UNIVERSIDADE CATÓLICA PORTUGUESA

Enhancing Global Supply Chain Sustainability

A Comprehensive Risk Perception Analysis

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Enhancing Global Supply Chain Sustainability

A Comprehensive Risk Perception Analysis

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Aknowledgments

As I turn the final page of this academic chapter, a profound sense of accomplishment and gratitude washes over. Writing this thesis was not just an academic endeavour but a journey of personal growth and discovery, both challenging and rewarding. Completing this work evokes a blend of relief and nostalgia, marking the end of a six-year academic journey I will fondly remember. I owe my deepest gratitude to many who have supported me along the way.

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Resumo

Numa altura onde a sustentabilidade transforma as cadeias de abastecimento globais, a presente dissertação explora o cenário em evolução da gestão sustentável da cadeia de abastecimento, centrada na perceção e gestão de risco das maiores empresas europeias 2022, em termos de lucros. Estas empresas operam num conjunto complexo de riscos de sustentabilidade, tornando-se imperativo que se saibam adaptar no controlo eficiente da multifacetada natureza destes riscos, ultrapassando desafios e pressões internas e externas.

O estudo utiliza uma metodologia mista para analisar o conjunto de nuances relativas à variabilidade da perceção do risco em todos os sectores de atividade, influenciada pela geopolítica e características específicas de cada sector, estabelecendo uma ponte entre os conceitos teóricos e o mundo real.

Relativamente à questão de investigação: "Como é que as empresas percepcionam os riscos na gestão sustentável da cadeia de abastecimento?", o trabalho conclui que as empresas europeias gerem os riscos de sustentabilidade de forma diferente intra-indústria, entre países e inter-indústrias, reflectindo a importância das pressões industriais e geopolíticas na gestão do risco.

Esta tese prova a diversidade da perceção do risco de sustentabilidade nas cadeias de abastecimento globais, oferecendo bases para a investigação e práticas futuras no sentido de melhorar as cadeiras nos permanentes desafios.

Palavras-chave: Gestão Sustentável da Cadeia de Abastecimento, Gestão Sustentável do Risco, Riscos da Cadeia de Abastecimento, Gestão Europeia da Cadeia de Abastecimento

Contagem de palavras: 9853 palavras.

Abstract

At a time when sustainability imperatives are reshaping global supply chains, this thesis ventures into the evolving landscape of sustainable supply chain management (SSCM), focusing on the risk perception and management among Europe's leading revenue-generating companies in 2022. By navigating a complex array of sustainability risks, companies must adapt a pivotal role in efficiently control the multifaceted nature of these risks, overcoming challenges and pressures from both internal and external spheres.

This study employs a mixed-method approach to analyse the plethora of nuances regarding risk perception variability across industries, influenced by geopolitical and industry-specific dynamics, while bridging the gap between theoretical concepts and real-word practices.

To answer the research question "How do companies perceive risks in sustainable supply chain management?", this thesis showcases that European companies articulate and manage sustainability risks differently intra-industry, across countries, and inter-industry, reflecting on the importance of industry-wise and geopolitical pressures on risk management strategies.

This thesis delineates the diversity of sustainability risk perception within global supply chains of Europe's top revenue-generating companies, laying the groundwork for future research and practice in enhancing SSCM amid the pressing challenges of the present.

Keywords: Sustainable Supply Chain Management, Sustainable Risk Management, Supply Chain Risks, European Supply Chain Management

Word count: 9853 words.

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Abbreviations

SC – Supply Chain
SCM – Supply Chain Management
SSCM – Sustainable Supply Chain Management
SCRM – Supply Chain Risk Management
TRBC – The Refinitiv Business Classification
RMP – Risk Management Process

Introduction

In an era marked by the escalating demands of sustainability, the dynamics of global supply chains are under intense scrutiny (Gustafsson et al., 2023; Kusi-Sarpong et al., 2023). This thesis embarks on a journey into the landscape of sustainability, examining the perceptions of sustainability risks of Europe's top 100 revenue-generating companies in 2022. The study aims to elucidate the perception through which these corporations navigate the waters of environmental, social, and economic sustainable challenges. The urgency of addressing these challenges is underscored by recent studies, such as Hajmohammad et al. (2024), which experimentally examined supplier sustainability risks, revealing the intricacies of risk management in the supply chain domain.

The motivation behind this work stems from a realization: the contemporary business environment mandates a departure from conventional operational models towards a holistic integration of sustainability within supply chain management. This paradigm shift, which prioritizes the triple bottom line—economic resilience, environmental stewardship, and social equity—is not merely a trend but a strategic imperative (Mathiyazhagan et al., 2023).

Despite the rich literature of knowledge surrounding Sustainable Supply Chain Management, there is a clear shortage of research regarding the communication of sustainability risks by corporations to their stakeholders (Siems et al., 2023). This gap signifies a critical area of inquiry, as the dialogue around sustainability evolves from a marginal concern to a central element of corporate strategy.

The centre of this work lies on the research question: "How do companies perceive risk in sustainable supply chain management?". This inquiry delves

into corporate disclosure practices, shedding light on how companies communicate their risks within SSCM to stakeholders. The relevance of this exploration is grounded by the growing scholarly interest in SSCM (Siems et al., 2023), reflecting the consensus on the importance of understanding and articulating sustainability risks within the corporate realm (Ahi & Searcy, 2013; Beske et al., 2014; Kähkönen et al., 2023).

Guiding this exploration are three hypotheses that aim to address the research question in detail, explaining the risk perception within and across industries, influenced by geographical and corporate strategies. These hypotheses serve as the foundational pillars upon which the analytical structure of this thesis is constructed, facilitating the understanding of sustainability risk dynamics within the context of leading European companies.

The study begins with a Literature Review that lays down the theoretical scaffolding of the study, followed by a detailed Methodology section that outlines the empirical framework. Subsequent chapters dissect the findings, covering theoretical insights with empirical evidence to bridge the theoretical underpinnings and practical realities.

Chapter 1: Literature Review

The present literature review aims to dissect the intricacies of SSCM, illuminating its interdisciplinary essence and examining its interplay with risk management within supply chains.

At the heart of this inquiry lies the fundamental question, “How do companies perceive risk in sustainable supply chain management?”. This question not only probes the corporate perspective on sustainability risks but also seeks to unravel how these risks are identified, categorized, and navigated, thereby offering valuable insights into corporate strategies and practices. The literature review aims to provide a clear understanding of SSCM, shedding light on its evolution, the key themes that underpin it, the risks inherent within it, and the contemporary challenges that shape it.

1.1. Sustainable Supply Chain Management

SSCM stands at an intersection of environmental stewardship, economic performance, and social responsibility, aiming to enhance organizational resilience, profitability, and competitiveness (Sadeghi R & Hasan Abadi, 2023). It strategically integrates sustainable development goals into supply chain practices, addressing stakeholders' environmental, social, and economic requirements (Ahi & Searcy, 2013; Siems et al., 2023). SSCM has evolved from an environmental emphasis to a holistic model incorporating the triple bottom line—people, planet, profit—reflecting its expanding scope (Carter & Rogers, 2008; Stock & Boyer, 2009).

The concept's interdisciplinary nature tackles supply chain challenges by merging supplier selection, performance measurement, and technology to promote sustainability (Koberg & Longoni, 2019; Seuring & Müller, 2008). This

comprehensive approach underscores the importance of stakeholder engagement and collaborative efforts in fostering sustainable supply chains, emphasizing risk management to navigate the complexities of global operations (Beske et al., 2014).

Recent advancements stress the significance of addressing the complexities and interconnected risks within supply chains, highlighting the need for innovative management strategies and tools for effective sustainability integration (Fan et al., 2021; Khan et al., 2021; Sarkis et al., 2011). This ongoing evolution underscores the dynamic nature of SSCM, offering numerous research and practical implementation opportunities.

1.2. Risks in Supply Chain

Supply chain management (SCM) involves managing risks that can disrupt the flow of goods, services, and information, impacting organizational performance and sustainability (Liu et al., 2023; Petratos & Faccia, 2023). These disruptions may posit a significant impact on an organization's performance and bottom line, creating the need for effective risk management in the supply chain, crucial for ensuring organizational resilience and sustainability (Adeseun et al., 2018; Tang, 2006).

1.2.1. Types of Risk

Supply Chain Management faces diverse risks that pose distinct challenges to supply chain stability and efficiency. These risks can be classified into operational, financial, and strategic categories, requiring detailed and holistic risk management approaches (Emrouznejad et al., 2023; Kusi-Sarpong et al., 2023; Yontar & Zengin, 2023).

Operational Risks in the supply chain stem from disruptions in daily activities, like natural disasters or equipment failures, impacting the flow of goods and services. Tang (2006) stresses the importance of robust strategies to counter these disruptions, as they can greatly influence supply chain continuity and performance (Ekinci et al., 2024; Sadeghi R & Hasan Abadi, 2023). These disruptions, whether due to natural calamities or equipment malfunctions, can have a profound impact on the operational efficiency and overall performance of the supply chain.

Financial Risks in supply chains encompass economic uncertainties like currency fluctuations, credit risks, and commodity price changes, impacting financial stability and necessitating robust risk management strategies (Ersahin et al., 2024; Tay et al., 2022; Ulfah et al., 2023). These risks affect the financial stability of supply chains, requiring effective financial risk management practices to safeguard against economic volatility.

Strategic risks are pivotal in long-term planning and decision-making, as they encompass potential shifts in government policies, market demand, and competitive dynamics that can reshape a company's strategic trajectory (Aljohani, 2023; Kähkönen et al., 2023). The strategic integration of sustainability into supply chain management, as proposed by Giannakis & Papadopoulos (2016), is crucial in addressing these risks. This approach involves considering the triple bottom line (environmental, social, and economic factors) to develop strategies that are not only economically viable but also environmentally and socially responsible.

