, profit-oriented understanding of innovation to a systemic one that encompasses financial, ecological and social value (Afeltra, et al., 2022). It involves embedding sustainability requirements from the inception of an innovation and reshaping business models and stakeholder relations in support of long-term development objectives.

2.3.2 Distinction with eco- and green innovation

Sustainable innovation should be differentiated from related concepts in line with eco-innovation and green innovation, which many use synonymously, however they differ with regard to the focus and objective. Eco-innovation is in general defined as the development of green products, processes, or organisational innovations that lead to reduction of environmental impacts or improve resource use efficiency throughout the entire life cycle (Carrillo-Hermosilla et al., 2010). It is specifically concerned with technologies that improve environmental performance, with an emphasis on cleaner production and pollution prevention.

According to Cisneros Chavira et al. (2023), green innovation is a subset of eco-innovation that focuses specifically on projects that produce quantifiable environmental benefits, like waste minimisation, energy savings, or emission reductions. Instead of being motivated by a systemic commitment to sustainable development, green innovation initiatives are frequently motivated by regulatory compliance, competitive market pressures, or the pursuit of benefits to corporate image (Kiefer et al., 2019).

Sustainable innovation, on the other hand, takes a more comprehensive approach by addressing environmental issues as well as social equity and economic viability in an integrated way (Adams et al., 2016). It doesn't just focus on being environmentally friendly or following the rules, it also wants to bring about changes in the system that will help achieve long-term sustainable development goals.

2.3.3 Sustainability-oriented innovation vs Sustainability-related innovation

SOI stands for innovation processes that are planned and carried out with the goal of promoting long-term growth. Organisations that use SOI make sustainability a key part of their innovation strategy, with the goal of creating value for everyone in the economy, society, and environment (Klewitz & Hansen, 2014). SOI usually means making big changes to the way things work, like coming up with new business models, redesigning products and services, and working with stakeholders in new ways to reach long-term sustainability goals (Wilkerson & Trellevik, 2021).

SRI, on the other hand, includes new ideas that weren't originally meant to be environmentally or socially friendly but end up having a big positive effect on the environment or society (Wagner, 2010). SRI may happen as a result of bigger efforts to innovate, where making things more efficient, safer, or more involved in the community indirectly supports sustainable development goals. Wagner (2010) shows that companies with good corporate social performance are more likely to come up with new ideas that help the environment. This suggests that values and responsible management can help create sustainable outcomes in an indirect way.

2.3.4 Key characteristics and theoretical definitions

There are different ways to define sustainable innovation, but most definitions agree that it must create economic value and have positive effects on the environment and society at the same time. Calik and Bardudeen (2016) give a clear and useful definition of sustainable innovation: "any new or significant improvement of products, services, technological or organisational processes, commercialised or internally implemented, that not only provide economic benefits but also generate positive social and environmental impacts" (p. 450). This integrated view makes it clear that sustainability must be a part of every step of the innovation process, from coming up with ideas to doing research, development, and commercialisation.

Sustainable innovation stands apart from more traditional forms of innovation in several ways. One of the most notable differences is its focus on the long term. Unlike conventional approaches, which often prioritise short-term gains, sustainable innovation looks at how well solutions will perform and hold up over time (Adams et al., 2016). This concern for durability and future relevance is directly linked to the principle of sustainable development, as outlined in the Brundtland Report (1987). The report insisted on the need to meet today's needs without limiting the ability of future generations to meet theirs (Kuhlman and Farrington, 2010).

Another important feature is the use of life cycle thinking. This means that environmental and social impacts are taken into account throughout the entire lifespan of a product or service from resource extraction and production to usage and end-of-life treatment (Geissdoerfer et al., 2016). This approach aims to avoid displacing environmental problems to other stages of the value chain and instead seeks to optimise the overall contribution to sustainability.

Sustainable innovation also puts emphasis on stakeholder involvement. It encourages collaboration with a variety of actors, including suppliers, customers, regulators, and local communities. The goal is to ensure that innovations are not only technically sound but also socially relevant and inclusive (Boons et al., 2013).

In many cases, sustainable innovation involves systemic change. Rather than focusing exclusively on incremental improvements or isolated products, it often requires broader transformations in organisational structures, user behaviour, or institutional settings (Adams et al., 2016). Its ambition is

to reshape the way value is created, delivered, and distributed, in line with the principles of sustainable development.

Finally, recent research calls for a wider evaluation lens. Focusing solely on technical performance or economic outcomes is not enough. It is equally important to understand the long-term consequences of innovation on social and environmental systems (Afeltra et al., 2022). This reinforces the need for robust, multidimensional assessment frameworks capable of capturing the full scope of sustainable innovation.

2.3.5 Strategic importance of sustainable innovation

Sustainability has increasingly become a driving force behind corporate innovation. Rather than limiting business activity, social and environmental challenges are now seen as opportunities to reduce risk, improve operational efficiency, and stimulate new forms of technological development and competitive positioning (Nidumolu, Prahalad, & Rangaswami, 2009). Responding to sustainability concerns often leads companies to question their current practices, rethink their offerings, and redesign the way they operate.

This shift frequently requires changes at the core of business models. More and more firms are moving toward models that aim to reconcile economic performance with environmental stewardship and social inclusion (Evans et al., 2017). Such transformations involve revisiting value propositions, applying circular economy principles, and strengthening the resilience of supply chains.

In this context, sustainable innovation plays a key role in generating what Porter and Kramer (2011) describe as shared value. By addressing societal needs while enhancing competitiveness, companies can create products, services, and business practices that contribute simultaneously to business success and to broader social goals. This dual impact helps firms secure long-term viability.

Rising public expectations reinforce the importance of this shift. According to the EIB Climate Survey 2021–2022, a large majority of Europeans support stronger action from both companies and governments to tackle climate change and accelerate the development of green innovation (European Investment Bank, 2021). Ignoring these demands could lead not only to reputational risks but also to a loss of investor confidence and market position.

At the same time, sustainable finance has become a key enabler of innovation. According to the European Investment Bank (2023), capital is increasingly directed toward projects that demonstrate clear environmental or social value. Companies that align their innovation strategies with sustainability objectives are more likely to access green funding, benefit from favourable lending conditions, and meet the expectations of investors who are increasingly guided by ESG criteria (Environmental, Social, and Governance).

2.4 Assessing sustainable innovation

2.4.1 Theoretical approaches to assess sustainable innovation

Evaluating sustainable innovation is anything but straightforward. The idea that a single innovation could at once generate profits, benefit the environment, and improve social outcomes is appealing but actually measuring such a triple impact remains a major challenge. As Calik and Bardudeen (2016) point out, there's still a lack of tools that can assess economic, environmental, and social effects together in

a meaningful way. Over time, different theoretical approaches have emerged to fill this gap. Each offers a different lens, some focus on the innovation process itself, others on the results it produces, and some on the broader organisational changes it may trigger.

A widely used entry point is the TBL, developed by Elkington (1997), which defines sustainability through the balance of three dimensions: economic viability, environmental responsibility, and social equity. From this perspective, an innovation is only truly sustainable if it creates value across all three. This notion of a “triple win” is central to the work of Adams et al. (2016) and also appears in Weidner, Nakata, and Zhu’s (2021) study of innovations that aim to generate both profit and positive impact. Yet, as Afeltra et al. (2022) note, the reality is rarely so clean-cut, companies often have to make tough choices between short-term profitability and long-term sustainability goals.

Other researchers move away from abstract frameworks and prefer to rely on tangible metrics. For them, the point is to look at what innovation actually achieves: less pollution, lower energy use, reduced costs, or better social outcomes (Calik & Bardudeen, 2016). In this field, LCA has gained traction, especially for environmental evaluation. Rybaczewska-Błazejowska (2020) shows how small companies in the rubber industry used LCA to pinpoint the most polluting stages of production and steer innovation accordingly.

DEA brings yet another perspective. Instead of looking at single indicators, it evaluates innovation performance based on multiple inputs and outputs at once. Mehmood, Iftikhar, and Khan (2022) used DEA to compare eco-innovation efficiency across OECD countries, taking into account things like patent filings, R&D investments, and emissions. Other DEA models such as those proposed by Tone and Tsutsui (2014) even integrate negative outputs like CO₂, giving a more complete picture of trade-offs.

Still, these data-driven methods tend to overlook social innovation. According to Krasnopolskaya and Korneeva (2020), this is largely because social innovations are often context-specific and qualitative, which makes them hard to capture with standard indicators. Unlike carbon emissions or cost savings, their effects are less visible in economic statistics even though they can be essential for addressing social needs.

A different school of thought focuses not so much on what innovation produces but on how it happens inside organisations. Here, sustainable innovation is seen as a process of internal transformation, one that relies on a company’s ability to learn, adapt, and evolve. Klewitz and Hansen (2014), in their study of small businesses, observe that innovation often happens incrementally, through small operational changes rather than major technological breakthroughs.

This process-oriented view also brings forward a useful distinction. On one hand, SOI refers to intentional, planned efforts to innovate in line with sustainability goals, usually embedded in strategic planning (Klewitz & Hansen, 2014). On the other, SRI describes cases where positive impacts emerge incidentally, without being the original intent (Wagner, 2010). As a result, assessing SOI requires a closer look at decision-making processes, while SRI can often be evaluated based on post-implementation outcomes.

More recently, some researchers have added a focus on internal capabilities. Weidner et al. (2021) identify two in particular that matter for sustainable innovation: market-based responsiveness to sustainability concerns and a strong learning culture. These two elements help organisations not only to respond to external pressures but also to refine their practices over time. In that sense, they create a bridge between good intentions and actual performance, something many evaluation tools tend to miss.

2.4.2 Comparative review of existing frameworks

2.4.2.1 Innovation radar

A particularly insightful framework for analysing innovation in a comprehensive manner is the Innovation Radar, developed by Sawhney et al. (2006). This model challenges the conventional view of innovation as being primarily product- or technology-driven. Instead, it conceptualises innovation as a systemic process that can emerge from various parts of an organisation. The framework is structured around four strategic dimensions: offering (what the company offers), customers (to whom it offers value), processes (how it creates and delivers value), and presence (where it operates). These four anchors are further broken down into twelve innovation dimensions, such as product innovation, customer experience, organisational innovation, and channel innovation. Each dimension corresponds to a distinct lever through which a firm can enhance its competitiveness. For instance, "channel innovation" within the "presence" category focuses on how firms engage with customers through innovative distribution and communication methods, an area often overlooked in assessments limited to technological outputs. According to Sawhney et al. (2006), this holistic framework enables firms to map their current innovation efforts and uncover untapped areas of opportunity across their value creation system.

Building on this foundational model, Petersen et al. (2023) developed the Green Digital Innovation Radar, which adapts the original framework to address emerging challenges related to digital transformation and environmental sustainability. Their model acknowledges that SMEs often struggle to integrate digital and sustainable practices simultaneously, despite mounting regulatory and societal pressures. To support these firms, the authors propose a structured self-assessment tool that retains the twelve innovation dimensions of the original radar but reformulates them to incorporate ESG considerations as well as digital enablers such as artificial intelligence, the Internet of Things, and blockchain technologies.

The Green Digital Innovation Radar, developed by Petersen et al. (2023), extends the original Innovation Radar framework by integrating sustainability and digitalisation into a unified strategic innovation model. It is structured around four anchor points, offering (what), customers (who), processes (how) and presence (where), each subdivided into three innovation dimensions, resulting in a total of twelve areas that collectively provide a 360-degree view of business transformation. The model enables firms to assess their innovation potential across multiple fronts: the Offering dimension encourages the creation of sustainable, modular, and repairable products; the Customers dimension emphasises segmentation, engagement, and responsiveness to sustainability-oriented demand; the Processes dimension focuses on digital integration, automation, and circular economy principles; and the Presence dimension addresses environmentally responsible market expansion and digital interaction channels. This structure allows firms to align innovation practices with ESG priorities while leveraging their existing capabilities to target the most strategic and feasible areas for sustainable transformation (Petersen et al., 2023).

Each of these twelve dimensions is operationalised through qualitative and quantitative indicators, allowing firms to evaluate their maturity using a Likert-type scale. This structure encourages a reflective and strategic approach to innovation, in which companies are not expected to innovate across all dimensions simultaneously. Rather, the model guides them to leverage their existing capabilities and resources to identify the most relevant and achievable areas for transformation. By using the Radar as a self-assessment tool, managers can systematically map their current innovation landscape, highlight areas of strength or stagnation, and define targeted actions for future growth. In doing so, the framework becomes not only a diagnostic instrument but also a strategic guide aligned with the ambitions of the European Green Deal and broader ESG objectives (Petersen et al., 2023).

From a methodological standpoint, the strength of these two models lies in their ability to articulate strategic diagnosis, self-assessment, and change management. While the model of Sawhney et al. (2006) provides a powerful conceptual framework for decentralising innovation analysis and revealing its transversal potential, the model of Petersen et al. (2023) offers a concrete implementation adapted to the constraints of medium-sized enterprises, which are often poorly equipped to fully integrate sustainability objectives into their strategic management.

2.4.2.2 Frugal innovation

Frugal innovation has become more and more popular as a possible way to promote sustainable development, especially in situations where resources are scarce, institutions are missing, or costs are high. It was first studied in emerging markets, but now it is seen as a good alternative to innovation models that use a lot of resources in both the Global South and mature economies. Frugal innovation doesn't try to make big technological leaps. Instead, it tries to create value by making things easier to use, using fewer materials, and being more adaptable to local needs. Some people still disagree about whether frugal innovation is naturally sustainable (Albert, 2019; De Marchi et al., 2022).

Albert (2019) was one of the first to think about how frugality and sustainability are related. He talks about three main ideas behind frugal innovation and says that while they may help with sustainable development, they don't always lead to better social or environmental conditions. Frugal innovation can cut costs and material use, but if sustainability isn't built into the design, it could lead to rebound effects or business models that take advantage of people. So, Albert stresses how important it is to be intentional and include all stakeholders when trying to align frugal innovation with sustainability goals, particularly in contexts of socio-economic vulnerability.

De Marchi et al. (2022) did a systematic literature review of 130 empirical studies to look at the long-term effects of frugal innovation on the environment. Their research shows that the real effect of frugal innovation on sustainability depends on a number of factors, including the type of actor involved, the reasons behind the innovation, and where it came from. They stress that collaborative processes like co-design and stakeholder engagement are very important for getting good results. The authors also say that the effects of frugal innovation on sustainability are often unclear or depend on the situation and that their evaluation is still incomplete because there are no standard indicators or assessment frameworks. They want more long-term and context-sensitive research to better understand when frugal innovation really helps with inclusive and sustainable development.

From a strategic and organisational standpoint, Lim and Fujimoto (2019) approach frugal innovation through a Schumpeterian lens, framing it as a set of design strategies that allow firms to expand the cost–performance frontier under resource constraints. Drawing on case studies, they identify several product architecture changes that enable the delivery of functional solutions at lower costs. These design strategies are not only technical responses but also reflect a strategic redefinition of value around essential use and user needs. The authors argue that such frugal design processes can disrupt established industrial dynamics by creating new market segments in underserved areas. However, they also warn that this trajectory is not without limitations: issues of scalability, integration into global value chains, and long-term user satisfaction remain unresolved.

While the previous contributions examine the sustainability potential and structural dynamics of frugal innovation, Albert (2022) turns attention to how its impacts can be systematically assessed. In a literature review of seventy peer-reviewed articles, he highlights the fragmented and often inconsistent ways in which sustainability is conceptualised and measured in frugal innovation studies. In response, he compiles a set of 47 sustainability-related criteria, drawn from existing research, that span environmental, social, and economic dimensions. These include indicators such as resource and

energy consumption, access to basic services, stakeholder inclusion, and long-term resilience. Although Albert does not present a ready-to-use tool, he offers a structured analytical framework that can inform future assessment models. Crucially, he insists on the need for contextualised and interdisciplinary evaluation approaches, recognising that the sustainability of frugal innovation is contingent upon its design intentions, governance structures, and alignment with local realities.

