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**Motivations and Barriers for Using
Technologies to Enhance Social and
Environmental Accountability**

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Abstract

With corporate sustainability facing stricter regulatory standards, such as the Corporate Sustainability Reporting Directive (CSRD), technologies have become a key driver in ESG reporting and environmental accountability. However, there is a wide variation in the adoption rate of technologies among corporations. This thesis aims to explore the underlying drivers and inhibitors in the adoption of different technologies in corporate social and environmental responsibility in the energy sector.

This thesis adopted a mixed-methods case to study the research design on a global leader in power technologies. Triangulation of data from semi-structured in-depth interviews with key informants, an employee survey, and their Sustainability Report of 2025 found a significant “implementation gap” in digital technologies adoption in corporate sustainability, characterized by a distinct “strategic and operational” divide.

The study found that the underlying driver of digital technologies adoption in corporate sustainability among strategic leadership in headquarters is motivated by reporting efficiency to deal with high administrative burdens. Their main obstacles are internal in-house (e.g., dealing with lack of cohesive governance and poor data quality). On the other hand, operational leadership in factories and R&D centers are motivated by institutional pressures and market competitiveness. And their main barriers are external in nature (e.g., dealing with high costs in the market).

This thesis found that simply acquiring sophisticated software is not enough to achieve a sustainable future. To fully integrate technologies in corporate sustainability, there is a need to bridge the gap between strategic intent and operational reality.

Abstract (in Italian)

Poiché la sostenibilità aziendale si trova a dover rispettare standard normativi sempre più severi, come la Direttiva relativa alla rendicontazione societaria di sostenibilità (CSRD), le tecnologie sono diventate un elemento trainante per la rendicontazione ESG e la responsabilità ambientale. Tuttavia, vi è un'ampia variazione nel tasso di adozione delle tecnologie tra le aziende. Questa tesi mira a esplorare i fattori trainanti e gli ostacoli di fondo nell'adozione di diverse tecnologie per la responsabilità sociale e ambientale d'impresa nel settore energetico. Questa tesi ha adottato un disegno di ricerca basato su uno studio di caso con metodi misti, focalizzato su un leader globale nelle tecnologie per l'energia. La triangolazione dei dati derivanti da interviste in profondità semi-strutturate con informatori chiave, un questionario rivolto ai dipendenti e il Bilancio di Sostenibilità 2025 ha rivelato un significativo "gap di implementazione" nell'adozione delle tecnologie digitali per la sostenibilità aziendale, caratterizzato da un netto divario tra livello "strategico" e "operativo". Lo studio ha rilevato che il principale fattore trainante per l'adozione delle tecnologie digitali nella sostenibilità aziendale da parte della leadership strategica presso la sede centrale è la ricerca di efficienza nella rendicontazione, al fine di gestire gli onerosi carichi amministrativi. I loro ostacoli principali sono di natura interna (ad esempio, affrontare la mancanza di una governance coesa e la scarsa qualità dei dati). D'altra parte, la leadership operativa negli stabilimenti e nei centri di ricerca e sviluppo (R&D) è motivata dalle pressioni istituzionali e dalla competitività di mercato. Le loro barriere principali, invece, sono di natura esterna (ad esempio, far fronte agli alti costi di mercato). Questa tesi conclude che la semplice acquisizione di software sofisticati non è sufficiente per raggiungere un futuro sostenibile. Per integrare pienamente le tecnologie nella sostenibilità aziendale, è necessario colmare il divario tra l'intento strategico e la realtà operativa.

Chapter 1: Introduction

1.1 Background of study

Over the past few years, the increasing focus on corporate responsibility has prompted organizations to reconsider their approach to social and environmental issues. Seeing now that stakeholders are increasingly demanding transparency and ethical practices, companies are always looking for innovative ways to reflect responsibility (**Frontiers, 2020**). Moreover, Technology has become a key driver and crucial factor in this shift, making it more practical and convenient to track, report, analyze, and, more importantly, improve the practices related to sustainability and social responsibility (**Crowther & Seifi, 2020**).

Digital platforms, data analytics, and automation are more and more integrated into companies' management systems to improve their ability to satisfy regulatory requirements and interact with their stakeholders in the meantime (**Crowther & Seifi, 2020**). However, the adoption of these technologies also raises challenges and difficulties. Organizational barriers, budgetary constraints and technical complications can slow down their implementation, particularly in sectors where traditional classic systems are still widely used (**Mutua et al, 2025**).

Furthermore, recent regulatory developments, in particular the Corporate Sustainability Reporting Directive (CSRD) and the European Sustainability Reporting Standards (ESRS), impose increased obligations on European companies regarding non-financial reporting. These standards require a high level of roughness in social and environmental data, which pushes organizations to invest in digital systems that ensure the traceability and reliability of information (**EU Directive 2022/2464; EFRAG, 2023**). This dynamic goes beyond just compliance; it shapes the entire strategy of modern companies. Today, businesses need to show they

are genuinely committed to sustainability if they want to remain legitimate and competitive (Hart, 1995; Freeman, 1984).

This study sets out to uncover both the motivations, and the obstacles companies face when using technology to advance social and environmental responsibility. To do this, we focus on a global player in the energy solutions sector. This company provides a compelling example for exploring how technological innovation can drive sustainability goals. By examining this case, we hope to understand better the factors that influence how and why technology is adopted in the energy industry.

1.2 Research problematic

Digital technologies offer exciting new ways to boost corporate transparency and accountability. However, not every company has embraced them equally when it comes to social and environmental responsibility. At the same time, some organizations are making real progress in integrating technological solutions and meeting stakeholder expectations and regulations. Others, however, are encountering obstacles and barriers that are holding back this transition. (Davis, 1989; Venkatesh et al, 2003).

Institutional pressures also play a major role. According to Di Maggio and Powell (1983), companies evolve in environments where mechanisms of institutional isomorphism forced regulations), mimetic (imitation of sectoral leaders), and normative (professional standards) homogenize practices. These forces explain why the adoption of ESG reporting technologies is becoming an almost unavoidable practice in certain sectors.

The central problematic of this research is two-sided: what motivates a company to adopt technologies to strengthen its social and environmental responsibility, and what barriers can hold back this approach? As we will be having a case study with one of the energy industry leaders,

this question takes on a particular dimension, as the company is positioned at the crossroads of technological innovation and sustainability issues.

Understanding the factors that encourage or limit the adoption of these technologies is essential if we are to support companies in their transformation. This involves analyzing not only the perceived benefits, but also the internal resistance, technical constraints, costs and cultural issues associated with this evolution. This study aims to shed light on these dynamics, focusing on a case study.

1.3 Objectives of the study

The main aim of this study is to gain a better understanding of how and why technologies are used to strengthen corporate social and environmental responsibility focusing on a case study. Through this analysis, the aim is to shed light on the internal dynamics that promote or hinder the adoption of these digital tools.

More specifically, this research aims to:

1. Identify the motivations that drive the integration of technologies into social and environmental responsibility practices (strategic, regulatory, ethical, or operational factors).
2. Examine the obstacles encountered during implementation (technical, organizational, financial, or cultural).
3. Formulate recommendations to overcome these barriers and promote a more fluid and efficient adoption of technologies in the service of sustainability and transparency.

By articulating these objectives, the study seeks to offer useful reflections not only for the case study but also for other companies in the energy sector committed to a responsible transition.

1.4 Research questions

To gain a better understanding of the issues surrounding the use of technology in the context of social and environmental responsibility, this study focuses on two main questions:

1. What factors motivate companies to adopt technologies to strengthen their social and environmental responsibility?

This question aims to explore the underlying reasons, being strategic, regulatory, ethical, or operational, that prompt companies to invest in technological tools to improve their transparency and impact.

2. What obstacles hold back this adoption, and how can they be overcome?

The aim here is to identify the potential obstacles to adoption, whether linked to internal constraints (resources, skills, corporate culture) or external factors (costs, technological complexity, regulations), and what the solutions are.

These questions will guide the research, structuring the analysis around facilitating and limiting factors, while offering concrete avenues for improving responsibility practices through the use of technologies

1.5 Significance of the study

At a time when social and environmental issues are taking center stage in corporate strategies, it is essential to understand how technology can be used to promote responsibility. This study is part of this dynamic, exploring the levers and obstacles to the adoption of technological solutions to improve the transparency, traceability, and impact of corporate actions.

The interest of this research has two sides. On one side, it develops a theoretical contribution by elevating our understanding of the factors influencing the integration of technologies into

social and environmental responsibility practices. On the other side, it offers practical lessons for companies in the energy sector, which are seeking to strengthen their sustainability commitments.

By shedding light on the specific motivations and obstacles encountered by a case study company, this study can serve as a benchmark for other organizations facing similar challenges. In this way, it aims to foster a more strategic and effective adoption of technologies in the service of a stronger and more reliable corporate responsibility.

This research contributes as well to the literature by combining three perspectives: TAM for individual adoption, Stakeholder Theory for multi-actor governance, and NRBV for the strategic dimension. It also offers practical recommendations for companies subject to the CSRD and international standards (ISSB, GRI), allowing them to anticipate the challenges related to the digitalization of reporting processes (Hart & Dowell, 2011; IFRS Foundation, 2023).

1.6 Structure of the thesis

This dissertation will be structured to guide the reader progressively through the various stages of the research, from problematic formulation to results analysis and recommendations.

Chapter 1: Introduction presents the context, the problem, the objectives, the research questions, the importance of the study, and its structure.

Chapter 2: Literature review explores existing theoretical frameworks, empirical studies on technology adoption, social and environmental responsibility, and the regulatory environment.

Chapter 3: Methodology; Description of the research design, justification for the choice of the study case company, collection methods (interviews, survey, document analysis), analysis plan, and ethical considerations.

Chapter 4: Results outlines the main motivations and obstacles identified through the data collection

Chapter 5: Discussion; interprets the results, compares them with existing literature, and proposes practical implications.

Chapter 6: Conclusion summarizes the main findings and contributions of the study and opens up avenues for future research.

This structure is designed to ensure clear, logical reading while facilitating understanding of the issues involved in using technology to support corporate responsibility.

Chapter 2: Literature review

2.1 The TAM model: adoption of technologies

To ensure theoretical coherence, this work mobilizes three complementary perspectives: first, the TAM/UTAUT to explain the acceptance and use of technologies at the individual level. Then the Stakeholder Theory (and institutional pressures) to inform multi-actor governance and legitimation. Moreover, the third perspective is the NRBV, which addresses the strategic dimension linking environmental capabilities and competitive advantage (**Davis, 1989; Venkatesh, Morris, Davis, & Davis, 2003; Freeman, 1984; Hart, 1995**).

2.1.1 Technology adoption theory: TAM

The Technology Acceptance Model (TAM), developed by **Davis (1989)**, is one of the most widely used frameworks for understanding how individuals adopt technology. It is based primarily on two variables: perceived usefulness and perceived ease of use, which influence usage

intention and actual behavior. In the context of sustainability, this model has been extended to incorporate environmental and social dimensions.

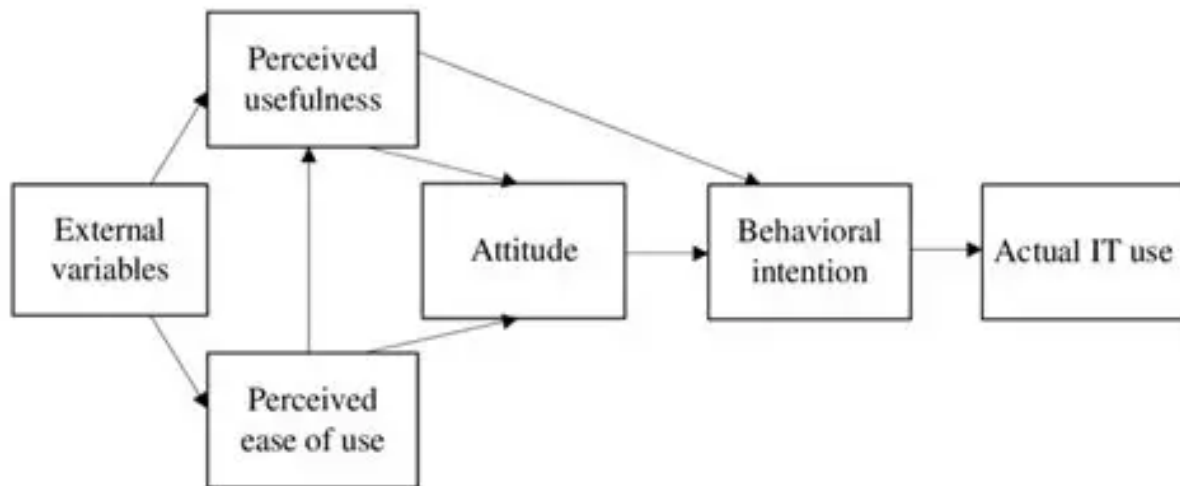


Figure 1: Davis technology acceptance model. Source: Davis (1989).

For example, in the article by **Anser et al. (2020)**, the authors propose an improved version of TAM, the Energy-Augmented TAM (EA-TAM), which includes factors related to green investment, sustainable supply chains, and eco-innovation. They show that these elements directly influence companies' attitudes toward green technologies (Frontiers, 2020).