The recognition of these risk categories underscores the complex nature of challenges in SCM, calling for the adoption of integrated risk management strategies that are responsive to the dynamic landscape of supply chains (Sadeghi R & Hasan Abadi, 2023). Such strategies should not only aim to mitigate the immediate effects of these risks but also align with broader

sustainability goals to ensure the long-term resilience and efficiency of supply chains.

1.2.2. Strategies for Risk Mitigation

Effective risk mitigation in SCRM involves a multifaceted approach to ensure supply chain resilience, including strategies such as diversification of suppliers, robust quality control measures, and leveraging advanced analytics for predictive insight (Ulfah et al., 2023). The management of risks in SC entails various stages, including identification, assessment, analysis, treatment, and monitoring. For example, as highlighted by Linton et al. (2007) and Tay et al. (2022), leveraging analytics is crucial for predicting and mitigating potential disruptions in the supply chain.

Ersahin et al. (2024) provided empirical evidence on how firms adapt to supply chain risks by diversifying their supplier base, including establishing relationships with industry leaders and domestic suppliers, and through vertical integration strategies. By understanding and implementing these stages and strategies, companies can proactively address risks, enhance their supply chain resilience, and minimize the impact of disruptions.

1.2.3. Risk Mitigation Frameworks

Various empirical studies underscore the efficacy of risk mitigation strategies in diminishing the impacts of supply chain disruptions. Among these, the RMP stands out as a comprehensive approach, entailing the identification, assessment, prioritization, and mitigation of risks. This methodology explains that the correct resource deployment alleviates the impact of identified risks (Adeseun et al., 2018).

The management of supplier sustainability risk is also a critical component of SCM, evidenced by the study conducted by Hajmohammad et al. (2024). Their

work investigates the experimental approaches to managing these risks, emphasizing the significance of strategic supplier selection and collaboration in mitigating sustainability-related vulnerabilities.

Recent advancements emphasize the critical role of advanced analytics and machine learning in boosting supply chain predictability and responsiveness to disruptions. These tools aid in forecasting and developing proactive risk mitigation strategies effectively. The integration of predictive analytics and machine learning enables real-time risk identification and agile responses, shifting from reactive to proactive risk management strategies (Aljohani, 2023; Ekinci et al., 2024; Ersahin et al., 2024).

Moreover, the integration of autonomous planning technologies in supply chain management marks a significant leap towards achieving operational resilience (Mathiyazhagan et al., 2023; Sadeghi R & Hasan Abadi, 2023). These technologies facilitate dynamic and real-time decision-making processes, allowing for a more agile response to unforeseen challenges (Aljohani, 2023). Schroeder & Lodemann (2021) further elaborate on this by presenting a systematic investigation into how machine learning can be seamlessly integrated into SCRM frameworks. Their research illustrates the potential of machine learning to not only predict risks but also optimize risk management strategies, thereby enhancing the overall robustness of supply chains against disruptions.

Incorporating these methodologies and technologies into SCM underscores the shift towards a more data-driven, analytical approach to risk mitigation. This paradigm shift is crucial for modern supply chains, enabling them to navigate the complexities of today’s global market dynamics with enhanced efficiency and resilience. This study aligns with the current research's focus on risk perception and management, highlighting the importance of integrating supply risk considerations into SSCM practices.

1.3. Risks in Sustainable Supply Chain Management

Sustainable Supply Chain Management introduces a set of unique risks that require a nuanced approach to traditional risk management. The integration of sustainability considerations in supply chain operations brings forth new challenges and uncertainties that traditional risk management approaches may not adequately address (Giannakis & Papadopoulos, 2016; Kähkönen et al., 2023; Koberg & Longoni, 2019; Sadeghi R & Hasan Abadi, 2023). These risks can be broadly categorized into environmental, financial/economic, and social risks, each presenting distinct challenges and implications for supply chain sustainability (Anderson & Anderson, 2009). When managing global supply chain risks, companies encounter challenges that necessitate strategies responsive to economic, social, and environmental risks. The complexity of global value chains and the interconnected nature of supply networks expose firms to various uncertainties and disruptions (Ersahin et al., 2024; Giannakis & Papadopoulos, 2016; Koberg & Longoni, 2019; Sato et al., 2020; Yontar & Zengin, 2023).

Understanding the perception of risks associated with SSCM is pivotal for developing effective management strategies. Sato et al. (2020) provided a comprehensive analysis of managers' risk perception of supply chain uncertainties, elucidating how these perceptions shape risk management practices, revealing significant variability across industries influenced by geopolitical and industry-specific dynamics, resonate with the objectives of this study. These insights serve as a foundational reference for examining the adaptable perspectives on risk among Europe's leading companies.

1.3.1. Environmental Risks

SSCM encompass challenges arising from supply chain activities affecting the natural environment, such as waste management, pollution, resource depletion, and climate change. Sarkis et al. (2011) emphasizes the significance of implementing green supply chain practices to address these risks. The authors highlight the role of social network theory (how organizations or individuals interact within a network, influencing decisions based on information and influence from their connections) in fostering environmental collaboration among supply chain partners, underscoring the importance of building strong relationships to enhance sustainability efforts (Kähkönen et al., 2023; Yontar & Zengin, 2023). By leveraging social network theory, companies can strengthen partnerships, promote knowledge sharing, and collectively work towards mitigating environmental impacts within the supply chain. Giannakis & Papadopoulos (2016) emphasize the importance of recognizing and managing these risks as they can significantly affect a company's environmental footprint and, in turn, its reputation and compliance with environmental regulations. Effective management of environmental risks in supply chain operations necessitates a comprehensive grasp of ecological impacts and the adoption of strategies to mitigate these impacts. This includes implementing green supply chain practices and investing in sustainable technologies (Kähkönen et al., 2023; Sato et al., 2020; Yontar & Zengin, 2023).

1.3.2. Financial/Economic Risks

Financial or economic risks in SSCM relate to the economic impacts of integrating sustainability into supply chain practices. These risks can manifest as increased operational costs due to the implementation of sustainable practices, fluctuations in commodity prices influenced by environmental

policies, or potential penalties for non-compliance with environmental regulations. Giannakis & Papadopoulos (2016) highlighted the need for a strategic approach to manage these risks, balancing the costs of sustainable practices with their long-term economic benefits, including conducting cost-benefit analyses of sustainable initiatives, and exploring financial incentives or subsidies for environmentally friendly practices. Beske et al. (2014) explored how dynamic capabilities in SSCM can be leveraged to enhance the economic resilience of the supply chain against such risks, suggesting that the ability to adapt and reconfigure supply chain practices in response to environmental changes is crucial for reducing the economic risks.

Geopolitical disruptions in recent years have shaped the scenario of SC, such as Brexit, the US-China trade war, the COVID-19 pandemic, emphasizing the necessity of classifying this risk within the triple bottom line as a Financial/Economical risk. These geopolitical risks have led to increased duties and tariffs, as well as border delays and regulatory compliance challenges, significantly impacting SC costs and a necessity of reevaluating its designs. As such, managers must consider geopolitical risks as a critical component of SSCM, employing strategies such as diversifying supply sources and enhancing supply chain visibility and flexibility to mitigate these risks (Roscoe et al., 2022).

1.3.3. Social Risks

Social risks in SSCM encompass labor practices, community relations, and human rights concerns, emphasizing ethical material sourcing and fair labor standards to mitigate these risks. These risks are crucial in managing the social impact of supply chain operations (Emrouznejad et al., 2023). As stated by Giannakis & Papadopoulos (2016), neglecting social risks can lead to reputational damage, legal challenges, and strained stakeholder relationships. This way, companies need to implement robust social responsibility policies,

conduct regular supplier audits, and engage in transparent communication with stakeholders to effectively manage these risks. The findings from an exploratory study in the Ready Made Garments (RMG) industry of Bangladesh underlines the complexity of implementing social sustainability practices, highlighting the importance of addressing both motivators and barriers to enhance social sustainability across the supply chain (Huq et al., 2014).

1.4. Contemporary Challenges and Shifts in SSCM

Sustainable Supply Chain Management is addressing modern challenges by integrating technological innovations, global trends, and environmental and social imperatives, aiming for adaptability, resilience, and comprehensive sustainability. The confluence of globalization and technological advancements has expanded and streamlined supply chains, while heightened environmental and social consciousness necessitates sustainable practices (Ashby et al., 2012; Beske et al., 2014; Gopalakrishnan et al., 2012; Huq et al., 2014; Koberg & Longoni, 2019; Kusi-Sarpong et al., 2023; Rebs et al., 2019; Siems et al., 2023).

Technological breakthroughs, namely blockchain, play a crucial role in improving supply chain transparency and efficiency, particularly in enhancing resilience in the retail sector amid disruptions. Simultaneously, developments in artificial intelligence (AI) and big data analytics offer strategic avenues that foster sustainable practices and strengthening supply chain resilience (Ekinci et al., 2024; Emrouznejad et al., 2023; Mahajan et al., 2023).

Recent studies highlight the significance of embedding sustainable and resilient practices in logistics through advanced optimization and computational intelligence, in line with sustainable development goals (Mathiyazhagan et al., 2023; Sadeghi R & Hasan Abadi, 2023). Furthermore, stakeholder integration and supplier engagement are identified as key

strategies for promoting sustainability across supply chain levels, emphasizing the importance of risk management, collaboration, and monitoring (Kähkönen et al., 2023; Sadeghi R & Hasan Abadi, 2023; Siems et al., 2023).

A shift in supply chain risk management, forecasting, and product design is necessary to address systemic disruptions more effectively, moving beyond traditional approaches constrained by past disruptions' limited scope and impact. This transition from a predominantly environmental focus to a holistic approach incorporating the triple bottom line mirrors the field's evolution towards integrated sustainability. This research builds upon these insights to offer a novel analysis of how companies perceive risks and communicate with stakeholders across different sectors and regions, thereby enriching the SSCM discourse (Ahi & Searcy, 2013; Browning et al., 2023; Rimmer & Hamilton, 2008).

Chapter 2: Methodology

This study embarks on a detailed exploration of sustainability risks coverage in the supply chains of the top 100 revenue-generating European companies in 2022 (list presented in detail in Appendix 1).