2.4.2.3 Corporate sustainability maturity models

The assessment of the incorporation of sustainability into organisations continues to be a corporate and academic issue of concern. Maturity models provide an important evaluative benchmark regarding the level of development of sustainability integration in strategies, actions, and organisational culture. In the words of Giménez-Medina et al. (2023), they have two main functions: first, they act as aids to diagnostics through looking at organisational positioning in relation to a given sustainability maturity framework and second, they act as plans of progressive action towards objectives. Maturity models, as opposed to static performance indicators, embrace dynamic capability and learning of the organisation, essential for implementing sustainability in ever-changing complex systems.

i) Structured CSMM

The CSMM, developed by Sari et al. (2020), was designed as a readiness assessment tool to help organisations evaluate and improve their sustainability integration across strategic and operational levels. In contrast to traditional sustainability assessment approaches, the authors argue that maturity models provide greater utility. A benchmark model describes a particular situation while simultaneously outlining a course of action for change. The CSMM has been organised under corporate sustainability actions, corporate drivers of sustainability both internal and external, corporate strategy on sustainability, sustainability performance by the corporation, degrees of maturity, and thresholds of evaluation. Each domain provides essential components of an organisation's sustainability perspective and organisational readiness.

The model defines three levels of maturity. Level 1 (initial) reflects that there is no proactive effort made towards corporate sustainability except in a reactive way which often stems from legal compliance. Level 2 (managed) suggests that there is some form of incomplete institutionalisation of sustainability with relatively clear but inconsistently executed processes. At Level 3 (optimised), sustainability is fully integrated into the corporate strategy of the organisation with unambiguous roles and responsibilities, performance metrics, and the attainment of TBL profits. This model allows domain cross-assessment using various indicators such as compliance, market supply, or demand for sustainable products, sustainability-focused leadership, and economic, environmental, and societal performance. Within this framework, the CSMM is presented as an ideal model for measuring corporate sustainability maturity and progress (Sari et al., 2020).

ii) Sustainability maturity model for MSMEs

Vásquez et al. (2021) conceptualised the Sustainability Maturity Model as a systematic diagnostic tool to measure the environmental sustainability performance of MSMEs. The SMMM is based on three key concepts: environmental knowledge management, environmental strategies and good practices, and environmental management systems. The first indicator entails that MSMEs have to invest in training workers, purchasing technological equipment, and generating internal documents that spread green knowledge. The second factor looks at the extent to which sustainable business practices like minimising wastage, using resources more efficiently, and controlling emissions are being practiced in relation to business goals. The third is about the inclusion of environmental management as part of

daily life through the use of structured systems and conformity to international standards like ISO 14001. All these together give us a complete image of how environmental sustainability is dealt with in all facets of an organisation.

The four levels of maturity of the model capture a firm's increasing integration of sustainability practices. At Level 1, insufficient maturity, firms have low environmental literacy where no policies exist and engagement with sustainability goals is erratic at best. Level 2 or initial maturity portrays a stage where some attempts at setting-up environmental policies exists, albeit informal and applied haphazardly. At developing maturity or Level 3, there are systematic attempts to track environmental impacts, participation of employees in sustainability activities, as well as eco-processes refinement. Level 4 or consolidated maturity is the most advanced stage where a firm integrates all sustainability initiatives into its operations with certified environmental management systems, performance metrics, and perpetual improvement culture, attaining or exceeding industry standards. The authors created an assessment tool consisting of 42 items grouped into three factors, including questions on policies, resource consumption, education, and strategy alignment. (Vásquez et al., 2021).

iii) Organisational sustainability readiness model

To enable the development of manufacturing firms towards sustainable operations, Barletta et al. (2021) propose OSR Model. Unlike prescriptive maturity models, the OSR model is designed as a flexible and adaptive assessment tool, tailored to assess the capability of firms to integrate sustainability into their operations. The model consists of two major dimensions: thematic categories and readiness levels, with a multi-dimension strategy for organisational readiness. The framework is capable of identifying six key categories that contribute to sustainability preparedness: Manufacturing Processes, directed towards efficiency monitoring and product life cycle improvement; Physical-Technical Systems, focused on the optimisation of resources and equipment quality; Data and Information, covering the establishment of infrastructures for sustainability indicators; ICT and Analytical Tools, focusing on stimulating AI, IoT, and big data use in sustainable decision-making; Governance, covering leadership engagement, incentives, and role clarification; and Competences, referring to training and capacity-building initiatives for employees. These categories capture the systemic nature of sustainability integration and highlight the different levers within the company that companies can leverage.

The OSR model presents four levels of readiness that represent different levels of integration of sustainability into business operations. The firm has awareness of the concept of sustainability without formal strategy or systematic initiatives at Level 1. The firm has early sustainability activities, though reactive and disconnected from core strategy, at Level 2 (developing). Level 3 (managed) involves the integration of sustainability into activities that are supported by clearly stated policies, designated responsibility, and performance monitoring mechanisms. With Level 4 (leading), sustainability as a strategic enabler is established based on company culture, innovation procedures, and supply chain control. In addition, the model also has a quantitative 0 to 3 point rating system in which 0 is for organisations without any preparation, 1 for organisations with minimal awareness, 2 for organisations with fixed implementation, and 3 for those organisations where constant improvement as well as adaptive sustainability measures are in place. By intertwining qualitative subjects with a clear scoring logic, the OSR model provides a concrete diagnostic tool to enable manufacturing firms to examine the current level of readiness for sustainability and target the requirements to be built in capacity (Barletta et al., 2021).

2.4.2.4 Innovation maturity models

Innovation maturity models are crafted to measure the manner in which businesses mature over time to the structure, management, and embedding of innovation into the culture. Models most often use a staged model, reflecting the manner in which companies develop more advanced innovation processes, strategic alignment, culture, and performance monitoring. There has been growing interest in using these models to include sustainability issues, especially in industries that must handle environmental and regulatory concerns (Giménez-Medina et al., 2023). As innovation is becoming a central way of solving issues in the environment and society, maturity models that include eco-innovation are becoming important.

i) Eco-Mi model

A key contribution to the advancement of innovation maturity assessment from a sustainability perspective is the Eco-Innovation maturity model (Eco-Mi) developed by Xavier et al. (2020). This model was designed in response to two major implementation challenges identified by the authors: organisational and operational barriers. Lack of strategic alignment, leadership involvement, and institutional support for eco-innovation are examples of organisational barriers while lack of formal processes, insufficient resource allocation, and fragmented knowledge management systems are examples of operational barriers. The Eco-Mi model gives organisations a structured way to include environmental, economic, and social sustainability in their innovation systems (Xavier et al., 2020).

The core objective of Eco-Mi is to embed sustainability principles holistically into innovation management processes. To this end, the model is structured around four interdependent organisational dimensions: strategy, structure, resources, and culture. The strategy dimension evaluates the extent to which sustainability goals are articulated within the firm's innovation vision and long-term planning. Structure assesses the presence of formal governance mechanisms and responsibilities to support eco-innovation. Resources refer to the allocation of financial, technical, and human capital dedicated to sustainable innovation practices. Finally, culture addresses the normative and behavioural context in which eco-innovation takes place, including employee engagement, openness to experimentation, and leadership values. This multidimensional architecture allows the model to move beyond product or process evaluations and assess how innovation is systemically supported at all levels of the organisation (Xavier et al., 2020).

To measure progress across these four dimensions, the model employs a five-level maturity scale that reflects increasing levels of eco-innovation institutionalisation. Level 1 (absence of eco-innovation) denotes organisations where sustainability is not considered in innovation efforts. Level 2 (reactive approach) captures firms that respond sporadically to environmental requirements or stakeholder pressures, without a structured policy. Level 3 (structured and proactive eco-innovation) indicates the existence of formal processes, though often limited in scope or isolated from corporate strategy. Level 4 (strategic and integrated eco-innovation) reflects a deeper alignment between sustainability and innovation goals, supported by cross-functional coordination and performance monitoring. Level 5 (holistic and transformational eco-innovation) describes organisations in which sustainability is fully embedded in innovation culture, strategy, and operations, and where eco-innovation drives continuous and systemic transformation. This progression serves not only as a diagnostic tool but also as a roadmap for capability development (Xavier et al., 2020).

The implementation of Eco-Mi follows a three-stage application methodology: evaluation, analysis and improvement, and control and monitoring. In the first stage, maturity is assessed using a structured diagnostic instrument administered through interviews with key stakeholders involved in eco-innovation activities. The tool evaluates the firm's positioning across the four dimensions, combining

qualitative and quantitative indicators. The second stage involves a dual analysis of the results: a quantitative assessment of maturity scores and a qualitative interpretation of organisational practices. Based on this analysis, targeted recommendations are formulated to support the firm's eco-innovation journey. The involvement of external experts may enhance the objectivity and relevance of these recommendations. In the final stage, the model incorporates a balanced scorecard to track the implementation of improvement strategies. A steering committee is recommended to ensure strategic alignment and governance continuity. The BSC translates eco-innovation objectives into operational metrics and enables continuous performance monitoring (Xavier et al., 2020).

ii) M. Inków innovation maturity model

Another significant contribution to the field of innovation maturity evaluation is offered by Inków (2019), whose work provides a structured overview of existing innovation maturity models and critically analyses how they assess different aspects of organisational innovation. The main objective of this literature review was to identify the most recurrent dimensions, assumptions, and limitations in prevailing frameworks, with the goal of clarifying the theoretical underpinnings of innovation maturity assessment. Inków reviewed more than 30 models and found that most of them relied on multi-stage structures typically ranging from 3 to 5 levels and focused on areas such as innovation culture, leadership, organisational learning, and formalisation of innovation processes. However, the author also identified significant weaknesses across many models, including the lack of empirical validation, low adaptability to different organisational contexts, and an underrepresentation of stakeholder engagement and customer orientation. This study laid the conceptual foundation for the development of more practical, context-sensitive tools to assess innovation maturity in enterprises (Inków, 2019).

Recognising these gaps, Inków (2024) proposed an original innovation maturity model designed to provide both a diagnosis of a firm's innovation capability and actionable guidance for progression. The aim of this model is twofold: first, to offer a practical framework that enables companies to assess their current level of innovation maturity; second, to help them identify the organisational changes needed to advance to higher maturity levels. The model is structured around five distinct maturity levels, each representing a stage in the evolution of innovation management practices: Level 1, lack of innovation, where no systematic innovation activities are conducted; Level 2, forced innovations, where innovations are reactive and imposed by external pressures; Level 3, planned innovations, where innovation is embedded in planning processes but not yet fully formalised; Level 4, innovation management, where innovation is managed through structured routines and dedicated resources; and Level 5, continuous improvement of innovation management, where innovation is strategically embedded, continuously evaluated, and improved (Inków, 2024).

To operationalise the assessment, the model includes an innovation maturity matrix that links these five maturity levels to five key functional areas of innovation management: enterprise strategy, knowledge management, organisational culture, customer involvement, and scope of innovation activities. These areas were selected based on an extensive review of prior research and reflect the core components necessary for building long-term innovation capabilities. The matrix defines the expected characteristics of each functional area at each maturity level, thus offering organisations a clear pathway to identify their current position and areas for development (Inków, 2024).

The model uses a quantitative questionnaire-based scoring system to determine a firm's maturity level. The diagnostic tool consists of 11 questions addressing various dimensions of innovation strategy, culture, and practice. Each question is broken down into a series of 1 to 16 evaluative statements, which respondents rate on a five-point Likert scale (1 = very low maturity; 5 = very high maturity). Based on the responses, each company receives a total score that corresponds to one of the

five defined maturity levels. The scoring thresholds are as follows: 0–160 points = Level 1, 161–208 = Level 2, 209–240 = Level 3, 241–288 = Level 4, and 289–320 = Level 5. This approach ensures a detailed yet accessible assessment that firms can use either internally or with the support of external consultants. By translating qualitative insights into a structured quantitative output, the model enhances transparency, comparability, and usability for industrial stakeholders (Inków, 2024).

iii) S3M-i model

In an era of constant disruption and data abundance, organisations are increasingly expected not only to collect and analyse information but also to translate it into sustainable competitive advantage. Companies can't just look at data anymore, they need to use what they learn from it to create and deliver new products, services, and business models. Demir (2018) came up with the strategic sustainability and innovation maturity model in response to this need. It is a framework that aims to make innovation a part of strategic management processes. The model tries to close the gap between long-term strategy and innovation by making innovation a part of the main functions of organisational governance.

The S3M-i model builds upon several foundational frameworks. It draws from the strategic management maturity model developed by the Balanced Scorecard Institute (2010), which defines progressive stages of maturity in aligning operations with strategy. It also builds on Demir's earlier empirical research on strategic maturity in Turkish public and private sector organisations, which found that there are important differences in how companies turn strategic intent into actionable processes (Demir, 2017). Unlike traditional maturity models that see innovation as a separate or supporting function, the S3M-i framework sees innovation as one of seven key pillars that are needed for strategic coherence and organisational excellence. These seven areas are leadership, planning and execution, processes and tools, structure and business model, people and organisational culture, performance management, and innovation itself (Demir, 2018).

To assess organisational progress across these areas, the model proposes a six-level maturity scale, ranging from Level 0 (undefined) to Level 5 (excellent). At the lowest levels (0–2), innovation is unstructured, reactive, or driven by isolated initiatives. Strategy and innovation are weakly aligned, and performance indicators are often absent. In the intermediate stages (Levels 3–4), firms begin to formalise processes, integrate innovation into core business functions, and develop supportive infrastructures. At the highest level (Level 5), organisations achieve full strategic integration of innovation, characterised by continuous, proactive, and transformational innovation practices across all levels of the firm. This maturity trajectory is not only descriptive but also prescriptive, as it provides firms with a structured pathway toward building innovation resilience and strategic adaptability (Demir, 2018; BSCI, 2010).

2.4.3 Key design features

First, one of the most consistent recommendations emerging from the literature is the adoption of a maturity-based framework. Maturity models such as Eco-Mi (Xavier et al., 2020), CSMM (Sari et al., 2020), and Inków's innovation matrix (2024) provide structured, staged representations of organisational progress, enabling firms to evaluate their current status and define pathways for improvement. These models not only capture the level of integration of innovation capabilities but also offer prescriptive guidance, making them particularly suitable for self-assessment purposes.

Second, the model should incorporate a multidimensional architecture that reflects the complex nature of sustainable innovation. The Eco-Mi model exemplifies this approach by integrating four key

organisational dimensions into its assessment framework (Xavier et al., 2020). Similarly, the CSMM and OSR models emphasise the importance of linking internal drivers, strategic intentions, operational practices, and governance mechanisms (Barletta et al., 2021; Sari et al., 2020). A well-designed assessment tool should, therefore, evaluate sustainable innovation not only as a set of outcomes but as a cross-functional organisational process.

Third, alignment with the TBL is a critical requirement. While many models reference sustainability, only a subset explicitly operationalises TBL through balanced indicators (Albert, 2022; Vásquez et al., 2021). To ensure relevance and comparability, the model should include evaluative criteria that reflect these three pillars, enabling a holistic understanding of how innovation contributes to long-term value creation across multiple domains.

Fourth, practicality and self-diagnosis are essential features for ensuring wide applicability, particularly among SMEs. Tools such as Inków's questionnaire-based model (2024) or the structured interviews proposed by Xavier et al. (2020) demonstrate how assessment instruments can be designed for autonomous implementation without requiring external experts. The model should adopt simple language, Likert-type scales, and adaptable indicators to accommodate diverse organisational contexts, resource constraints, and levels of familiarity with sustainability concepts.

Fifth, the model should support sectoral adaptation and contextual relevance. As De Marchi et al. (2022) and Petersen et al. (2023) point out, the sustainability performance of innovation is often contingent upon local, sectoral, and institutional factors. A flexible structure that allows customisation would increase the model's usability across industrial contexts.

Finally, the model should be capable of evaluating innovation based on its structural characteristics, such as the nature of the offering, the targeted customer segments, the internal processes, and the geographical presence. Frameworks like the Innovation Radar (Sawhney et al., 2006) and its sustainability-oriented extensions (Petersen et al., 2023) provide a valuable basis for this, as they allow a multidimensional mapping of innovation activities within organisations and help identify underexplored areas of value creation. Their structured approach can support a comprehensive and modular evaluation of sustainable innovation.

2.5 Conclusion

As summarised above, the literature offers several key design principles that should inform the development of effective tools for assessing sustainable innovation. These include multidimensionality, maturity orientation, self-diagnosis capability, sectoral adaptability, and alignment with the triple bottom line. Despite the conceptual strengths of existing models such as Eco-Mi, CSMM, or Inków's matrix, many of them remain difficult to operationalise in industrial contexts. Their lack of procedural clarity and methodological complexity often limits their usability by operational teams and decision-makers in industrial firms (Chen, Delmas, & Lieberman, 2014; Salvador et al., 2023).