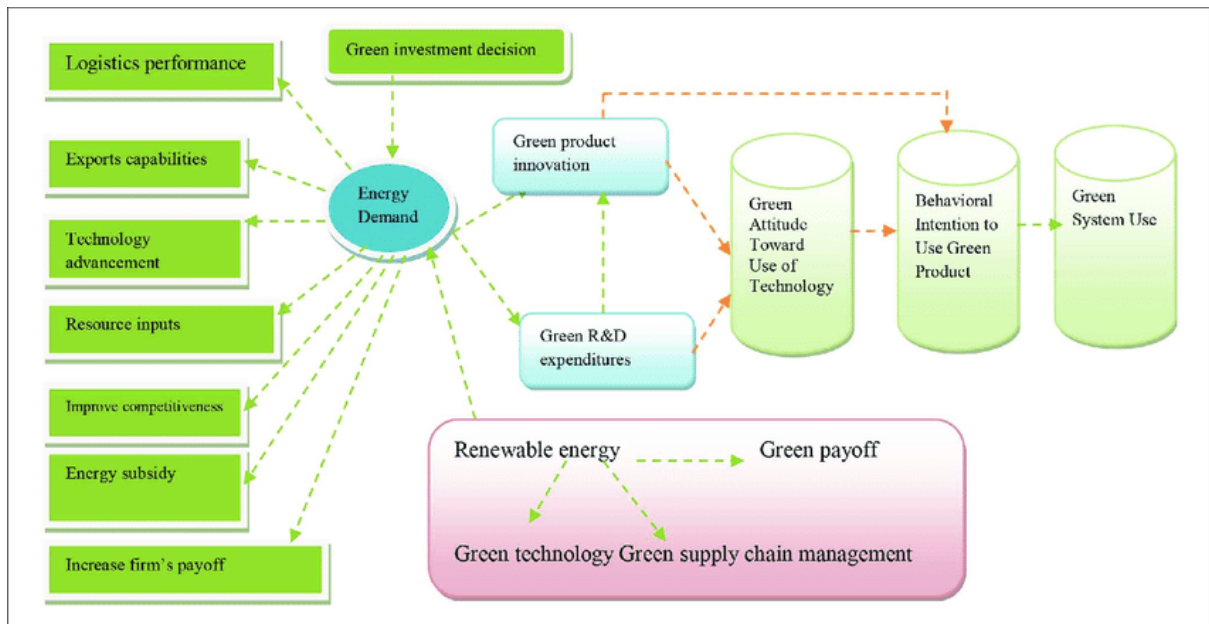


Figure 2: Firms' view of EA-TAM model. by Anser et al (2020).

Furthermore, **Du et al. (2024)** emphasize that behavioral intention and attitude toward usage play a mediating role between perceptions and actual usage, which is crucial for understanding adoption dynamics in companies committed to sustainability.

2.1.2 Stakeholder theory and social responsibility

Stakeholder theory, introduced by **Freeman (1984)**, posits that companies must consider the interests of all stakeholders affected by their activities: employees, customers, communities, suppliers, etc. (Figure 3). This approach primarily focuses on analyzing social responsibility practices.

Awa et al. (2024) show that this theory can strengthen CSR (**Corporate Social Responsibility**) programs by promoting structured dialogue between companies and their stakeholders. Their four-step model of stakeholder dialogue illustrates how a company can move from a reactive state to a proactive social responsibility strategy.

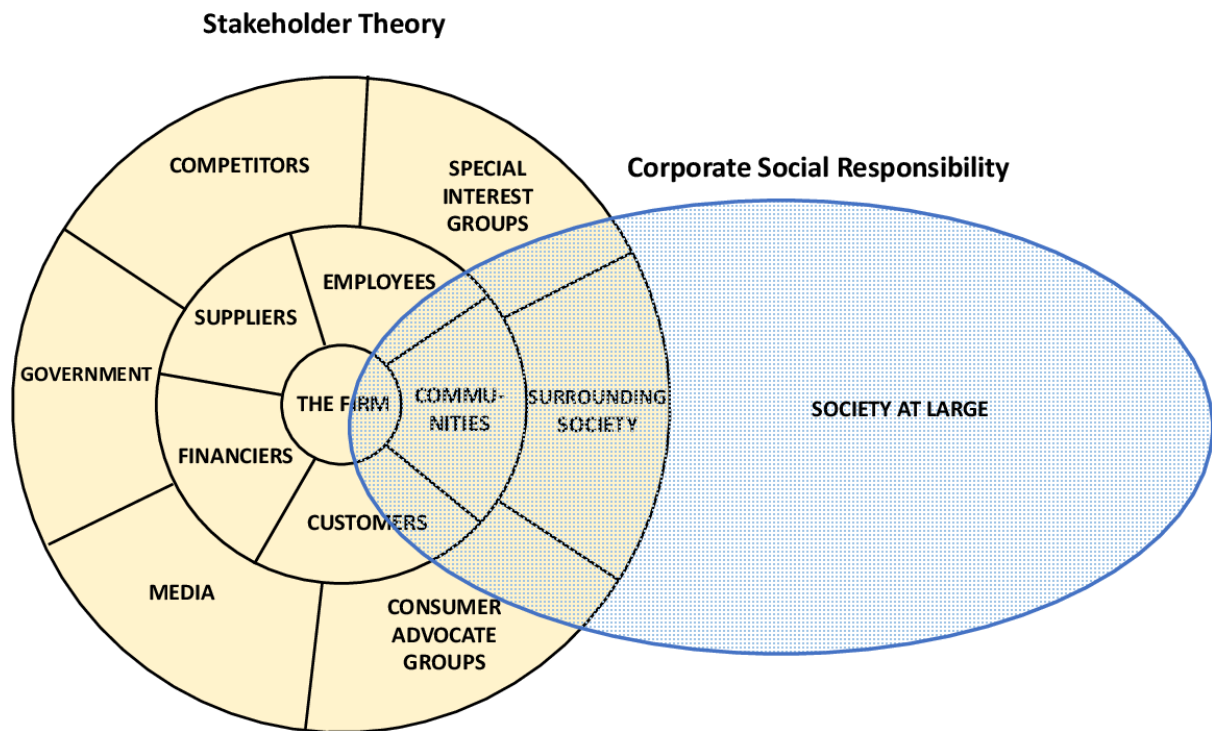


Figure 3: The relation between Stakeholder Theory and CSR, Freeman (1984)

2.1.3 Natural Resource-Based View (NRBV) and environmental responsibility

The Natural Resource-Based View (NRBV), proposed by **Hart (1995)**, extends resource theory by integrating environmental issues as a source of competitive advantage. It is based on three pillars: pollution prevention, responsible product management, and sustainable development.

In their review article, **Hart & Dowell (2011)** explain that companies that invest in clean technologies and green practices can improve their performance while reducing their environmental impact.

Appannan et al. (2020) go further by showing that environmental proactivity acts as a moderator between environmental accounting and sustainable performance, particularly in ISO 14001- certified companies.

2.1.4 Institutional theory: coercive, mimetic, normative

Beyond the stakeholders, institutional theory explains the progressive homogenization of practices by isomorphism: coercive (legal pressures, mandatory standards), mimetic (imitation of organizations perceived as legitimate under uncertainty), and normative (professionalization, professional standards) (DiMaggio & Powell, 1983). Applied to ESG reporting, this perspective directly links CSRD/ESRS requirements and global standards with the motivation to adopt digital solutions, even when immediate internal benefit is uncertain, to ensure sincerity and sector alignment.

2.1.5 Towards an integrated TAM x Stakeholder / Institutional NRBV x framework

The combination of TAM/UTAUT (performance/effort expectancy, social influence, facilitating conditions), Stakeholder Theory (salience of expectations) + institutional isomorphism, and NRBV (environmental capabilities) articulates a useful causal logic: motivations (regulatory, legitimacy, expected performance, environmental orientation) intention/use of tools, accountability results (traceability, completeness, auditability). This coupling is particularly relevant in energy, where regulatory constraints, investor pressure, and technical issues overlap (Venkatesh et al., 2003; Hart & Dowell, 2011).

2.2 Review of empirical studies

2.2.1 ESG data value chain

Recent studies emphasize the data value chain (Capture, governance, internal control, insurance/external, and disclosure), where IoT (Internet of Things), analytics, and platforms play a role of 'backbone' to produce auditable information at the right level of granularity (Tripathi

et al., 2024; Raman et al., 2024). This procedural approach explains why companies invest in solutions covering quality, traceability, security and interoperability of data.

2.2.2 Studies on the impact of technologies on transparency and accountability

Several empirical studies have shown that digital technologies can significantly improve corporate transparency, social and environmental accountability. For example, in the manufacturing sector, integrating IoT sensors enables real-time monitoring of emissions, energy consumption, and waste management. This facilitates decision-making, sustainable reporting, and regulatory compliance. The article by **Yang et al. (2023)** shows that integrating IoT into industrial processes reduces carbon footprints while optimizing resource use.

Another study, conducted by **Cavalieri et al. (2022)**, proposes a conceptual model to evaluate the efficacy of IoT technologies in guiding industrial companies toward sustainability. The model focuses on environmental and social indicators that can be used to measure the real impact of these technologies on sustainability.

2.2.3 IoT and Environmental Performance in energy

In energy and industry, IoT allows continuous measurement (consumptions, emissions, releases) and promotes more refined decisions (process optimization, predictive maintenance), which reduces the footprint and makes reporting data reliable (**Yang et al, 2023**). Recent reviews show efficiency gains but also highlight challenges: integration with existing IS, cybersecurity, total cost of ownership, and energy sustainability of the IoT park (**Arshi et al., 2024; López, O. L. A., et al., 2023**).

2.2.4 Traceability and blockchain in chains

For social accountability and ESG compliance (human rights, risk materials), blockchain solutions are tested in order to offer inviolable evidence of traceability and provenance. The 2024 reviews highlight benefits in transparency and trust, but also note obstacles such as interoperability, integration costs, governance, and the regulatory framework (Varma et al., 2024). Prototypes combining IoT + blockchain show the feasibility of auditable journals with a small footprint and controlled costs (Farahani & Treiblmaier, 2025).

2.2.5 Data governance and assurance

The requirement of limited/reasonable assurance (external certificates), internal controls and interoperability with repositories (ESRS, ISSB, GRI) imposes data governance mechanisms: common repositories, lineage (data lineage), formalization, access management (EFRAG, 2023; IFRS Foundation, 2023). Companies then orient their investments towards data architectures that facilitate dual materiality and multi-source consolidation.

2.2.6 Case studies on the use of technologies in corporate responsibility

Existing cases illustrate how some companies have integrated technologies to support their responsibility. The example of Siemens is particularly relevant (Siemens Sustainability Report 2024). By implementing smart grids, the company has been able to improve its energy effectiveness and automate data collection for its sustainability reports. The report details how these technologies have enabled better environmental governance and increased transparency for stakeholders.

In the logistics sector, Liu & Li (2025) studied the case of SF Holding, a Chinese company that has adopted electric vehicles, photovoltaic panels, and digital tools to reduce its emissions.

Their study shows that cumulative technological capacity and the level of digitalization are key factors in improving environmental performance.

Finally, in terms of social responsibility, **Hwang (2024)** explains that digitalization is profoundly transforming CSR practices. It enables better communication with stakeholders, increased transparency, and more effective management of social commitments.

For their part, **Singh Kharwar & Meena (2024)** present several cases of companies using AI and blockchain to ensure supply chain traceability and enhance transparency in social initiatives.

2.3 Regulatory framework and reporting standards

2.3.1 CSRD & ESRS: dual materiality and granularity of data

The CSRD (Corporate Sustainability Reporting Directive) greatly expands the scope of companies subject to reporting and imposes double materiality (impacts 'inside-out' and risks/opportunities 'outside-in'). ESRS (European Sustainability Reporting Standards) specify the structure, indicators and expected revelations, creating a need for systems capable of ensuring data quality, traceability, and auditability (**EU Directive 2022/2464; EFRAG, 2023**).

2.3.2 ISSB (IFRS S1/S2): Global Pillar “Focused Investor”

The IFRS (International Financial Reporting Standard) S1 (general) and IFRS S2 (climate), published by the **ISSB** (International Sustainability Standards Board) in 2023, define a global foundation aligned on the TCFD pillars (governance, strategy, risks, metrics/targets). They push to structure sustainable information in a comparable way, with data and control requirements very close to the expectations of capital markets (**IFRS Foundation, 2023; Deloitte, 2023**).

2.3.3 GRI: framework oriented 'impacts' and sectors

The GRI (Global Reporting Initiative) standards (universal, sectoral, thematic) remain the most widespread impact reference to describe the effects of business on the economy, the environment and people, complementary to the focus “investor-focused” of the ISSB. Many companies adopt CSRD/ESRS + GRI to cover multi-stakeholder regulation and expectations (**GRI, 2021/2024**).