Adopting a novel approach in the field SSCM, Wang et al., (2024) utilizes a "seed word + Word2Vec similar word expansion" method, a technique not previously applied within SSCM research for textual analysis. This method, inspired by innovative methodologies from recent studies, allows the examination of corporate strategies by conducting a textual analysis of annual reports. By focusing on keyword frequency and contextual relevance, this approach offers a new way of quantifying companies' strategic orientations towards sustainability. This approach inspired the development of the methodology used in this investigation.

The first step of the work was defining the research question that would set the ground for this work, namely, "How do companies perceive risk in sustainable supply chain management?". This question seeks to delve into the corporate perspective on risks associated with sustainable practices within their supply chains, offering insights into how companies identify, perceive, and communicate risks to their stakeholders. To provide a structured approach to this exploration, the study is driven by the following hypotheses:

H1: The perception of sustainability-related risks varies across different industries.

H2: The perception of sustainability risks is influenced by the country of origin of the companies.

H3: Sustainability risks' coverage differ across companies within the same industry.

2.1. Research Process

The research unfolds through a series of carefully planned steps, each building on the insights gained from the preceding one, ensuring a comprehensive approach to investigating the intersection of corporate performance and responsibility.

Step 1: Defining the Research Framework.

Step 2: Data Collection.

Step 3: Database Creation.

Step 4: Quantitative Data Analysis.

Step 5: Qualitative Data Analysis.

2.2 Data Collection

The study on the top 100 European companies utilized the Refinitiv Eikon platform to rank companies based on revenue (Noels et al., 2023). This platform facilitated the acquisition of precise and current financial data, ensuring a focus on the most relevant entities in the European market. Refinitiv Eikon was instrumental in gathering crucial details like the companies' country of origin, determined by their headquarters' location, and industry classification (TRBC) (Mamatzakis et al., 2024). Initially planning to analyse the annual reports of all 100 companies, the study had to exclude Russian-origin companies for 2022 due to inaccessibility. Consequently, the analysis included the next 6 highest-revenue companies from the list.

2.3 Database Creation

The creation of the database was central to this study. Using the same structured prompt that included the risk list and some pre-built indications, the AskYourPDF API searched for mentions related with these sustainability risks pertinent to supply chain management in each report individually. This list was built with the extensive framework outlined by Giannakis & Papadopoulos (2016), which offered an operational lens on supply chain sustainability through a risk management process. Their work categorized 30 distinct risks, spanning the environmental, social, and economic dimensions of sustainability, encompassing both exogenous and endogenous factors.

To enrich this framework and ensure the study's analysis encompassed a broader spectrum of potential sustainability-related risks, additional categories were integrated. These were not only proposed by the author to address emerging concerns but also inspired by the insightful contributions of Roscoe et al. (2022), who shed light on the evolving landscape of supply chain risks, particularly emphasizing geopolitical risks and their impact on the supply chain resilience. By incorporating these insights, the study broadens its scope to include cutting-edge issues that are increasingly relevant in today's complex global supply chains. Consequently, this amalgamation of sources resulted in a comprehensive coverage of sustainability-related risks, as seen in Table 2. This expanded typology aims to provide the research in capturing a wide array of risks, reflecting the complex nature of sustainability challenges confronting modern supply chains.

Dependency	Category	Typology (M. Giannakis, T. Papadopoulos)
Endogenous	Environmental	Carbon Footprint **
		Climate Change Adaptation **
		Emission of Greenhouse Gas
		Energy Consumption
		Environmental Accident
		Excessive or Unnecessary Packaging
		Non-compliance with Sustainability Law
		Pollution
		Product Waste
	Financial/Economic	Antitrust Claim
		Bribery
		Digital Transformation in Supply Chain **
		False Claim
		Patent Infringement
		Tax Evasion
		Inventory Management **
	Social	Child Labor
		Excessive Working Time
		Exploitative Hiring Policy
		Gender, Racial and Age Diversity *
		Healthy and Safe Working Environment
		Sustainable Procurement **
		Unethical Treatment of Animal
		Unfair Wage
Exogenous	Environ-mental	Heatwave
		Natural Disaster
		Water Scarcity
	Financial/Economic	Boycott
		Cybersecurity Threat **
		Energy Price Volatility
		Financial Crisis
		Geopolitical Risk ***
		Litigation
		Price Fixing Accusation
		Resource Scarcity (e.g., Raw Material Scarcity) **
		Supplier Risk Management **
	Social	Demographic Challenge
		Pandemic
		Social Instability (includes Human Rights)
*Adaptaded from M. Giannakis, T. Papadopoulos; **Proposed by the Author; ***S. Roscoe et al		

Table 1: Risk Identification and Classification

The database compiled through this process includes essential information such as the company name, industry group (TRBC), country of origin, and specific expressions related to each identified sustainability risk. One of the significant challenges in this process was the categorization of text into specific

sustainability risk categories (see Appendix II for examples). To overcome this problem, each sentence retrieved was analysed to allow a correct categorization and identification of risks according to the outset of the analysis. Given the subjective nature of language in corporate reports, some phrases did not directly align with the predetermined risk categories. The challenge was met by employing a combination of automated and manual review processes, which allowed for more accurate and contextually appropriate categorization.

After manual checking each phrase, the expressions were grouped in the database, building both a database of expressions, as well as a binary numeric representation that could be used for statistical inferences. This binary matrix reports whether a given risk is covered in each report, using a 0 or 1 outset. If the company mentions a given risk (R_i) in its annual report, then the risk coverage will be 1, and 0 otherwise.

Moreover, the database was structured to facilitate both qualitative and quantitative analysis, enabling a multifaceted examination of the data. This structure supported the subsequent analytical phases to draw insights from the data. Instead of utilizing the broad industry classifications from Refinitiv Eikon, the study employed the more detailed Industry Group categorization from the TRBC, which has 62 industry groups. This decision was made to achieve a more granular understanding of industry-specific sustainability risk perceptions.

2.4 Data Analysis

Qualitative Analysis

The qualitative component involved a detailed examination of the content extracted from the annual reports. This process focused on:

Content Interpretation: The textual data was carefully analysed to interpret the context and implications of the sustainability-related expressions found in the reports.

Contextualization of Data: The study placed a strong emphasis on contextualizing the findings within the broader framework of supply chain sustainability. This involved analysing the data considering the literature, trends, practices in the industry, as well as geographical and sectoral variations, allowing a focused identification and selection of the data.

Quantitative Analysis

Complementing the qualitative analysis, the quantitative aspect was conducted using statistical and analytical tools. During the initial stages of quantitative analysis, it was observed that certain types of risk such as "Unfair Wage," "Price Fixing Accusation," "Patent Infringement," "Heatwave," and "False Claim" had zero instances across all reports. These categories were subsequently removed from the quantitative dataset, streamlining the analysis. The absence of these risks in the data could be attributed to various factors, as seen in Table 2.

Risk Type	**Reason for Underreporting/Not Mentioned**
Unfair Wage	Highly regulated and scrutinized; companies may avoid mentioning to not draw negative attention or imply malpractice. These issues are closely monitored and mentioning them could suggest wrongdoing or attract unwanted scrutiny.
Price Fixing Accusation	
Patent Infringement	Due to its legal and sensitive nature, companies prefer handling such issues discretely through legal channels rather than disclosing them in public reports.
Heatwave	Often included within broader environmental or climate-related risks rather than being highlighted separately, leading to potential underreporting.
False Claim	Considered a serious allegation, likely only mentioned in reports if there is a legal obligation or a significant event necessitating disclosure.

Table 2: Risk Typology Removal

This quantitative analysis phase involved several key techniques, besides the pre-processing and data cleaning. The foundational step of descriptive statistics was essential for understanding the general behaviour of the data points and setting the stage for more complex analyses.

Subsequently, correlation analysis was undertaken to delve into the relationships between variables, with a specific focus on understanding how different sustainability risks are interrelated and how they correlate with key financial metrics, such as revenue, uncovering potential patterns and dependencies among variables.

2.4 Methodology Limitations

While the methodology of this study was carefully designed and executed, it is important to acknowledge certain inherent limitations that could influence the interpretation and generalizability of the findings, namely:

Reliance of the Textual Analysis: A key limitation is the dependence on AskYourPDF for analysing the annual reports. The subjective nature of language in corporate reports, as highlighted in various studies (Anand & Korotkova, 2022; Slattery, 2014), can result in phrases not accurately reflecting intended risk categories, potentially leading to misinterpretation or oversight of risks. Despite manual checks being conducted, the vast number of expressions in such reports may still allow some expressions to evade detection (Sayyed Hussain et al., 2020). As these tools advance, they are expected to enhance the identification of discrepancies between intended and perceived risk categories in corporate reports (Lewis & Young, 2019).

Variability in Report Clarity and Comprehensiveness and Bias Towards More Transparent Companies: The effectiveness of the textual analysis within this study is inherently tied to the variability in the quality and depth of information presented in the annual reports across different companies and industries. In some instances, the clarity and comprehensiveness of these reports vary significantly, leading to potential gaps in capturing the full scope of sustainability risks. The challenge of relying on publicly available reports for

sustainability analysis may introduce bias towards transparent companies (Cismaș et al., 2023; Raghupathi et al., 2023). This bias can lead to an incomplete understanding of risks managed in diverse operational contexts due to the multinational nature of many corporations (Kwarto et al., 2024). The limited scope of information from these reports may skew the analysis, hindering a comprehensive assessment of sustainability practices and risks across global operations (Băndoi et al., 2021).

Geographical Scope and Multinational Operations: The study focusing on European companies acknowledges their global operations and the potential limitations in fully capturing them due to varied regulations and operational disparities in other regions (Villiers, 2022). This limitation implies that the findings may not entirely represent the global complexities and strategies in managing sustainability risks, emphasizing the necessity to view these companies' activities within a broader international context (Zhivkova, 2022).