However, several critical limitations persist across existing frameworks. First, most tools remain overly complex, data-intensive, or reliant on expert knowledge, rendering them inaccessible to firms that lack dedicated sustainability expertise. Second, only a minority of frameworks adopt a maturity-based architecture, which would enable organisations not only to diagnose their current level of sustainable innovation but also to follow structured, incremental pathways toward improvement. Third, sector-specific and contextual adaptability remains underdeveloped in many existing models, which often overlook the constraints and heterogeneity of industrial environments. Finally, the social dimension of

innovation such as inclusion, well-being, or territorial value creation is rarely operationalised in a consistent, measurable way, despite its central role in the sustainable development agenda.

These limitations confirm the relevance of designing a new tool that combines operational clarity, adaptability, and strategic alignment. Such a model should go beyond static evaluation to support reflexive learning, guide progressive improvement, and foster sustainable innovation within complex industrial ecosystems.

3. Development

This chapter presents the process through which the self-assessment tool for assessing sustainable innovation in industrial companies was designed. Grounded in the theoretical perspectives and guiding principles discussed in the literature review, it clarifies the rationale that informed the structure of the model, the formulation of its indicators, and the methodological choices underlying its design. The ambition was to build a pragmatic, multidimensional instrument capable of capturing both the innovation dynamics that characterise organisational processes and the sustainability outcomes they generate. Particular emphasis was placed on clarity, adaptability, and contextual relevance to ensure the tool can be applied across various industrial environments without compromising interpretability. In order to promote reflexivity and continuous improvement, the model is embedded within a maturity-based framework, allowing firms to assess their positioning and identify potential areas for advancement over time.

3.1 Structure of the model

The structure of the self-assessment model developed in this research is based on the Innovation Radar framework introduced by Sawhney et al. (2006). This model was selected for its holistic perspective on innovation, allowing organisations to evaluate innovation activities across their full range. Rather than focusing solely on technological or product-based innovation, the Innovation Radar maps twelve dimensions organised around four strategic axes: offering (what), customers and markets (who), processes and organisation (how), and presence and access (where), as detailed in Section 2.4.2.1. This comprehensive view aligns with the objective of this research, which aims to assess the entirety of innovation practices within organisations.

In addition to its conceptual relevance for mapping innovation broadly, the framework has already been successfully extended to incorporate sustainability considerations. The Green Digital Innovation Radar, developed by Petersen et al. (2023), demonstrates the adaptability of the original Innovation Radar to integrate ESG dimensions and digital enablers. This precedent confirms the suitability of the Innovation Radar not only as a structural foundation for innovation assessment but also as a flexible framework that can be expanded to include sustainability-related variables.

To conclude, the Innovation Radar was selected as the structural foundation for the development of this self-assessment model. Its ability to capture the full scope of innovation activities, combined with its demonstrated adaptability to sustainability objectives, makes it a particularly relevant and robust framework for evaluating sustainable innovation in industrial contexts.

3.2 Questionnaire design

The diagnostic tool is based on a structured questionnaire composed exclusively of closed-ended questions. This methodological choice supports both the evaluative ambition and the practical usability of the model. Closed-ended questions enhance standardisation and comparability of responses, allowing the assessment to be reproducible across organisations and over time (Hyman & Sierra, 2016). They also facilitate integration into a maturity grid, which is central to the model's scoring logic (see Section 3.3), by linking each response option to a predefined level of sustainable innovation development.

From a practical standpoint, closed-ended questions enhance usability in self-diagnostic contexts by minimising respondent burden. They allow users to complete the evaluation quickly and without needing extensive narrative justifications. This aligns with findings showing that closed-ended formats reduce cognitive effort while still generating robust evaluative data (Baburajan et al., 2022). In industrial settings, this format is particularly appropriate for encouraging participation and avoiding response fatigue, especially in organisations where time and resources for non-core activities may be limited.

For each of the four pillars, a distinct set of questions has been developed to evaluate the integration of sustainability in terms of strategic intent, operational practices, stakeholder involvement, and performance orientation. Each question is associated with one or more transversal sustainability dimensions drawing on the TBL framework (Elkington, 1997) and on recent conceptualisations of frugal and sustainable innovation (Albert, 2019, 2022). These indicators enrich the model by linking each innovation practice to its systemic and societal effects.

The indicators were constructed following several key principles derived from Section 2.3.4 of the literature review. First, they aim to balance diagnostic utility with usability by avoiding excessive technical detail while preserving conceptual rigour. Second, they are designed to be context-sensitive and applicable across different industrial sectors, particularly those that lack formal sustainability governance systems. Third, the questions target both practices and intentions, enabling the model to capture progress as well as ambition. Finally, the indicators promote internal reflection and learning by encouraging respondents to critically evaluate their organisational routines, resource allocations, and innovation outcomes.

Each pillar includes between five and eight questions, for a total of approximately thirty questions across the model. These are grouped into thematic clusters allowing for both horizontal (within-pillar) and vertical (across-pillar) analyses of innovation performance. The design of these indicators fosters comparability, reproducibility, and iterative application, making the tool suitable for both one-off assessments and longitudinal evaluations.

3.3 Maturity scoring system

As highlighted in the literature review, integrating a maturity framework is essential to ensure that the assessment model provides a coherent and actionable interpretation of the data collected through the survey. To this end, a scoring system was implemented to translate qualitative responses into structured diagnostic insights. Each item in the questionnaire is rated on a five-point Likert scale, allowing respondents to express their level of agreement with each statement. The scale is defined as follows: 1 = Not at all, 2 = Slightly, 3 = Moderately, 4 = Well, and 5 = Completely. This format was chosen for its clarity and user-friendliness, particularly in self-assessment contexts where time and interpretive capacity may be limited.

Following the collection of responses, the model calculates a global score and a score for each of the four pillars. While the average scores by pillar offer a more in-depth analysis, highlighting the dimensions where the maturity level is lowest, the global score provides an overall view of the organisation's maturity in terms of sustainable innovation. A maturity scale based on the Eco-Mi model developed by Xavier et al. (2020) is then used to interpret these averages. This model enables organisations to position their sustainable innovation practices along a continuum that ranges from a complete lack of integration to a systemic and transformative approach.

The maturity levels are defined as follows:

- **Level 1**, also called **absence**, is represented by a score between 1.0 and 1.9, and means that sustainability is not taken into account in innovation processes.
- **Level 2**, or **reactive**, is represented by a score between 2.0 and 2.9. At this level, practices are present but irregular, frequently motivated by demands from external sources rather than strategic goals.
- **Level 3**, referred to as **structured**, spans from 3.0 to 3.9, and denotes formalised efforts that are not yet fully integrated into the innovation strategy.
- **Level 4**, or **integrated**, is represented by a score between 4.0 and 4.4, where sustainability is embedded in key processes and strategic planning.
- **Level 5**, also known as **transformational**, is represented by a score between 4.5 and 5.0, where sustainability is a major force behind innovation initiatives, fully embraced at all organisational levels.

In addition to diagnosing the current maturity level, this scale offers an evolutionary framework to guide transformation trajectories. Its ordinal and intuitive structure ensures a balance between methodological standardisation and contextualisation of results and also enables comparisons over time, across sectors, or between organisations.

3.4 Presentation of the model

The complete version of the self-assessment tool, as used during the validation phase, is presented below. It brings together the four strategic pillars and associated indicators introduced in the previous sections and integrates the structured questionnaire and maturity-based scoring system developed throughout this chapter.

The model was designed in French, as all interviews and interactions with participating organisations were conducted in this language. This linguistic choice was made to ensure conceptual clarity, facilitate participant engagement, and guarantee that the questions were interpreted as intended by respondents during the evaluation process. The full version of the model appears on the following pages and serves as the basis for the empirical validation discussed in Chapter 5.

1. Nos produits intègrent des principes d'éco-conception (réduction matière, recyclabilité, énergies renouvelables).	
2. Nous avons développé des offres accessibles à des clients à faibles revenus ou marginalisés.	
3. Nous privilégions des solutions simples et frugales plutôt que complexes et coûteuses.	
4. Nos produits/services réduisent l'empreinte environnementale sur leur cycle de vie (CO ₂ , eau, déchets).	
5. Nos innovations répondent à des besoins essentiels non satisfaits.	

6. Nous avons conçu des produits pour les personnes en situation de handicap ou d'exclusion.	
7. L'analyse du cycle de vie (ACV) est utilisée dans la conception de nos offres.	
8. Nous avons supprimé certaines fonctionnalités non essentielles pour améliorer l'accessibilité et la simplicité d'usage.	

Figure 1: Pillar 1 - Sustainable Offerings (What?)

Source: Nicolas Dewandre (2025)

1. Nous ciblons activement des segments mal desservis (zones rurales, publics précaires...).	
2. Nos produits sont utilisables par tous, y compris les publics fragilisés.	
3. Nous intégrons les retours clients pour améliorer nos offres durables.	
4. Nous menons des actions de sensibilisation des clients à une consommation responsable.	
5. Nous développons des offres pour des besoins sociaux ou environnementaux peu adressés par le marché.	
6. Nos relations clients sont basées sur la transparence, la confiance et des valeurs partagées.	
7. Nous évaluons l'impact social et environnemental de nos activités vis-à-vis des clients.	

Figure 2: Pillar 2 - Customers and Markets (Who?)

Source: Nicolas Dewandre (2025)

1. Nos processus intègrent des mécanismes de réutilisation ou de recyclage.	
2. Nous avons optimisé certains processus pour réduire l'empreinte écologique (énergie, papier, déchets).	
3. La durabilité est prise en compte dans les décisions stratégiques de la gouvernance.	
4. Les collaborateurs sont formés aux enjeux de durabilité.	

5. Des indicateurs de durabilité sont intégrés au pilotage de la performance.	
6. Les équipes sont encouragées à proposer des initiatives durables	
7. Nous avons évalué l'impact environnemental de nos opérations internes.	

Figure 3: Pillar 3 - Processes and Organisation (How?)

Source: Nicolas Dewandre (2025)

1. Nos offres sont disponibles dans des zones rurales ou mal desservies.	
2. Nos modes de distribution visent à réduire l'empreinte carbone (logistique verte, circuits courts).	
3. Nos points de vente ou solutions sont accessibles aux personnes à mobilité réduite.	
4. Nous prenons en compte les inégalités territoriales dans le déploiement de nos offres.	
5. Nos partenaires logistiques sont sensibilisés à adopter des pratiques durables.	

Figure 4: Pillar 4 - Presence and Access (Where?)

Source: Nicolas Dewandre (2025)

4. Methodology

The objective of this research is to examine how the self-assessment tool I designed to evaluate sustainable innovation is understood, received, and potentially used by industrial companies. To address this objective, an abductive qualitative approach was adopted. While enabling theoretical refinement based on empirical insights, this method is particularly well-suited to studies that seek to compare conceptual models with actual practices (Timmermans & Tavory, 2012; Gehman et al., 2018).

First, an in-depth literature review was conducted to define the key concepts of the study and identify existing models that could serve as a foundation for developing my own framework. Based on this review, the model was built using key insights identified during the research phase. It was then tested in the field through a series of semi-structured interviews with industrial practitioners, and the data collected were analysed thematically to identify convergences and divergences between theory and practice. The choice of qualitative interviews was motivated by the exploratory nature of the research and is further justified in the sections below. The insights generated through this process contributed to both managerial practice and academic knowledge by enabling the empirical validation of the model and the development of new interpretive categories.

In addition to traditional qualitative methods, this research integrated generative artificial intelligence tools (e.g., ChatGPT) at various stages of the project, both for methodological support and writing assistance. AI was used while building and refining the model as a cognitive partner to reword questions, explore alternative formulations based on expert feedback, and clarify concepts. Moreover, AI was also employed during the drafting of the thesis to help structure arguments, improve paragraph clarity, and enhance the overall coherence and academic tone of the text.

AI was used strictly for linguistic support, sentence refinement, and idea generation. Since the thesis was initially written in the researcher's native French and then translated into English to meet academic requirements, AI also functioned as a translation tool. It is important to emphasise that all editorial, conceptual, and analytical decisions were made by the researcher. The use of AI tools was carefully controlled to preserve the originality, critical thinking, and scientific rigour expected in a master's thesis. The reliability of sources, the accuracy of interpretations, and the overall coherence of the work remained entirely the responsibility of the researcher.

The sampling plan, data collection procedures, and analytical methodology used in the study are detailed in the following sections.

4.1 Sampling

Given the sensitive nature of the topic, namely sustainable innovation practices within industrial firms, special care was taken in the sampling and recruitment process. The study employed purposive sampling, with the sole selection criterion being the presence of an active industrial production unit. This condition was essential, as the research specifically aimed to explore innovation practices embedded in industrial production settings. The objective was not to obtain a statistically representative sample but rather to collect rich, context-specific insights from organisations directly involved in manufacturing processes.

Participants were approached through a combination of professional and personal networks, as well as direct outreach via email. However, recruiting companies proved particularly challenging, mainly due to confidentiality concerns raised by several potential participants. Innovation processes are often

considered strategic and highly competitive, and several firms expressed reluctance to disclose information they perceived as sensitive. In addition to confidentiality concerns, time constraints were also cited as a reason for declining participation.

In response to these concerns, the recruitment strategy emphasised strong ethical safeguards. All participants were explicitly assured that their identities, company names, and any potentially identifiable details would remain strictly confidential.

Moreover, the data would be used solely for the purposes of this academic research project and analysed anonymously, without any reference to specific organisations or individuals. This commitment to anonymity was a decisive factor in securing participation and enabling open, honest contributions from respondents.

Thanks to these assurances, eight industrial firms agreed to take part in the study, along with one independent ESG consultant. Eight participants were interviewed through semi-structured discussions, while one company provided written feedback on the self-assessment tool. Although the number of respondents remained modest, the final sample exhibited a rich diversity in terms of company size, sector of activity, and sustainability maturity. It included small enterprises, mid-sized industrial firms, and large multinational groups, offering a broad perspective on the various ways sustainable innovation can be conceptualised and implemented. This was further enriched by the external viewpoint of an expert not subject to internal industrial constraints.

In order to interpret the responses collected in a meaningful way, it is essential to understand the organisational context and position of each interviewee. The nature of their responsibilities, as well as the size and structure of the company they represent, strongly influence how they perceive and assess the relevance of the self-assessment tool. For this reason, a brief overview of the participants is presented in the table below. It provides a concise summary of their roles and the size of their organisations, which serves as a foundation for the thematic analysis developed in the following sections.

Interviewee 1	CEO of a small industrial company with 11 to 50 employees provided written feedback.
Interviewee 2	Head of eco-design and circular economy practices in a large industrial group employing between 5,000 and 10,000 employees.
Interviewee 3	Managing director of a small industrial company with 11 to 50 employees.
Interviewee 4	Sustainability manager in a large industrial company employing between 501 and 1,000 employees.
Interviewee 5	Vice President of Development Projects in a large international company with 1,000 to 5,000 employees.
Interviewee 6	CEO of a small industrial company employing between 11 and 50 employees.
Interviewee 7	Sustainability Director for the Western Europe division of a multinational group with more than 10,000 employees.

Interviewee 8	Dual interview: one site director and one head of the sustainability business unit in a global industrial group with more than 10,000 employees.
Interviewee 9	Independent ESG consultant with cross-sector experience, specialised in sustainability strategy and reporting frameworks.

Figure 5: Overview of Interviewees

Source: Nicolas Dewandre (2025)

Although the final sample size was limited, it proved sufficient to generate relevant and nuanced insights, particularly given the exploratory and qualitative nature of the study. Importantly, no identifying company details are disclosed, in full compliance with the ethical agreement that enabled open and honest participation. This confidentiality was particularly important given the strategic and competitive dimensions associated with innovation practices.

4.2 Data collection

The data collection process was carried out through semi-structured interviews, chosen for their ability to combine analytical consistency with interpretive flexibility. This method allowed for structured cross-case comparison while enabling participants to elaborate freely (Kvale and Brinkmann, 2009) on the themes most relevant to their context. Each interview followed a clear structure, beginning with a short presentation of the research context, the purpose of the study, and the logic behind the self-assessment tool. The interviewer also introduced himself and explained the origin and objectives of the model. Participants were then invited to briefly introduce themselves and describe their role within the company, in order to situate their feedback in relation to their operational and strategic responsibilities.

In preparation for each interview, an online search was conducted on the participating company to gain a better understanding of its sector, sustainability profile, and recent strategic developments. This background information helped to contextualise the feedback provided and to tailor the discussion where appropriate.

All interviews were conducted in French, the native language of both the interviewer and the participants. They were held online using Microsoft Teams, a format selected for its practicality and its compatibility with the participants' time constraints. The remote setting allowed greater flexibility for scheduling, which was essential given the participants' limited availability. The discussions lasted on average between 35 and 45 minutes. The self-assessment model presented in Section 3 served as a guiding framework for the conversation, structuring the questions while leaving space for open-ended insights and spontaneous reactions.

