

Article

Incorporating ESG Risk in Companies' Business Models: State of Research and Energy Sector Case Studies

Magdalena Ziolo ¹, Iwona Bąk ² and Anna Spoz ^{3,*}¹ Faculty of Economics and Management, University of Szczecin, Mickiewicza 64, 71-101 Szczecin, Poland² Faculty of Economics, West Pomeranian University of Technology, Janickiego 31, 71-270 Szczecin, Poland³ Institute of Economics and Finance, The John Paul II Catholic University of Lublin, Aleje Raławskie 14, 20-950 Lublin, Poland* Correspondence: aspoz@kul.lublin.pl

Abstract: The article aims to systematize the state of knowledge of and research on the inclusion of ESG (Environmental, Social, and Governance) risk in companies' business models, with a special stress on energy sector companies. Many publications address incorporating ESG, but only some deal with it from the perspective of business models. This paper fills that gap. The methods of incorporating ESG risk into a sustainable business model, identified on the basis of the literature review, were verified based on the examples of three companies from the energy industry. A two-stage review of publications from the WoS and Scopus databases was carried out, considering a more comprehensive (sustainability) and a narrower (ESG risk) range of keywords, and the period from 2000 to 2022. The result showed that SMEs and large enterprises consider ESG risk in their risk management systems (ERMs), while small enterprises and start-ups do not. In Europe, Asia, and Australia, it is common to include ESG risk in an ERM, while it is rare in Latin America. In developing countries, companies in the service sector are more likely to include ESG risk in ERMs than those in the manufacturing sector. These findings may be useful for policymakers who wish to provide support and financial incentives for companies transforming their business models toward sustainability.

Keywords: energy sector; ESG; risk; business; methods; models; companies



Citation: Ziolo, M.; Bąk, I.; Spoz, A. Incorporating ESG Risk in Companies' Business Models: State of Research and Energy Sector Case Studies. *Energies* **2023**, *16*, 1809. <https://doi.org/10.3390/en16041809>

Academic Editor: Peter V. Schaeffer

Received: 5 January 2023

Revised: 1 February 2023

Accepted: 8 February 2023

Published: 11 February 2023



Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

ESG risk is currently one of the leading risks in terms of its impact and probability of occurrence. Its effect is felt in almost every enterprise; hence, rulers and business managers take several measures to reduce this risk. Practical actions to reduce ESG (Environmental, Social, Governance) risk are necessary because the link between ESG risk and financial performance has been documented [1]. However, it is worth noting that the impact of ESG on financial performance might also be negative, although very few studies have found a negative correlation [2].

Mitigating the impact of ESG risk on companies because of its financial and non-financial consequences is an essential part not only of the actions taken by companies themselves, but also of those taken by financial markets, governments, and regulators [3].

The impact of mitigating the ESG risk for companies also means a positive impact on environmental and social sustainability. It is crucial in a global context and to ensure sustainability. The incorporation of ESG risk into companies' planning implies the transition of companies to corporate sustainability and to reducing the ESG risk, which is critical in the context of strategic action, for example, the European Green Deal or Taxonomy.

Integrating ESG into companies' business models means an ESG risk reduction for the businesses and increasing opportunities for business development, especially with the support of external funding (some financial institutions exclude dirty companies from cooperation and limit access to financing).

There are different motives for why companies integrate ESG risk into business models. Some are related to regulatory frameworks or financial markets, and to institutions' requirements [3]. Some have other aims, such as to reduce the exposure to ESG risk or stakeholders' expectations [4].

Studies of, analyses of, and research on incorporating ESG risk into companies' business models are critical for supporting businesses, governments, and financial institutions throughout the transition process toward corporate sustainability. In particular, there is a recognized research gap in the area of integrating ESG risk into companies' plans because few studies deal with incorporating ESG in business models [5].

The motives for incorporating ESG risk and how companies accomplish this are the subjects of intensive research [6]. There are many research streams in the area of the integration of ESG risk by companies. The major ones are related to risk management [7], the decision-making process [8,9], ESG scoring and rating [9], responsibility [10], and business models [5].

The research on the incorporation ESG risk by companies is justified to ensure sustainability in the global context. Companies are the critical driver of sustainability and are responsible for negative externalities. Therefore, the knowledge of how to mitigate negative externalities throughout the companies' transitions to corporate sustainability is necessary. One possible action is to adjust companies' business models toward sustainability by incorporating ESG considerations.

However, the scope of the research and the significant number of works makes it difficult to comprehensively analyse the results and determine the actual state of knowledge. In particular, this concerns the systematization of the state of research in the context of the size of the surveyed enterprises and their locations, the area of the research, and the methodology.

Thus, this paper aims to systematically review the literature and examine how companies incorporate ESG considerations into their business models, which is the current knowledge gap addressed by the article. In particular, the article focuses on the search for the relationships between the size of the company and its geographical location and the method of ESG risk management that it has adopted, as well as the research methodology used by the researchers.

The purpose of the paper is to fill a research gap regarding the state of the research on ESG risk in companies' business models. A systematic literature review with elements of statistical analysis was used to achieve this objective. It was possible to carry out the research by identifying relevant variables that give information about how companies take ESG risks into account. For this purpose, the Academic Database of Elsevier Scopus and the Web of Science database were used. After eliminating duplicate titles and analysing the content of each publication, the sample was reduced to 52 references describing how to incorporate ESG risk into the business models of enterprises.