In conclusion, these limitations highlight the need for cautious interpretation of the study's findings and suggest areas for future research.

Chapter 3: Findings and Discussion

This chapter presents the findings of the study, which aimed to explore sustainability risks in the supply chains of the top 100 revenue-generating European companies in 2022. The results presented here are discussed considering the three hypotheses formulated at the outset of the research, providing an understanding of how these companies perceive, manage, and communicate sustainability risks to stakeholders. To better formulate each one of these analyses, the hypotheses will be displayed individually, allowing a focused interpretation of the results in their scopes.

3.1 Case Analysis

The statistical analysis forms the backbone of the empirical investigation in this study, elucidating the perception and categorization of sustainability risks among the datasets. Table 3 analyses the data on sustainability risk coverage in corporate annual reports, revealing a nuanced prioritization across different typologies. As previously stated, when each type of risk is identified at least once in each report, the risk will be considered as covered by the company, and not covered, if otherwise. Table 3 was built using a relative ponderation of the number of companies that covered a given risk and the total number of companies in the data set (n=100). These percentages serve as indicators of the importance companies place on different types of risks. Hence, a higher risk coverage possibly denotes activities of most concern or those most impacted by regulatory and public scrutiny.

The environmental risks such as “Emission of Greenhouse Gas” (79%) and “Environmental Accident” (86%) are amongst the most acknowledged in the dataset, highlighting a widespread corporate recognition of climate-related

impacts. In contrast, “Product Waste” (1%), “Water Scarcity” (2%), “Excessive or Unnecessary Packaging” (3%), and “Non-compliance with Sustainability Law” (3%) are least present, suggesting possible underreporting, effective management within these areas, or even included within other risk typologies.

In the realm of financial/economic risks, “Cybersecurity Threat” stands out (82%), indicating a high level of concern across companies about the implications of digital vulnerabilities. Notably, “Geopolitical Risk” and “Financial Crisis” are also significantly recognized (69% and 58%, respectively), pointing towards a keen awareness of macroeconomic and political factors that can disrupt supply chains. Risks like “Inventory Management” (1%), “Boycott” (1%), “Litigation” (3%), “Energy Price Volatility” (3%), and “Tax Evasion” (3%) are least covered in the reports, possibly indicating effective management concerns in these areas.

Social risks are led by “Social Instability” (85%), reflecting the critical importance companies place on human rights and societal factors. Interestingly, “Child Labor” and “Sustainable Procurement” are also considerably mentioned (34% and 55%, respectively), underscoring the emphasis on ethical sourcing and employment practices. Risks like “Unethical Treatment of Animals” (1%), “Exploitative Hiring Policy” (1%), and “Excessive Working Time” (2%) are residually covered in the analysed annual reports, possibly due to their significant importance in corporate governance, implying that these conducts are self-applied, by default, within the risk management.

Category	Typology	Reports that Covered
Environmental	Carbon Footprint	19%
	Climate Change Adaptation	76%
	Emission of Greenhouse Gas	79%
	Energy Consumption	17%
	Environmental Accident	86%
	Excessive or Unnecessary Packaging	3%
	Non-compliance with Sustainability Law	3%
	Pollution	31%
	Product Waste	1%
	Natural Disaster	14%
	Water Scarcity	2%
Financial/Economic	Antitrust Claim	12%
	Bribery	46%
	Digital Transformation in Supply Chain	9%
	Tax Evasion	3%
	Inventory Management	1%
	Boycott	1%
	Cybersecurity Threat	82%
	Energy Price Volatility	3%
	Financial Crisis	58%
	Geopolitical Risk	69%
	Litigation	3%
	Resource Scarcity	18%
	Supplier Risk Management	60%
Social	Child Labor	34%
	Excessive Working Time	2%
	Exploitative Hiring Policy	1%
	Gender, Racial and Age Diversity	30%
	Healthy and Safe Working Environment	57%
	Sustainable Procurement	55%
	Unethical Treatment of Animal	1%
	Demographic Challenge	11%
	Pandemic	8%
	Social Instability (includes Human Rights)	85%

Table 3: Individual Risk Typology Mentions

Table 4 delves into the risk coverage across companies individually, where there is a clear variability within the data sample, with an average of 9.80 risks covered per report and a standard deviation of 3.22. This dispersion suggests a wide diverse approach to risk reporting and management, when communicating with stakeholders, where some companies exhibit an extensive risk coverage, signalling a comprehensive approach, while other report fewer risk, possibility indicating a different focus and reporting strategies.

Company Identifier	**Number of Risk Covered**	**Company Identifier**	**Number of Risk Covered**	**Company Identifier**	**Number of Risk Covered**	**Company Identifier**	**Number of Risk Covered**
E1	10	E27	7	E52	14	E76	8
E2	7	E28	7	E53	8	E77	8
E3	13	E29	12	E54	14	E78	9
E4	13	E30	8	E55	6	E79	7
E5	10	E31	11	E56	12	E80	6
E6	5	E32	11	E57	6	E81	8
E7	8	E33	5	E58	8	E82	11
E8	9	E34	11	E59	7	E83	10
E9	10	E35	6	E60	6	E84	5
E10	9	E36	15	E61	15	E85	7
E11	7	E37	8	E62	9	E86	9
E12	12	E38	15	E63	6	E87	5
E13	12	E39	15	E64	11	E88	8
E14	11	E40	8	E65	8	E89	8
E15	14	E41	10	E66	14	E90	15
E16	9	E42	8	E67	15	E91	6
E17	8	E43	13	E68	13	E92	10
E18	16	E44	8	E69	10	E93	16
E19	5	E45	11	E70	8	E94	14
E20	15	E46	10	E71	10	E95	15
E21	6	E47	5	E72	10	E96	11
E22	18	E48	11	E73	11	E97	7
E23	13	E49	8	E74	6	E98	8
E24	10	E50	6	E75	9	E99	7
E25	8	E51	17	E76	15	E100	7
Average		9.80		**Standard Deviation**		3.22	

Table 4: Total Risk Coverage (by Company)

Table 5 showcases the frequency of reported risks aggregated by dependency, where there is a clear narrative that companies, from a macro perspective, are more vocal about reporting risks stemming from within (endogenous risks), when compared with the ones arising from the outbounds of their control. With different endogenous risks being covered, in total, 566 times across all the 100 annual reports, companies may be signalling a proactive stance in managing these internal risks. Yet, the higher average coverage of exogenous risks suggests a weighted importance or perhaps a recognition of the complexity these risks entail. The statistical dispersion, indicated by the standard deviation, hints at significant variability in how companies report these risks, suggesting that while some companies are deeply engaged with external risk management, others may be less so, or they may be affected differently based on their industry, size, or geographic footprint.

Dependency	**Total Risk Covered**	**Average**	**Median**	**St. Dev.**
Endogenous	566	26.95	17.00	28.01
Exogenous	414	31.85	14.00	31.89

Table 5: Risk Coverage Dependency Statistical Analysis

Table 6 reflects the occurrence of sustainability risk mentions across categories: “Environmental”, “Financial/Economic”, and “Social”. The “Environmental” category has a total frequency of 331 different risk covered across all reports, with an average of 30.09 per company, a median of 15.50, and a standard deviation of 31.07, indicating a wide variability in risk reporting. “Financial/Economic” different risks covered 365 times, averaging 28.08 risks per company, but with a lower median of 9.00, suggesting a skewed distribution where a few companies report these risks much more frequently than others. The “Social” category, while having a lower coverage of 284 different risk mentions across all reports, has a higher median of 20.50 compared to “Financial/Economic”, suggesting a more consistent reporting

across companies, with a standard deviation of 27.71 indicating moderate variability. These statistics suggest that while environmental issues are widely reported, the depth and frequency of reporting vary, with some companies potentially discussing these issues more extensively than others. "Financial/Economic" risks, despite being the most frequently mentioned, may be concentrated within certain companies, whereas social risks tend to be more evenly reported across the dataset.

Category	Total Risks Covered	Average	Median	St. Dev.
Environmental	331	30.09	15.50	31.07
Financial/Economic	365	28.08	9.00	30.62
Social	284	28.40	20.50	27.71

Table 6: Risk Categorization Statistical Analysis

The correlation analysis in Table 7 reveals a complex interplay between the top 10 highest covered frequency sustainability risk typologies, as well as the Revenue financial indicator. Notably, "Emission of Greenhouse Gas" shows a positive correlation with "Financial Crisis" (0.208), suggesting that companies attentive to emissions may also be acutely aware of broader financial risks. Interestingly, "Cybersecurity Threat" is strongly correlated with both "Financial Crisis" (0.234) and "Geopolitical Risk" (0.249), indicating an understanding that digital and geopolitical landscapes are intertwined with financial stability.

A significant positive correlation between "Supplier Risk Management" and "Sustainable Procurement" (0.410) highlights the close relationship between supply chain oversight and ethical sourcing initiatives. Meanwhile, "Healthy and Safe Working Environment" also shows a strong correlation with "Sustainable Procurement" (0.432), implying that companies committed to workforce wellbeing also prioritize sustainable supply chain practices.