Participants were asked to reflect on the clarity, relevance, and applicability of the tool's questions in relation to their company's characteristics, sustainability maturity, and market model. They were encouraged to point out any areas of ambiguity, misalignment, or incompleteness. In several cases, the conversation naturally broadened into a more general discussion on sustainability and innovation practices, providing valuable contextual depth beyond the structure of the tool itself.

With participants' informed consent, all interviews were audio-recorded and transcribed. The initial transcripts were generated using Microsoft Teams' built-in AI-based transcription tool, then carefully

reviewed and corrected by the researcher. When needed, selected excerpts were re-listened to in order to clarify ambiguous passages and ensure that the exchanges were rendered as coherently and faithfully as possible. In one case, written feedback was provided directly on the questionnaire instead of through a live interview. The types of data collected included full interview transcripts, interviewer notes taken during and after the conversations, and annotated documents. All data were anonymised immediately after collection to protect confidentiality, particularly in light of the strategic and sensitive nature of innovation-related topics discussed.

4.3 Data analysis

To analyse the qualitative data collected during the evaluation of the self-assessment tool, a thematic analysis approach was adopted. This method enables the identification, organisation, and interpretation of patterns of meaning within qualitative datasets and is particularly appropriate for exploring stakeholders' views, experiences, and perceptions of a complex phenomenon or instrument (Braun & Clarke, 2006). Thematic analysis was chosen for its methodological flexibility and its ability to generate a rigorous, transparent, and credible interpretation of data, even in an exploratory research context. As emphasised by Nowell et al. (2017), thematic analysis is especially suitable when working with semi-structured interviews and aiming to meet established standards of reliability and transferability in qualitative research.

The dataset analysed included full interview transcripts, notes taken during and after the discussions, as well as one written response to the questionnaire. These materials were examined using a hybrid thematic coding approach, combining both deductive and inductive coding strategies (Fereday & Muir-Cochrane, 2006). The deductive coding was guided by the structure of the self-assessment model ensuring a systematic review of each predefined component. In parallel, inductive coding allowed for the emergence of unexpected insights such as critical feedback, practical suggestions for improvement, and broader reflections on sustainable innovation in industrial settings.

This hybrid approach proved particularly effective in evaluating both the internal coherence and the external relevance of the model. The overall analytical process followed an abductive logic, wherein empirical findings and theoretical frameworks were iteratively linked to progressively refine the understanding of the phenomenon under investigation (Timmermans & Tavory, 2012).

In summary, this methodological framework combines a qualitative design, purposive sampling, and abductive reasoning to explore the applicability of a self-assessment tool for sustainable innovation in industrial settings. The use of semi-structured interviews, combined with a hybrid thematic analysis approach, provided both structure and flexibility to capture participants' perspectives. This methodology enabled the validation of the tool while generating insights into the broader dynamics of sustainable innovation.

5. Findings

This chapter presents the key findings from the validation of the self-assessment model developed in Chapter 3. In order to assess the model's relevance and applicability, an iterative field-based process was implemented using qualitative interviews. The tool was tested in three successive waves, each corresponding to a different version of the model. After each round, the model was refined based on the feedback received. This approach follows an abductive logic, allowing for a continuous dialogue between theoretical frameworks and empirical realities. It enabled the model to evolve through direct engagement with industrial stakeholders, adapting to their needs, constraints, and perspectives.

- **Wave 1** was based on the initial version of the model, constructed from the literature review. It allowed for a first confrontation between the conceptual framework and field reality, revealing several limitations regarding the clarity of wording, the complexity of certain terms, and the transferability of the model to industrial B2B contexts.
- **Wave 2** introduced a revised version of the model that incorporated the initial feedback. It enabled a deeper analysis of the tool's applicability across various industrial sectors and triggered discussions on interpretation challenges, sector-specific constraints, and the potential enrichment of the model.
- **Wave 3** relied on the final version of the model, enriched by cumulative feedback from previous interviews. The goal of this last validation round was to test the clarity, operational consistency, and perceived strategic relevance of the tool in real-world industrial settings.

The following sections synthesise the main lessons learned from each wave, highlighting both recurring insights and progressive refinements brought to the model.

5.1 Wave 1 - First confrontation with the field

5.1.1 Perceived inadequacy with the B2B context

The interviews conducted during the first wave highlighted a consensus among participants regarding certain limitations of the initial version of the self-assessment model. Several formulations were perceived as inadequate to the specificities of industrial companies operating in a B2B environment. This perceived gap, both lexical and conceptual, was largely attributed to an orientation considered too strongly inspired by logics specific to B2C companies, both in terms of the vocabulary used and the implicit assumptions of certain questions.

A first point of friction concerned the use of categories such as "low-income clients", "marginalised clients" or even "vulnerable populations". While such notions may make sense in a context oriented toward individual consumers, they were deemed inoperative in an inter-business environment, where clients are essentially legal entities such as private companies, public institutions, or local authorities, rarely defined according to individual socio-economic criteria. People in positions of strategic responsibility, such as CEOs, insisted on the inadequacy of this type of terminology in the B2B context. Conversely, interviewee 2 with a profile more involved in sustainability management proposed an adaptation path by suggesting to reformulate these items to target under-addressed or specific-needs professional actors, such as SMEs, public clients, or economic segments considered as low-profit but presenting a long-term strategic interest.

Questions related to social inclusion through the design of products or services also raised concerns. The statement according to which a company voluntarily designs offers intended for people with disabilities or in situations of exclusion was perceived as not very applicable in an industrial context. Participants pointed out that these issues, although important, fall more under internal human resources policy or the accessibility of physical infrastructures and not the offer design process, especially when the end users are generally neither known nor directly targeted in B2B relationships. It was therefore suggested to reposition this type of question in another part of the tool, potentially in a section dedicated to the work environment or governance, or to remove it if no clear link can be established with the main activity.

This critical feedback also resonated with another item, located in a distinct pillar of the model. In pillar 4, related to presence and accessibility, a question focused on the accessibility of sales points for people with reduced mobility. Again, all participants noted that this formulation relied on an assumption hardly compatible with the functioning of industrial B2B companies, which generally have neither physical sales points nor reception areas intended for the general public. However, this observation led to a more coherent reformulation, consisting in broadening the notion of accessibility to industrial sites, administrative buildings, or production areas. Such an approach would help maintain the issue of inclusion while adapting it to the specific realities of industrial organisations.

Finally, other statements related to geographic or territorial presence, such as “our offers are available in rural or underserved areas” were also considered of limited relevance. According to the participants, market coverage logic in industrial B2B sectors is not based on broad geographical accessibility, as in B2C distribution, but rather on targeted, contractual commercial relationships, often structured outside of traditional consumption channels.

5.1.2 Technical and ambiguous formulations

In addition to the remarks related to the initially overly B2C-oriented focus of the model, the interviews conducted during the first wave highlighted several interpretation difficulties linked to certain formulations considered vague, technical, or too abstract. These responses pointed to an issue of clarity, essential for the proper appropriation of the model, particularly by industrial actors who do not necessarily possess advanced expertise in sustainability.

The term “frugality” used in a statement from the pillar related to the offering, elicited contrasting reactions. Interviewee 2, a CSR expert, drew attention to the polysemy of the word. Although he understands its intentions, he emphasises that in an industrial context, the notion can be interpreted in multiple ways: energy sobriety, material efficiency, functional simplification, among others. He recommends replacing the term with a more technical and operational formulation. This critical feedback is reinforced by the testimonies of Interviewees 1 and 3, who stated that they were not familiar with the term and did not clearly understand its meaning. Faced with this uncertainty, Interviewee 2 suggests adding a glossary or reformulating the statement to ensure a shared understanding, regardless of the user’s level of familiarity with the vocabulary of sustainable innovation.

The formulation referring to the satisfaction of “essential needs” was also deemed insufficiently precise. Interviewee 3 pointed out the abstract nature of the expression, considering it difficult to interpret in a business-to-business framework without concrete examples. Interviewee 2 shares this analysis, recommending that the statement be refocused around functional, environmental, or performance-related needs that are not addressed by the existing offering. Such a reformulation would help preserve the original objective while facilitating its application to an industrial B2B context.

The statement concerning the impact of activities on clients also generated divergent interpretations. Interviewee 2, from an expert perspective, emphasised the relevance of the topic but regretted a formulation that was too open-ended. According to him, the lack of framing makes it difficult to understand the expected level of analysis. He wonders, for example, about the nature of the impact to be evaluated: should one measure the client's performance, their behavioural evolution, or their engagement in responsible approaches? Conversely, Interviewee 3, as CEO, considers this statement one of the most relevant in the concerned pillar, as he believes it allows for an articulation between innovation and systemic responsibility. This divergence in interpretation highlights the influence of the level of expertise on the understanding of the model. While a specialised profile is able to question the exact scope of a formulation, a strategic profile without specific expertise in sustainability may perceive its interest without grasping all of its implications. This underlines the need to further clarify the expectations of certain statements so that their reflective potential is not weakened by ambiguous wording.

Throughout the interviews, it appeared that certain statements were understood differently depending on the profile, which repeatedly required clarification during the exchange to ensure a coherent analysis of the feedback. While these oral reformulations allowed for more precise and targeted responses, they highlight a significant risk. In a real self-assessment situation, an unaccompanied user might misinterpret a statement and thus assess themselves inaccurately. This type of error could distort the analysis of perceived maturity on certain key aspects of sustainable innovation, particularly in complex or weakly structured domains.

5.1.3 Structural adaptation

Beyond the formulation-related comments mentioned previously, participants from the first wave of interviews questioned the model's ability to cover, in a single format, the very different realities of B2C and industrial B2B. This criticism did not emerge as a theoretical hypothesis a priori but rather through concrete feedback formulated during the discussions, in response to certain statements perceived as unsuitable for an inter-business environment. These reactions led to a reflection on the need to consider two distinct versions of the model in order to enhance its relevance depending on the type of market addressed.

This debate did not concern all pillars in a uniform way. The comments evoking a B2C bias related more specifically to pillars 1, 2, and 4, while pillar 3 did not give rise to any comment questioning its applicability in a B2B context.

In pillar 1, related to the integration of sustainability into offerings, certain elements were considered of limited relevance in B2B, particularly those referring to the design of products intended for people in situations of disability or exclusion. Participants indicated that this type of issue, although legitimate, falls more under HR policy or infrastructure accessibility than under product design in an inter-business context. The fact that this type of formulation was identified as problematic shows that certain contents must be adapted to align with the B2B context.

However, it is pillar 2, focused on customer segments and targeted beneficiaries, that crystallised the most comments. The interviewees pointed out that several expressions were not applicable to their reality, as the clients were other companies or institutions. Numerous reformulation suggestions were made to better reflect relevant B2B targets. This feedback highlights a strong convergence, insofar as the final customer targeted is of a different nature depending on whether one operates in B2C or B2B, a common pillar 2 does not appear feasible. A structural adaptation of this part of the model is therefore clearly necessary.

Pillar 4, related to access to solutions and territorial anchoring, also generated several comments pointing to an overly strong anchoring in a B2C logic. Statements referring to the accessibility of sales points or presence in underserved areas were perceived as difficult to transpose into an industrial context. Conversely, participants suggested reformulating these questions to focus on the accessibility of production sites, openness to stakeholders, or integration into local territorial dynamics. Here again, the feedback clearly showed that targeted reformulations are necessary to ensure the relevance of this pillar in a B2B context.

Conversely, pillar 3, dedicated to the governance of sustainable innovation, did not generate any comments indicating a mismatch between B2B and B2C. The absence of feedback in this regard seems to indicate that the dimensions addressed are perceived as cross-cutting and applicable to both types of configurations. This pillar could therefore remain common to both versions of the model, without major adaptation.

In summary, the feedback collected during this initial exploratory phase highlights the need for a structural differentiation of the model. Pillars 2 and 4 must be rethought to better adapt to the B2B context, while pillar 1 requires certain adjustments. Pillar 3, for its part, can be maintained as it is. It was therefore decided to evolve the structure of the model towards two distinct versions: one dedicated to B2C and another specifically adapted to industrial companies operating in B2B.

5.1.4 Model refinement

The feedback obtained during the first wave of interviews constituted an essential starting point for the in-depth revision of the self-assessment model. The observations made by the participants, notably concerning the B2C bias of certain formulations, the imprecision of some terms, and the lack of alignment with the industrial realities of B2B, were translated into concrete adjustments aimed at strengthening the relevance and clarity of the tool.

In order to respond to the perceived inadequacy with the inter-business context, an explicit distinction was introduced between two versions of the model: one designed for B2C-oriented companies, the other specifically adapted to industrial B2B environments. This structural differentiation addresses one of the main findings of the first wave, namely the incompatibility of certain categories and concepts with the operational logic of exchanges between organisations.

Several statements deemed inappropriate were thus reformulated or removed in the B2B version. Expressions such as “low-income clients”, “marginalised populations” or “clients with disabilities” were replaced by formulations more suited to the industrial context, such as “under-served professional segments” or “clients with specific constraints”. Moreover, certain expressions considered too abstract, such as “frugal solutions” were clarified to refer to “simple, efficient, and low-resource-consuming solutions”. Similarly, the notion of “essential needs” was reformulated in more concrete terms, based on functional or operational dimensions.

The internal structure of the model was also adapted to account for the differentiated relevance of the pillars depending on the type of company. Pillars 1, 2, and 4, respectively addressing sustainable offerings, market segments, and accessibility, were specifically revised to better match the expectations of industrial actors. Conversely, Pillar 3, focused on organisational processes and governance, was maintained as is, since no particular misalignment was identified in this area.

At the end of this revision phase, the model presents itself in a more contextualised and adapted form. It retains its initial purpose, namely to encourage strategic reflection on sustainable innovation, while offering better readability, enhanced applicability, and easier use for industrial companies operating

in B2B. This revised version served as the basis for the second wave of validation interviews (see Appendices).

5.2 Wave 2 - Thematic refinements of the tool

5.2.1 Interpretation and reformulation needs

The interviews conducted during the second wave highlighted several formulations in the model that, despite the adjustments made after the first phase, continued to pose difficulties in terms of understanding or interpretation. This feedback serves as a reminder that the language used in a self-assessment tool is never neutral. The words chosen directly influence how companies relate to the content and project their own realities onto it. The difficulties reported here concern less the substance of the topics addressed than the gap between the original intention behind the questions and how they are received in specific industrial contexts.

5.2.1.1 Ambiguous terminology

One of the most striking examples concerns the term “offering” used in several statements in the model. While this word might seem generic and consensual, it was understood in very different ways depending on the respondents' profiles. Interviewee 4 and 5, familiar with sustainability approaches, spontaneously understood it to refer to the solutions proposed by the company. Interviewee 6, more focused on strategic and commercial functions, immediately thought of a price offer or a quotation. This confusion sometimes hindered comprehension of the statement or led to questions about the intended meaning. Interviewee 6 emphasised the interest of using clearer vocabulary, such as “solutions”, “innovations” or “products” which better aligns with the language used in B2B industries and limits multiple interpretations.

Another formulation that generated a lot of feedback was the one stating that the company “offers solutions adapted to the economic constraints of its clients”. This expression was considered too vague, even ambiguous. Interviewees 5 and 6 were unsure whether it referred to pricing, profitability, budgets or broader structural constraints. The lack of framing weakened the interpretation of the question, especially in environments where competitive pressure and profitability are central concerns. It was suggested to better define the economic dimensions involved or to illustrate this statement with concrete examples to help companies relate to it.

The term “ease of integration” used in another statement was also seen as too vague. All respondents questioned what this expression actually referred to. They wondered whether it concerned technical, commercial, organisational, or human integration. Without further detail, the question remained open to interpretation, which could reduce the quality of responses. A more targeted reformulation or segmentation by type of integration could help resolve this ambiguity.

5.2.1.2 Inappropriate or unclear concepts

The notion of “ease of use” was specifically criticised by Interviewee 5, whose profile is focused on product development. In sectors where the proposed solutions are inherently complex and integrated into advanced technical systems, this idea of simplicity seemed to him not only difficult to apply but also irrelevant. He suggested that the statement be clarified or removed, as simplicity is neither sought nor achievable in his field. This comment highlights the importance of carefully contextualising statements according to the technical nature of the relevant sector.

Another frequently cited example is the statement about working with “under-addressed markets” It was considered unclear or poorly understood by all respondents, regardless of their sector or level of responsibility. While some grasped the intent behind the question, notably the idea of assessing a social dimension or commitment to non-traditional actors, the current formulation did not allow for a confident response. It was systematically explained during the interviews, which confirms that a reformulation is necessary to avoid multiple interpretations. It was suggested to clarify the target groups involved or to reposition the statement within a more strategic rather than strictly social perspective.