The approach used by the authors differs from previous research practices, which mainly focus on the use of qualitative methods. The authors also included in their systematic literature review selected methods of statistical analysis, i.e., dependency analysis based on multivariate tables and multivariate correspondence analysis. The use of these methods made it possible to determine the strength of the relationship among the qualitative variables studied and to search for relationships among selected keywords describing ways for companies to create sustainable value. This resulted in the identification of groups of scientific articles that were similar in terms of the issues they analysed.

The main research questions were as follows:

- What are the primary research trends in the field of ESG risk for companies?
- How do small, medium, and large enterprises manage ESG risk?
- Does the area of research depend on the location, and, if so, how?
- What is the relationship between ESG risks in enterprises in developed and developing countries?
- How do companies in different sectors manage ESG risk?
- What research methodology is used to study companies' ESG risk?

The paper is organized as follows: The introduction is Section 1; Section 2 contains a literature review. Section 3 presents the methodological approach, the data collection procedure, the description of the methods, and the research results. Section 4 discusses the research results, and Section 5 is the conclusion.

2. Literature Review—ESG Risk in Companies

The concept of risk is related to uncertainty [11], or to the nonexistence of absolute certainty [12], which can have positive or negative impact on the organization [13]. Risk is an inseparable element of business. In the literature, there are several classifications of the risks to which enterprises are exposed. According to the Casualty Actuarial Society, companies are exposed to financial risk, hazard risk, operational risk, and strategic risk [14,15]. Leo et al. [16], creating a taxonomy of the risks to which banks are exposed, divided the risks into two main categories, i.e., financial risk, under which he distinguished credit risk, market risk, principal risk, liquidity risk, and non-financial risk, which included country risk, compliance risk, conduct risk, legal risk, model risk, business and strategy risk, reputation risk, strategic risk, and operational risk. A similar approach was presented by Boulwood [17], who distinguished financial (quantitative) risk and non-financial (qualitative) risk, where the latter included business risk, reputation risk, operational risk, strategic risk, and ESG risk. The Cambridge Taxonomy of Business Risks includes the following classes of risk: financial risk, geopolitical risk, technology risk, environmental risk, social risk, and governance risk. Each of these main classes includes several families of risks, and a family of risks may contain many types of risk [18].

The growing impact of non-financial factors on the activities of business entities means that ESG risk is increasingly identified as part of the risks to which enterprises are exposed. In the literature on the subject, the term ESG risk most often refers to environmental, social, and governance conditions or events [19]. Some authors identify ESG risk with the concept of sustainability risk [20], which some authors relate to environmental and social issues, while governance risk issues are included in social risk [21,22].

Among the factors that determine environmental risk, the following are most frequently indicated: climate change, environmental pollution (air, water, land), environmental degradation, and resource scarcity [23]. The Task Force on Climate-related Disclosure (TCFD) [24] distinguished two classes of this type of risk: physical risk and transition risk. In scientific research, environmental risk is analysed in the context of risk management [25,26], its relationship with companies' financial performance [27,28], the cost of capital [29], the ability to repay debts and the probability of default [30], and financial stability [31].

Social risk is a broad concept and has the potential to grow the fastest. These risks include human rights, equality, social cohesion, social inclusion, consumer rights, health, safety, and security. Social risk is analysed in the context of labour market instability, the social relations of communities, political transformations [32], the fair treatment of employees [33], management [34], and financial stability [31].

Governance risk arises from management structures, employee relations, relevant staff remuneration, tax, and legal compliance [20]. In scientific research, governance risk appears in the context of the prevention of corruption and bribery, transparency [35], risk management [36], and the impact of the management staff on the risks taken by a company [37].

The growing importance of ESG risk in enterprise operations causes this risk to be more and more often included in the enterprise risk management system (ERM). Non-financial risk management could be a way to link company development with the concept of sustainability [38]. Wijethilake and Lama [39], Bui and de Villiers [40], and Aziz et al. [41], in a separate study, showed that a proactive approach to the concept of sustainability helps companies to implement effective sustainable risk management. Non-financial risk management may contribute to a competitive advantage [42,43], increase the company's

value [44], and translate into the reduction of the negative effects of unsustainable practices, such as penalties and noncompliance [45–47].

The emergence of the concept and implementation of Enterprise Risk Management (ERM) is the response of enterprises to the changes brought about by globalization and the pressure from regulators to manage risk holistically [48]. By focusing on managing and mitigating global risk, companies can avoid excessive costs of risk management [49,50]. The risk management process is also a way to reduce the complexity of enterprise risks and has the benefits of ease of use and transparency. Identifying risks and expressing their value in numbers facilitates the risk monitoring and management processes. In the process of implementing a risk management system in an enterprise, an initial phase and four main phases can be distinguished. The initial phase consists of a contextual analysis during which risk management goals are defined, consistent with the company's strategic goals, and the resources owned by the organization and needed in the risk management process. The main phases are risk identification, risk estimation, risk evaluation (defining procedures in terms of the occurrence and effects of acceptable risk and unacceptable risk), and risk control planning and implementation [51]. The last stage of the risk management process is communication and consultation with stakeholders about the occurring risks and the risk management process [52]. The method of implementing ERM in an enterprise is individual for each entity because each entity adjusts the system parameters to its own functionality [53].