Risks	Revenue (FY0, EUR)	Climate Change Adaptation	Emission of Greenhouse Gas	Environmental Accident	Cybersecurity Threat	Financial Crisis	Geopolitical Risk	Supplier Risk Management	Healthy and Safe Working Environment	Sustainable Procurement	Social Instability (includes Human Rights)
Revenue (FY0, EUR)	1.000	0.105	0.096	0.133	0.122	0.179	0.085	0.102	0.000	-0.022	0.123
Climate Change Adaptation	0.105	1.000	0.055	-0.092	0.041	-0.051	0.079	-0.029	-0.157	-0.179	0.026
Emission of Greenhouse Gas	0.096	0.055	1.000	0.004	-0.114	0.208	-0.133	0.130	-0.001	0.076	0.127
Environmental Accident	0.133	-0.092	0.004	1.000	0.036	0.124	0.103	0.082	0.057	0.041	0.234
Cybersecurity Threat	0.122	0.041	-0.114	0.036	1.000	0.234	0.249	0.096	0.171	0.099	0.168
Financial Crisis	0.179	-0.051	0.208	0.124	0.234	1.000	0.306	0.174	0.243	0.126	0.096
Geopolitical Risk	0.085	0.079	-0.133	0.103	0.249	0.306	1.000	-0.062	0.204	0.002	0.082
Supplier Risk Management	0.102	-0.029	0.130	0.082	0.096	0.174	-0.062	1.000	0.239	0.410	0.114
Healthy and Safe Working Environment	0.000	-0.157	-0.001	0.057	0.171	0.243	0.204	0.239	1.000	0.432	0.144
Sustainable Procurement	-0.022	-0.179	0.076	0.041	0.099	0.126	0.002	0.410	0.432	1.000	0.183
Social Instability (includes Human Rights)	0.123	0.026	0.127	0.234	0.168	0.096	0.082	0.114	0.144	0.183	1.000

Table 7: Correlation Analysis

3.2 Industry-Risk Perception (H1)

The variability in risk perception across different sectors is a key area of exploration in SSCM research. Yontar & Zengin (2023) identify and analyse risk factors specific to the textile sector, offering insights into industry-specific challenges in sustainable supply chain management. Similarly, Niyonsaba et al. (2023) examined the barriers, risks, and management strategies within the European insect supply chains, providing a unique lens through which to view SSCM. These studies underscore the importance of tailoring risk management strategies to the specific needs and challenges of individual industries, a theme central to this study.

Table 8 denotes the number of companies within each industry group, with a clear higher concentration of companies in the "Oil & Gas", "Automobiles & Auto Parts", and "Food & Drug Retailing" sectors. This suggests that the data

may present a skew towards industries traditionally associated with significant sustainability impacts. The industry groups referred supra represent 31 of the total 100 companies in the dataset.

Industry Group	Number of Companies	Industry Group	Number of Companies
Aerospace & Defense	1	Hotels & Entertainment Services	1
Apparel & Accessories	1	Machinery, Tools, Heavy Vehicles, Trains & Ships	7
Automobiles & Auto Parts	10	Metals & Mining	5
Beverages	3	Multiline Utilities	7
Chemicals	2	Natural Gas Utilities	1
Communications & Networking	1	Oil & Gas	11
Construction & Engineering	4	Passenger Transportation Services	2
Construction Materials	1	Personal & Household Products & Services	2
Consumer Goods Conglomerates	1	Pharmaceuticals	6
Electrical Utilities & IPPs	3	Professional & Commercial Services	1
Food & Drug Retailing	10	Renewable Energy	1
Food & Tobacco	5	Software & IT Services	1
Freight & Logistics Services	5	Specialty Retailers	1
Healthcare Providers & Services	1	Telecommunications Services	4
Homebuilding & Construction Supplies	1	Textiles & Apparel	1

Table 8: Distribution of Companies (per Industry Group)

The exploration of risk perceptions across various industries, as detailed in Table 9, uncovers a landscape where environmental, financial/economic, and social risks are covered differently by sectors. This variability underscores the influence of industry-specific factors on risk management strategies. Notably, the analysis indicates a general balance in addressing these risk categories, yet deviations presented in the data highlight unique industry approaches to sustainability challenges.

Focusing on the three most frequent industries in the data ("Oil & Gas," "Automobiles & Auto Parts," and "Food & Drug Retailing"), there is a clear distinction between patterns in risk perception, namely: the "Oil & Gas" industry group predominantly addresses environmental and financial/economic risks, reflecting its environmental impact and market sensitivities; the "Automobiles & Auto Parts" industry group emphasizes financial/economic risks, highlighting the significant investments in sustainable technologies; conversely, the "Food & Drug Retailing" sector shows a more balanced approach to all risk categories, likely due to its direct consumer engagement and the scrutiny over its environmental and health impacts.

Unique patterns emerge in sectors like "Textiles & Apparel" and "Communications & Networking", where the former exhibits a high concern across all risk categories, possibly due to heightened scrutiny over sustainability practices. The latter sector shows a strong emphasis on financial/economic risks, likely influenced by the rapid technological advancements and digital transformation challenges.

Industry Group	**Relative Environmental Risk Coverage**	**Relative Financial/Economic Risk Coverage**	**Relative Social Risk Coverage**
Aerospace & Defense	4.00	5.00	4.00
Apparel & Accessories	2.00	1.00	3.00
Automobiles & Auto Parts	3.80	4.00	3.30
Beverages	3.00	4.67	1.67
Chemicals	2.00	3.00	3.50
Communications & Networking	3.00	7.00	0.00
Construction & Engineering	3.75	3.75	3.25
Construction Materials	4.00	2.00	2.00
Consumer Goods Conglomerates	2.00	3.00	2.00
Electrical Utilities & IPPs	4.33	3.67	4.33
Food & Drug Retailing	3.00	3.70	2.80

Industry Group	Relative Environmental Risk Coverage	Relative Financial/Economic Risk Coverage	Relative Social Risk Coverage
Food & Tobacco	3.60	2.60	3.20
Freight & Logistics Services	2.00	3.60	1.40
Healthcare Providers & Services	2.00	5.00	4.00
Homebuilding & Construction Supplies	3.00	3.00	0.00
Hotels & Entertainment Services	6.00	3.00	4.00
Machinery, Tools, Heavy Vehicles, Trains & Ships	3.29	2.57	2.00
Metals & Mining	3.00	3.60	1.40
Multiline Utilities	3.57	4.00	2.86
Natural Gas Utilities	4.00	4.00	6.00
Oil & Gas	4.00	4.36	3.09
Passenger Transportation Services	4.00	4.50	4.00
Personal & Household Products & Services	4.00	4.00	4.50
Pharmaceuticals	2.67	3.17	2.67
Professional & Commercial Services	3.00	3.00	3.00
Renewable Energy	2.00	3.00	2.00
Software & IT Services	1.00	3.00	4.00
Specialty Retailers	4.00	3.00	5.00
Telecommunications Services	2.50	3.25	2.50
Textiles & Apparel	5.00	5.00	5.00
Average	3.250	3.615	3.015
Standard Deviation	1.037	1.083	1.364
$Relative\ Risk\ Converage = \frac{\sum Risk\ r\ in\ Category\ i\ for\ Industry\ x}{\sum Company\ in\ Industry\ x}$, $where\ r = Risk\ Type, i = Risk\ Category\ , and\ x = Industry\ Group$			

Table 9: Relative risk Coverage by Category (per Industry Group)

The detailed analysis in Table 9 confirms that industry-specific characteristics significantly influence risk perception, validating H1. This highlights the necessity for industry-tailored sustainability strategies, reinforcing the

importance of aligning risk management practices with the specific challenges and opportunities faced by each sector.

3.3 Country-Risk Perception (H2)

The investigation into country-specific risk perception draws on the premise of H2, which posits that a country of origin influences how companies perceive and report sustainability risks. The exploration of this hypothesis is vital to understanding the geographical dimensions that shape corporate risk reporting narratives.

Table 10 portrays the distribution of companies' headquarters across different European countries, highlighting the varied landscape of corporate presence with Germany (25) and France (24) having the most considerable representation in the dataset, followed by the United Kingdom (16). This distribution could signify the potential influence of regional regulatory frameworks and cultural factors on corporate sustainability reporting.

Country of Exchange	**Number of Companies**
Austria	1
Belgium	2
Denmark	2
Finland	2
France	24
Germany	25
Italy	4
Netherlands	6
Norway	1
Poland	1
Portugal	2
Spain	6
Sweden	2
Switzerland	6
United Kingdom	16

Table 10: Distribution of Companies (per Country)

Table 11 provides a relative assessment of the relative risks covered across the environmental, financial/economic, and social categories for each country. Notably, while Finland exhibits a pronounced emphasis on financial/economic risks, the United Kingdom demonstrates a considerable focus on environmental risks. This disparity may reflect each country's unique regulatory and cultural approach to environmental governance and economic challenges. Meanwhile, countries like Poland and Denmark, despite having fewer companies, show higher relative mentions of certain risks, suggesting a concentrated awareness or impact within these corporate cohorts.

Delving deeper, a comparative analysis of the top 3 countries - Germany, France, and the United Kingdom - reveals distinct risk reporting patterns. Germany, with the highest number of companies, has an average environmental risk coverage of 3.12, financial/economic risk coverage of 3.68, and social risk coverage of 2.84. France follows closely, with slightly higher average coverage across all categories, reflecting its comprehensive regulatory framework and active stakeholder engagement in sustainability practices. The United Kingdom, notable for its advanced environmental governance, reports a relatively high emphasis on environmental risks, with an average coverage of 3.25, showcasing the country's proactive approach to addressing climate change and environmental sustainability.

Country of Exchange	Relative Environmental Risk Coverage	Relative Financial/Economic Risk Coverage	Relative Social Risk Coverage
Austria	3.00	4.00	3.00
Belgium	2.00	3.50	2.00
Denmark	1.00	4.00	1.50
Finland	4.00	6.00	2.50
France	3.88	3.96	3.50
Germany	3.12	3.68	2.84
Italy	3.00	3.75	2.75
Netherlands	3.50	3.67	2.17
Norway	3.00	2.00	3.00

Country of Exchange	Relative Environmental Risk Coverage	Relative Financial/Economic Risk Coverage	Relative Social Risk Coverage
Poland	5.00	4.00	2.00
Portugal	2.50	4.00	2.50
Spain	3.50	2.83	3.67
Sweden	2.50	2.00	2.50
Switzerland	3.17	3.50	2.33
United Kingdom	3.25	3.38	2.44
Average	3.09	3.62	2.58
Standard Deviation	0.88	0.91	0.55
$Relative\ Risk\ Converage = \frac{\sum Risk\ r\ in\ Category\ i\ for\ Country\ x}{\sum Company\ in\ Country\ x}$, $where\ r = Risk\ Type, i = Risk\ Category, and\ x = Country\ of\ Exchange$			

Table 11: Relative risk Coverage by Category (per Country)

These observations confirm H2, suggesting that there is indeed a country-specific lens through which companies report sustainability risks. The varied risk perceptions and reporting practices highlight the need for multinational corporations to adopt a nuanced global risk management strategy that is sensitive to the regulatory and cultural landscapes of their operational geographies. Despite the global operations of these companies, the analysis based on their headquarters' location offers critical insights into how regional contexts influence corporate sustainability narratives.