2.4 Critical review of literature

The existing literature clearly shows that digital technologies can play a strategic role in improving corporate social and environmental responsibility. Theoretical models such as the Technology Acceptance Model (TAM) and its extensions (UTAUT) explain well how perceptions of utility and usability influence the adoption of digital tools (**Davis, 1989; Venkatesh et al., 2003**). Similarly, the Stakeholder Theory recalls that accountability is not limited to shareholders but encompasses the expectations of a set of actors: customers, employees, communities, regulators, which reinforces the need for reliable and transparent systems (Freeman, 1984). Finally, the Natural Resource-Based View (NRBV) highlights the idea that environmental capabilities can become a source of competitive advantage, which justifies the integration of sustainability-oriented technologies (**Hart, 1995; Hart & Dowell, 2011**).

However, despite these contributions, several limitations appear. First of all, most theoretical studies remain general and do not take sufficient account of sectoral specificities, particularly in energy where technical and regulatory constraints are strong. For example, the TAM is widely used, but it does not always take into account institutional pressures or cultural issues specific to large industrial organizations. That is why combined approaches : TAM for individual adoption, Stakeholder and institutional theory for governance, NRBV for strategy, seem more relevant to explain the real dynamics.

Then, empirical studies, although informative, often focus on isolated cases. The example of Siemens shows that smart grids can improve transparency and energy efficiency, but these results are not necessarily generalized to other industrial contexts (**Siemens, 2024**). Similarly, research on IoT or blockchain highlights clear benefits in terms of traceability and reporting, but rarely addresses concrete obstacles such as cost, integration complexity, cybersecurity, or resistance to change (**Varma et al., 2024**).

Another critical point concerns the regulatory dimension. Existing work seen may not mention that much the impact of new standards such as CSRD and ESRS, which impose unprecedented granularity and auditability requirements. These obligations transform the nature of the systems needed: it is no longer just a matter of collecting data, but of ensuring their quality, traceability and compliance with multiple standards (**EFRAG, 2023; IFRS Foundation, 2023**). This evolution creates strong institutional pressures (coercive, mimetic, normative) that accelerate the adoption of technologies, sometimes independently of immediate operational gains (**DiMaggio & Powell, 1983**).

Finally, the literature found may remain limited on integrating the three dimensions “social, environmental and technological “in a single analysis. Many studies treat these aspects separately, which reduces the overall understanding of adoption dynamics and their impact on sustainable governance. Conceptual models that link motivations (regulatory, strategic, stakeholder-driven), barriers (technical, organizational, cultural) and results (transparency, auditability, ESG performance) are less analyzed based on the current findings. This is precisely what this thesis proposes: an integrated approach, applied to a concrete case study, to fill these gaps and offer practical recommendations.

Chapter 3: Methodology

3.1 Introduction

This chapter wants to explain how the research was designed and implemented. The objective is to show how the data was collected, analyzed and interpreted to answer the questions asked in the first part of the thesis. The methodology is an essential element because it ensures the credibility of the results and their consistency with the objectives of the study.

For this work, we have chosen an approach that combines qualitative and quantitative. This combination is justified by the nature of the subject: understanding the motivations and obstacles to adopting technologies for social and environmental responsibility. These trends are complex and involve human, organizational and technical factors. A purely quantitative approach would have been too limited to capture the nuances, while a purely qualitative approach would have lacked measurable data to confirm certain trends.

Therefore, we opted for a unique case study, focused on a firm positioned as a global technology leader in the electrification and Power Grids, headquartered in Switzerland, employing over 50 000 people across 67 countries.

This method allows us to explore in depth a real context and to link the observations to theoretical frameworks such as TAM, Stakeholder Theory and NRBV. The case study is particularly suitable when seeking to understand processes in their natural environment (Yin, 2018).

3.2 Research design

Research design is the backbone of any study, as it defines how data will be collected and analyzed to answer the questions asked. In this thesis, we have chosen a mixed approach,

specifically a combination of qualitative and quantitative methods. This choice is not random: it comes directly from the nature of the subject and the objectives of the research.

Indeed, understanding the motivations and barriers to the adoption of technologies for social and environmental responsibility cannot be limited to numbers. It is a complex phenomenon, influenced by human factors (perceptions, attitudes), organizational (culture, resources) and regulatory (standards, obligations). A purely quantitative approach would have allowed measuring certain trends, but it would have left out the nuances and deep explanations. Conversely, a purely qualitative approach would have provided rich narratives, but without measurable indicators to confirm or compare the results.

That's why we opted for a unique case study of a global leader. This method is particularly suitable when one wishes to explore a real context in depth and link the observations to existing theoretical frameworks (Yin, 2018). The case study allows us to combine several data sources: interviews, surveys, documents, and to analyze them to strengthen the validity of the conclusions.

Concretely, the design is based on three components:

- **Qualitative component:** semi-structured interviews with key stakeholders (BU managers, engineers, CSR managers) to understand their perceptions, motivations, and the obstacles encountered.
- **Quantitative component:** a questionnaire administered to a sample of employees to measure variables such as perception of usefulness, ease of use, social influence and facilitating conditions, based on the TAM/UTAUT model (Davis, 1989; Venkatesh et al., 2003).

- **Documentary component:** the analysis of sustainability reports (ESG), internal policies and procedures related to ESG reporting to complete and contextualize the primary data.

This design is consistent with the objectives of the research, as it allows both to explore the deep reasons that drive or hold back the adoption of technologies and to quantify certain trends to support the recommendations. It also offers flexibility, as it allows the integration of rich qualitative data and simple quantitative measures, which is essential in a study applied to an industrial context.

3.3 Case study choice justification

The choice of the study case company was not made by chance. Several reasons explain this decision, and they are both practical and strategic.

First, the chosen firm is a major player in the energy sector, an area where sustainability and social responsibility issues are particularly important. Companies in this sector are subject to strong regulatory pressures (**company's ESG report of 2025**), particularly with the implementation of the CSRD and the ESRS, which impose very detailed non-financial reporting obligations (**EFRAG, 2023**). This means that these companies must not only collect reliable data but also make it traceable and auditable. This context creates an ideal field for observing how technology can be used to meet these requirements.

Then, our case study firm publicly displays ambitious sustainability commitments, such as carbon neutrality by 2050 and the regular publication of ESG reports (**Company's ESG report of 2025**). These commitments show that the company is proactive in integrating digital solutions to improve its reporting and governance practices. This gives us access to an environment

where digital transformation is already underway, which is essential for analyzing the motivations and obstacles related to technology adoption.

in summary, the case study firm represents a relevant case for three main reasons:

- **Sectoral relevance:** a sector highly exposed to ESG issues and regulatory obligations.
- **Strategic commitment:** a company that invests in sustainability and digitalization.

This choice is therefore consistent with the objectives of the research and with the desire to produce useful results, both for theory and for practice.

3.4 Data collection method

To answer research questions, it is not enough to read reports or analyze numbers. It is also necessary to understand what the people who work in the company think and how they experience the adoption of technologies. That's why we chose to combine several data collection methods. This combination allows us to have a more complete view and cross-reference the information to avoid bias (Yin, 2018).

Firstly, the semi-structured interviews:

These interviews are conducted with various profiles: managers, engineers and CSR (Corporate Social Responsibility) managers. The objective is to understand their perceptions, motivations and the obstacles they encounter. Semi-structured interviews are useful because they allow following a question guide while allowing the person to express themselves freely (Yin, 2018). This gives richer and more nuanced answers than a closed questionnaire. For example, if an engineer explains that he finds technology complicated, we can ask him why and obtain concrete details. So in this phase we decided to interview 5 key informants.

Secondly, a questionnaire / survey:

This questionnaire is distributed / shared to a sample of employees to measure variables such as perception of usefulness, ease of use, social influence and facilitating conditions. These variables come from the TAM/UTAUT model, but they are adapted to the context of social and environmental responsibility. Responses were collected on Likert-type (**Likert, R, 1932**) scales (for example: “Strongly disagree” to “Strongly agree”). The advantage of the questionnaire is that it reaches a larger number of people and provides quantitative data to confirm certain trends observed in the interviews.

Third, the documentary analysis:

The analyze of internal and public documents, such as sustainability reports, ESG policies, and internal procedures. This analysis is allowing to complete the data from the interviews and questionnaires, giving a more global vision of the company’s practices. For example, if a CSR manager claims that the company invests a lot in digitalization, we can verify this statement in official reports.

By combining these **three methods**, we obtained both qualitative and quantitative data, which is strengthening the reliability of the results (**Yin, 2018**). This triangulation is important because it allows for the comparison of discourse, perceptions and documented facts. This gives a more realistic picture of the situation.

3.5 Sample and selection criteria

For the research to be credible, it is important to explain who is participating and why these people are chosen. The sample does not need to be huge, as it is a case study, but it should be representative of the profiles concerned by the adoption of technologies in the company studied (**Yin, 2018**).

For the **interviews**, we interviewed 5 key informants that are considered important decision-makers in the company. These participants are chosen from different departments:

- Managers, who make strategic decisions,
- Engineers / R&D, who use technologies a daily basis,
- And CSR managers, who take care of social and environmental aspects.

These profiles are important because they have different views: managers see strategy, engineers and R&D see practice, and CSR managers see compliance and sustainability. We also decided to vary the sites, including people from headquarters and operational units, to have a more complete vision.

For the **questionnaire**, Participants are employees who work in departments related to production, maintenance, quality and information technology. The choice is made based on availability and willingness to participate. The objective is not to have a statistically perfect sample, but to obtain data that reflects the diversity of perceptions in the company.

These selection criteria are based on relevance: we want people who are directly concerned by the use of technologies for social and environmental responsibility. This is to provide useful and concrete information.

3.6 Collection instruments

To collect the data, we need tools adapted to our methods. These instruments must be simple to use and provide reliable information (Yin, 2018).

3.6.1 The interview

3.6.1.1 Interview protocol

To gather in-depth qualitative data, a semi structured interview protocol was designed following the case study methodology recommended by **Yin (2018)**. This format was selected to ensure consistency across different stakeholders while allowing the flexibility to explore specific technological examples (e.g., AI tools, SF6 alternatives) relevant to each interviewee's role.

3.6.1.1.1 Objectives of the interview

The primary objective of the interviews was to explore the lived experience of digital transformation within the sustainability function. Specifically, the protocol aimed to identify strategic and operational views in the company, by comparing how leadership views sustainability goals versus how shopfloor managers implement them. Then the second aim is to map the technological structure by categorizing specific tools currently in use (e.g., Hard Tech like Gas Insulated Switchgears vs. "Soft Tech" like Gen AI) as well as detect traces of perceived usefulness and ease of use aligning with the core constructs of TAM (**Davis,1989**). Finally, to uncover hidden barriers by checking cultural, organizational and data related obstacles.

3.6.1.1.2 Target sampling strategy

The sampling was purposive. Interviewees were selected based on their ability to represent distinct perspectives within the organization (**Yin, 2018**); Strategic profiles (Global Head of Sustainability, Global Sustainability Specialist, Environmental Sustainability Manager) and Operational profiles (Head of Sustainability for the Business Unit, R&D engineer etc.)

3.6.1.1.3 Interview thematic structure

The interview structure was organized into five thematic sections to ensure a logical flow from general to specific technical challenges:

- Section 1: Context and Role

Opening question: “Can you describe your current role and how it relates to the organization’s sustainability strategy?”

- Section 2: Strategic vision & Technology

Core question: “What is the strategic vision regarding the integration of digital technologies into sustainable initiatives?”

Follow-up: “Do you view technology primarily as a compliance tool or competitive asset?”

- Section 3: The Technological Structure (Hard vs. Soft)

Operational question: “which specific digital tools (e.g., InteleX, Power BI, AI) do you use in your daily tasks?”

Product question: “How does physical technology (e.g., SF6 alternatives in producing switch-gears) contribute to the carbon neutrality goals.

- Section 4: Barriers to Adoption

Critical question: “what are the main difficulties or resistances you have faced in implementing these technologies? (e.g., cost, data quality, training).”

- Section 5: Future Trends (AI and Regulations)

Open question: “How do you perceive the role of AI in the future of sustainability reporting? Are there current pilots in place?”

3.6.1.1.4 Administration and Ethics

All interviews were conducted virtually via Microsoft Teams to accommodate the global distribution of the interviewees (Switzerland, India, Germany, Mexico, Italy).

In adherence to ethical research standards (**Bhandari, 2021**), participants were informed prior to the recording to have their consent, the nature of the study was explained, and verbal consent was obtained for transcription purposes, besides the consent on the data privacy form aligning with the University's guidelines.

Moreover, for the confidentiality, all participants were assured that their identities are anonymized (referred to as "Interviewee A," etc.) and that sensitive data would be treated with confidentiality.

3.6.2 The Quantitative Survey

3.6.2.1 Guide to the Quantitative Survey

For the quantitative part, we used a questionnaire based on Likert-type, ranging from "Not agree at all" to "Completely agree". The questions are inspired by the TAM/UTAUT model but adapted to the context of social and environmental responsibility (**David, 1989; Venkatesh et al.,2003**). For instance:

- "Digital tools facilitate transparency and traceability."
- "Digital tools help me monitor environmental performance indicators"

Each item will be rated on a scale of 1 to 5. This format is simple for participants and allows for easy-to-analyze data.