Gardiner and Endicott [54] suggested the integration of sustainability risk management (SRM) in ERM as a critical part. SRM is a process that addresses and manages a wide spectrum of new and unknown risks derived from sustainability issues, and the goal of this process is to achieve sustainable value for long-term survival. Due to the complexity of the risks to which businesses are exposed, SRM should be encompassed within the ERM framework [42]. Sustainability Risk Management is becoming a corporate strategy [55], which ensures the survival and development of the company while maintaining sensitivity to environmental, social, and management issues.

Deloitte proposed the Sustainability Risk Management Framework [56]. The framework encompasses corporate strategy, including value drivers, value chain, risk exposure, response design, outcome, and performance. Additionally, appropriate responses must be designed and implemented to achieve results that maximize value for a company and its stakeholders. The role of the directors is to supervise how their companies' risk management strategies and practices comply with the ESG requirements of a wide range of stakeholders. Wijethilake and Lama [39], based on a survey of senior management in both local and multinational organizations in Sri Lanka, showed that the participation of senior management positively affects the process of integrating sustainability into core values and sustainability risk management. The results obtained are in line with the results of the study by Aziz et al. [41], who showed that top management leadership is crucial to successful management of sustainability risk. Wijethilake and Lama [39] also showed that the pressure of stakeholders (shareholders, customers, government and regulatory bodies, suppliers, employees, and competitors) does not affect the process of sustainability risk management, which is in line with the views of Jolland et al. [57]. In the opinion of Horisch et al. [58], incorporating ESG issues into the company's core business creates real value for stakeholders.

Managing relationships and building trust and transparency are key to gaining approval and support from key stakeholders of the company [56]. Supply chain management (SCM) is perceived as a key factor in improving business effectiveness and success [59]. Sustainable supply chain management (SSCM) becomes a strategic requirement for companies [60], as it is an important source of cost reduction and increases the long-term profitability of the organization [61].

To the best of the authors' knowledge, there are no similar studies in the literature. So far, articles aimed at systematizing the state of knowledge related to ESG have focused on the following areas: ESG literature reviews and prospects for future research [62,63],

ESG performance in the context of multinational business research [64,65], ESG disclosure and firm performance [66], ESG and Socially Responsible Investment [67–69], and ESG and CSR [70].

3. Data and Methodology

The amount of work related to ESG risk in enterprises is impressive. The Web of Science (WoS) database contains thousands of papers related to this issue (Table 1).

Table 1. Number of articles identified in the WoS and Scopus databases according to the selected keywords.

Search Terms	Number of Publications
ESG OR integrating	111,416
ESG OR business	79,093
sustainability risk	1434
ESG	1411
ESG AND business	47

Given the purpose of the article, the focus was on publications that concern the integration of sustainable development risk into the business models of companies. The review of the literature available in the Web of Science (WoS) database shows, that in the years 2000–2022, 2244 publications were indexed that, in the title, abstract, or keywords, referred to terms related to the researched topic and included the following combinations of keywords: sustainability risk* AND sustainab* AND business OR ESG* AND ESC* OR integrating*. These are mainly papers by authors from China (554 works), the USA (500), Germany (162), India (124), Japan (118), Spain (112), and the United Kingdom (103). They were published primarily by such publishers as Elsevier (459 papers), IEEE (362), Spie-Int Soc Optical Engineering (263), Springer Nature (220), and Wiley (89).

In the years 2000–2022, the number of publications on the topic investigated showed an upward trend, with slight decreases in some periods (Figure 1). In 2000, only 20 publications were indexed in the WoS database, while, 15 years later, their number exceeded 150. In the following years, slight decreases were noted, but the number never dropped below 110. With the increase in the number of publications, the number of their citations also increased, from 304 in 2000 to 5584 in 2021, with 27% more a year later.