The statement “we assess the social or environmental impact generated for our clients” also received critical feedback, particularly from Interviewee 4, who has a CSR expert profile. He pointed out two main issues. First, the question combines the social and the environmental impact making it difficult to give a single, unambiguous answer. Second, the term “social impact” seemed too generic to him. He stressed that this broad concept should either be defined or at least illustrated to avoid divergent interpretations. He therefore suggested splitting this statement into two distinct questions and clarifying what is meant by “social impact” for example, by mentioning accessibility, reduction of inequalities or improvement of working conditions.

The question on the accessibility of infrastructures for people with disabilities reignited a discussion that had already begun during the first wave. All respondents acknowledged the importance of the issue, provided it focused on buildings and industrial sites, rather than retail outlets, which are largely irrelevant in a B2B context. This consensus was reaffirmed in the second wave. However, a more nuanced view was expressed by interviewee 5 whose profile is oriented towards offer development and product innovation. For him, this question relates more to HR policy or an internal social issue rather than to a sustainable innovation approach. This feedback does not question the legitimacy of the topic but invites reconsideration of its presence in the tool.

5.2.1.3 Need for practical anchoring

The statement related to life cycle analysis was generally well received. All respondents recognised its relevance. However, interviewee 4 expressed the need for a more explicit formulation. It was suggested to refer to recognised tools or standards, such as ISO 14040, and to anchor the question in actual design practice rather than in a simple declared intention. More generally, participants pointed out that adding concrete examples to certain statements would facilitate understanding and allow for more consistent appropriation of the model.

5.2.1.4 B2C-oriented formulations

It is also important to note that, despite the differentiation introduced between the B2B and B2C versions of the model after the first wave, certain statements were again perceived as too inspired by a B2C logic. This was notably the case for statements such as “our offers are designed to be easy to understand and use for all our clients”, “our infrastructures are accessible to everyone, including people with disabilities” or “our solutions meet key needs for the operation or transition of our clients”. These formulations were considered by interviewee 6 insufficiently adapted to inter-business contexts, where solutions are often technical, customised, and intended for professional clients. These comments confirm the need to continue refining the model by differentiating more clearly between B2C and B2B-oriented statements.

5.2.2 Applicability and sector-specific features

Although the model was designed with a logic of transversality and adaptability to a wide variety of organisations, several participants from the second wave expressed doubts about the applicability of certain statements to their sector of activity or type of company. This feedback did not concern the clarity of the formulations but rather the very relevance of certain dimensions of the model in light of very different industrial, commercial, or organisational realities.

One of the first points raised concerns the technical complexity of products in certain industrial environments. Statements such as “our offers are easy to understand and use for all our clients” were considered of little relevance in companies where the proposed solutions are by definition complex, intended for experienced professionals, and integrated into advanced technical systems. In these contexts, simplicity is neither a desired criterion nor an applicable one. This observation, notably made by profiles involved in product development, serves as a reminder that complexity is sometimes a deliberate added value, which can hardly be reduced to a generalised logic of accessibility.

The size and level of structuring of the company were also identified as limiting factors for the applicability of certain statements. All respondents from SMEs or family businesses expressed their difficulty in projecting themselves into approaches that imply an advanced organisation, such as appointing a sustainability officer, formally assessing impacts, or involving the executive committee. Due to a lack of dedicated resources or available time, these practices are often absent or informal. Far from calling the tool into question, these companies proposed integrating response options such as “not applicable”, allowing this diversity of situations to be reflected without distorting the self-assessment.

Finally, market pressure appeared as a determining factor in the applicability of certain dimensions of the model. Interviewee 6 notably pointed out that in his sector, sustainability is not yet a recognised or demanded criterion by clients. In this context, lower-impact products are often disregarded, as they are systematically more expensive. The only decisive criterion remains price. This situation makes certain statements, such as those concerning the alignment of the offer with the transition needs of clients, difficult to mobilise. They then appear disconnected from reality not due to a lack of interest on the part of the company, but due to misalignment with the dominant logics of the market.

To conclude, these observations do not call into question the general structure of the model but raise a fundamental question: can a tool designed to assess sustainable innovation be applied uniformly to all types of companies, regardless of their sector or size? This feedback invites reflection on the introduction of contextualisation mechanisms, interpretation margins, or differentiated responses in order to ensure that the model remains relevant without losing methodological coherence.

5.2.3 Missing elements and suggestions for enrichment

Participant feedback in the second wave extended beyond simple criticisms or reformulation requests. Several participants highlighted dimensions that were absent from the model yet considered crucial to fully reflect the reality of sustainable innovation within companies. These elements, identified as missing throughout the discussions, refer to strategic, organisational, or territorial concerns that would deserve to be integrated into an enriched version of the tool. Taking them into account would not aim to call into question the structure of the model but rather to broaden its scope so that it can better capture the diversity of action levers mobilised in the field. To facilitate reading, these proposals have been grouped according to five themes that recurred in the feedback: strategy and steering, the value chain, client relationships, resources and infrastructures, and territorial anchoring.

5.2.3.1 Strategy and steering

The strategic steering of sustainability emerged as a critical, yet underrepresented dimension within the model. According to several participants, this aspect plays a central role in determining a company's ability to implement a coherent and structured sustainable innovation approach.

A first key point raised concerns the internal sponsorship of the initiative. As interviewee 4 put it, it is essential to know who is really driving these dynamics within the organisation: is it a commitment led by top management, relayed by middle managers, or initiated by the teams themselves? This question does not only concern formal governance, but also the way in which the strategic incentive is embodied and supported within the company. It also raises the issue of the intensity of the support provided: what resources, in terms of time or budget, are allocated to these initiatives? What is the level of conviction or engagement of the internal sponsors? According to Interviewee 4, it would be relevant to introduce a statement that questions both the leading roles and the resources actually mobilised.

This reflection is extended by a second suggestion, expressed by interviewee 5, who emphasised the need to designate a clearly identified person responsible for sustainability. The presence of a reference person within the organisation, with an explicit mandate, is perceived as an indicator of maturity. It helps move away from a fragmented project logic and anchors sustainability within a clearly defined framework of responsibility.

Finally, interviewee 5 goes even further by proposing to question the involvement of the executive committee in the monitoring of these issues. The goal is not only to determine whether sustainability appears in the company's values or external reports but to understand how frequently these issues are addressed at the decision-making level: are they discussed regularly? Are they subject to formal monitoring (monthly, quarterly, annually)? Such a statement would make it possible to assess whether sustainability is truly integrated at the heart of strategic governance or if it remains confined to peripheral discourse.

5.2.3.2 Value chain

A recurring concern among participants was the limited attention given to the value chain as a key driver of sustainable innovation. Beyond internal efforts, several respondents emphasised that innovation processes are often deeply intertwined with external stakeholders, whose involvement is essential for delivering concrete and lasting impact.

One of the first points raised was the need to assess how companies identify and actively engage key stakeholders across their value chains. Interviewee 4 noted that sustainability should not be approached solely as an internal optimisation exercise but rather as a collaborative process that creates shared value with both upstream and downstream partners such as strategic suppliers, technical subcontractors, or clients involved in co-development. Building on this, Interviewee 5 suggested that the model would benefit from a statement designed to assess the extent to which companies establish long-term, trust-based partnerships that support mutual sustainability goals.

Beyond stakeholder cooperation, all interviewees from the second wave emphasised the importance of capturing the company's contribution to a broader notion of value encompassing not just financial aspects but also social and environmental dimensions. Interviewee 4 pointed out that firms can contribute to their ecosystems by providing stable employment, encouraging knowledge transfer, or fostering inclusive forms of collaboration. Including an item that reflects this extended impact logic would help the model differentiate between organisations that pursue internal compliance and those that actively influence their wider environment.

Finally, Interviewee 4 raised the issue of accountability and monitoring mechanisms within the value chain. In an increasingly regulated landscape, companies are being asked to assess and report on the environmental and social performance of their suppliers and partners. Interviewee 6 added that his organisation is already preparing for demands from larger clients who expect documented evidence of sustainable practices across the supply chain. In light of this, interviewee 4 and 5 recommended including an item that evaluates whether companies have implemented structured monitoring procedures such as sustainability audits, selection criteria, or formalised questionnaires.

5.2.3.3 Client relationships

While the issue of the client is already partially addressed in the model, several participants from the second wave emphasised the value of deepening certain aspects. It is not so much the structure of the pillar that is being questioned but rather the need to integrate still-missing strategic dimensions related to market receptiveness, value proposition and the actual commercial impact of sustainability efforts.

A natural extension of the observations made in section 5.2.2 concerns the explicit need to assess the market's maturity in terms of sustainability. Several participants, notably Interviewee 6 and Interviewee 5, highlighted the relevance of including a statement to evaluate the extent to which clients themselves express demands regarding transparency, traceability, or environmental impact. This pressure or lack thereof directly influences how companies structure their offerings. Interviewee 5 goes even further by suggesting an assessment of whether sustainability has a real effect on sales: is it a decisive commercial argument or, on the contrary, an obstacle in a market where only price matter? This suggestion echoes comments made by other participants, particularly in cost-sensitive industrial sectors, where more sustainable offerings are still rarely requested or even systematically rejected by default.

The issue of the value proposition also came up repeatedly. Already briefly mentioned by Interviewee 2 during the first wave, it was further developed by Interviewee 5, who emphasised the importance of thinking in terms of usage rather than product. According to him, it is not simply about offering an object or a service but about clarifying what is being made available to the client, how it is useful to them, and what functional value is actually being delivered. This reflection aligns with approaches such as functional economy models or usage-based value perspectives. For him, the mistake lies in speaking only of "products" when what should be questioned more fundamentally is what the company actually enables or improves for its client.

5.2.3.4 Resources and infrastructures

Several participants emphasised that certain dimensions related to resources and production processes should be further developed in the model. They suggested integrating elements considered important to better reflect industrial realities.

A first area of improvement concerns the management of raw materials. Interviewee 5 insisted on the importance of evaluating how the company selects and controls its inputs: does it use renewable, recycled, or recyclable materials? Does it implement clear traceability regarding the origin of components? Do suppliers comply with ethical and social criteria? These elements, currently absent from the model, are nevertheless at the core of responsible purchasing policies. A dedicated statement would thus make it possible to verify whether sustainability is considered from the design stage of the offer, in coherence with the principles of the circular economy.

A second topic, raised by Interviewee 4 and Interviewee 6, relates to energy optimisation. While the model already mentions the overall reduction of ecological footprint (energy, paper, waste), this formulation was considered too generic. Respondents suggested clearly distinguishing these dimensions by adding a specific statement on energy efficiency actions: high-performance equipment, optimised lighting, etc. Such precision would better reflect the concrete efforts undertaken in each company, without being diluted in an overly broad formulation.

Interviewee 5 also emphasised the need to include a dedicated statement on the use of renewable energy in industrial processes. He referred to concrete examples such as the use of solar panels, green electricity contracts, or autonomous installations. For him, this distinction is essential to avoid confusing structural energy transition with simple optimisation practices.

Finally, this same participant proposed broadening the reflection to include industrial site location choices. In a more systemic logic, he suggested questioning the role that the location of sites plays in the company's environmental strategy: are site location decisions aimed at reducing transport-related emissions? Do they promote local synergies or sustainable logistics? By integrating such a statement, the model could highlight levers that are still little explored but highly structuring.

5.2.3.5 Territorial anchoring

Territorial issues elicited contrasting reactions among participants. Several of them expressed the desire to see this dimension better explored, particularly from the perspective of local anchoring and the indirect impact of activities.

Some respondents regretted the absence of a statement allowing the assessment of how the company interacts with its territorial environment. Interviewee 5, in particular, emphasised that beyond industrial choices, certain companies actively contribute to local dynamics: use of regional partners or subcontractors, support for local employment and participation in collaborative projects. For this profile, these elements deserve to be highlighted in the model, even if they do not always take the form of formalised policies. He thus proposed introducing a statement to assess whether the company measures or takes into account its territorial impact in connection with local ecosystems or indirect social and environmental effects.

This feedback echoes other suggestions, notably concerning the social effects linked to the establishment of a site. It is not only a question of physical presence but also of examining the concrete benefits for the territory: creation of accessible jobs, ease of access for employees, or quality of dialogue with local stakeholders. Interviewees 4 and 5 brought this type of reflection forward, considering it a lever still largely underestimated in the evaluation of sustainable innovation. For them, the model would benefit from including a statement questioning how the company integrates into its territorial ecosystem, beyond the sole logic of production.

Finally, another recurring suggestion concerns business travel, already mentioned during the first wave by Interviewee 3 and raised again during the second by Interviewee 6. In a context where mobility-related emissions represent a significant share of the carbon footprint, several participants proposed adding a statement on the actions implemented to limit its impact: use of remote work, shared mobility, low-carbon vehicles, or travel optimisation. This feedback highlights the importance of assessing the company's logistical maturity from a sustainability perspective by integrating aspects related to the movement of people and goods.

5.2.4 Second model refinement

The insights gathered during the second wave of interviews led to a new series of adjustments to the self-assessment model. These refinements were based not only on the need to clarify certain formulations (as highlighted in section 5.2.1) or to adapt the tool to the diversity of organisational contexts (as seen in sections 5.2.2 and 5.2.3) but also on the broader ambition of enhancing the model's capacity to reflect the complexity of sustainable innovation in industrial B2B settings.

Several adjustments focused on terminology. Words or expressions that had previously caused confusion, such as "offering", "ease of use" or "under-addressed markets", were reformulated to better match the operational vocabulary used by professionals in the field. Particular attention was paid to ensure that each statement could be easily interpreted by users with varying levels of expertise in sustainability, while preserving conceptual rigour.

In parallel, new items were integrated into the B2B version of the tool to address previously missing dimensions. These additions emerged directly from the thematic areas outlined in section 5.2.3. For instance, new statements were added to assess internal sponsorship mechanisms, the presence of sustainability leadership, and the frequency of strategic monitoring at the executive level. Similarly, the company's relationship with its value chain was better captured through items focused on stakeholder engagement, extended value creation, and accountability mechanisms.

Other additions addressed client-side dynamics, such as market demand for sustainable solutions and the relevance of value propositions based on use or functional benefit. In terms of operational resources, new statements addressed the responsible sourcing of materials, the adoption of renewable energy, and site localisation strategies. The territorial dimension was also strengthened, with added emphasis on the company's impact on local ecosystems and the management of mobility-related emissions.

Due to the lack of sufficient data regarding B2C-specific challenges and expectations, it was ultimately decided to abandon the development of the B2C version of the model. Instead, the efforts were fully focused on refining the B2B version, for which complete and actionable feedback had been collected across all pillars. This strategic decision ensured that the final model would be both coherent and grounded in the empirical insights gathered throughout the research.

This second round of refinement sought to preserve the model's core structure while making it more comprehensive, sector-appropriate, and user-friendly. The revised version resulting from these enhancements served as the basis for the third and final wave of interviews, aimed at validating the model's operational relevance and its capacity to trigger strategic reflection in industrial contexts.

The final version of the self-assessment model, as it will be used for this third validation phase, is presented below.

1	Nos solutions sont conçues pour limiter leur impact environnemental à toutes les étapes, y compris lors de leur usage chez le client (ex : matières utilisées, consommation d'énergie, recyclabilité, durée de vie utile).	
2	Nos produits ou services apportent un bénéfice concret et durable à nos clients dans leur activité (ex : performance, sécurité, conformité, réduction des risques).	

3	Nos solutions sont accessibles à différents types de clients professionnels, y compris ceux ayant des contraintes économiques, techniques ou sectorielles spécifiques.	
4	Nous analysons l'impact environnemental de nos produits ou services sur l'ensemble de leur cycle de vie (conception, fabrication, usage, fin de vie).	
5	Certaines fonctionnalités de nos solutions ont été volontairement simplifiées pour en faciliter l'usage ou l'intégration dans des contextes professionnels variés.	
6	Nos innovations visent à répondre à des enjeux environnementaux ou sociaux concrets rencontrés par nos clients.	
7	Nous utilisons des ressources ou matériaux durables, renouvelables, recyclés ou recyclables pour la conception de nos produits/services.	
8	Nous vérifions l'origine responsable et éthique des matières premières ou composants utilisés (traçabilité, certifications, conditions sociales...).	