3.4 Risk Variability Intra-Industry (H3)

This sub-chapter delves into an in-depth analysis of the top three industries with the highest representation in the dataset: “Oil & Gas” (11), “Automobiles & Auto Parts” (10), and “Food & Drug Retailing” (10). This targeted analysis is instrumental in testing H3, which posits that sustainability risks differ even among companies within the same industry, reflecting the diversity of corporate strategies and operational realities.

3.4.1. Oil & Gas Industry

In examining the “Oil & Gas” industry's approach to sustainability risk reporting, a discernible pattern of prioritization becomes evident, as illustrated by Table 12. This pattern highlights the industry's varying emphasis on environmental, financial/economic, and social risks, reflecting the complexity of managing sustainability in a sector under scrutiny for its impacts.

Table 12 provides a comprehensive overview of how prominent “Oil & Gas” companies report on sustainability risks, indicating a broad spectrum of focus areas. On average, companies covered 4.00 environmental risks, 4.36 financial/economic risks, and 3.09 social risks. This distribution suggests a slightly higher emphasis on financial and economic concerns over environmental and social aspects. The standard deviation values (1.48 for environmental risks, 0.98 for financial/economic risks, and 1.24 for social risks) indicate variability in reporting practices among companies, underscoring the industry's diverse approaches to risk management.

A closer look at the top three companies – “TotalEnergies SE”, “Neste Oyj”, and “Eni SpA” - reveals a more balanced and comprehensive approach to sustainability risk reporting. Both “TotalEnergies SE” and “Neste Oyj” exhibit an equal concern across all three risk categories, each covering 5 environmental, 5 financial/economic, and 5 social risks. “Eni SpA” follows closely, with 6 environmental, 5 financial/economic, and 4 social risks covered. This balanced reporting approach may reflect a strategic understanding of the interconnected nature of these risks and their combined impact on corporate performance and reputation.

Contrastingly, companies like “Repsol SA” show a different focus, with a notably lower incidence of environmental risk mentions (1). This may indicate either a targeted risk mitigation strategy or a different assessment of impact

severity. Notably, “Shell PLC” reports the least on social risks (1), suggesting variations in perceived materiality or effectiveness of engagement strategies with stakeholders regarding these issues.

The diversity in risk reporting practices within the “Oil & Gas” industry points to a complex landscape of sustainability management. While regulatory and market environments are consistent, individual corporate strategies and stakeholder interactions contribute to unique risk profiles (Raghupathi et al., 2023; Wang et al., 2024). This diversity emphasizes the need for tailored approaches to sustainability that consider both the shared challenges of the industry and the specific circumstances of each company.

Company	**Country of Exchange**	**Total Environmental Risks Covered**	**Total Financial/Economic Risks Covered**	**Total Social Risks Covered**
Shell PLC	United Kingdom	4	5	1
TotalEnergies SE	France	5	5	5
BP PLC	United Kingdom	6	5	3
Equinor ASA	Norway	3	2	3
Eni SpA	Italy	6	5	4
Repsol SA	Spain	1	3	4
OMV AG	Austria	3	4	3
Orlen SA	Poland	5	4	2
Galp Energia SGPS SA	Portugal	3	5	2
Neste Oyj	Finland	5	5	5
Esso Societe Anonyme Francaise SA	France	3	5	2
Average		4.00	4.36	3.09
Standard Deviation		1.48	0.98	1.24

Table 12: Oil & Gas industry risk mentions (per Category)

3.4.2. Automobiles & Auto Parts Industry

The "Automobiles & Auto Parts" industry, intrinsically connected with environmental sustainability due to its implications on emissions and resource utilization, exhibits a diverse approach to sustainability risk reporting. This

diversity is captured in Table 13, which presents a comparative analysis of environmental, financial/economic, and social risks covered in the annual reports of key players within the industry. The variance in risk coverage emphasizes the unique strategies companies adopt to address sustainability challenges, reflecting a spectrum of priorities and operational contexts. This section delves into the insights retrieved from the data, offering an understanding of the industry's engagement with sustainability risks.

On average, companies covered 3.80 environmental risks, 4.00 financial/economic risks, and 3.30 social risks, with standard deviations of 1.33, 1.18, and 1.55, respectively. This data suggests a slightly higher emphasis on financial/economic risks, potentially indicating the significant economic implications and investments required for sustainable innovation and practices. The variation in reporting, highlighted by the standard deviations, illustrates the valuation and management of sustainability risks among companies, driven by individual corporate strategies and market positions.

A closer examination of the top three companies—"Compagnie Generale des Etablissements Michelin SCA", "Renault SA", and "Dr Ing hc F Porsche AG"—reveals distinct patterns in their sustainability risk reporting. "Compagnie Generale des Etablissements Michelin SCA" stands out with the highest coverage across all risk categories, indicating a comprehensive and proactive sustainability strategy. This approach may be driven by consumer expectations and regulatory demands, positioning "Michelin" as a leader in sustainability within the industry's dataset. In contrast, "Renault SA", while reporting the highest number of financial/economic risks, shows a balanced coverage across all categories, reflecting its focus on financial sustainability amid transitioning to greener practices. "Dr Ing hc F Porsche AG", notable for its higher social risk coverage, may emphasize corporate social responsibility and stakeholder engagement as key components of its sustainability agenda.

The differential risk reporting within the industry, particularly the lower social risk coverage by companies such as “Volkswagen AG” and “Volvo Car AB”, raises questions about the perceived importance of these risks or the effectiveness of existing social initiatives. This aspect highlights the need for further exploration into how companies assess and prioritize different sustainability challenges. Additionally, the overall data suggest that while environmental sustainability remains a critical concern for the "Automobiles & Auto Parts" industry, financial/economic and social dimensions are increasingly becoming integral to corporate sustainability strategies, influenced by broader market dynamics and stakeholder expectations.

Company	**Country of Exchange**	**Total Environmental Risks Covered**	**Total Financial/Economic Risks Covered**	**Total Social Risks Covered**
Volkswagen AG	Germany	3	4	1
Stellantis NV	Italy	2	5	2
Mercedes Benz Group AG	Germany	3	4	4
Bayerische Motoren Werke AG	Germany	4	5	3
Renault SA	France	5	6	4
Continental AG	Germany	4	3	3
Dr Ing hc F Porsche AG	Germany	4	2	5
Volvo Car AB	Sweden	3	3	1
Compagnie Generale des Etablissements Michelin SCA	France	7	5	6
Umicore SA	Belgium	3	3	4
Average		3.80	4.00	3.30
Standard Deviation		1.33	1.18	1.55

Table 13: Automobiles & Auto Parts industry risk mentions (per Category)

3.4.3. Food & Drug Retailing Industry

The "Food & Drug Retailing" industry exhibits a unique pattern in sustainability risk reporting, driven by its direct engagement with consumers and consequent scrutiny over health and environmental impacts.

Table 14 underscores the variability in reporting environmental, financial/economic, and social risks among companies within the "Food & Drug Retailing" industry. On average, environmental risks are reported at a consistent rate (average = 3.00; standard deviation = 0.63), indicative of a sector-wide recognition of their critical impact on business operations and consumer perception. Financial/economic risks, however, show a higher variability (average = 3.70; standard deviation = 1.68), suggesting a differential emphasis on financial sustainability strategies across companies. Social risks exhibit the lowest average reporting rate (average = 2.80; standard deviation = 1.60), potentially reflecting a disparity in addressing or disclosing social sustainability issues within the industry.

Among the analysed entities, "Casino Guichard Perrachon SA", "L'Air Liquide Societe Anonyme pour l'Etude et l'Exploitation des Procedes Georges Claude SA", and "Finatis SA" stand out for their comprehensive risk reporting. "Casino Guichard Perrachon SA" reports the highest number of financial/economic risks (7), closely followed by "L'Air Liquide" with 6, indicating a strong focus on financial resilience amid competitive and operational challenges. Both companies also exhibit robust reporting in social and environmental risks (5 each for "Casino" and "L'Air Liquide"), highlighting an integrated approach to sustainability that balances economic performance with environmental stewardship and social responsibility. "Finatis SA" matches this integrated perspective, demonstrating high engagement across all risk categories, especially in social risks where it is tied for the highest reporting rate (5).

The diversity in risk reporting patterns within the "Food & Drug Retailing" industry demonstrates that companies employ varied strategies to navigate the multifaceted challenges of sustainability. Companies like "Tesco PLC" and "Carrefour SA" showcase a balanced distribution across risk categories,

reflecting a comprehensive risk management strategy that aligns with the sector's operational risks, including supply chain management and regulatory compliance. Conversely, “J Sainsbury PLC” and “Rallye SA” have lower social risk reporting, which might suggest either a strategic prioritization of other risk types or a mature handling of social issues. This analysis highlights the importance of context-specific strategies that align with company values, operational realities, and stakeholder expectations, underpinning the complex landscape of sustainability risk management in the “Food & Drug Retailing” sector.