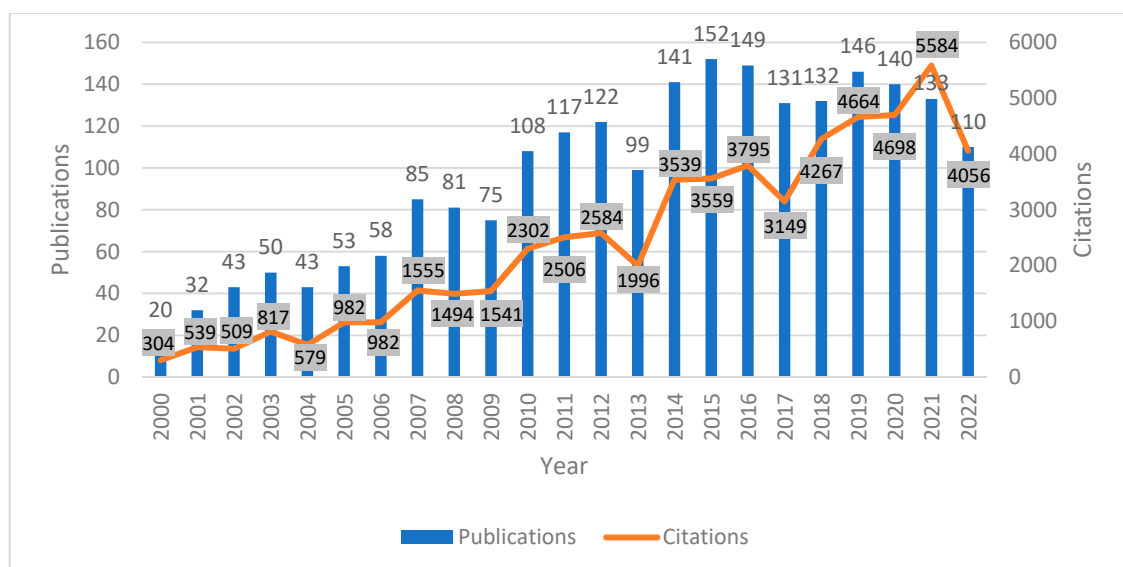


Figure 1. The evolution of publications and citations by year.

Table 2. Numbers and types of documents under examination.

Search String	Area of Search	Number of Publications	Publication Types	
“sustainability risk” AND sustainab* AND business	Article title and Abstract, Keywords	81	Article	49
			Book	4
			Book chapter	8
			Conference paper	20
“ESG risk” AND sustainab* AND integrat*	Article title and Abstract, Keywords	12	Article	12
			Book	0
			Book chapter	0
“sustainability risk” AND sustainab* AND business AND incorporat*	Article title and Abstract, Keywords	8	Conference paper	0
			Article	4
			Book	2
“sustainability risk” AND sustainab* AND enterpris*	Article title and Abstract, Keywords	29	Book chapter	0
			Conference paper	2
			Article	15
			Book	1
			Book chapter	1
			Conference paper	12

After eliminating duplicate titles and analysing the contents of the publications, the sample was reduced to 52 references. The final sample consists of publications describing how to incorporate ESG risk into the business models of enterprises. The characteristics of the research sample are included in the Table 3.

Table 3. The characteristics of the research sample.

Description	Structure of the Studied Publications	
Year of publication	2022	15%
	2021	21%
	2020	23%
	2019	6%
	2018	6%
	2017	8%
	2016	2%
	2015	4%
	2014	2%
	2013	6%
	2012	2%
	2011	2%
	2010	2%
Regions where the headquarters of the surveyed companies are located	2008	2%
	Asia & Australia	36%
	Europe	26%
	North America	18%
	Latin America	10%
The level of the country’s development	Africa	10%
	Developed countries	53%
The size of the companies	Developing countries	47%
	Large enterprises	58%
	SME	29%
The industry in which the company operates	Small enterprises	11%
	Start-ups	2%
	Manufacturing/production	60%
	Service	40%

The selected categories from Table 3 are presented graphically in Figure 3.

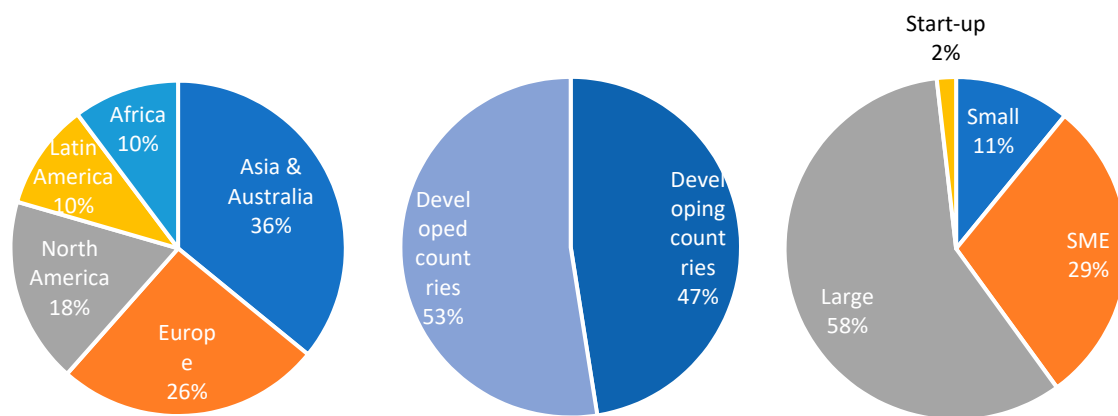


Figure 3. Graphical presentation of the research sample structure.

Looking at the share of the continents, it is clear that cases from Asia and Australia are the most frequently described by researchers. At the same time, the shares of developed and developing countries are very similar. The authors most often present cases of large enterprises (they are described twice as often as enterprises from the SMEs sector). This can be explained by the fact that it is mainly large companies that consider ESG risk in their activities, as they have the appropriate resources or are required to have a risk management system.

Based on the analysis of the content of the publications from the research sample, the following ways of incorporating ESG risk in business models were distinguished:

- ESG risk management (38 publication);
- ESG risk in decision-making/investment processes (19 publications);
- Sustainable (green) supply chain (16 publications);
- ESG risk in business model (16 publications);
- Risk culture (8 publications);
- Communication with stakeholders (4 publications).