These instruments are chosen for their complementarity, given that the interview guide gives detailed and nuanced answers, while the questionnaire provides quantitative data to confirm certain trends.

3.6.2.2 Structure of the Quantitative Survey

Section	Variable/ Thematic	Questions	Measurement Scale
1. Profile	Demographics	Current Position / Role	Text (Open)
	Seniority	How long have you worked in the company?	Multiple Choice (<3, 3-7, >7 years)
	Department	Which department do you work in?	Multiple Choice
	Usage Experience	Have you used digital tools for social or environmental initiatives?	Binary (Yes/No)
2.Motivations	Perceived Usefulness	"Digital tools help me monitor environmental performance indicators."	5-Point Likert
	Perceived Usefulness	"Digital tools facilitate transparency and traceability."	5-Point Likert

	Perceived Usefulness	"It is easier to find the correct data in the system rather than emailing colleagues."	5-Point Likert
	Work environment encouragement	"My work environment encourages the use of digital tools for sustainability."	5-Point Likert
3. Barriers	Training	"I lack training to use digital tools effectively."	5-Point Likert
	Data Quality	"I often find that the data in the system is 'messy' or incomplete, forcing me to double-check it offline."	5-Point Likert
	Manual Workload	"I spend a lot of time manually copying data from Excel or Emails into official systems."	5-Point Likert
	Suitability	"Available tools are not adapted to my specific needs."	5-Point Likert
	Human Factor	"Machines and software cannot replace human judgment in my specific job."	5-Point Likert
4. Qualitative data	Open Feedback	"What could encourage wider adoption of digital tools for Sustainability?"	Open Text

	Open Feedback	"Do you have any other comments, ideas, or concerns regarding technology and sustainability?"	Open Text
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Table 1: The Quantitative Survey Form

3.7 Analysis plan

Once the data has been collected, it is necessary to explain how it is analyzed. The objective is to transform raw information into useful results for answering research questions. As we have qualitative (interviews) and quantitative (questionnaires) data, we are using two complementary approaches beside the final documentary analysis for triangulation (Yin,20218).

3.7.1 For qualitative data

The interviews were analyzed with a method called **Thematic Analysis (Braun, V., & Clarke, V. 2012)**. This consists of reading the answers, identifying the ideas that often come back and grouping them into themes. For example, if several people talk about “lack of training”, this becomes a theme related to obstacles. This method is practical because it allows understanding the perceptions and experiences of participants without reducing them to numbers. In addition to Thematic Analysis, this research includes also the use of NVivo software. This tool is very useful for organizing and coding data from interviews. It allows us to create categories (or nodes) and associate related texts with them, which facilitates the identification of recurring themes. The advantage of NVivo is that it makes the process more rigorous and traceable, avoiding getting lost in manual notes; for example, if several participants mention difficulties

related to training, we can group these extracts under the same code and analyze their frequency and context.

The use of NVivo software is recommended in our qualitative research to improve the reliability and transparency of the analysis (**Bazeley& Jackson, 2013**).

3.7.2 For the quantitative data

The questionnaires were analyzed with descriptive statistics, such as averages and percentages, to see general trends. The purpose is to make simple correlations to see if there are links between certain variables, for instance, between the perception of usefulness and the intention to use technology (**David, 1989**). These analyses are not meant to be very complex, as it is a case study, but they are sufficient to confirm or nuance the results of the interviews (**Yin, 2018**).

By combining these two approaches, we will have a complete vision: the figures show the trends, and the themes explain the reasons behind these trends (**Yin, 2018**).

3.8 Ethical Considerations

When conducting research with people, it is essential to follow certain rules to ensure their security and confidentiality. In our study, several precautions have been taken in consideration.

- Informed consent

Before each interview or questionnaire, we clearly explained to the participants the purpose of the research, how their data will be used and that they can withdraw at any time without consequence. They gave their consent before participating (**Bhandari, 2021**). This consent can be written or oral.

- Anonymization of data

All responses are anonymized. This means that we do not keep the names of participants in analysis or reports.

- Confidentiality

The data collected (interviews, questionnaires) are securely stored on a password-protected medium. They are only shared with the people involved in the research. No sensitive details are published in this research.

- Compliance with internal rules

As the research is done in a company, we will also comply with its internal policies regarding confidentiality and communication of information.

These precautions are important to ensure that the research is conducted in an ethical environment and that participants feel confident (**Bhandari, P. 2021**).

Chapter 4: Findings

4.1 Introduction

This chapter presents the empirical findings derived from the qualitative semi structured interviews and the quantitative survey conducted within the case study organization. The analysis aims to answer research questions regarding the motivations and barriers to using digital technologies for social and environmental accountability,

The data was processed using NVivo software for thematic coding and analysis. The findings are structured to first present the profile of the participants, followed by a detailed analysis of the technological landscape, the barriers to adoption, and the motivations driving digital transformation in sustainability.

4.2 Qualitative Findings: Interview Analysis

To ensure a comprehensive understanding of strategic and operational dynamics, the study selected a purposive sample of five key informants holding senior positions related to Sustainability, Research and Development (R&D), and Environmental Management.

As requested for confidentiality, the interviewees are identified by their functional roles. The sample represents a mix of Strategic Profiles (focused on reporting, data management, and software implementation), and Operational Profiles (focused on market, product design, and legislation).

4.2.1 Overview of interview participants

The semi structured interviews were conducted between October 27, 2025, and November 4, 2025. The details of the sample are provided in the following table (Table 2).

<i>Participant ID</i>	<i>Functional Role</i>	<i>Department / Focus</i>	<i>Date of Interview</i>	<i>Duration</i>	<i>Profile Type</i>
<i>Interviewee A (Female)</i>	Global Head of Sustainability	Corporate Sustainability	30-Oct-25	30 minutes	Strategic
<i>Interviewee B (Female)</i>	Global Sustainability Specialist	Sustainability Reporting	27-Oct-25	31 minutes	Strategic
<i>Interviewee C (Male)</i>	R&D Manager (High Volt-age)	Product Development / R&D	28-Oct-25	28 minutes	Operational
<i>Interviewee D (Female)</i>	Global Environmental Manager	Environmental Operations	31-Oct-25	26 minutes	Strategic
<i>Interviewee E (Female)</i>	Head of Sustainability (BU)	Transformers Business Unit	4-Nov-25	19 minutes	Operational

Table 2: Participant Profiles (Anonymized) (Source: Author's elaboration based on primary data)

4.2.2 Detailed profile descriptions

Interviewee A (Global Head of Sustainability): Her role involves overseeing the global sustainability strategy, which was recently separated from the Health, Safety and Environment

(HSE) function. She is responsible for high-level commitments, such as “1000 million tons of avoided emissions” (Interviewee A), leads to target and oversee the integration of digital tools.

Interviewee B (Global Sustainability Specialist): She specializes in coordinating responses to external sustainability questionnaires. her daily work involves managing data flow between different digital portals (e.g. SharePoint, Power BI) and manually integrating information from diverse systems to ensure reporting compliance.

Interviewee C (R&D Manager - High Voltage): This participant represents the technical product side of sustainability. They are responsible for the development of eco-efficient alternatives to SF6 gas (a potent greenhouse gas). Their perspectives focus on “**Hard Tech**” related to physical innovation required by European Commission regulations rather than purely software solutions.

Interviewee D (Global Environmental Sustainability Manager): Based in Germany, she leads a team of subject matter experts on climate change and circular economy. They are directly involved in the application of IT tools to sustainability landscape, using platforms like “**Intalex**” for environmental data gathering and scenario planning for climate adaptation.

Interviewee E (Head of Environmental Sustainability – Transformers Business Unit): Based in India, this participant bridges the gap between technology and market demand. Her team focus on how sustainability trends (such as the **Digital Product Passport or DPP**) impact product costs and customer willingness to pay.

4.2.3 NVivo Analysis Structure

4.2.3.1 Coding strategy

The coding process followed a hybrid approach (Yin, 2018), combining deductive and inductive reasoning:

- **Deductive (Top-down):** Parent nodes were established prior to analysis based on the theoretical framework (Technology Acceptance Model and Institutional Theory) (Davis, 1989) These included Motivations, Barriers and Technologies.
- **Inductive (Bottom – up):** Child nodes emerged directly from the interview transcripts (e.g., Gas Insulated Switchgear, InteleX, Power BI...).

4.2.3.2 Coding structure

The following coding hierarchy represents the final thematic structure applied to the five interview transcripts with some examples (**quotes**), from the participants themselves, that helped to create the child thematic nodes:

- Node 1: Barriers and implementation challenges
 - Data Quality (Tier 3/4 suppliers, messy data...)
 - Financial Cost (Cost of new technologies)
 - Governance (Defining who needs to focus on what...)
 - Human Factor (Human wanting cars with noisy engines instead of electric cars)
 - Manual data verification (the need of manual reviewing of data to differentiate between non logical “weird data” and logical ones)
 - Regulatory Uncertainty (Missing legislation...)
 - Resistance to change (Sustainability often implies change, and people don’t like that)
- Node 2: Motivations (Drivers for change)
 - Competitiveness (How can we compete against...)
 - Customer Demand (In order to respond to customer requirements...)

- Regulatory Mandates (The Commission forced us to develop a new technology that works without a gas that has a real impact on the environment...)
- Node 3: Strategic Frameworks and Reporting
- Business-Led strategy (If our processes are not sufficient to handle data internally... then we start searching for what kind of tool we can onboard)
- Company Principles (We have this target of 1 000 tons of avoided CO2 emissions...)
- Double Materiality (You don't look only at the impacts you have from sustainability perspective but also at the financial impact...)
- Internal Coordination (Creating and coordinating something we call Sustainability Network...)
- Measurement frameworks (We have something that we call underlying KPI's...)
- System Fragmentation in reporting (We need to start integrating sustainability modules into our ERP system, otherwise we are going to struggle...)
- Manual Integration in reporting (We don't have at the moment a consolidated platform for all our data...)
- Stakeholder engagement (We engage with over 270 stakeholders from our board of directors to customers...)
- Node 4: Technological levers

In this Node we have identified 3 sub-parent nodes: **AI**, **Digital Tools (Soft Tech)** and **Hardware (Hard tech)**

AI nodes:

- AI for customers (A generative AI tool to respond customer request...)

- AI for human rights (The other one that we are working on is human risk trigger...)
- AI for tendering (As part of a tender you receive an Excel file to answer questions, you can upload it and it will preload the answers...)
- Generative AI (you can use it like Gen AI and ask it what the company's scope on emissions from whatever year is...)
- Limits of AI facing human decisive knowledge (We are a really human drive company, so maybe we are using something in order to facilitate our works, but decision are man-made.

Digital Tools nodes:

- Digital Product Passeport DPP (We already have DPP in our company... it's for tracking quality...)
- Intelex (Our global HSE team owns the tool Intelex... a globally implemented tool where we collect HSE data...)
- SharePoint for knowledge sharing (Everything we want to share it's in our SharePoint sustainability network...)
- Lifecycle Assessment LCA (LCA basically is a study in which we consider the whole life of the product...)
- Power BI (a Power BI dashboard where we get the analytics on the trends and the focus areas...)
- External software for risk management (It's a company called X where in this software we input all of our site's data and with insurance data points we can see and prepare ourselves for the future...)

Hardware nodes

- Circularity (We have some examples of collaboration with customers and some partners coming from the recycling industry...)

Econiq (You can think as well of our gas SF6 insulated switchgear...)

HVDC technology (HVDC is allowing the integration of renewable power into the grids...)

4.2.4 Analysis of Barriers thematics to sustainable digital tools

implementation

4.2.4.1 Introduction

When beginning the data analysis phase of this research, the initial hypothesis was that the barriers to adopting sustainable technology would be uniform across the organization. We assumed that whether an employee worked in the Global Headquarters in Switzerland or on the factory floor in Italy, they would mention similar obstacles, possibly a lack of budget or the technical difficulty of using new software.

However, the qualitative analysis of the interviews revealed a much more complex and fascinating reality which relies on having two main different strategical priorities depending the function. Therefore, and by using NVivo, we decided to categorize the participants into two distinct groups depending the reality we discovered: the **Strategic Group** (Global Heads and Specialists like **Interviewee A, B and D**) and the **Operational Group** (Factory and Business Unit Managers like **Interviewee C and Interviewee E**). The noticed differentiation represents a disconnect.

The data shows that these two groups operate in two different sides of obstruction. The Headquarters is fighting a battle against **internal complexity** (disorganization, data sets, culture), while the Factory is fighting a battle against **external obstacles** (market costs, physics, and unclear legislation).

To quantify this difference, a **Matrix Coding Query** was performed using NVivo. The participants were segmented into two groups: the Strategic Group (Global Head of Sustainability, Environmental Managers) and the Operational Group (Factory Managers, BU Sustainability Heads).

Table 3 below presents the frequency of coded references regarding implementation barriers.