Figure 6: FINAL-Pillar 1

Source: Nicolas Dewandre (2025)

1	Nous adressons des clients ou segments généralement peu ciblés par notre secteur (ex : petites structures, collectivités, niches industrielles).	
2	Nous échangeons régulièrement avec nos clients pour comprendre leurs attentes en matière de durabilité	
3	Nous établissons avec nos clients professionnels une relation de transparence, de confiance mutuelle et de collaboration sur le long terme.	
4	Nous co-développons des projets ou des solutions durables avec certains clients ou partenaires clés.	
5	Nous accompagnons nos clients dans leur propre démarche de durabilité (ex : transmission de bonnes pratiques, outils, formations).	
6	Nous observons une demande croissante de nos clients en faveur de solutions durables	
7	La durabilité de nos offres a un impact positif ou croissant sur nos ventes ou sur l'attractivité de notre entreprise.	
8	Nous développons avec nos clients des projets qui apportent des bénéfices réciproques (ex : réduction conjointe des coûts, amélioration de la performance, innovation conjointe dans leur chaîne de valeur).	

Figure 7: FINAL-Pillar 2

Source: Nicolas Dewandre (2025)

1	Nous mettons en œuvre des actions concrètes pour réduire notre consommation d'énergie dans nos opérations (ex : équipements efficaces, éclairage, usage numérique raisonné)	
2	Nous avons adopté des pratiques visant à réduire les déchets produits par notre activité (ex : tri, réduction à la source, réutilisation, valorisation)	
3	Une personne ou une équipe est désignée comme responsable des sujets de durabilité au sein de l'entreprise	
4	Le sujet de la durabilité est abordé régulièrement en comité de direction	
5	Nos collaborateurs sont formés ou sensibilisés aux enjeux de durabilité en lien avec leur métier ou nos activités	
6	Nos managers sont activement impliqués dans la mise en œuvre des initiatives durables (ex : animation, reporting, intégration dans les objectifs d'équipe)	
7	Le top management soutient activement la démarche de durabilité (ex : communication interne, pilotage de projets, engagement personnel)	
8	Des moyens concrets (temps, budget, outils) sont spécifiquement alloués à la mise en œuvre des projets durables dans l'organisation	
9	Des indicateurs de performance durable sont utilisés dans le pilotage stratégique ou opérationnel (ex : suivi CO ₂ , consommation d'énergie, taux de déchets valorisés)	
10	Nous avons évalué l'impact environnemental de nos opérations internes (ex : bilan carbone, ACV, audit environnemental)	
11	Nous sensibilisons nos fournisseurs ou partenaires aux engagements durables	
12	Nous avons mis en place une évaluation structurée des pratiques durables de nos partenaires (ex : questionnaire, audits, grilles de sélection RSE)	

Figure 8: FINAL-Pillar 3

Source: Nicolas Dewandre (2025)

1	Nos sites de production ou de travail ont été choisis ou adaptés pour réduire notre empreinte carbone (ex : proximité client/fournisseur, limitation des transports)	
2	Nous avons mis en place des actions pour réduire l'impact environnemental de notre logistique ou de nos livraisons (ex : itinéraires optimisés, fournisseurs locaux, transport à faible émission)	
3	Nous collaborons avec nos fournisseurs ou partenaires logistiques pour réduire les impacts environnementaux associés à notre chaîne d'approvisionnement	
4	Nos bâtiments ou infrastructures intègrent des critères de performance environnementale (ex : isolation, matériaux durables, certification...)	
5	Nos infrastructures sont accessibles à toutes et tous, y compris aux personnes en situation de handicap.	

6	Nous utilisons ou développons des sources d'énergie renouvelable pour alimenter tout ou partie de nos opérations (ex : panneaux solaires, contrats d'électricité verte, cogénération durable)	
7	Nous mesurons ou analysons notre impact territorial, notamment en lien avec les écosystèmes locaux, les partenaires régionaux ou les effets indirects sociaux/environnementaux	
8	Nous prenons en compte les effets sociaux de notre implantation territoriale (ex : emploi local, accessibilité pour les collaborateurs, dialogue avec les parties prenantes locales)	
9	Nous cherchons à réduire les déplacements professionnels ou à limiter leur impact (ex : télétravail, mobilité partagée, véhicules bas carbone)	

Figure 9: FINAL-Pillar 4

Source: Nicolas Dewandre (2025)

5.3 Wave 3 – Final validation of the B2B model

5.3.1 Reformulation and clarification needs

Despite the adjustments already made after wave 2, the third series of interviews revealed several elements of the model that still raise questions, particularly in terms of formulation. As previously mentioned, the way statements are worded is never neutral: their clarity, scope, and tone directly influence how companies understand them and how they project their own practices onto the evaluation scale.

One of the issues raised concerns question 1 of pillar 1, which relates to the design or adaptation of production sites to reduce the carbon footprint. Interviewees 8 and 9 pointed out difficulties in understanding this statement, which was perceived as too broad because it combines site location, product design, usage, and end of life. Both recommended splitting this statement into two distinct questions: one addressing the impact of the product itself, the other its use and end-of-life phase. Interviewee 9, with his profile as a sustainability expert, added that some products are not designed to reduce impact but can nevertheless contribute to impact reduction during use. He also highlighted a potential avenue for enriching the question: the use of the rebound effect concept to better assess usage-related impacts.

The term “benefit” used in question 2 was also questioned. Interviewee 9 warned against a possible misinterpretation: a product or service can be “beneficial” to a client without necessarily having a positive impact on society or the environment. He proposed clarifying the meaning of this benefit, specifying that it should contribute to the common good, in order to avoid conflating private interest with societal value.

The notion of accessibility in question 3 was also challenged. Interviewees 8 and 9 highlighted its ambiguity: does it refer to economic, logistical, geographical, or social accessibility? Interviewee 9 suggested broadening the notion to include various audiences such as people with low education, with disabilities, or from marginalised sectors. A reformulation could clarify this openness without leaving room for interpretation.

Question 6, which addresses social and environmental issues, was perceived as too broad, notably by Interviewee 7. He noted that the social dimension is particularly difficult to assess, even for experienced professionals. He suggested including concrete examples, such as health, to facilitate understanding and evaluation. The need to clarify what is meant by “social” recurs frequently in the comments.

The formulation of question 1 of pillar 2, about client segments under-addressed by the sector, was also judged ambiguous by interviewees 7 and 8. The word “addressed” was perceived as vague: does it refer to a commercial policy, marketing targeting, or something else? Both interviewees converged toward a reformulation centred not on the preference given to certain segments but on a logic of inclusiveness. The question should therefore be reformulated to highlight the fact that certain clients are not excluded, even in small volumes, rather than suggesting that certain segments are prioritised. The idea is to focus the statement on inclusion and not on presumed favouritism.

Another relevant comment concerns question 1 of pillar 4, which relates to the location or adaptation of production sites with a view to reducing emissions. Interviewee 8 pointed out that the current wording, in the past tense, can be misleading. Indeed, many industrial facilities were built several decades ago, at a time when environmental criteria were not yet strategic priorities. According to him, the aim of the evaluation should not be to judge historical decisions but rather to understand how the company acts today and anticipates the future. He therefore recommends reformulating the statement in the present tense to better reflect current actions and future intentions regarding carbon footprint.

Questions 7 and 8 of pillar 4, which respectively address social and environmental territorial impacts, also drew comments and were perceived as difficult to understand. Interviewees 8 and 9 considered them too general and therefore open to favourable interpretations. Interviewee 9 recommended merging the formulations to refocus both questions on the generation of positive impacts on the territory while integrating concrete examples to guide the reading and avoid self-congratulatory responses.

Finally, several observations concerned the difficulty of assigning an accurate score on a scale from 1 to 5. Interviewee 8 noted that it is easy to rate oneself at the extremes but much harder to distinguish between levels 2, 3 or 4 without a precise framework. He also pointed out that it is difficult to provide an overall answer for a company with a diverse range of products, as the questionnaire is heavily based on a single product, which may skew the score in the case of multi-offer companies.

5.3.2 Thematic enrichment proposals

5.3.2.1 Environmental assessment

Several participants emphasised the importance of strengthening the environmental dimension of the model by structuring the evaluation steps more clearly.

Interviewee 8 thus suggested repositioning question 4 of pillar 1, which concerns the analysis of the environmental impact of products or services over their entire life cycle, at the very beginning of the pillar. In his view, this analysis constitutes an essential starting point: even before considering the use or integration of solutions, it is crucial to understand and measure the impacts generated from the design stage. This proposal aims to anchor the reflection in a logic of rigorous objectification, which then structures the entire sustainable reasoning.

Another suggested enhancement relates to the environmental labelling of products. Interviewee 7, from the construction sector, drew attention to the growing importance of certain labels such as Indoor Air Comfort Gold or Lean & Green, which are becoming standards sought after by professional clients. Including a specific statement on this topic would make it possible to highlight the efforts of companies engaged in certification processes while raising awareness among others about these emerging requirements.

Finally, as already mentioned in section 5.3.1, the issue of gradation on the 1 to 5 scale remains delicate, particularly in complex industrial contexts where environmental performance may vary greatly from one product or site to another. To address this, Interviewee 8 recommended accompanying the model with a self-assessment guide, offering concrete examples or benchmark criteria to help respondents better position themselves between intermediate levels (notably 2, 3, and 4). Such a measure would strengthen the consistency of responses and allow for a maturity assessment that is closer to the reality of companies.

5.3.2.2 Resources and responsible consumption

The issue of resource consumption, already partially addressed in the model, was the subject of more in-depth reflections during this third wave. Several participants highlighted the need to further structure this theme by integrating a more systemic logic and differentiated levels of maturity.

Interviewee 9, drawing on his expertise in sustainability, proposed explicitly introducing the ARC logic (Avoid, Reduce, Compensate) into the tool. According to him, any reflection on resource consumption should first question the possibility of avoiding such consumption. If this is not possible, efforts should then focus on reducing it and, as a last resort, on implementing compensation mechanisms. This hierarchical logic, often used in eco-design approaches, would allow for a more structured analysis of the company's choices and align the assessment with best practices in sustainable innovation.

Interviewee 7 provided a complementary perspective by emphasising the importance of end-of-life recovery. According to him, even if some activities inevitably generate waste, the key issue is to ensure that this waste can be recovered, rather than sent to landfill or incineration. He therefore suggested including a dedicated statement on the company's ability to limit ultimate waste, based on sorting, reuse, or value-added treatment practices.

On the topic of raw material traceability, Interviewee 8 nuanced the current approach of the model. In his company, control is not carried out at the level of each component but is based on a global evaluation of suppliers. The company ensures that they meet strict ethical and environmental criteria without necessarily tracing the exact origin of each material. This distinction suggests that the tool could incorporate differentiated levels of requirements, for example, by distinguishing between component-level control and a broader supplier-based evaluation.

Finally, Interviewee 9 proposed introducing an intermediate statement between questions 11 and 12 of pillar 3, to better capture responsible purchasing policies. The idea would be to assess whether the company has formalised specific commitments or procedures in its procurement relationships, going beyond simple awareness-raising but not yet reaching the level of a structured audit. Such a question would allow for a finer gradation of maturity in practices and encourage a progressive increase in expectations across the entire supply chain.

5.3.2.3 Objectives and strategic management

A clear consensus emerged across the three interviews of wave 3 regarding the need to strengthen the strategic dimension of sustainability management within the tool. All participants emphasised the importance of not limiting the model to the measurement of environmental impacts but rather going further by integrating the issue of concrete objectives set by the company.

Interviewee 8 particularly insisted on the difference between tracking indicators and setting ambitious targets. For him, a company that defines measurable goals (e.g., CO₂ emission reductions, improved waste recovery rates, etc.) and commits to achieving them demonstrates a higher level of maturity. He believes that a specific statement should be added to the model to verify whether such objectives exist, whether they are formalised, and to what extent they structure internal action plans.

This idea was also developed by Interviewee 7, who stressed that it is essential to know whether the organisation has actually imposed clear reduction targets on itself, rather than simply monitoring its impacts passively. According to him, this approach implies an investment, planning, and accountability logic that clearly distinguishes committed companies from those still in an exploratory phase.

Still within this management logic, Interviewee 8 mentioned a lever that is often underestimated: variable compensation. He explained that, in some companies, bonuses for executives or managers are partially indexed to the organisation's environmental results. For him, this is a strong signal of strategic alignment and deserves specific evaluation. Interviewee 9 shared this view and went even further by suggesting that the model should explore how managers are "objectivised" based on sustainability criteria. The integration of such objectives into individual or collective performance evaluations appears as an advanced indicator of managerial ownership of sustainability issues.

These various comments suggest enriching the model with statements that address not only the existence of environmental objectives but also their concrete implementation within management processes: governance, incentives, performance evaluations, and resource allocation.

5.3.2.4 Stimulating sustainable demand

Interviewee 9 critically challenged the evaluation logic underlying questions 6 and 7 of pillar 2. He argued that these statements, in their current form, tend to reward companies simply for responding to existing market demand, without distinguishing between reactive alignment and truly proactive sustainability efforts. In his view, such a logic may lead to overestimating the maturity of companies that act primarily out of economic opportunism, rather than genuine environmental or social commitment.

He advocated for a more discerning approach, suggesting that points should not be attributed solely because the market is already demanding sustainable solutions. Instead, the evaluation should explore whether the company goes beyond market expectations. In other words, it should assess whether the company takes steps to introduce sustainability offers or raise awareness among clients, even in the absence of explicit demand. This perspective highlights a more advanced level of maturity, where the firm does not merely respond to pressure but acts as a driver of change.

5.3.2.5 Shared value and territorial anchoring

A new expectation emerged during wave 3, namely the need to assess how companies contribute positively to their territorial context. The aim is no longer only to limit negative effects but rather to

measure the beneficial impact that an organisation can generate locally through its practices, partnerships, and commitments.

Interviewee 9 particularly emphasised the need to move beyond a purely defensive approach to the territory. According to him, becoming aware of one's territorial impact is a first step, but it must be accompanied by active engagement aimed at creating tangible positive effects. He mentioned several forms of positive contribution: involvement in local life, partnerships with universities, hosting interns, sponsorship or support for associations, corporate volunteering actions, etc.

For this CSR expert, these actions constitute powerful levers for sustainability. They strengthen local anchoring, build trust with the territory's stakeholders, and contribute to the emergence of collective transition dynamics.

5.3.2.6 Transparency and external communication

The issue of environmental transparency was also raised by Interviewee 8, particularly in the context of increasing regulatory requirements in terms of reporting. He thus suggested integrating a specific statement on the publication of key environmental performance indicators. Some companies, he specified, already make data such as CO₂ emissions or particulate pollution levels publicly available, for example via their website.

For this participant, this transparency approach deserves to be highlighted and assessed in the model. It reflects a concrete commitment to stakeholders and fully aligns with the expectations set by frameworks such as the CSRD directive, which strengthens non-financial reporting obligations. Measuring one's impacts is a first step; reporting on them openly and accessibly is another, equally essential, which reflects the organisation's maturity and responsibility.

5.3.3 Conclusion of wave 3

The third and final wave of interviews confirmed the relevance of the model's overall structure while identifying a series of final refinements necessary to ensure its full applicability and clarity within industrial B2B contexts. Several recurring themes emerged from the discussions, pointing to both persistent ambiguities in certain formulations and opportunities for structural enrichment.

First, the importance of precise and unambiguous wording was repeatedly emphasised. Participants called for clarification of terms such as "benefit", "accessibility" or "under-addressed markets", which can be interpreted in multiple ways depending on the respondent's background. These observations underline the need for clear definitions and, in some cases, supporting examples to ensure shared understanding.

Second, the interviews highlighted the necessity of better distinguishing environmental impacts across the product life cycle. Suggestions included reordering the environmental assessment questions and incorporating references to labels, standards, and end-of-life valorisation strategies. This more structured approach would support a more objective and comparable evaluation.

Third, a strong call was made to reinforce the strategic and managerial dimension of sustainability, notably through the assessment of concrete objectives, governance mechanisms, and the alignment of incentives (e.g., linking performance evaluations or bonuses to sustainability results). These additions would help move the model beyond declarative intentions toward effective implementation.

Fourth, participants insisted on integrating the concept of positive territorial contribution, shifting the focus from limiting harm to creating shared value. Concrete actions such as local partnerships, volunteering, or stakeholder engagement were mentioned as levers of impact that should be recognised in the model.

Furthermore, Interviewee 9 raised a fundamental question regarding the rationale behind questions 6 and 7 of pillar 2. He pointed out that companies should not be rewarded solely for responding to market demand for sustainability, as this may reflect opportunistic adaptation rather than genuine commitment. Instead, the model should aim to capture whether firms actively seek to influence or educate their clients, even in contexts where sustainability is not yet a dominant expectation.