Company	**Country of Exchange**	**Total Environmental Risks**	**Total Financial/Economic Risks**	**Total Social Risks**
Koninklijke Ahold Delhaize NV	Netherlands	3	2	2
Carrefour SA	France	2	3	3
Tesco PLC	United Kingdom	3	4	1
J Sainsbury PLC	United Kingdom	3	2	1
Fonciere Euris SA	France	3	3	2
Finatis SA	France	3	5	5
Rallye SA	France	3	2	1
Casino Guichard Perrachon SA	France	4	7	5
L'Air Liquide Societe Anonyme pour l'Etude et l'Exploitation des Procedes Georges Claude SA	France	4	6	5
Jeronimo Martins SGPS SA	Portugal	2	3	3
Average		3.00	3.70	2.80
Standard Deviation		0.63	1.68	1.60

Table 14: Food & Drug Retailing industry risk mentions (per Category):

The examination of sustainability risk reporting practices within the “Oil & Gas”, “Automobiles & Auto Parts”, and “Food & Drug Retailing” industries unveils how companies within these sectors approach the multifaceted challenges of sustainability. This analysis, settled in the exploration of H3, has

illuminated the variation in risk perception and management strategies employed by companies sharing the same industrial backdrop, confirming the stated hypothesis.

The findings from this investigation underscore a critical insight: despite navigating through similar regulatory landscapes and industry-specific pressures, companies' chart unique paths in their sustainability risk reporting. This divergence is not merely a function of operational variance but a reflection of strategic choices, underlining the profound impact of corporate ethos, market position, and stakeholder dynamics on sustainability practices.

In the "Oil & Gas" sector, the analysis revealed a broad spectrum of emphasis on financial/economic risks, with notable differences in the reporting of environmental and social risks. This pattern suggests an industry grappling with its environmental impact while strategically considering financial sustainability and social responsibilities.

The "Automobiles & Auto Parts" industry presented a slightly higher focus on financial/economic risks, indicative of the substantial investments required for innovation towards sustainability. Yet, the variance in social risk reporting within this sector points to diverse approaches to stakeholder engagement and corporate social responsibility.

Contrastingly, the "Food & Drug Retailing" industry showcased a consistent recognition of environmental risks across the board, paired with a variable emphasis on financial/economic and social risks. This variability highlights the sector's direct consumer interface and the resultant scrutiny over health and environmental impacts, driving a balanced yet distinct risk management strategy.

These sector-specific insights not only affirm the existence of intra-industry variation in sustainability risk perception as posited by H3 but also advocate for the adoption of nuanced, company-specific sustainability strategies. These

strategies should not only resonate with industry benchmarks but also reflect the unique corporate objectives, operational realities, and the broader societal expectations.

Conclusion

This thesis aimed to explore the complexities of risk perception within SSCM, focusing on Europe's leading revenue-generating companies in 2022. Through a deep examination, this study focused on uncovering the multifaceted perspectives that these corporations hold towards sustainability risks. The significance of this work lies in its contribution to bridging the divide between the conceptual frameworks of SSCM and the actual practices adopted by leading European companies to navigate sustainability risks.

Using a mixed-methods approach, the study revealed a diversified spectrum of risk perception across industries, influenced by a confluence of regulatory, market, and geopolitical factors. The findings highlight that risk perception within SSCM is far from being a monolithic construct; instead, it varies significantly across different industries and is shaped by a variety of external and internal influences.

The research question, "How do companies perceive risk in sustainable supply chain management?" found its answer through the lens of three formulated hypotheses. Industry-specific variations (H1) were evident, indicating that sectoral dynamics play a crucial role in shaping corporate approaches to sustainability risks. The distinct impact of national and geopolitical contexts (H2) on risk perceptions highlights the significance of regulatory and cultural environments in influencing corporate risk management strategies. The intra-industry analysis (H3) further illuminated the strategic diversity within sectors, affirming the complexity of sustainability risk management even among closely matched industry peers.

This research makes an academic contribution by elucidating the diverse approaches companies take toward covering sustainability risks, enriching the

discourse on SSCM with empirical evidence. It brings to light the intricate dynamics in the integration of sustainability into supply chain operations and offers a foundational for future explorations in the domain.

The study recognizes limitations that may influence the breadth of its applicability. At the top of considerations is its reliance on textual analysis of corporate reports, which, while insightful, presents a view of risk communication coverage rather than a measure of the impact or effectiveness of risk management practices. The focus on European companies limits the generalizability of the findings to a broader global context, suggesting the need for caution in extending these insights universally.

Looking ahead, there is a compelling case for expanding the geographic scope of this investigation to encompass a more global perspective on SSCM. Future research could benefit from incorporating a broader array of data sources and employing advanced textual analysis methodologies to deepen the understanding of how sustainability risks are managed and communicated across different regions and industries. By doing so, the academic community can continue to build upon the groundwork laid in recent works like this study, exploring the dynamic relationship between corporate strategies, sustainability risks, and the evolving global supply chain landscape.

Statement

During the preparation of this work, the author used:

ASKYOURPDF to extract textual content from the annual reports;

CHATGPT to retrieve suggestions on risk analysis identification in annual reports;

RESEARCHRABBITAPP to acknowledge literature regarding the topic;

QUILLBOT to enhance the quality of writing;

The author reviewed and edited the content as needed and takes the full responsibility for the content of the publication.

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Appendixes

Appendix I: Companies Database

Rank	Identifier	Company Name	Industry Group (TRBC)	Country of Exchange	Revenue (FY0, Million EUR)
1	E1	Shell PLC	Oil & Gas	United Kingdom	€ 356,299.80
2	E2	Volkswagen AG	Automobiles & Auto Parts	Germany	€ 279,232.00
3	E3	Uniper SE	Multiline Utilities	Germany	€ 274,120.00
4	E4	TotalEnergies SE	Oil & Gas	France	€ 246,036.86
5	E5	Glencore PLC	Metals & Mining	United Kingdom	€ 239,191.45
6	E6	BP PLC	Oil & Gas	United Kingdom	€ 225,556.68
7	E7	Stellantis NV	Automobiles & Auto Parts	Italy	€ 179,592.00
8	E8	Mercedes Benz Group AG	Automobiles & Auto Parts	Germany	€ 150,017.00
9	E9	Bayerische Motoren Werke AG	Automobiles & Auto Parts	Germany	€ 142,610.00
10	E10	Equinor ASA	Oil & Gas	Norway	€ 139,229.34
11	E11	Eni SpA	Oil & Gas	Italy	€ 132,512.00
12	E12	E ON SE	Multiline Utilities	Germany	€ 115,660.00
13	E13	Deutsche Telekom AG	Telecommunications Services	Germany	€ 114,197.00
14	E14	Nestle SA	Food & Tobacco	Switzerland	€ 95,445.46
15	E15	Deutsche Post AG	Freight & Logistics Services	Germany	€ 94,436.00
16	E16	Engie SA	Multiline Utilities	France	€ 93,865.00
17	E17	Enel SpA	Electrical Utilities & IPPs	Italy	€ 89,486.00
18	E18	BASF SE	Chemicals	Germany	€ 87,327.00
19	E19	Koninklijke Ahold Delhaize NV	Food & Drug Retailing	Netherlands	€ 86,984.00
20	E20	Carrefour SA	Food & Drug Retailing	France	€ 83,089.00
21	E21	LVMH Moet Hennessy Louis Vuitton SE	Apparel & Accessories	France	€ 79,184.00
22	E22	Christian Dior SE	Textiles & Apparel	France	€ 79,184.00
23	E23	Siemens AG	Machinery, Tools, Heavy Vehicles, Trains & Ships	Germany	€ 77,769.00

Rank	Identifier	Company Name	Industry Group (TRBC)	Country of Exchange	Revenue (FY0, Million EUR)
24	E24	AP Moeller - Maersk A/S	Freight & Logistics Services	Denmark	€ 0.00
25	E25	Repsol SA	Oil & Gas	Spain	€ 75,153.00
26	E26	ArcelorMittal SA	Metals & Mining	Netherlands	€ 74,606.23
27	E27	Tesco PLC	Food & Drug Retailing	United Kingdom	€ 74,479.84
28	E28	Roche Holding AG	Pharmaceuticals	Switzerland	€ 63,965.56
29	E29	OMV AG	Oil & Gas	Austria	€ 62,298.00
30	E30	Vinci SA	Construction & Engineering	France	€ 62,265.00
31	E31	Unilever PLC	Personal & Household Products & Services	United Kingdom	€ 60,073.00
32	E32	Orlen SA	Oil & Gas	Poland	€ 59,247.47
33	E33	Airbus SE	Aerospace & Defense	France	€ 58,763.00
34	E34	EnBW Energie Baden Wuerttemberg AG	Electrical Utilities & IPPs	Germany	€ 56,002.60
35	E35	Anheuser-Busch Inbev SA	Beverages	Belgium	€ 53,995.24
36	E36	Iberdrola SA	Electrical Utilities & IPPs	Spain	€ 53,949.00
37	E37	Rio Tinto PLC	Metals & Mining	United Kingdom	€ 51,909.66
38	E38	Compagnie de Saint Gobain SA	Homebuilding & Construction Supplies	France	€ 51,197.00
39	E39	Daimler Truck Holding AG	Machinery, Tools, Heavy Vehicles, Trains & Ships	Germany	€ 50,945.00
40	E40	Bayer AG	Pharmaceuticals	Germany	€ 50,739.00
41	E41	Novartis AG	Pharmaceuticals	Switzerland	€ 48,347.72
42	E42	Renault SA	Automobiles & Auto Parts	France	€ 46,391.00
43	E43	Vodafone Group PLC	Telecommunications Services	United Kingdom	€ 45,706.00
44	E44	Sanofi SA	Pharmaceuticals	France	€ 45,389.00
45	E45	Bouygues SA	Construction & Engineering	France	€ 44,322.00
46	E46	Orange SA	Telecommunications Services	France	€ 43,471.00
47	E47	Veolia Environnement SA	Multiline Utilities	France	€ 42,885.30
48	E48	Volvo AB	Machinery, Tools, Heavy Vehicles, Trains & Ships	Sweden	€ 42,508.39
49	E49	Exor NV	Machinery, Tools, Heavy Vehicles, Trains & Ships	Netherlands	€ 41,844.00
50	E50	AstraZeneca PLC	Pharmaceuticals	United Kingdom	€ 41,441.57