The methods specified were compared with the data from the individual categories presented in Table 3.

Based on the information from the analysed publications, 18 binary variables were constructed, having two categories of “yes” and “no,” which were assigned ranks of 1 and 0, respectively:

- X1—Publication Year (1 if the paper was published later than 2018; 0 in other cases);
- X2—Europe (1 if European companies were analysed; 0 in other cases);
- X3—North America (1 if North American companies were analysed; 0 in other cases);
- X4—Asia and Australia (1 if Asian and Australian companies were analysed; 0 in other cases);
- X5—Developing countries (1 if companies from Developing Countries were analysed; 0 in other cases);
- X6—Developed Countries (1 if companies from Developed Countries were analysed; 0 in other cases);
- X7—SME sector (1 if companies from SME sectors were analysed; 0 in other cases);
- X8—Large Enterprise (1 if companies of the Large Enterprise sector were analysed; 0 in other cases);
- X9—Manufacturing/Production/Industry (1 if companies from the Manufacturing/Production/Industry were analysed; 0 in other cases);
- X10—Service sector (1 if companies from the Service sector were analysed; 0 in other cases);
- X11—Sustainable Supply Chain Risk Management (1 if companies from Sustainable Supply Chain Risk Management were analysed; 0 in other cases);
- X12—Including ESG Risk In Enterprise Risk Management (1 if companies from Including ESG Risk In Enterprise Risk Management were analysed; 0 in other cases);

- X13—Including ESG Risk In Decision Making (1 if companies from Including ESG Risk In Decision Making were analysed; 0 in other cases);
- X14—Sustainable Business Strategy (1 if companies from Sustainable Business Strategy were analysed; 0 in other cases);
- X15—Sustainable (Green) Supply Chain (1 if companies from Sustainable (Green) Supply Chain were analysed; 0, in other cases);
- X16—ESG Risk Management (1 if companies from ESG Risk Management were analysed; 0 in other cases);
- X17—ESG Risk in Decision Making/Investment (1 if companies from ESG Risk In Decision Making/Investment were analysed; 0, in other cases);
- X18—ESG Risk in Business Model (1 if companies from ESG Risk in Decision Making/Investment were analysed; 0 in other cases).

In the next step, cross-tabulation was carried out, based on which statistics were calculated to determine the strength of the association between the two qualitative (unmeasured) variables under study. The Q-Yulea contingency (association) coefficient [71,72], which is applied when the data are presented as a 2×2 contingency table, was used. The value of this coefficient belongs to the interval $[-1,1]$. Its sign does not indicate the direction of the relationship, since the value depends on the design of the array. The closer the absolute value is to unity, the stronger the relationship between the features.

During the next stage, groups of articles with similar views on how companies integrate ESG risks into their business models were identified. For this purpose, correspondence analysis, which belongs to the group of multivariate methods for studying interdependence, was used. It is widely discussed and used in socio-economic research [73–75].

4. Results and Discussion

Analyzing the methods of incorporating ESG risk into business models used by enterprises of various sizes, it can be seen that, regardless of size, companies most often use risk management (Table 4). The second place was taken by including ESG risk in decision-making and investment processes. When it comes to start-ups, each of the above-mentioned practices covers 50% of all of the companies in this category.

Table 4. ESG risk management practices and enterprise size.

	Small Enterprises	SME Sector	Large Enterprises	Start-Ups
Sustainable (green) supply chain	17%	20%	14%	0%
ESG risk management	42%	40%	35%	50%
ESG risk in decision-making/investment processes	17%	27%	22%	50%
ESG risk in business model	8%	10%	16%	0%
Communication with stakeholders	8%	3%	5%	0%
Risk culture	8%	0%	8%	0%

When analysing the relationship between the locations of the companies and their methods of incorporating ESG risk into their business model, ESG risk management is again the most frequently implemented, regardless of the region where the companies are located (Table 5). Also, the second position is the same as in the previous comparison (ESG risk in decision making/investment).

Table 5. ESG risk management practices and enterprise location.

	Europe	North America	Latin America	Asia & Australia	Africa
Sustainable (green) supply chain	13%	15%	15%	19%	10%
ESG risk management	38%	33%	46%	41%	67%
ESG risk in decision-making/investment processes	18%	26%	23%	22%	19%
ESG risk in business model	18%	11%	15%	11%	5%
Communication with stakeholders	8%	4%	0%	2%	0%
Risk culture	5%	11%	0%	6%	0%

Another category in which ESG risk management and the inclusion of ESG risk in decision-making and investment processes are the most popular types of business activity is shown in Table 6. Manufacturing enterprises implement these practices first, as well as enterprises providing services. However, in the case of service companies, the advantage of using the first two methods is particularly clear, while manufacturing companies care about ensuring a green supply chain (18%) almost as often as they consider ESG risk in their decision-making and investment processes (20%).

Table 6. ESG risk management practices and type of business activity.