Finally, the question of gradual scoring and interpretation guides was brought up again, particularly in relation to the 1–5 evaluation scale. Respondents expressed a need for better guidance to distinguish between intermediate levels and to account for complexity, especially in companies with diversified product portfolios.

5.4 Cross-cutting analysis

This section aims to analyse the cross-cutting findings that consistently emerged throughout the three waves of interviews conducted to validate and refine the self-assessment tool for sustainable innovation. Each wave involved industrial actors with diverse profiles, ensuring a variety of perspectives, sectors, and levels of maturity in terms of sustainability.

The objective here is to highlight the elements that were mentioned or supported in each of the three waves, thereby granting them particular legitimacy and relevance. Their recurrence reflects an implicit consensus among the respondents, despite the diversity of industrial contexts encountered.

These cross-cutting elements therefore represent key areas of attention, to which particular vigilance should be paid during the deployment and future improvement of the tool, due to the consistency with which they were raised.

5.4.1 Importance of LCA

LCA stands out as one of the few elements that elicited unanimous consensus across all three waves of interviews. Regardless of company size, industry sector, or the profile of the interviewees, this dimension was systematically mentioned as a central benchmark in any sustainable innovation approach.

This point was not only raised by sustainability experts or CSR managers, for whom LCA is considered a basic tool. It also emerged spontaneously and directly in conversations with industrial business leaders, who emphasised the efforts already undertaken to analyse, measure, or reduce the environmental footprint of their products throughout their life cycle. This recurrence, observed independently of the level of maturity in sustainability, reinforces the legitimacy of LCA as a structuring framework in the evaluation of sustainable innovation.

This observation makes it possible to affirm that LCA is not just one good practice among others but a fundamental methodological foundation, perceived as a concrete lever for environmental transformation. Its role is twofold: on the one hand, it allows the formalisation of actions undertaken and on the other hand, it structures the reflection upstream of any product or process innovation.

Therefore, its explicit integration into the self-assessment model is not an arbitrary choice but a methodological necessity, as this approach embodies a strong consensus on what it concretely means to “innovate sustainably” in an industrial context.

5.4.2 Structuring role of top management and internal processes

Another central element that consistently emerges across the three waves of interviews concerns the structuring role of top management as well as the importance of internal processes to support a dynamic of sustainable innovation. This finding runs not only through the content mentioned during the discussions but is also reflected in the very structure of the final tool.

From the first wave, interviewees 2 and 3 emphasised the importance of this pillar, stating that it is the only one that should remain identical in the B2B and B2C versions of the tool, given how fundamental its role is. For them, the involvement of the leadership and internal organisation constitutes the *sine qua non* condition for a credible transition toward sustainability.

Waves 2 and 3, more focused on content to be integrated, made it possible to specify and enrich this pillar by systematically stressing the importance of internal governance. Several levers were highlighted throughout the interviews: sustainability governance, mobilisation of resources (financial, human, temporal), the objective-setting of employees through performance indicators, and the formalisation of sustainable procedures.

Finally, the significantly higher number of questions in this pillar compared to the others also testifies to its strategic importance. This imbalance is not accidental it reflects the shared perception among all respondents of the centrality of this dimension in a sustainable innovation approach, but also its key role in evaluating the overall maturity of a company.

5.4.3 Value chain and shared value creation

Although this dimension was only briefly mentioned during the first wave, which can be explained by the very nature of this initial phase that focused more on the formulation and structure of the statements than on thematic enrichment, the issue of integrating the value chain and creating shared value strongly emerged during the second and third waves of interviews. Several participants, particularly those in roles related to strategy or sustainability, emphasised the importance of broadening the analysis to include all upstream and downstream stakeholders, including suppliers, distributors, and territorial partners.

During the second wave, interviewees 6 and 7 highlighted the need to explicitly assess sustainable impact within the supply chain in connection with the increasing requirements of European standards such as the ESRS. The third wave helped to reinforce this orientation, with in-depth contributions around the notion of shared value. Interviewee 9, a CSR expert, notably proposed a dual interpretation of this concept: on the one hand, internally, through mechanisms such as profit-sharing, organisational transparency, and employee engagement and on the other hand, externally, through territorial contributions, partnerships with local actors, and positive social impacts generated within the value chain.

While this theme did not occupy a central place during the first series of exchanges, it gradually asserted itself as a key strategic dimension in assessing sustainable maturity. It reflects a shift in expectations toward a more systemic approach to sustainable innovation, rooted in an ecosystem of interdependent actors. It therefore appears relevant to consider this orientation as a priority area for enhancing the model, ensuring that environmental and social impacts are addressed not only at the

level of the product or process but also at the level of the territory and the broader value chain in which the company operates.

5.4.4 Readability and accessibility of the tool

A recurring comment across all three waves of interviews concerns the readability of the tool and the need to ensure maximum accessibility, both in terms of vocabulary and structure. Whether in the first, second, or third wave, remarks consistently highlighted the need to clarify certain terms, specify the meaning of some statements, or avoid any ambiguity likely to lead to divergent interpretations.

Several concrete suggestions were made in this regard, such as adding an explanatory glossary, illustrating certain statements with concrete examples, or simplifying the language used in some questions. These adjustments aim to make the tool more inclusive, ensuring its appropriation both by experts and by users less familiar with sustainable development issues.

Accessibility therefore does not only refer to the ergonomics of the tool or its visual structure but also to its cognitive and terminological readability. It constitutes a key condition for ensuring the dissemination, adoption, and effectiveness of the model within companies, as well as a methodological requirement to guarantee the robustness of the data collected and the coherent interpretation of the results.

Taken together, these cross-cutting findings highlight the key levers that must be preserved, reinforced, or clarified to ensure the effective deployment of the self-assessment tool. The consistency of these insights across all three waves of interviews gives them particular analytical weight: they reflect not only areas of consensus but also strategic pillars around which future refinements and dissemination efforts should be structured. As such, they form the foundation for both the short-term adjustments and the long-term evolution of the model.

6. Discussion

This chapter aims to put into perspective the results obtained during the validation phase of the self-assessment model. It analyses the main empirical findings from the interviews conducted with B2B industrial companies by confronting them with the established theoretical framework. It then offers a methodological reflection on the testing process, formulates several concrete recommendations for improved use of the tool, identifies the main limitations of the study, and finally suggests future research avenues to refine and extend the model.

6.1 Empirical insights

The validation phase of the self-assessment model, conducted with several B2B industrial companies, made it possible to confront the theoretical structure of the tool with field realities. Far from being limited to a simple verification of comprehension, this experimentation revealed valuable insights into how companies perceive, structure, and manage sustainable innovation. The results highlighted both recurrent dynamics, limitations in appropriation and unexpected reflexive effects.

6.1.1 Dimension Bias

The interview analysis reveals that the self-assessment tool, although generally well received, highlighted a partial understanding of some of the dimensions it covers. In particular, the environmental dimensions were by far the most frequently mobilised by respondents, with concrete, detailed, and easily illustrated answers. In contrast, the social dimensions were less frequently addressed and less developed during the discussions.

This imbalance does not reflect a structural flaw in the model itself, but rather a reception bias linked to dominant representations of sustainability in the B2B industrial sector. Several respondents, even those aware of CSR issues, held positions focused primarily on environmental impact. Others, more strategic and without specific expertise, spontaneously associated “sustainability” with “ecology”, thereby reducing the systemic scope of the proposed evaluation. This tendency aligns with the definition of eco-innovation proposed by Carrillo-Hermosilla et al. (2010), which emphasises environmental performance without necessarily integrating social or economic considerations. This empirical observation confirms the relevance of the conceptual distinction drawn in the literature review between eco-innovation and sustainable innovation and reinforces the need to clarify these concepts when developing diagnostic tools.

This partial reception raises two issues for the model. First, the readability of certain terms, which may appear too technical or too broad without additional support. Second, the maturity of companies on certain dimensions, which limits their ability to position themselves on items they have never explicitly considered as part of their innovation strategy. This difficulty resonates with what was identified in the literature concerning the evaluation of social innovation, which is often qualitative, self-reported, and lacks standardised metrics and thus making it less visible in both academic and policy frameworks (Krasnopolskaya & Korneeva, 2020).

To prevent the model from becoming a barrier to use, adjustments must be considered: simplification or reformulation of certain items, addition of a glossary, or even the introduction of illustrated examples to make the concepts more accessible.

6.1.2 Client-driven logic

A second major insight from the validation phase concerns the way B2B industrial companies approach sustainability: primarily in response to their clients' expectations. The interviews revealed that, for the majority of respondents, sustainable innovation efforts are triggered by explicit or implicit demands from their contracting parties, whether these be large corporations, public procurement markets, or requirements linked to calls for tenders.

This dynamic, acknowledged as such by the participants, fits within a pragmatic commercial logic where the priority remains satisfying client demand. In this context, sustainable innovation is often perceived more as a compliance criterion than as an autonomous strategic lever. The company acts “upon request” rarely through anticipation or its own conviction.

This pattern echoes the distinction highlighted in the literature between SOI and SRI. While SOI is based on a proactive integration of sustainability into the firm's innovation strategy, SRI refers to innovations that deliver positive environmental or social outcomes incidentally or reactively, without being initially designed with sustainability in mind (Wagner, 2010). The observed client-driven logic places the interviewed companies closer to the SRI profile, where sustainability is more a response to market pressures than a core strategic commitment.

This orientation is also consistent with the concept of weak sustainability as described by Soysa (2022), where economic growth and environmental protection are seen as compatible through technological efficiency and incremental improvements. The interviews reveal that many companies adopt this pragmatic stance, addressing sustainability through targeted actions and often driven by client requirements rather than through a systemic transformation of their innovation logic.

Moreover, the findings support Gehringer and Kowalski's (2024) observation that many sustainability efforts use a mix of both paradigms, depending on the sector, resource, and societal priorities. In practice, the companies interviewed do not reject sustainability, but they tend to integrate it selectively and often privileging environmental aspects (e.g., energy efficiency, CO₂) over deeper social or systemic change. This confirms that most approaches remain hybrid, with a strong leaning toward weak sustainability, especially in B2B industrial contexts.

It is precisely within this configuration that the self-assessment tool takes on its full meaning: it acts as a trigger for endogenous reflection. By asking questions that are independent of client requirements, the model prompts companies to position themselves on dimensions they would not have spontaneously explored. It thus enables them to temporarily “detach” from the client-driven logic to reflect on what, internally, could form the basis of their own sustainable innovation strategy.

This ability to generate new lines of questioning was particularly emphasised by Interviewee 9, an independent CSR consultant. Thanks to his external position, he adopts a perspective that is less centred on commercial constraints and believes that a tool like the one developed here could help rebalance the current dynamic, by opening up a more “society-driven” perspective, rather than one strictly “client-driven”. While this shift remains to be confirmed on a larger sample, it nonetheless highlights a critical function of the model: that of prompting a strategic reappropriation of sustainability issues, beyond the pressures exerted by the market.

6.1.3 Process-oriented innovation

A third clear finding emerges from the testing phase: the sustainable innovation mentioned by the industrial companies interviewed relates primarily to internal processes, far more than to the products

themselves. The respondents mostly referred to actions such as energy optimisation, waste reduction, or the rationalisation of travel. These initiatives, although essential, fall under a logic of continuous improvement rather than a transformation of the offering.

This focus on internal optimisation aligns closely with the concept of process innovation, as defined in the Oslo Manual (OECD & European Union, 2019), which refers to improvements in the methods of production or delivery rather than changes to the product itself. Although such initiatives are valuable, they often reflect incremental adjustments rather than radical shifts. In this sense, the results confirm the operational predominance of process-driven innovation within industrial B2B settings, possibly due to lower associated risks and faster returns on investment.

However, this emphasis on process innovation, while understandable from a pragmatic standpoint, also reflects a limited conception of sustainable innovation. As highlighted in section 2.3.4, sustainable innovation is expected to go beyond isolated improvements and embrace more systemic transformations that integrate environmental and social objectives into the core of business models (Adams et al., 2016; Afeltra et al., 2022). In this regard, the observed focus on internal efficiency rather than on redesigning products or rethinking value propositions may signal a form of constrained innovation, where sustainability remains peripheral rather than strategic.

Finally, although this was not explicitly formulated by the respondents, a more critical reading invites us to question the risk of “peripheral greening” when the company acts on the margins, improves its operations, but does not question the core logic of its activity. From this perspective, the model could, over time, integrate a more strategic level of analysis, encouraging companies to reflect not only on the efficiency of their processes but also on the meaning, social value, and overall impact of their offering.

6.1.4 Strategic reflexivity

The previous findings highlighted several limitations in the way industrial companies currently approach sustainable innovation: a still partial appropriation of social and territorial dimensions (6.1.1), a dynamic largely dictated by client expectations (6.1.2), and a focus on internal processes at the expense of a broader transformation of the offering (6.1.3). It is precisely within this context that the self-assessment tool reveals an unexpected but essential function, that of a trigger for strategic reflection.

Respondents from smaller-sized structures, holding positions with strategic responsibility, spontaneously indicated that the exercise of positioning themselves on the various statements led them to question dimensions they had never previously formalised, or had only touched upon in a diffuse manner. This reflective dynamic, sometimes described as a “useful moment of perspective”, translated into the identification of internal observations, the highlighting of unclear responsibility areas, and the recognition of gaps in the structuring of certain practices.

This reflective potential goes beyond the scope of simple evaluation. Interviewee 4 even suggested that the model could be used as a support for collective discussion, bringing together CSR, management, production, and quality functions. This resonates with the perspective developed by Edwards-Schachter (2018), who highlights that innovation is increasingly shaped by collaborative, cross-sectoral, and learning-based processes. In particular, sustainable innovation requires deep transformations in organisational routines, governance, and culture. In this sense, the tool’s capacity to trigger strategic dialogue across departments contributes to creating the organisational conditions necessary for sustainable innovation to emerge and mature.

Ultimately, one of the model's deepest contributions may lie less in its measuring capacity than in its ability to structure strategic dialogue. By helping companies articulate often diffuse practices and discuss them collectively, the model contributes to the emergence of shared governance in sustainable innovation, in contexts where responses to external pressures still largely prevail.

6.1.5 Readability and neutrality of language

A final insight from the testing phase concerns the formulation of the statements and their reception by users. Although the tool was designed to be self-administered, without the need for external expertise, the respondents' feedback confirms that this objective has been substantially met. Indeed, the instructions were considered clear, and the overall logic of the model intuitive even for diverse profiles, including those not specialised in sustainability.

However, several participants emphasised the need to reformulate certain statements whose vocabulary was perceived as too technical, too abstract, or too open to interpretation. Expressions such as "territorial value creation", "social impact in the value chain", or "ease of use" prompted requests for clarification. These comments do not call into question the structure of the model but reveal a central issue inherent to any self-administered tool the importance of the neutrality of language.

In a system where the user must position themselves without guidance, every word matters. A vague or biased formulation can lead to divergent interpretations depending on the user's function, sector, or maturity level. This semantic variability constitutes a potential point of weakness, especially if the model is intended for broad adoption across organisations with heterogeneous profiles.

Therefore, the need for reformulation expressed by respondents goes beyond a simple readability issue. It highlights a true challenge of universality. For the tool to be used reliably and comparably, regardless of the size, sector, or profile of the user, the words must be chosen with precision, formulated in a neutral manner, and remain perfectly clear.

6.2 Methodological reflection

The validation phase of the model was built around a three-wave scheme, designed from the outset to allow for a comparative and evolving analysis. While the general organisation into waves had been anticipated, the exact order of the interviewees was not defined a priori. However, this sequencing turned out, in hindsight, to be particularly fruitful in supporting the progressive improvement of the model.

The first wave, composed of two CEOs and a CSR expert, primarily made it possible to identify issues related to formulation and differences in relevance between B2B and B2C contexts. The second wave, more diverse with a CEO, a CSR expert, and an innovation manager, allowed for a deeper exploration of key themes related to the offering, the value chain, and management practices. Finally, the third wave, composed exclusively of CSR experts with a strategic perspective, generated particularly refined feedback, going beyond structural aspects to offer a critical rereading of the model and its potential applications.

Thus, although unintentional, the order of the interviews produced a kind of gradual deepening in the depth and precision of the feedback. It facilitated an iterative dynamic in three stages: validation of the structure, substantive adjustments, and strategic consolidation. One can reasonably think that if

less expert profiles had been involved at the end of the process, the richness of the contributions would have been lower, which reinforces the empirical relevance of this sequence.