	Strategic Group	Operational Group
1 : Barriers and Implementation challenges	6	10
2 : Data quality	1	2
3 : Financial Cost	1	4
4 : Governance	1	0
5 : Human Factor	1	0
6 : Manual data verification	1	0
7 : Regulatory uncertainty	0	4
8 : Resistance to change	1	0
9 : Skill gaps	0	0

Table 3 Illustration of frequency references related to the parent node of Barriers in Nvivo software

The data reveals an evident pattern: **the Operational group** is heavily focused on **external market and legal constraints**, while **the Strategic group** is predominantly concerned with **internal organizational complexes**.

As table 3 illustrates, the "Operational" column is dominated by codes related to **Financial Cost** and **Regulatory Uncertainty**, while these codes are virtually absent from the "Strategic" column. In the other side, the Strategic group is the only one identifying **Governance** and **Data**

Quality as primary barriers. The following sections provide a detailed analysis of these two contrasting realities.

4.2.4.2 Operational barriers

The managers working closer to the physical product (Interviewee C in the High Voltage factory and Interviewee E in Transformers BU) **did not** mention "data governance" a single time. Their barriers are tangible, external, and existential. They are trying to build physical machines in a **market that is price-sensitive and a legal environment that is confusing.**

- **The financial cost barrier**

The most significant barrier identified by the Operational group is the tension between sustainability and profitability. In the NVivo analysis, the code for "**Financial Cost**" appeared significantly more often in the Operational interviews (Table3).

Interviewee E (Transformers BU) provided a brutally honest assessment of this market reality. She explained that while the firm has the R&D capabilities to build green products, the customers are not always willing to buy them. She mentioned "Nobody wants to pay double" for a product just because it is sustainable. She elaborated that customers might accept a price increase of 5% or 10%, but anything higher becomes a **deal-breaker** unless a regulation forces the entire market to shift.

This creates a "**profitability barrier**" for the operational teams. They are pressured by the strategic level to innovate, but they are restricted by the market reality. **Interviewee C** (High Voltage Factory) supported this by explaining the immense cost of R&D. Moving away from SF6 gas requires a "total redesign" of the machine, changing the mechanical, electrical, and fluid dynamic properties. This is not a software update; it is heavy industrial re-engineering that requires massive capital investment, which inevitably drives up the final product cost.

- **Regulatory Uncertainty**

The second critical barrier for the Operational group is "**Regulatory Uncertainty.**" This is a crucial finding: the barrier is not the existence of regulations, but their "Lack of clarity".

Interviewee C described the current situation with the European Union as a "waiting game." He explained that while the EU has issued a ban on **SF6 gas**, the legislation is missing critical technical details regarding the "comparison technology". This creates a paralysis in decision-making. The factory engineers know they must change, but they are hesitant to fully commit to a specific manufacturing path until the EU Commission clarifies the rules. As the interviewee C stated, "difficult to move at this moment without a clear output from the legislators".

Interviewee E highlighted a similar struggle with the **EU Deforestation Regulation (EUDR)**. She noted that this new law, set to come online in 2026, requires an immense amount of data traceability. The barrier here is that the supply chain is not ready. She explained that "Tier 3 and Tier 4 suppliers" are often unprepared to provide this data, leaving the business units struggling to prove compliance. This shows that for the **Operational group**, the barrier is often **outside their control** located deep in the supply chain or in the offices of regulators.

- **Physical and technical limits**

Finally, the Operational group faces physical barriers that the Strategic group does not encounter. **Interviewee C** pointed out that digitalization has limits in a high-voltage environment. He explained that electronic components (like sensors for IoT) "are not working really, really well when they are deeper into high electrical fields". This physical reality limits how much "digital sustainability" can be implemented inside the product itself, a limitation that is supposed to be in reality rarely mentioned in high-level strategic discussions.

4.2.4.3 The Strategic Barriers

When turning the analysis to the **Strategic Group** (Interviewee A, B and D), the conversation shifts completely. They are not worried about the price of copper or the physics of high voltage. Their barriers are **internal**. They are struggling with the sheer complexity of organizing a massive global company and changing its culture.

- **The Governance Gap**

Interviewee B (Global Specialist) identified "**Governance**" as the single biggest difficulty in sustainability. In the interview, she explained that without clear rules on who owns the data, the company suffers from "**silos**".

She described a chaotic scenario where different departments (such as Product Management and HSE) might try to build the same tool or measure the same KPI without talking to each other. This leads to duplicated work and inefficiency. For the strategic team, the barrier isn't the market, it is the "Internal Organization". They are trying to create order out of chaos to ensure that 40,000 employees are aligned and not wasting resources on parallel projects.

- **Data Quality**

Despite the Strategic group's focus on Artificial Intelligence and "Soft Tech", the reality of their daily work reveals a significant barrier: "**Data Quality**."

Interviewee A (Global Head of Sustainability) was very clear: "If your data is a mess, the tool is not going to solve your issue". She and **Interviewee B** both admitted that there is currently no consolidated platform for all non-financial information. Instead, they rely on a patchwork of systems (Hinext, Intellex, SAP) that do not always communicate perfectly with each other.

This leads to the barrier of "**Manual Verification**". **Interviewee B** admitted that her team still has to "**manually review**" data in Excel to find discrepancies. This manual workload prevents the strategic team from moving faster. They are taken by spreadsheets rather than focusing on

high-level strategy. This finding suggests that the "digital transformation" is being held back by a lack of basic data architecture.

- **Resistance to Change**

Finally, the Strategic group was the only one to discuss "Resistance to Change" as a cultural barrier. Sustainability requires people to work differently, and human beings naturally resist this.

Interviewee A shared a quick scenario to illustrate this. She spoke about the company's internal policy to switch to electric vehicles. She noted that many employees were initially **against it**, not for logical reasons, but because they "want the big cars with the back engines..." rather than the quiet electric ones.

This story serves as a powerful metaphor for the cultural barrier. The strategic leaders are trying to push a new mindset down through the organization, but they face psychological resistance from employees who are comfortable with traditional ways of working. **Interviewee A** emphasized that "sustainability often implies change," and convincing people to accept that change even when it doesn't cost more, which is a constant struggle.

4.2.4.4 Conclusion

The comparative analysis confirms a fundamental implementation gap in the company's sustainable transition. The barriers are not shared; they are stratified.

- **The Operational Level** is blocked by **external factors**: They are waiting for the rules to be clear (Regulatory Uncertainty) and the market to accept higher prices (Financial Cost) so they can justify the engineering effort.
- **The Strategic Level** is blocked by **internal factors**: They are waiting for the data to be clean (**Data Quality**) and the people to align (**Governance**) so they can report progress to stakeholders.

This creates a difficult situation for the company. To succeed, the Headquarters must solve internal governance issues to free up resources. Only then can they effectively support the Operational teams, who are on the front lines navigating the external complexities of cost and regulation.

4.2.5 Analysis of “Technology”, “Digital tools” and “AI” thematics

4.2.5.1 Introduction

Following the analysis of barriers, a second Matrix Coding Query was performed in NVivo to investigate which specific technologies the different groups prioritize. The initial assumption was that "digitalization" meant the same thing to everyone in the company. However, the data reveals a fundamental split in the definition of technology itself.

The results, presented in the following table (Table 4), highlight that the two groups are effectively building two different digital infrastructures. For the **Strategic Group** (Headquarters), technology is predominantly **digital** and focused on **efficiency and governance** (AI, Reporting Platforms). For the **Operational Group** (Factory/Business Unit), technology is largely **physical** or compliance-oriented, focused on engineering and supply chain traceability.

	Strategic Group	Operational Group
1 : AI	5	0
2 : AI for customer requests	2	0
3 : AI for human rights	1	0
4 : AI for tenders	1	0
5 : Generative AI	1	0

6 : Limits of AI with human knowledge	0	2
7 : Digital Tools	1	0
8 : Digital Product Passport (DPP)	0	3
9 : Intelix	4	0
10 : Knowledge sharing	1	0
11 : Life Cycle Assessment	0	3
12 : Power BI	2	0
13 : Risk management	4	0
14 : Circularity	1	0
15 : SF6 Gas Insulated Switchgear	1	4
16 : HVDC	1	0

Table 4: Illustration of frequency references related to the parent nodes of Technology, Digital Tools and AI in NVivo software.

4.2.5.2 The Strategic View

As illustrated in Table 4, the Strategic Group accounts for **100%** of the references related to **Artificial Intelligence (AI)** and **Risk Management** tools. The analysis of the transcripts suggests that for Headquarters, the primary motivation for adopting technology is to manage the volume of data and to protect the company's reputation through automated oversight.

- **Generative AI for Speed and Tenders**

There is a distinct enthusiasm for "**Generative AI**" at the global level, viewing it as a solution to administrative bottlenecks. **Interviewee D** (Global Environmental Manager) detailed a specific "Generative AI tool" currently in the testing phase. She explained that account managers often struggle with complex customer questionnaires.

The new tool allows them to upload an Excel file from a customer, and the AI (fed with internal policies and approved reports) will "preload the answers" automatically.

Interviewee A (Global Head) reinforced this, explaining that her team has explicitly built **two AI tools**. One is designed to streamline tenders (efficiency), but the other is a sophisticated "Human Rights Risk Trigger" tool integrated into Salesforce. This tool uses AI to scan potential partners and alerts managers with a "traffic light" system if a partner poses a reputational risk regarding human rights. This confirms that for the Strategic group, technology is an efficiency lever intended to automate manual tasks and a compliance shield to manage intangible risks.

- **Centralized Intelligent Platforms**

Beyond AI, the strategic team is heavily reliant on "Intelligent Platforms" for high-level governance. The code for "Risk Management" appeared 4 times in the Strategic column but 0 times in the Operational column.

Interviewee B (Global Specialist) provided a concrete example of this: the use of external software provided by an external company resource. This tool is not used for manufacturing, but for financial insurance logic. It maps all company sites globally to predict long-term climate risks, such as determining "which sites are at flooding risk" or drought risk over the coming decades.

Similarly, **Interviewee D** emphasized the use of **Intalex** and **Power BI** dashboards to consolidate global health and safety data. For the headquarters, these platforms act as a Dashboard Control, allowing them to aggregate data from 40,000 employees into a single dashboard to monitor performance against global targets.

4.2.5.3 The Operational View

In sharp contrast, the Operational Group (Column B in Table 3) has zero references to the specific AI tools or risk dashboards mentioned by headquarters. Their high-frequency codes

are Econiq (4 references), Digital Product Passport (3 references), and Life Cycle Assessment (3 references).

- **Physical Technology in total redesign**

For the factory managers, "**technology**" is often **physical engineering** rather than software. **Interviewee C** (Factory manager) explicitly stated that the transition to sustainability requires a "Total Redesign" of the machine to replace the SF6 gas with the "**Gas Insulated Switchgear**" mixture. He emphasized that this is a massive technical challenge involving changes to mechanical, electrical, and fluid dynamics properties. It is not a simple digital update, but it is fundamental **re-engineering** of the hardware.

Crucially, **Interviewee C** was the only one to discuss the "Limits of AI". He noted that in the high-voltage sector, digitalization faces physical constraints. He explained that electronic components (like IoT sensors) "are not working really, really well when they are deeper into high electrical fields". Furthermore, when asked about using AI for strategy, he remained skeptical, stating, "We are a really human-driven company... decisions are man-made". This suggests **resistance to the "automation"** narrative found and mentioned by the strategist **Interviewee A** and counted as a crucial barrier. Therefore, on the factory floor, **human expertise** and **physical reliability** are still seen as **irreplaceable**.

- **The Supply Chain Challenge: The Digital Product Passport (DPP)**

A critical finding from the interview with **Interviewee E** (Transformers BU) is the emergence of the **Digital Product Passport (DPP)**. Unlike the optional AI tools mentioned by headquarters to save time, the same interviewee views the DPP as an upcoming mandatory requirement for the European market.

She explained that this regulation represents a massive data challenge because it requires tracking data deep into the supply chain. The company must reach out to "Tier 3 and Tier 4 suppliers"

to calculate the carbon footprint of raw materials. **Interviewee E** described this as a significant struggle because current ERP systems are not fully ready to integrate these sustainability modules.

This highlights a crucial difference in the function of technology:

- **Headquarters** is building tools to report data.
- **Operational Teams** are struggling with tools to trace data.

4.2.5.4 Synthesis

The comparative analysis of the NVivo results provides mathematical proof of the "**Implementation Gap**" hypothesized in this thesis.

- **The Strategic Level** is investing in "**Soft Tech**" (Generative AI, Chatbots, Dashboards). Their goal is Speed and Visibility, they need to see the global picture and report it to stakeholders and investors efficiently.
- **The Operational Level** is investing in "**Hard Tech**" (the innovation of SF6 Gas Insulated Switchgear, Supply Chain tracking). Their goal is **Feasibility** and **Compliance**; they need to ensure the physical product can actually be built and is legal to sell under new EU laws like the DPP and EUDR.

Currently, these two technological roadmaps are running in parallel. The major challenge for the company, as identified by **Interviewee D**, will be bridging this gap: integrating the distinct "Hard Tech" data from the factory and supply chain into the "Soft Tech" reporting tools used by headquarters. Until the ERP systems can bridge this divide, the "AI efficiency" promised by Headquarters will likely remain disconnected from the physical reality of the Operational group.