Rank	Identifier	Company Name	Industry Group (TRBC)	Country of Exchange	Revenue (FY0, Million EUR)
51	E51	Fresenius SE & Co KGaA	Healthcare Providers & Services	Germany	€ 40,840.00
52	E52	Traton SE	Machinery, Tools, Heavy Vehicles, Trains & Ships	Germany	€ 40,335.00
53	E53	Telefonica SA	Telecommunications Services	Spain	€ 39,993.00
54	E54	Kuehne und Nagel International AG	Freight & Logistics Services	Switzerland	€ 39,824.20
55	E55	Continental AG	Automobiles & Auto Parts	Germany	€ 39,408.90
56	E56	RWE AG	Multiline Utilities	Germany	€ 38,366.00
57	E57	L'Oreal SA	Personal & Household Products & Services	France	€ 38,260.60
58	E58	Centrica PLC	Multiline Utilities	United Kingdom	€ 38,021.43
59	E59	Dr Ing hc F Porsche AG	Automobiles & Auto Parts	Germany	€ 37,630.00
60	E60	thyssenkrupp AG	Metals & Mining	Germany	€ 37,536.00
61	E61	Imperial Brands PLC	Food & Tobacco	United Kingdom	€ 37,473.77
62	E62	Compass Group PLC	Hotels & Entertainment Services	United Kingdom	€ 35,804.04
63	E63	J Sainsbury PLC	Food & Drug Retailing	United Kingdom	€ 35,661.69
64	E64	Hapag Lloyd AG	Freight & Logistics Services	Germany	€ 34,542.70
65	E65	Schneider Electric SE	Machinery, Tools, Heavy Vehicles, Trains & Ships	France	€ 34,176.00
66	E66	Fonciere Euris SA	Food & Drug Retailing	France	€ 34,021.00
67	E67	Finatis SA	Food & Drug Retailing	France	€ 34,021.00
68	E68	Rallye SA	Food & Drug Retailing	France	€ 34,009.00
69	E69	Casino Guichard Perrachon SA	Food & Drug Retailing	France	€ 34,004.00
70	E70	Naturgy Energy Group SA	Natural Gas Utilities	Spain	€ 33,965.00
71	E71	ACS Actividades de Construccion y Servicios SA	Construction & Engineering	Spain	€ 33,615.23
72	E72	GSK plc	Pharmaceuticals	United Kingdom	€ 33,146.25
73	E73	Anglo American PLC	Metals & Mining	United Kingdom	€ 32,814.26
74	E74	Deutsche Lufthansa AG	Passager Transportation Services	Germany	€ 32,770.00
75	E75	Industria de Diseno Textil SA	Specialty Retailers	Spain	€ 32,569.00
76	E76	DSV A/S	Freight & Logistics Services	Denmark	€ 31,699.28

Rank	Identifier	Company Name	Industry Group (TRBC)	Country of Exchange	Revenue (FY0, Million EUR)
77	E77	British American Tobacco plc	Food & Tobacco	United Kingdom	€ 31,259.70
78	E78	Siemens Energy AG	Renewable Energy	Germany	€ 31,119.00
79	E79	SAP SE	Software & IT Services	Germany	€ 30,871.00
80	E80	L'Air Liquide Societe Anonyme pour l'Etude et l'Exploitation des Procedes Georges Claude SA	Food & Drug Retailing	France	€ 29,934.00
81	E81	METRO AG	Chemicals	Germany	€ 29,754.00
82	E82	Volvo Car AB	Automobiles & Auto Parts	Sweden	€ 29,640.03
83	E83	Holcim AG	Construction Materials	Switzerland	€ 29,504.76
84	E84	Heineken NV	Beverages	Netherlands	€ 28,719.00
85	E85	Heineken Holding NV	Beverages	Netherlands	€ 28,719.00
86	E86	Compagnie Generale des Etablissements Michelin SCA	Automobiles & Auto Parts	France	€ 28,590.00
87	E87	Edison SpA	Multiline Utilities	Italy	€ 28,500.00
88	E88	Danone SA	Food & Tobacco	France	€ 27,661.00
89	E89	Randstad NV	Professional & Commercial Services	Netherlands	€ 27,568.00
90	E90	Abb Ltd	Machinery, Tools, Heavy Vehicles, Trains & Ships	Switzerland	€ 27,514.34
91	E91	Galp Energia SGPS SA	Oil & Gas	Portugal	€ 27,161.00
92	E92	BayWa AG	Food & Tobacco	Germany	€ 27,061.80
93	E93	Air France KLM SA	Passager Transportation Services	France	€ 26,393.00
94	E94	Hochtief AG	Construction & Engineering	Germany	€ 26,219.33
95	E95	Neste Oyj	Oil & Gas	Finland	€ 25,707.00
96	E96	Umicore SA	Automobiles & Auto Parts	Belgium	€ 25,435.52
97	E97	Jeronimo Martins SGPS SA	Food & Drug Retailing	Portugal	€ 25,385.00
98	E98	DCC PLC	Consumer Goods Conglomerates	United Kingdom	€ 25,265.43
99	E99	Esso Societe Anonyme Francaise SA	Oil & Gas	France	€ 24,936.10
100	E100	Nokia Oyj	Communications & Networking	Finland	€ 24,911.00

Appendix II: Risk Expressions

Category	Type	Expression Retrieved (example)	Company Identifier
ENVIRONMENTAL	Carbon Footprint	"The target is to significantly increase the volume of net CO2-reduced steel to 500,000 tons by fiscal year 2024 / 2025"	E63
	Climate Change Adaptation	"Rising concerns about climate change and effects of the energy transition could continue to lead to a fall in demand and potentially lower prices for fossil fuels. Climate change could also have a physical impact on our assets and supply chains."	E1
	Emission of Greenhouse Gas	"Greenhouse gas reduction 50% reduction from FY17 baseline by 2025"	E46
	Energy Consumption	"Energy consumption, measures taken to improve energy efficiency and use of renewable energy"	E45
	Environmental Accident	"Accidents or technical faults in production facilities may cause hazardous substances to contaminate water, soil, and air"	E55
	Excessive or Unnecessary Packaging	"would like to see brands reduce the amount of packaging used and remove unnecessary plastic."	E64
	Non-compliance with Sustainability Law	"We also communicated relevant identified laws and regulations and potential fraud risks to all engagement team members including internal specialists and significant component audit teams and remained alert to any indications of fraud or non-compliance with laws and regulations throughout the audit"	E6
	Pollution	"Measures to prevent, reduce or repair emissions that seriously affect the environment, taking into account any form of air pollution specific to an activity, including noise and light pollution"	E75
	Product Waste	"…combating food waste..."	E50
	Natural Disaster	"Increased severity of extreme weather events such as heatwaves, floods, cyclones, forest fires, pests and diseases"	E66
	Water Scarcity	"We are reliant on water supplies for both our food products and bottled waters, we are conscious of the issue of water scarcity, not only in terms of the operational risks it poses to our business, but also in terms of our activities' impacts on the availability and quality of water"	E94
FINANCIAL/ECONOMIC	Antitrust Claim	"The company could be subject to compliance cases in connection with violations of anti-corruption laws, anti-trust regulations, international sanctions and/or data privacy"	E24
	Bribery	"Anti-corruption and anti-bribery matters - We take a zero-tolerance approach to bribery and to those involved in bribery"	E30
	Digital Transformation in Supply Chain	"Data mining, artificial intelligence and new technologies bring new solutions for the Group's projects while protecting personal data"	E33
	Tax Evasion	"Combating tax evasion"	E50
	Inventory Management	"Risks in the upstream supply chain"	E79
	Boycott	"...purchasing boycotts..."	E100

Category	Type	Expression Retrieved (example)	Company Identifier
	Cybersecurity Threat	"The ever-increasing reliance on digital technologies has brought with it a corresponding rise in cyber-related risks, ranging from the proliferation of ransomware to nation-state activity and the monetisation of cybercrime"	E5
	Energy Price Volatility	"Impact on the Group's economic activities: business disruption, higher raw material prices, higher energy prices"	E73
	Financial Crisis	"Deterioration of the economic environment in markets where VINCI operates: Weakening of demand, Rising levels of competition, Increase in inflation"	E33
	Geopolitical Risk	"An unstable geopolitical environment with complex new and enduring regional conflicts remained a constant security focus throughout 2022."	E32
	Litigation	"Legal proceedings and other disputes: relating to including legal proceedings arising in the ordinary course of business with dealers, customers, suppliers or regulators"	E52
	Resource Scarcity	"Non-availability of critical materials and services: Interruptions to global supply chains and the scarcity of materials and personnel"	E37
	Supplier Risk Management	"Achievement of a High Risk Supplier Reduction (HSR) of 36.4% at group level by 2026 / 2027"	E63
SOCIAL	Child Labor	"Operations and suppliers at significant risk for incidents of child labor"	E28
	Excessive Working Time	"Findings differ per country and include topics such as excessive working hours"	E90
	Exploitative Hiring Policy	"The company works with suppliers, contractors and collaborating companies whose practices do not respect human rights"	E74
	Gender, Racial and Age Diversity	"Building a culture of inclusion, promoting diversity and inclusion, Embracing the full spectrum of talent, Ensuring gender equality"	E25
	Healthy and Safe Working Environment	"A work environment that accommodates employees' expectations, An approach to ensure health and safety for all staff"	E60
	Sustainability Procurement	"Responsible procurement/supply chain management: Danone sources a wide range of ingredients, particularly dairy inputs, from suppliers globally"	E94
	Unethical Treatment of Animals	"Farming and trapping practices concerning raw materials of animal origin, Protecting biodiversity"	E39
	Demographic Challenges	"Difficulties in recruiting, hiring and retaining urgently needed specialized employees could have significant adverse consequences for our company's future development"	E43
	Pandemic	"Covid-19: A future spike in the pandemic could lead to the partial or total shutdown of retail space and warehouses due to staff absences, supply-related difficulties, and/or government decisions"	E72
	Social Instability (includes Human Rights)	"We have identified salient human rights risks from our business activities which we may cause or contribute to, and which we seek proactively to identify, cease, prevent or mitigate"	E89