6.3 Recommendations

Based on the empirical insights from the testing phase, several recommendations can be formulated to optimise the use of the self-assessment model within B2B industrial companies.

The first and most central recommendation concerns the use of the model as a trigger for strategic reflection. Several companies emphasised that the tool had enabled them to formalise intuitions, question grey areas, or identify untapped levers for action (see 6.1.4). It is therefore advised not to use the model as a simple evaluation grid but to integrate it into key moments of the strategic cycle, like annual reviews, CSR objective assessments, team discussions, or the launch of innovation projects. This positioning gives full meaning to the model as a support for analysis, projection, and structuring of sustainability approaches.

Secondly, it appears essential to encourage collective and cross-functional completion of the tool across several departments within the company. The perception gaps observed between management, engineering, and CSR profiles (see 6.1.5) show that the tool can act as a revealer of internal divergences. Shared use helps to break down silos, build a common vision, and initiate a transversal strategic dialogue around sustainable innovation practices.

Thirdly, it is recommended to adopt a contextualised and reflective posture when using the tool. Rather than seeking a standardised evaluation, companies would benefit from documenting their answers with concrete examples directly drawn from their operational reality. This posture not only allows for a more accurate positioning but also sheds light on diffuse, informal, or under-recognised practices that nevertheless represent important levers for sustainable innovation.

Finally, it is recommended to consider the model as a monitoring tool over time, by repeating the exercise at regular intervals, for example, every 12 or 18 months. This recurring use would allow companies to track the evolution of their practices, objectify their progress, and feed a dynamic of continuous improvement.

6.4 Limitations

As with any exploratory approach, this study presents several empirical limitations that deserve to be acknowledged.

The first concerns the geographical and sectoral scope of the validation phase. The tests were carried out exclusively with B2B industrial companies, mostly located in the Walloon region. This geographical concentration likely influenced the nature of the feedback received, due to similar economic constraints, public policies, and regulatory frameworks among the companies interviewed. Since the model aims to be accessible to a wide range of organisations, its relevance remains to be confirmed in other national or institutional contexts, where dynamics of sustainable innovation, organisational cultures, or strategic priorities may differ significantly.

Furthermore, the sample did not include any B2C companies. The tested model was applied exclusively in a B2B industrial context, which limits its transferability to sectors more oriented toward end

consumers. However, the logics of innovation, stakeholder expectations, and modes of sustainable value creation can vary greatly between these two environments. This absence therefore constitutes a significant restriction regarding the general applicability of the developed model.

Another limitation concerns the very conditions in which the questionnaire was administered. Although the tool was designed to be used autonomously, all the tests were conducted in the form of semi-structured interviews. The presence of the interviewer, able to provide clarifications or reformulate certain statements, likely made the exercise easier for participants. In a real self-assessment situation, without support, some formulations could nevertheless lead to misunderstandings or divergent interpretations, especially in companies less familiar with sustainability issues.

The scoring system integrated into the model could also not be thoroughly evaluated. Although several participants completed the self-positioning and all reacted to the different statements, the specific feedback regarding the relevance of the scale, the clarity of maturity levels, or the strategic usefulness of the overall score remained very limited. In the absence of detailed comments, it was therefore not possible to empirically validate the robustness, readability, or operational value of this evaluation system.

Logistical constraints, including limited time during certain interviews, may also have affected the quality of the responses. This lack of availability or scheduling flexibility potentially limited the depth of some reflections, or even introduced bias by encouraging participants to provide quicker or partial responses.

Finally, this study is situated within a one-off timeframe. The self-assessment model was tested at a given moment, without longitudinal follow-up. It was therefore not possible to observe the evolution of sustainable innovation practices over time, nor to evaluate the actual ability of the tool to support a learning dynamic, transformation process, or strategic management over the medium or long term.

6.5 Future research

First of all, a sectoral and geographical extension constitutes a necessary next step. The model was designed to be adaptable to a wide range of organisations but it has so far only been tested with B2B industrial companies located mainly in Wallonia. It would therefore be relevant to apply it to B2C companies, where the logics of innovation, stakeholder expectations, and channels of value creation differ significantly. Likewise, its transposition to other European geographical contexts would make it possible to better understand the influence of regulatory frameworks, public incentives, or organisational cultures on the reception and use of the model.

A second priority concerns the validation of the scoring system. While the self-positioning framework based on maturity levels was well understood and generally appreciated, very little feedback was given on the relevance or clarity of the proposed thresholds. Additional quantitative testing, conducted on a larger sample of companies, would make it possible to evaluate the internal consistency of the system, its discriminating power, as well as its added value in supporting progress-oriented approaches.

Thirdly, longitudinal studies would be useful to assess the transformational potential of the model. At present, the tool has been used as a one-time diagnostic mechanism. However, its ambition goes beyond this sole function: it also aims to structure a learning dynamic and strategic reflection.

Evaluating it in a follow-up logic would make it possible to verify its ability to support progress trajectories, to break down internal silos, or to bring out new sustainable initiatives within companies.

Finally, research could further explore certain dimensions that were still underdeveloped in this first version of the model. In particular, the social dimension of innovation was often perceived as vague and difficult to measure by respondents, which suggests the need to enrich this part. Furthermore, the integration of the notion of "rebound effect", proposed by Interviewee 9, could strengthen the rigour of the model by encouraging companies to assess not only their intentions or efforts but also the indirect or counterproductive effects of their initiatives.

7. Conclusion

The objective of this research was to respond to a dual need identified both in the literature and in the field. On the one hand, there is a lack of a self-assessment tool specifically designed to evaluate sustainable innovation, particularly for SMEs operating in industrial contexts. On the other hand, there is a need to make such tools accessible, understandable, and strategically useful for companies themselves. Existing models most often offer partial or purely theoretical approaches. The study undertaken therefore aimed to build a tool that integrates a structural reading of innovation, a consideration of its environmental, social, and economic impacts, and an evaluation of the organisational maturity level. The whole model had to remain understandable and usable, regardless of the type of organisation or the profile of the users.

Starting from the observation that industrial companies still lack clear frameworks to structure, objectify, and manage their sustainable innovation approaches, this research set out to develop a tool that is both conceptually rigorous and practically relevant. The final goal was to offer companies a way to better position themselves, identify their transformation levers, and initiate a self-driven process of sustainable innovation improvement.

To achieve this ambition, the work unfolded in several stages, combining theoretical construction and empirical validation. The first phase consisted of an in-depth literature review drawing from the field of sustainable innovation. This analysis helped clarify the main concepts and identify relevant existing models, particularly in terms of organisational maturity, frugal innovation, and integrated assessment. Three axes emerged as the foundation of the developed model: the strategic configuration of innovation, inspired by the Innovation Radar, the evaluation of the systemic impact of innovations, incorporating the three ESG dimensions and the analysis of organisational maturity, based on the Eco-Mi model.

Based on this, a structured self-assessment tool was developed. It relies on four interconnected pillars corresponding to the main dimensions proposed by the Innovation Radar: offerings, customers and markets, internal processes, and territorial access. Each pillar is broken down into a series of closed questions designed to assess sustainable innovation practices through the ESG lens. Designed to be self-administered, the tool aims to be accessible to a variety of profiles while fostering a transversal and educational understanding of sustainable innovation dynamics.

The second phase of the research focused on the empirical validation of the tool. It was conducted through a qualitative survey with eight B2B industrial companies, enriched by written feedback and an interview with an independent expert in corporate responsibility. The survey was structured into three successive waves, each corresponding to a revised version of the model. This iterative approach made it possible to test the clarity and relevance of the tool, to identify appropriation limits, and to generate concrete improvement pathways based on field feedback.

The analysis of the data from this validation revealed several key findings. The tool is perceived as a useful trigger for strategic reflection, capable of structuring sustainable innovation approaches and highlighting underexplored levers. It appears that environmental dimensions are better integrated by the interviewed companies, whereas social dimensions are often perceived as more complex or abstract. The model also helps to move beyond a strictly client-driven approach to sustainability. It encourages organisations to reflect on their own logic of action, independently of external demands. Finally, although the tool is considered relevant and intuitive, it still requires some semantic clarifications, as well as finer adaptation to different sectoral contexts.

This research makes contributions on both academic and managerial levels. From a theoretical perspective, it helps fill a gap identified in the literature by proposing a sustainable innovation assessment tool specifically designed for autonomous use in industrial settings. By combining a structure inspired by the Innovation Radar, an ESG impact assessment, and a maturity logic drawn from the Eco-Mi model, the tool offers an integrated, systemic, and evolving view of sustainable innovation. On a practical level, the feedback collected shows that the tool goes beyond simple assessment. It also serves as a support for strategic reflection, capable of revealing blind spots, fostering cross-functional dialogue, and encouraging a continuous improvement process. Its ease of use, combined with the richness of the topics addressed, makes it a promising lever to support companies toward more responsible innovation.

Like any exploratory approach, this work presents certain limitations. The sample used remains deliberately limited and sectorally homogeneous, consisting exclusively of B2B industrial companies mostly located in Wallonia. This territorial consistency allowed for in-depth analysis but limits the transferability of the model to other contexts, notably B2C companies or those operating in different institutional environments. Furthermore, the presence of the researcher during the interviews may have influenced the understanding or interpretation of certain elements. Finally, although the scoring system was well received, its capacity to be used strategically or discriminatively could not be tested in depth.

Beyond these limitations, several avenues open up. It would be relevant to test the B2C version of the model as well as its applicability in other geographical contexts. A longitudinal evaluation would also make it possible to observe whether the model supports a lasting learning and transformation dynamic. Finally, certain dimensions such as social innovation deserve to be further developed, as do complex notions such as the rebound effect, mentioned by one of the interviewed experts.

Thus, the approach undertaken contributes both to the advancement of scientific knowledge on sustainable innovation assessment and to the provision of an operational tool for industrial companies in transition. It constitutes a first step towards better structuring, empowerment, and enhancement of sustainable innovation practices in a rapidly changing environment.

Appendices

1) B2B Model

1. Nos solutions sont conçues pour limiter leur impact environnemental chez nos clients (matières, énergie, recyclabilité).
2. Nous proposons des offres adaptées aux contraintes économiques de nos clients (ex : PME, collectivités).
3. Nous privilégions des solutions simples, efficace et peu couteuse
4. Nos produits ou services réduisent l'impact environnemental sur leur cycle de vie chez nos clients.
5. Nos innovations permettent de répondre à des enjeux sociaux ou environnementaux chez nos clients.
6. Nous prenons en compte l'impact environnemental sur tout le cycle de vie de nos solutions.
7. Nous avons simplifié certaines fonctionnalités pour faciliter l'intégration et l'usage de nos solutions.

Appendice 1: Pillar 1 – B2B Model

1. Nous travaillons avec des organisations ou marché peu adressé (coopératives, associations, collectivités,...)
2. Nos offres sont conçues pour être simples à comprendre et à utiliser pour tous nos clients.
3. Nous intégrons les retours de nos clients pour améliorer nos produits ou services sur le plan social/environnemental.
4. Nous informons ou accompagnons nos clients vers des pratiques plus durables (étiquettes, conseils, formation...).
5. Nos solutions répondent à des besoins clés pour le fonctionnement ou la transition de nos clients.
6. Nos relations clients sont basées sur la transparence, la confiance et des valeurs partagées.
7. Nous évaluons l'impact social ou environnemental généré chez nos clients (accessibilité, économie d'énergie...).

Appendice 2: Pillar 2 – B2B Model

1. Nos processus intègrent des mécanismes de réutilisation ou de recyclage.
2. Nous avons optimisé certains processus pour réduire l’empreinte écologique (énergie, papier, déchets).
3. La durabilité est prise en compte dans les décisions stratégiques de la gouvernance.
4. Les collaborateurs sont formés aux enjeux de durabilité.
5. Des indicateurs de durabilité sont intégrés au pilotage de la performance.
6. Les équipes sont encouragées à proposer des initiatives durables
7. Nous avons évalué l’impact environnemental de nos opérations internes.

Appendice 3: Pillar 3 – B2B Model

1. Nous essayons de limiter l’impact environnemental de nos livraisons ou déplacements
2. Nos infrastructures sont accessibles à toutes et tous, y compris aux personnes en situation de handicap.
3. Nous prenons en compte les inégalités territoriales dans le déploiement de nos offres.
4. Nous travaillons avec nos fournisseurs ou sous-traitants pour réduire leur impact.

Appendice 4: Pillar 4 – B2B Model

2) B2C Model

1. Nos produits sont conçus pour réduire leur impact sur l’environnement (matières, énergie, recyclage).
2. Nous avons des produits accessibles pour les personnes à faibles revenus ou en situation de fragilité.
3. Nous privilégions des solutions simples, efficace et peu couteuse
4. Nos produits ou services réduisent l’impact environnemental sur leur cycle de vie chez nos clients.
5. Nos produits visent à répondre à des besoins essentiels et non satisfaits
6. Nos produits sont utilisables facilement par tous, y compris les personnes en situation de handicap.

7. Nous prenons en compte l'impact environnemental sur tout le cycle de vie de nos solutions.

8. Nous avons simplifié certaines fonctionnalités pour faciliter l'intégration et l'usage de nos solutions.

Appendice 5: Pillar 1 – B2C Model

1. Nous développons des offres pour des publics souvent négligés (zones rurales, publics précaires...).

2. Nos offres sont conçues pour être simples à comprendre et à utiliser pour tous nos clients.

3. Nous intégrons les retours de nos clients pour améliorer nos produits ou services sur le plan social/environnemental.

4. Nous informons ou accompagnons nos clients vers des pratiques plus durables (étiquettes, conseils, formation...).

5. Nos produits répondent à des besoins importants de la vie quotidienne (santé, alimentation, énergie...).

6. Nos relations clients sont basées sur la transparence, la confiance et des valeurs partagées.

7. Nous évaluons l'impact social ou environnemental généré chez nos clients (accessibilité, économie d'énergie...).

Appendice 6: Pillar 2 – B2C Model

1. Nos processus intègrent des mécanismes de réutilisation ou de recyclage.

2. Nous avons optimisé certains processus pour réduire l'empreinte écologique (énergie, papier, déchets).

3. La durabilité est prise en compte dans les décisions stratégiques de la gouvernance.

4. Les collaborateurs sont formés aux enjeux de durabilité.

5. Des indicateurs de durabilité sont intégrés au pilotage de la performance.

6. Les équipes sont encouragées à proposer des initiatives durables

7. Nous avons évalué l'impact environnemental de nos opérations internes.

Appendice 7: Pillar 3 – B2C Model

1. Nos offres sont disponibles dans des zones rurales ou mal desservies.
2. Nous essayons de limiter l'impact environnemental de nos livraisons ou déplacements
3. Nos points de vente ou d'accueil sont accessibles à toutes et tous, y compris aux personnes en situation de handicap.
4. Nous prenons en compte les inégalités territoriales dans le déploiement de nos offres.
5. Nous travaillons avec nos fournisseurs ou sous-traitants pour réduire leur impact.

Appendice 8: Pillar 4 – B2C Model

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EXECUTIVE SUMMARY

This thesis develops a self-assessment model designed to support industrial companies in evaluating and enhancing their sustainable innovation practices. While sustainability is increasingly recognised as a strategic priority, many firms still lack accessible and structured tools to assess how their innovation efforts contribute to environmental, social, and economic objectives in an integrated way.

The model introduced in this research is built around four strategic pillars, each encompassing key sustainability dimensions. It adopts a maturity-based approach, enabling organisations to situate their current practices, identify gaps, and define actionable trajectories for improvement.

The tool was empirically validated and iteratively refined through three waves of qualitative interviews, involving eight representatives from industrial companies and one sustainability expert. This process led to progressive enhancements in clarity, applicability, and conceptual scope, including the integration of governance, value chain, and territorial impact considerations to better reflect industrial realities and strategic priorities.

The findings highlight the role of self-assessment not only as a diagnostic mechanism, but also as a lever for cross-functional dialogue, strategic alignment, and organisational learning. They further underscore the demand for models that combine conceptual rigour with practical usability, particularly within SMEs that often lack dedicated sustainability resources.

By bridging theoretical foundations with empirical insights, this thesis contributes to the literature on sustainable innovation and organisational assessment. It offers a tested and adaptable framework that enables industrial firms to embed sustainability into their innovation strategies in a structured, reflexive, and continuous manner. It also provides a foundation for future applications, including sectoral adaptations, comparative benchmarking, and longitudinal evaluation.

KEYWORDS: sustainable innovation, sustainable innovation assessment, self-diagnostic audit tool, sustainable innovation maturity model

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