4.2.6 Motivations for adopting Digital Tools in Sustainability

The analysis of the interview transcripts reveals that the adoption of digital technologies at the study case company is characterized by a "**Two Roads**" of motivation. While the overarching goal of sustainability is shared across the organization, the specific drivers for adopting technology differ significantly depending on the employee's role (Strategic vs. Operational).

The NVivo Matrix Coding Query results provide quantitative confirmation of this divergence. As shown in Table 5 below, there is a clear split between the Operational Group and the Strategic Group.

	Operational Group	Strategic Group
1 : Motivations (Drivers for change)	6	4
2 : Competitiveness	2	0
3 : Customer Demand	2	0
4 : Regulatory mandates	2	4

Table 5: Illustration of frequency references related to the parent nodes of Motivations for technology adoption in NVivo software.

The data highlights that the **Strategic group** is heavily skewed toward **Regulatory Mandates** (4 references vs. 0 for market variables), whereas the **Operational group** is the exclusive driver for **Competitiveness** and **Customer Demand**.

The following sections detail the four primary drivers identified through this analysis.

4.2.6.1 Regulatory Compliance and Institutional Pressure

Theoretical Framework: Institutional Theory

For **strategic profiles**, the primary motivation for integrating technology into sustainability is existential. As indicated in **Table 5**, this group cites regulatory mandates twice as often as their **operational** colleagues. In this context, digital tools are viewed not as optional assets but as essential mechanisms to maintain the company's legitimacy and legal ability to operate.

As **Legislation** being a "**Catalyst**", **Interviewee C** (R&D) explicitly identifies European regulations, specifically the ban on SF6 gas, as the "catalyzer" for technological innovation. He notes that the company faces a "clear deadline" enforced by the European Commission, which "forced us to develop a new technology" (SF6 Gas Insulated Switchgear). Without digital R&D tools to redesign products and calculate their lifecycle impacts, the company would eventually be excluded from the market.

Moreover, the aim for **managing Data Complexity** (EUDR & DPP), **Interviewee D** (Transformers BU) highlights that new regulations like the EUDR (European Union Deforestation Regulation) and the upcoming Digital Product Passport (DPP) impose a level of data granularity that is impossible to manage manually. She explains that tracking raw materials down to "Tier 3 and Tier 4 suppliers" requires sophisticated IT solutions because "companies are struggling because it requires so much data".

4.2.6.2 Competitiveness and Customer Demand

Theoretical Framework: Stakeholder Theory

In contrast to the Strategic group, the Operational profiles are highly motivated by the need to **satisfy external stakeholders** (specifically customers) who demand detailed sustainability

data. As shown in Table 5, the codes for "**Competitiveness**" and "**Customer Demand**" appear exclusively in the Operational group column.

For instance, **Interviewee D** (Environmental Manager) views digital platforms not just as compliance tools, but as **competitive weapons**. She explicitly states that using intelligent data platforms to predict climate risks allows the company to "compete against Company X and Y". Here, the motivation is to transform sustainability data from a bureaucratic burden into a value-added service that wins tenders, which illustrate the driver of "**Competitiveness**".

Then, we can talk about the "**Willingness to Pay**" gap, **Interviewee E** provides a critical economic insight: customers "don't want to pay double" for green products unless a regulation forces them to. Therefore, this gap leads to **the motivation to use technology** for finding a way to **provide detailed environmental data** (like Lifecycle Assessments) that justifies a "premium" price. She notes that customers are willing to pay higher only if the data proves a significant reduction (e.g., 50%) in carbon footprint.

Therefore, this proves that employees closer to the daily workflow utilize technology as a **strategic tool to win business**, confirming the **Stakeholder Theory** application where satisfying client demands drives technological adoption.

4.2.6.3 Operational Efficiency and Automation

Theoretical Framework: Technology Acceptance Model (TAM)

This is the strongest motivation for the Strategic staff who deal with the "**heavy lifting**" or **complexity of reporting**. The qualitative data establishes a direct link between the adoption of tools (like GenAI and Chatbots) and the desire to reduce "painful" manual labor.

The target is to **survive the workload**, **Interviewee A** (Global Head of Sustainability) describes the first year of manual sustainability reporting as a "nightmare". This negative experience was the direct motivation for developing an internal GenAI tool designed to "preload

answers" for customer questionnaires. By automating this repetitive task, the technology's perceived usefulness (TAM) becomes the primary driver for its adoption.

Moreover, the aim to **reducing "human error"**, **Interviewee D** emphasizes that "humans are open to errors". The motivation for using intelligent platforms is to validate data and provide "straight away answers" that are accurate. This reduces the reputational risk associated with reporting incorrect data to stakeholders.

Finally, the goal of "**Centralizing Knowledge**", **Interviewee B** (Global Sustainability Specialist) explains that her motivation for creating an AI Chatbot was the overwhelming volume of queries from account managers. The tool acts as a "**first line of contact**," allowing the sustainability team to focus on strategy rather than answering repetitive questions.

4.2.6.4 Risk Management and Strategic Foresight

Theoretical Framework: Natural Resource-Based View (NRBV)

The final motivation identified is the use of technology to build "Strategic Capabilities" that allow the firm to predict and mitigate future environmental risks, aligning with the Natural Resource-Based View (NRBV).

Interviewee D describes using intelligent platforms to model climate scenarios (e.g., floods, droughts) for the years 2030 and 2050. This motivates adoption because it allows the firm to offer "**business continuity**" planning to clients, turning a sustainability tool into a strategic asset for **asset protection** as a motivation.

Furthermore, **Interviewee A** mentions the implementation of a "Human Rights Risk Trigger" (a traffic light system) within Salesforce. The motivation here is **proactive risk mitigation**: the tool warns the company before a problem occurs ("remediation in the worst case"), protecting the **company's reputation** and ensuring ethical supply chain management.

And as quantitative confirmation, In the NVivo coding analysis (Table 4), the code "**Risk Management**" has 4 references associated with the **Strategic profile** and 0 for the Operational profile. This indicates that the Strategic team is actively using these tools to manage possible risks that leadership may view more abstractly as compliance issues.

4.3 Quantitative Findings: Survey Analysis

To validate the qualitative themes identified in the interviews, a structured survey was distributed to employees across various departments (IT, Engineering, Logistics, R&D, and Maintenance). The survey utilized Likert-scale questions (**Likert, 1932**) based on the Technology Acceptance Model (TAM) to measure Perceived Usefulness and Ease of Use (**Davis, 1989**), as well as specific questions regarding operational barriers.

4.3.1 Respondent Demographics

The survey collected responses from **12 key employees**. The demographic breakdown supports a high level of organizational knowledge:



Figure 4: Graphic representing the seniority of the survey's respondents.

- **Seniority:** Many respondents possess significant experience (Figure 4), with 50% (6 out of 12) having worked at the company for "**More than 7 years**". This indicates that the feedback reflects a deep understanding of legacy systems and long-term changes.

- **Departmental Mix:** The sample covers the "Operational" perspective well, including Maintenance, Logistics (Heavy Lift) , R&D , and Factory Operations, alongside IT support.

4.3.2 Validation of the Barrier thematic

The interviews highlighted "**Messy Data**" and "**Manual Work**" as major operational barriers (e.g., **Interviewee A** mentioning the "nightmare" of manual reporting). The survey results strongly confirm this (Figure 5).

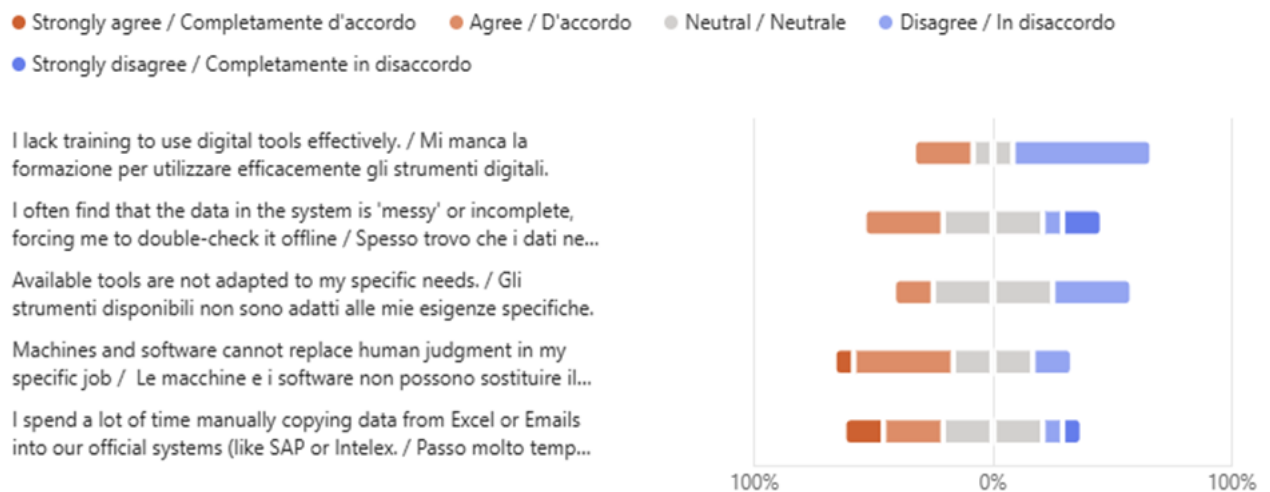


Figure 5: Respondents' level of agreement regarding the barriers listed in the survey.

The "**Manual tasking**" reality illustrated when asked if they "spend a lot of time manually copying data from Excel or Emails into official systems," there was a clear consensus.

- Respondent 5 (Executive Assistant) and Respondent 11 (Master Data Manager) marked "Strongly Agree".
- Respondent 4 (Logistics) and Respondent 2 (IT) marked "Agree".

This quantitative data proves that despite the existence of advanced platforms like “**Intalex**”, manual Excel work remains a standard operating procedure for many employees, validating the "efficiency gap" identified in the qualitative phase.

System Fragmentation is confirmed when **Respondent 12** (IT Support) provided a critical insight in the open comments, stating: "Wider adoption could be encouraged by improving data transparency and integrating fragmented legacy systems, as many organizations struggle to track sustainability metrics effectively when data sources are outdated or disconnected”.

This directly corroborates Interviewee B's statement about the lack of a "consolidated platform".

4.3.3 Lack of training

The interviews suggested that employees feel overwhelmed by the tools. The survey confirms that they don't lack training but at the same time it might be insufficient and we can consider this a paradoxical barrier to adoption.

As **survey evidence**, when asked about **lack of training** 25% agreed, 58% disagreed while 16% remained neutral about it (Figure 5). Meanwhile, and when asked what could encourage wider adoption, “Training” was the most frequent keyword.

- **Respondent 2** (IT): "they should be advertised more and training sessions should be available".
- **Respondent 6** (Engineering): Calls for "Better awareness, training and access to digital tools".
- **Respondent 10** (Maintenance): Specifically, requests "update sessions for the use of new and old digital tools".

This aligns with the "**Human Factor**" barrier identified in the NVivo coding node. The technology exists (Intelex, Power BI), but the Facilitating Conditions (training, support) are perceived as insufficient.

4.3.4 Motivations between usefulness and complexity

Applying the TAM model, we see a paradox. Employees believe the tools are useful “Perceived Usefulness” but find them hard to implement “Ease of Use” (**Davis, 1989**).

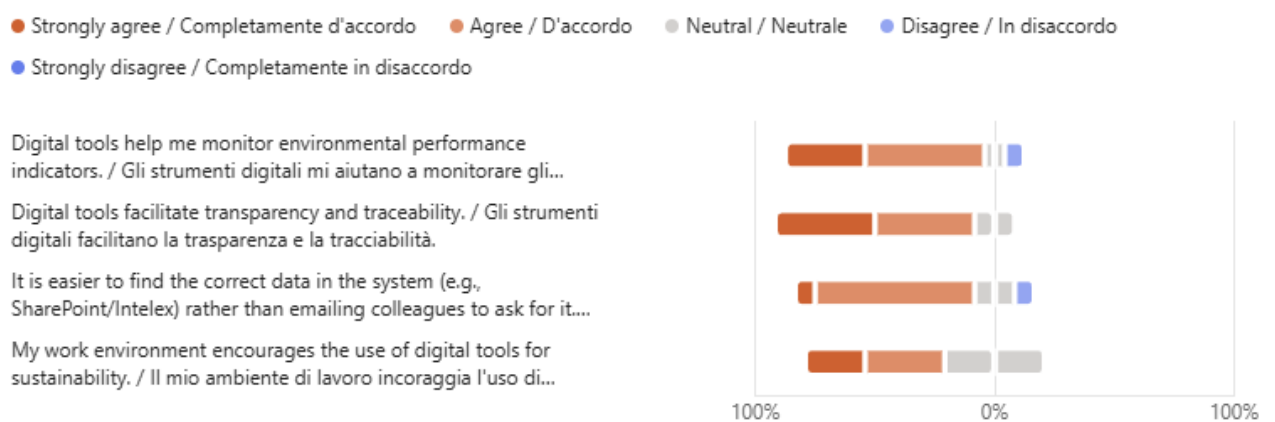


Figure 6: Respondents' level of agreement regarding the Motivations listed in the survey.