	Manufacturing/Production/Industry	Service
Sustainable (green) supply chain	18%	10%
ESG risk management	34%	41%
ESG risk in decision making/investment processes	20%	31%
ESG risk in business model	15%	10%
Communication with stakeholders	8%	4%
Risk culture	5%	11%

The analysis of the relationship between the ESG risk management methods implemented and the level of development of the countries of origin of the companies showed slightly different results (Table 7). ESG risk management is again most often implemented by companies from developing countries, but a sustainable supply chain is in the second place, ahead of including ESG risk in decision-making and investment processes. Companies from developed countries had as their first-place strategy the incorporation of ESG risk management in decision-making and investment processes, while just behind this practice are ex aequo a sustainable supply chain and incorporating ESG risk into the business model (21% each). ESG risk management is not far behind them, with 18% of the share. The results show that there is a clear difference in the implementation of ESG risk management methods depending on the level of development of the companies' countries of origin.

Table 7. ESG risk management practices and the level of development of the country of origin of the company.

	Developing Countries	Developed Countries
Sustainable (green) supply chain	25%	21%
ESG risk management	41%	18%
ESG risk in decision-making/investment processes	22%	24%
ESG risk in business model	9%	21%
Communication with stakeholders	0%	2%
Risk culture	0%	6%

The next step in our research was a more detailed analysis of ESG risk management, which turned out to be the most popular way of integrating risk management into enterprises' business models and strategies. ESG risk management includes three activities distinguished by our analysis of the research sample, namely the following:

- Including ESG risk in Enterprise Risk Management;
- Risk identification;
- Risk monitoring;
- Risk mitigation.

The analysis shows that large enterprises include risk identification and risk monitoring in their ESG risk management systems more often than risk mitigation, while companies in the SME sector focus primarily on risk mitigation (Table 8).

Table 8. ESG risk management activities and companies' characteristics.

	Risk Identification	Risk Monitoring	Risk Mitigation
	Company size		
SME sector	29%	29%	43%
Large enterprises	40%	40%	20%
	Location		
Europe	40%	30%	30%
North America	38%	25%	38%
Latin America	43%	29%	29%
Asia & Australia	44%	38%	19%
Africa	40%	20%	40%
	Type of business activity		
Manufacturing/Production/Industry	40%	40%	20%
Service	50%	40%	10%
	Level of development of country of company's origin		
Developing Countries	40%	40%	20%
Developed Countries	38%	38%	23%

Risk identification is a most common activity regardless of a company's location. Only in the case of companies from North America and Africa is risk mitigation as popular as identification. In Europe and Latin America, the second place is shared by risk monitoring and risk mitigation, while, in Asia, risk monitoring is only slightly less popular than risk identification.

The share of each activity in the management of ESG risk by manufacturing companies is the same as that for large companies. This indicates that the large companies are also manufacturing companies. For half of the service companies, risk identification is the main activity in the area of risk management, but risk monitoring is not far behind, with 40%.

Taking into account the level of development of the country of origin of the company, there are no significant differences in risk management practices. Among companies from both developing and developed countries, the most popular are risk identification and monitoring. Each of these activities is undertaken by 40% of the companies from developing countries and by 38% of the companies from developed countries.

Tables 9–16 present cross-tabulation tables between variables for which there was a clear relationship, including the values of the Q-Yulea contingency coefficient in parentheses. As shown in Table 9, most of the publications related to sustainable business strategies were written before 2020, and 40% of them were related to developing countries (Table 10). In the case of developed countries, a clear association (coefficient of coincidence of 0.323) was identified with the variable of ESG risk consideration in decision making (Table 11). In developed countries, about 29% of the publications are related to sustainable business strategies (Table 12). For the developing countries, there is a clear relationship with the variable "Developing Countries and ESG Risk in Decision Making/Investment" (Table 13). More than 21% of large companies use a sustainable business strategy, and the relationship between these variables is statistically significant (Table 14). More than 30% of the publications emphasize considering risk in business models in manufacturing firms (Table 15) and in-service companies, and about 60% of the publications focus on including ESG risk in enterprise risk management (Table 16).

Table 9. Cross-way table for variables: Year and Sustainable Business Strategy (0.268).

Year	Sustainable Business Strategy		Sum
	No	Yes	
No	13	7	20
Yes	28	4	32
Sum	41	11	52

Source: own calculations.

Table 10. Cross-way table for variables: Year and Developing Countries (0.241).

Year	Developing Countries		Sum
	No	Yes	
No	15	5	20
Yes	16	16	32
Sum	31	21	52

Source: own calculations.

Table 11. Cross-way table for variables: Developed Countries and Including ESG Risk in Decision Making (0.323).

Developed Countries	Including ESG Risk in Decision Making		Sum
	No	Yes	
No	26	5	31
Yes	11	10	21
Sum	37	15	52

Source: own calculations.

Table 12. Cross-way table for variables: Developed Countries and Sustainable Business Strategy (0.228).

Developed Countries	Sustainable Business Strategy		Sum
	No	Yes	
No	22	9	31
Yes	19	2	21
Sum	41	11	52

Source: own calculations.

Table 13. Cross-way table for variables: Developing Countries and ESG Risk in Decision Making/Investment (0.332).

Developing Countries	Risk in Decision Making/Investment		Sum
	No	Yes	
No	24	7	31
Yes	9	12	21
Sum	33	19	52

Source: own calculations.