The “**High Perceived Usefulness**” is demonstrated when the majority agreed that "Digital tools help me monitor environmental performance" and "facilitate transparency" (Figure 6). Meanwhile, **Respondent 11** noted that people need to understand how "these two things (Tech & Sustainability) can bind together".

While “**Low Ease of Use**” is shown when **Respondent 8** (IT) disagreed that the environment encourages these tools, explicitly stating that "**Greater simplicity of use**" is needed to drive adoption.

4.3.5 Strategic vs. Operational Perspectives in the Survey

Even within this small sample, the divergence appears:

- **Strategic View (Sales/Business Development): Respondent 3** raised a high-level strategic concern about the environmental cost of digitalization itself, noting that "reckless use 24/7 of digital technologies produces an unsustainable impact" (translated). This reflects a high-level maturity regarding the sustainable IT paradox.
- **Operational View (Maintenance/Logistics): Respondent 4 and Respondent 10** were much more practical, asking for "more information" and "sharing of problems/improvements". They are not questioning the philosophy of digital tools; they basically just want them to work better for their daily tasks.

4.3.6 Conclusion of Quantitative Findings

The survey data successfully completes and confirms the interview findings. It confirms that the "**Barrier Gap**" is real:

- 1) **Manual Workload:** Confirmed by the high agreement on "copying data from Excel."
- 2) **Training Deficit:** Confirmed by 50% of respondents explicitly mentioning "training" or "awareness" in their open comments.
- 3) **Fragmented Systems:** Confirmed by IT staff pointing out "disconnected legacy systems."

4.4 Documentary Analysis: ESG Report Analysis

To complete the triangulation of data (Yin, 2018), the study analyzed the organization's Sustainability Report of 2025. While the interviews and survey revealed the operational challenges of digital adoption, the official report articulates the strategic imperative and the formal role of technology in achieving the company's goals.

4.4.1 Strategic Vision: the “Planet, People, Principles” Framework

The report confirms the strategic framework described by the Global Head of Sustainability (**Interviewee A**) during the interviews. It formally outlines the “Sustainability 2030” strategy, structured around three pillars: Planet, People, and Principles (**Company’s sustainability report, 2025**)

The document explicitly states the target to be “Carbon Neutral in own operations by 2030”. This Validates the pressure cited by operational managers regarding the need to **decarbonize factories**.

The report recognizes **technology as a critical enabler**, stating that “Digitalization is key to creating a resilient and adaptable grid” and estimating that digital operations could reduce power sector emissions by up to 20%. This supports the **Strategic group’s** view that software is not just an administrative tool but a core component of the sustainability value proposition.

4.4.2 Validation of Hard Tech Innovation

The report strongly supports the operational focus on **physical engineering** found in the interviews with R&D manager (**Interviewee C**). The document highlights the **SF6 Gas Insulated Switchgear** as a central pillar of the environmental strategy, specifically noting the roadmap to replace SF6 with more eco-efficient alternatives (**Company’s sustainability report, 2025**).

Furthermore, the report describes the SF6 Gas Insulated Switchgear as “proven to deliver exceptional environmental performance”. This shows the testimony of **Interviewee C**, who described the “**total redesign**” of products to meet EU Regulations. The document confirms that the organization is banking on “**Hard Tech**” to maintain its market leadership in a regulated future.

4.4.3 Data Reality

Crucially, the Sustainability Report 2025 contains a clear admission that demonstrates the “**Data Quality**” barrier identified in both **the interviews** and **the survey**. Specifically in the report’s disclaimer/methodology section, the organization admits that “Data availability and collection is an **ongoing challenge**” due to the varying regulatory landscapes across the 67 countries of operation.

This official acknowledgement that data collection is difficult validates the survey findings, where 58% of respondents agreed that they spend time manually copying data. It confirms that the “**messy data**” described by the Global Sustainability Specialist (**Interviewee B**) is a recognized systemic issue, even at the highest level of corporate reporting.

4.4.4 Future Regulatory Alignment

Finally, the report addresses the “**Regulatory Uncertainty**” Barrier mentioned by the Operational group. It explicitly lists compliance with the Corporate Sustainability Reporting Directive (CSRD) and the EU Taxonomy as key governance priorities (**Company’s sustainability report, 2025**). This confirms that the “**external pressure**” felt by the business units is indeed driving the central corporate strategy to invest in better reporting system.

4.5 Conclusion of Findings

This chapter presented the empirical evidence collected through semi-structured interviews, a quantitative survey, and documentary analysis. The triangulation of these three data sources reveals a consistent but complex reality regarding the adoption of technology for sustainability at the case study organization.

The findings highlight three major themes that will be discussed in the following chapter:

- 1) **The implementation gap:** while the Sustainability Report 2025 and strategic leaders articulate a clear vision of “Digitalization for Decarbonization”, the operational reality is characterized by friction. The survey confirms that 58% of staff still rely on manual Excel work, and interview data reveals that internal systems (like Hinext and Intalex) are often perceived as fragmented rather than enabling.
- 2) **The definition of Technology:** a distinct split emerged in how “technology” is perceived. For the strategic group, it is an administrative tool (AI, Dashboards) used for governance and reporting. For the operational group, it is a physical necessity (Gas Insulated Switchgear, sensors) required to meet regulatory mandates like the SF6 ban.
- 3) **The Regulatory Catalyst:** Across all data sets, external regulation (EUDR, CSRD, and the SF6 ban) appears as the primary driver for investment. As noted by **Interviewee C**, legislation acts as the “catalyzer” that forces the organization to overcome financial barriers and invest in sustainable innovation.

These findings suggest that while the **motivation to adopt technology** exists, it is currently hindered by **organizational barriers** (Data Governance) and **market barriers** (Cost). The next chapter is interpreting these findings through the theoretical lenses of the Technology Acceptance Model (**Davis, 1989**), Institutional Theory (**DiMaggio & Powell, 1983**), and the Natural Resource-Based View (**Hart,1995**).

Chapter 5: Discussion

5.1 Introduction

The central objective of this study was to identify the motivations and barriers regarding the use of technology for social and environmental accountability at the company. The analysis of the data reveals a significant finding: while the organization is unified in its high-level sustainability goals (such as achieving carbon neutrality and deploying the SF6 Gas Insulated Switchgear) there is a distinct divergence in how these goals are perceived and executed depending on the employee's role.

This chapter demonstrates that the “**Strategic group**” (Headquarters) and the “**Operational group**” (Factory/ R&D) operate under different theoretical pressures. This has created an “**implementation gap**” between the corporate vision of sustainability and the daily digital reality of the employee responsible for executing it.

5.2 The differences in Motivations

The first major divergence lies in the main **need to adopt technology**. The data suggests that while the **Headquarters** adopts technology primarily to survive the **increasing workload** related to reporting and merging different tools, **the Operational** staff adopts technology to satisfy **external regulators** and maintain **market balance**. And we can relate this difference to both theories: Institutional theory (illustrated by the Operational strategy), and Technology Acceptance Model theory (Strategic group vision).

5.2.1 Operational view

For the operational staff (**Interviewee C and Interviewee E**) the **primary driver** is the pressure from external Institutions.

- **Regulatory Mandates: Interviewee C** (R&D Manager explicitly describes regulation as a “Catalyser” that forces the company to innovate or risk losing its ability to sell products. This shows the immense pressure of regulations like the EU’s SF6 ban (Interviewee B)
- **Supply Chain Transparency (EUDR & DPP): Interviewee E** (Head of Sustainability for Transformers BU) highlighted the upcoming EU Deforestation Regulation (EUDR) and the Digital Product Passport (DPP), she noted that these regulations force the company to implement IT solutions capable of tracking data down to “Tier 3 and Tier 4 suppliers”

For this group, technology is not just an efficiency tool, but it is a governance mechanism used to maintain the company’s legal “**license to operate**” and avoid exclusion from the European market specifically and global one generally.

5.2.2 Strategic view

In contrast, for the Strategic leadership (**Interviewees A, B and D**) views technology through the lens of the **Technology Acceptance Model** (TAM) theory. Their adoption is driven by “**Perceived Usefulness**” specifically the ability to automate manual tasks.

Interviewee A (Global Head of Sustainability) described the early days of manual reporting as a “nightmare”. Consequently, the motivation to develop internal AI tools was specifically to “Preload answers” for customer tenders (**Interviewee B**). This supports the TAM hypothesis: employees will only embrace a tool if they believe it will enhance their job performance by reducing repetitive labor (**Davis, 1989**).

Moreover, regarding the reduce of **human error**, Interviewee D (Environmental Manager) supported this, noting that digital platforms are necessary because “Humans are open to errors”. For the strategic group, motivation is **practical efficiency** rather than **abstract compliance**. Finally, the “**Competitive advantage**” where Interviewee D also linked data platforms to Market **resistance and flexibility**, noting that using data to predict climate risks allows the company to “compete against other competitors”. Here, technology is motivated by the immediate need to win business against rivals.

5.3 The differences in Barriers

The study identifies a disconnect regarding the obstacles slowing down full technological adoption.

5.3.1 The Operational Fear: External Market Cost

The **Operational group** views the primary barrier as Economic. **Interviewee E** (Transformers BU) highlights the challenge of “**willingness to pay**”, noting that customers will not accept the cost of green premium technology unless forced by law.

The **market motivation issue** is when **Interviewee C** (R&D) mentions the development of eco-efficient products by eliminating the SF6 gas. However, **Interviewee E** reveals that without regulatory mandates, “Nobody wants to pay double” for these innovations, this barrier is external which means the market is not yet ready to pay for the technology the company has developed.

Interviewee C (R&D) explained that shifting away from SF6 gas requires a “product re-design” of the hardware, involving mechanical, electrical, and chemical changes. This represents a massive financial barrier that slows down the transition.

5.3.2 The Strategic struggle: Internal Data Chaos

For the strategists, the barrier is Technical and Organizational.

Data Quality as **Interviewee B** (Global Sustainability Specialist) admitted that she must “manually review” data in Excel because systems like Power BI provide only a “first glance”, necessitating offline checks to fix discrepancies. **Interviewee A** (Global head) reinforces this, stating, “if your data is a mess, the tool is not going to solve your issue”.

We had the survey validation (Quantitative Triangulation): the quantitative survey confirms this strategic struggle:

- When asked about barriers, respondents agreed with “i spend a lot of time manually copying data from Excel”
- Respondent 12 (IT support) explicitly commented: “wider adoption could be encouraged by improving data transparency and integrating fragmented legacy systems, as many organizations struggle to track sustainability metrics effectively when data sources are outdated or disconnected”

Therefore, this validates the qualitative finding that the tools are often perceived as adding to the workload rather than simplifying it.

5.4 The technology gap: Hardware vs. software

Finally, the definition of “technology” itself varies between the groups, creating a potential resource conflict.

5.4.1 Operational focus: Hard Tech

For the R&D and BU leaders, “technology” refers to **physical engineering** innovations.

- **Interview evidence: Interviewee C (R&D)** explicitly notes that digital sensors are difficult to use in high voltage fields due to physical interference and importance of human decisions. This suggests that for the core product team, the priority is physical re-engineering to meet European regulations, not software implementation.

5.4.2 Strategic focus: Soft Tech

For the sustainability managers, “technology” refers to **software platforms**.

- **Interview evidence: interviewee B and Interviewee D** focus entirely on software tools like Intalex, Power BI, and AI Chatbots for reporting. Their technology is about moving data, not redesigning a switchgear.

This divergence suggests a risk of disconnection. The company invests heavily in R&D for physical products (SF6 Gas Insulated switchgears) to satisfy the market demands, while the internal operational team struggles with fragmented software structure (multiple portals) to manage the resulting data.

5.5 The role of AI

The study highlights that Artificial Intelligence (AI) is currently in a transitional phase at the company. The analysis reveals a dual approach to AI deployment.

5.5.1 AI for Efficiency

Strategic group view AI as a solution to administrative struggles or “Bottlenecks”. First in **Tender automation** as confirmed by **Interviewee A** when she described the Generative AI Tool currently in testing that allows account managers to upload customer questionnaires (Excel files) and have the AI “preload the answers” based on verified internal documents. And secondly, in **Risk management**: the company is developing a “Human right risk trigger” inside

Salesforce. This AI tool acts as a “traffic light system” to warn managers about potential ethical risks with partners before a contract is signed.

5.5.2 AI for strategy

Being considered as a predictive tool, **interviewee D** (Environmental manager) described using intelligent platforms to model and predict climate scenarios (floods, droughts...) for the years 2030 and 2050. This moves AI beyond reporting and into strategic risk management: referring to NRBV theory, allowing the company to prepare its factories for future environmental shocks.

5.5.3 Limitations of AI in the Operational field

Despite these advancements, there is resistance to AI in critical operations in the shopfloor, **Interviewee C** (R&D) stated “we are really human-driven company... decisions are man-made”. This indicates that while AI is accepted for reporting (soft tech), it is viewed with caution in High Voltage field and close to being not trusted yet, where a failure could lead to a blackout.

5.6 Conclusion of the discussion

The findings suggest a risk of **divided goals** and **objectives**, even if the clear company vision is eliminating carbon footprints and providing innovative sustainable solutions, however its strategic vision doesn't fully match its daily practices. The information technology structure as revealed in the survey indicates that digital implementation has not yet caught up with the strategic vision.

The adoption of technology is going in “Two Roads”: **Efficiency** from the top and **Compliance** from the bottom. Nevertheless, for digital transformation to be fully effective, the company

must bridge the gap between the product portfolio focus and the Data struggling by the employees.

As the survey indicates, the solution lies not just in acquiring new software, but in “investing in training” and data governance to ensure the workforce can utilize the tools provided.

Chapter 6: Conclusion

6.1 Summary of the study

This research set out to explore the motivations and barriers influencing the adoption of digital technologies for social and environmental accountability within the energy sector. Using a single case study of a Global leader in power technologies, the study employed a mixed-method approach triangulating qualitative data (semi-structured interviews with key informants), quantitative data (an employee survey), and documentary analysis (**Sustainability Report of 2025**).

The study aimed to answer two primary questions: what drives the adoption of these technologies? And what obstacles hinder their effective implementation?

6.2 Key Findings: The Implementation Gap

The **central finding** of this thesis is the existence of a significant “**Strategic and Operational divide**”. While the organization is unified in its high-level sustainability goals (Net Zero by 2050), the reality of digital adoption differs fundamentally depending on the employee’s level within the hierarchy.

1) Motivations

In the **strategic** level (Headquarters), in this research it’s considered driven by **Efficiency** as per the Technology Acceptance Model (**Davis, 1989**). For managers in the headquarters,

technology is motivated by the desperate need to cope with the administrative workloads. The survey revealed that employees adopt tools not for sustainable reasons, but to automate the constraint of manual reporting.

In the other side, in the **operational** level, being considered in this research driven by institutional pressure “**Isomorphism**” (DiMaggio & Powell, 1983). For leaders, technology is a mechanism to maintain the “license to operate” in the face of regulations like the CSRD and EUDR. The Sustainability report of 2025 confirms this, positioning digitalization as a key pillar for global decarbonization and compliance.

2) Double definition of “Technology”

The study reveals that the term “Technology” means two different things within the same company:

The first definition is **Soft Tech** focused on by the strategic group, it means AI and Data Platforms (e.g., Risk Triggers, Dashboards, Power BI...) used for governance and oversight.

The second one is **Hard Tech** for the operational group, and it means physical engineering (e.g., Gas Insulated Switchgear) required to meet market specifications and physical laws.

3) The Barrier Paradox

Regarding the barriers we have identified in this research two types of barriers: **Internal** and **External**.

Internal barriers are when the **Strategic group** is blocked by **Data Quality** and **Governance**. They struggle with “messy data” and fragmented systems (Hinext, Intellex, SAP), this was confirmed in the quantitative analysis that showed 58% of respondents are still relying on manual Excel work, proving that the sophisticated digital tools at the top have not yet fully automated the workflow.

And for **External barriers**, they are identified when the **Operational group** is blocked by **Market Costs** and **Regulatory Uncertainty**, they are ready to build green products but face customers unwilling to pay the “green premium” and regulators who have not yet defined technical standards.

6.3 Theoretical Implications

This study contributes to literature by demonstrating the necessary integration of three theoretical frameworks:

1. **Institutional theory** explains the initiation of the strategy: The company invests in technology because coercive pressures (EU Regulations) leave it no choice.
2. **Natural Resource-Based View (NRBV)** explains the strategy: the company uses “Hard Tech” to build a competitive capability that rivals cannot easily copy.
3. **Technology Acceptance Model (TAM)** explains the stagnation: the “ease of use” barrier remain high. Because internal systems are perceived as complex and training is insufficient (as shown in the survey), employees revert to tools like Excel, which is slowing down the digital transformation.

6.4 Managerial Recommendations

Based on the findings, the following recommendations are proposed for the study case company and other similar organizations as well:

Harmonization of Data: the current reliance on manual Excel integration is inconvenient for CSRD compliance. The company must restructure its system to be more unified, and to connect operational ERP systems directly to ESG dashboards

More training: as shown in the survey, the lack of training was highlighted among the primary barriers. So it's recommended investment in training the employees on how to manage efficiently the already existing tools, making them always ready to acquire new skills in the digital field.

Bridge the gap between Strategists and operational: in this research, we've noticed the difference between the vision of the two identified groups, strategist (Soft Tech) and operational (Hard Tech). Both teams must collaborate more closely. The Digital Product Passport (DPP) represents a critical opportunity to merge these two sides, linking physical product data directly to digital reporting systems.

6.5 Limitations

Like all research, this study has certain limitations that it is important to recognize. First, we relied on a single case. This allows for in-depth analysis but limits the possibility of generalizing the results to all companies in the sector. The conclusions are therefore specific to this context (Yin, R. K. 2018).

Then, there may be biases related to the participants. For example, respondents may give responses influenced by their position in the company or by the desire to show a positive image (Yin, 2018). We tried to reduce this bias by guaranteeing anonymity and asking open questions, but it is impossible to completely eliminate it.

Another limit is the **sample size**; with a limited number of interviews and questionnaires, we have interesting data, but not enough to make complex statistical analyses. This remains consistent with a case study, but it must be specified.

Finally, there is the availability of data; some internal informations are difficult to obtain for confidentiality reasons. This may have limited the depth of the documentary analysis.

These limitations do not call into question the relevance of the research, but they must be considered.

6.6 Final Conclusion

Technology is indeed a powerful enabler of social and environmental accountability, but it is not an immediate game changer. As this study demonstrates, purchasing advanced software is not enough. To truly enhance accountability, organizations must overcome the obstacle of manual data, resolve the cost-value paradox for customers, and most importantly, align their Strategic vision with the Operational reality of their workforce. Only then can the digital transition truly serve the sustainable transition.

Bibliography

- Anser, M. K., Yousaf, Z., & Zaman, K. (2020). Green Technology Acceptance Model and Green Logistics Operations: “To See Which Way the Wind Is Blowing.” *Frontiers in Sustainability*, 1(3). <https://doi.org/10.3389/frsus.2020.00003> [researchgate.net]
- Appannan, J. S., Mohd Said, R., Ong, T. S., & Senik, R. (2020). Environmental proactivity on environmental performance: An extension of natural resource-based view theory (NRBV). *International Journal of Industrial Management*, 5, 56–65. <https://doi.org/10.15282/ijim.5.0.2020.5622> [scispace.com]
- Arshi, P. S., Vahidi, E., & Zhao, F. (2024). Internet of Things (IoT) and the Environmental Sustainability: A Literature Review and Recommendations for Future Research. *Corporate Social Responsibility and Environmental Management*. <https://doi.org/10.1002/csr.70098> [onlinelibr...wiley.com]
- Awa, H. O., Etim, W., & Ogbonda, E. (2024). Stakeholders, stakeholder theory and Corporate Social Responsibility (CSR). *International Journal of Corporate Social Responsibility*, 9(11). <https://doi.org/10.1186/s40991-024-00094-y> [jcsr.sprin...eropen.com]
- Bazeley, P., & Jackson, K. (2013). *Qualitative data analysis with NVivo* (2nd ed.). Sage Publications.
- Bhandari, P. (2021). Ethical considerations in research: Types & examples. Scribbr. Retrieved from <https://www.scribbr.com/methodology/research-ethics/>
- Braun, V., & Clarke, V. (2012). Thematic analysis. In H. Cooper, P. M. Camic, D. L. Long, A. T.
- Cavalieri, A., Reis, J., & Amorim, M. (2022). A conceptual model proposal to assess the effectiveness of IoT in sustainability orientation in manufacturing industry: An environmental and social focus. *Applied Sciences*, 12(11), 5661. <https://doi.org/10.3390/app12115661> [researchgate.net]
- Crowther, D., & Seifi, S. (Eds.). (2020). *Governance and sustainability*. Emerald Publishing Limited. <https://doi.org/10.1108/S2043-0523202015>

- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340.
<https://doi.org/10.2307/249008> [scirp.org]
- Deloitte. (2023). Global Sustainability Disclosure Standards Converge: ISSB Finalizes IFRS S1 and IFRS S2. Retrieved from
<https://dart.deloitte.com/USDART/home/publications/deloitte/heads-up/2023/global-sustainability-disclosure-standard-coverage-issb-finalizes-ifrs-s1-s2>
[dart.deloitte.com]
- DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review*, 48(2), 147–160. <https://doi.org/10.2307/2095101> [scirp.org]
- Du, S., Hashim, N., & Kamarudin, S. (2024). Unveiling the Technology Acceptance Model: A Systematic Review of Evolution, Impact Across Industries and Future Directions. *Pakistan Journal of Life and Social Sciences*, 22(1), 83–95.
<https://doi.org/10.57239/PJLSS-2024-22.1.0083>
- EFRAG. (2023). European Sustainability Reporting Standards (ESRS) – Delegated Act. Retrieved from <https://www.efrag.org> [efrag.org]
- European Union. (2022). Directive (EU) 2022/2464 – Corporate Sustainability Reporting Directive (CSRD). EUR-Lex.
- Farahani, R. Z., & Treiblmaier, H. (2025). Blockchain and IoT integration for sustainable supply chains. *Journal of Cleaner Production*.
- Freeman, R. E. (1984). *Strategic Management: A Stakeholder Approach*. Boston: Pitman.
- Frontiers. (2020). Role of Technological Innovation in Achieving Social and Environmental Sustainability. *Frontiers in Sustainability*.
- GRI. (2021/2024). *GRI Standards: Universal, Sector & Topic Standards*. Global Reporting Initiative.
- Hart, S. L. (1995). A natural-resource-based view of the firm. *Academy of Management Review*, 20(4), 986–1014.

- Hart, S. L., & Dowell, G. (2011). A natural-resource-based view of the firm: Fifteen years after. *Journal of Management*, 37(5), 1464–1479.
- Hwang, J. (2024). Corporate Social Responsibility (CSR) in the Digital Age: Investigating the Challenges and Future Insights. *GSC Advanced Research and Reviews*, 21(1), 503–518. <https://doi.org/10.30574/gscarr.2024.21.1.0383>
- IFRS Foundation. (2023). IFRS S1 General Requirements for Disclosure of Sustainability-related Financial Information & IFRS S2 Climate-related Disclosures. Retrieved from <https://www.ifrs.org>
- Study case company's sustainable report (2025). *Sustainability Report 2025*.
- Jinyoung Hwang. “Corporate Social Responsibility (CSR) in the Digital Age: Investigating the Challenges and Future Insights.” *GSC Advanced Research and Reviews* 21, no. 1 (2024): 503–18. <https://doi.org/10.30574/gscarr.2024.21.1.0383>.
- Kharwar, Sheetal Singh, and R S Meena. CSR in the Digital Age: Leveraging Technology for Social Good. 11, no. 8 (2024).
- Likert, R. (1932). *A technique for the measurement of attitudes*. *Archives of Psychology*, 140, 1–55.
- Liu, Y., & Li, W. (2025). From technological empowerment to green performance: Empirical evidence on digitalization-driven energy conservation and emission reduction in logistics enterprises. *Energy Informatics*, 8(1), 105. <https://doi.org/10.1186/s42162-025-00570-0>
- López, O. L. A., et al. (2023). Energy-Sustainable IoT Connectivity. *arXiv preprint*.
- Mutua, J., et al. (2025). An In-Depth Analysis of Barriers to Corporate Sustainability. *Journal of Sustainable Business*.
- Raman, R., et al. (2024). Green & sustainable AI: A systematic review. *Journal of Big Data*, 11(55).
- Siemens. (2024). *Siemens Sustainability Report 2024*. Retrieved from <https://assets.new.siemens.com>
- Singh Kharwar, S., & Meena, R. S. (2024). CSR in the Digital Age: Leveraging Technology for Social Good. *Journal of Corporate Social Responsibility*.
- Textes juridiques: Directive (UE) 2022/2464 – CSRD (EUR-Lex)

- Tripathi, S., et al. (2024). AI and sustainability literature review. *Journal of Big Data*, 11(65).
- Varma, A., et al. (2024). Blockchain for sustainable supply chains. *World Journal of Advanced Research and Reviews*, 21(3), 980–994.
- Vasheghani Farahani, Javad, and Horst Treiblmaier. “A Sustainability Assessment of a Blockchain-Secured Solar Energy Logger for Edge IoT Environments.” *Sustainability* 17, no. 17 (2025): 8063. <https://doi.org/10.3390/su17178063>.
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27(3), 425–478.
- Yang, Z., Wang, Q., & Jia, M. (2023). Integrating Industry 4.0 and the Internet of Things (IoT) for eco-friendly manufacturing. *International Journal of Advanced Manufacturing Technology*. <https://doi.org/10.1007/s00170-023-12331-y>
- Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.). Sage Publications.
- Likert, R. (1932). *A technique for the measurement of attitudes*. *Archives of Psychology*, 140, 1–55.