Table 14. Cross-way table for variables: Large Enterprise and Sustainable Business Strategy (0.266).

Large Enterprise	Sustainable Business Strategy		Sum
	No	Yes	
No	16	8	24
Yes	25	3	28
Sum	41	11	52

Source: own calculations.

Table 15. Cross-way table for variables: Manufacturing/Production/Industry and ESG Risk in Business Model (0.240).

Manufacturing/Production/Industry	ESG Risk in Business Model		Sum
	No	Yes	
No	20	13	33
Yes	16	3	19
Sum	36	16	52

Source: own calculations.

Table 16. Cross-way table for variables: Service and Including ESG Risk in Enterprise Risk Management (0.271).

Service and Including ESG	Risk in Decision Making Including ESG Risk in Enterprise Risk Management		Sum
	No	Yes	
No	9	22	31
Yes	12	9	21
Sum	21	31	52

Source: own calculations.

The use of correspondence analysis allowed for the separation of groups of articles describing similar approaches by enterprises to the integration of ESG risk into their business models. Three groups of publications have been identified:

- Group I includes sixteen articles related to sustainable supply chain risk management and sustainable (green) supply chains;
- Group II refers to articles on developing and developed countries in Europe, North America, Asia, and Australia. They address the following issues: the consideration of ESG risks in decision-making, sustainable (green) supply chains, and ESG risks in decision-making/investment;
- Group III includes mainly papers published in 2020 or later that address the following issues: ESG risk in enterprise risk management, sustainable business strategies, ESG risk management, and ESG risk in a business model.

Enterprises can incorporate ESG risk in several ways. The methods of incorporating ESG risk into business models described in the publications analysed are presented as graphic symbols in Table 17.

Table 17. List of publications with methods of incorporating ESG risk into business models.

Authors and Title	Type of Publication	How ESG Risk Is Incorporated?
Abdel-Basset, M., & Mohamed, R. (2019). A novel plithogenic TOPSIS-CRITIC model for sustainable supply chain risk management. <i>Journal of Cleaner Production</i> , 119586. doi:10.1016/j.jclepro.2019.119586 [76]	case study	▲
Aziz, N. A. A., & Manab, N. A. (2020). Does risk culture matter for sustaining the business? Evidence from Malaysian environmentally sensitive listed companies. <i>International Journal of Management and Sustainability</i> , 9(2), 91–100 [77]	based on data	■ ♣
Jahankhani, H., Jamal, A., & Lawson, S. (Eds.). (2021). <i>Cybersecurity, Privacy and Freedom Protection in the Connected World. Advanced Sciences and Technologies for Security Applications</i> . doi:10.1007/978-3-030-68534-8 [78]	literature review	▲
Bathrinath, S., Dhanasekar, M., Dhanorvignesh, B., Kamaldeen, Z., Santhi, B., Bhalaji, R. K. A., & Koppiahraj, K. (2022). Modeling sustainability risks in sugar industry using AHP-BWM. <i>Materials Today: Proceedings</i> . doi:10.1016/j.matpr.2021.08.324 [79]	literature, experts' opinion	■
Brockett, A. M., & Rezaee, Z. (Eds.). (2012). <i>Corporate Sustainability</i> . doi:10.1002/9781119202899 [80]	literature review	■
Caputo, L. (2013). It's all about your people [New York Power Authority]. 3rd Annual Forum on Asset Management. doi:10.1049/ic.2013.0173 [81]	case study	■ ♦ ♣
Chatzitheodorou, K., Tsalis, T. A., Tsagarakis, K. P., Evangelos, G., & Ioannis, N. (2021). A new practical methodology for the banking sector to assess corporate sustainability risks with an application in the energy sector. <i>Sustainable Production and Consumption</i> , 27, 1473–1487. doi:10.1016/j.spc.2021.03.005 [82]	case study	■ ♦
Choirun, A., Santoso, I., & Astuti, R. (2020). Sustainability risk management in the agri-food supply chain: literature review. <i>IOP Conference Series: Earth and Environmental Science</i> , 475, 012050. doi:10.1088/1755-1315/475/1/012050 [83]	literature review	▲

Table 17. Cont.

Authors and Title	Type of Publication	How ESG Risk Is Incorporated?
Dumay, J., & Hossain, M. A. (2018). Sustainability Risk Disclosure Practices of Listed Companies in Australia. <i>Australian Accounting Review</i> . doi:10.1111/auar.12240 [84]	case study	■ ◇
Hajmohammad, S., & Shevchenko, A. (2020). Mitigating sustainability risk in supplier populations: an agent-based simulation study. <i>International Journal of Operations & Production Management</i> , 40(7/8), 897–920. doi:10.1108/ijopm-03-2019-0192 [85]	case study, based on data	▲
Hossan Chowdhury, M. M., & Quaddus, M. A. (2020). Supply chain sustainability practices and governance for mitigating sustainability risk and improving market performance: A Dynamic capability Perspective. <i>Journal of Cleaner Production</i> , 123521. doi:10.1016/j.jclepro.2020.123521 [86]	based on data	▲
Juettner, U., Windler, K., Podleisek, A., Gander, M., & Meldau, S. (2020). Implementing supplier management strategies for supply chain sustainability risks in multinational companies. <i>The TQM Journal</i> , 32(5), 923–938. doi:10.1108/tqm-05-2019-0136 [87]	case study	▲
Karwowski, M., & Raulinajtys-Grzybek, M. (2021). The application of corporate social responsibility (CSR) actions for mitigation of environmental, social, corporate governance (ESG) and reputational risk in integrated reports. <i>Corporate Social Responsibility and Environmental Management</i> , 28(4), 1270–1284. doi:10.1002/csr.2137 [20]	based on data	■ ◇ ●
Kazancoglu, Y., Ozkan-Ozen, Y. D., Mangla, S. K., & Ram, M. (2020). Risk assessment for sustainability in e-waste recycling in circular economy. <i>Clean Technologies and Environmental Policy</i> . doi:10.1007/s10098-020-01901-3 [88]	case study	■
Kim, S., Wagner, S. M., & Colicchia, C. (2018). The impact of supplier sustainability risk on shareholder value. <i>Journal of Supply Chain Management</i> . doi:10.1111/jscm.12188 [89]	based on data, case study	▲
Kimanzi, M. K., & Gamede, V. W. (2020). Embracing the role of finance in sustainability for SMEs. <i>International Journal of Economics and Finance</i> , 12(2), 453–468. doi:10.34109/ijefs.202012213 [90]	based on data	■ ◇
Klute-Wenig, S., & Refflinghaus, R. (2015). Integrating sustainability aspects into an integrated management system. <i>The TQM Journal</i> , 27(3), 303–315. doi:10.1108/tqm-12-2013-0128 [91]	case study	■ ◇
La Torre, M., Leo, S., & Panetta, I. C. (2021). Banks and environmental, social and governance drivers: Follow the market or the authorities? <i>Corporate Social Responsibility and Environmental Management</i> . doi:10.1002/csr.2132 [92]	based on data	●
Lau, C.K. and Chen, H. (2022), Stakeholder perceptions on the risk factors, challenges and benefits of business sustainability practices in the Singapore construction industry. <i>Property Management</i> , 40 (2), 149–168. https://doi.org/10.1108/PM-02-2021-0014 [93]	based on data	■ ◇
Lenssen, J.-J., A. Dentchev, N., & Roger, L. (2014). Sustainability, risk management and governance: towards an integrative approach. <i>Corporate Governance: The International Journal of Business in Society</i> , 14(5), 670–684. doi:10.1108/cg-07-2014-0077 [94]	literature review (conceptual analysis)	■
Maloni, M. J., Hiatt, M. S., & Astrachan, J. H. (2017). Supply management and family business: A review and call for research. <i>Journal of Purchasing and Supply Management</i> , 23(2), 123–136. doi:10.1016/j.pursup.2016.12.002 [95]	literature review	▲
Manab, N. A., & Aziz, N. A. A. (2019). Integrating knowledge management in sustainability risk management practices for company survival. <i>Management Science Letters</i> , 585–594. doi:10.5267/j.msl.2019.1.004 [96]	based on data	■ ◇
Manab, N. A., Aziz, N. A. A., & Jadi, D. M. (2020). Sustainability risk management: an integrative framework to evaluate emerging risks and other non-quantifiable risks affecting company survival. <i>World Review of Science, Technology and Sustainable Development</i> , 16(2), 87. doi:10.1504/wrstd.2020.109678 [97]	based on data/case study	■ ◇
Abd Manab, N., Othman, S. N., & Jadi, D. M. (2017). Analysing the Critical Factors of Sustainability Risk Management (SRM) Implementation in Managing the Emerging Risks and Non-Quantifiable Risks on Corporate Survival using PIs-Sem Path Modelling. <i>International Journal of Economic Research</i> 14, 463–475 [98]	based on data, case study	■ ◇

Table 17. Cont.

Authors and Title	Type of Publication	How ESG Risk Is Incorporated?
Mittal, M., Pareek, M., Sharma, S., Chohan, J., Kumar, R., & Singh, S. (2021, November). A Sustainable environmental change and ESG initiatives by the manufacturing and others service Industries during COVID19 Pandemic. In IOP Conference Series: Earth and Environmental Science (Vol. 889, No. 1, p. 012081). IOP Publishing. [99]	literature review	■ ◇
Muff K. Learning from Positive Impact Organizations: A Framework for Strategic Innovation. Sustainability. 2021; 13(16):8891. doi:10.3390/su13168891 [100]	case study	■ ●
Namchoochai, R., Kiattisin, S., Darakorn Na Ayuthaya, S., & Arunthari, S. (2020). Elimination of FinTech Risks to Achieve Sustainable Quality Improvement. Wireless Personal Communications. doi:10.1007/s11277-020-07201-9 [101]	based on data (survey)	■ ◇
Nogueira, F. G., Lucena, A. F. P., & Nogueira, R. (2017). Sustainable Insurance Assessment: Towards an Integrative Model. The Geneva Papers on Risk and Insurance—Issues and Practice, 43(2), 275–299. doi:10.1057/s41288-017-0062-3 [102]	based on data (survey)	■ ●
Oduoza, C. F. (2020). Framework for Sustainable Risk Management in the Manufacturing Sector. Procedia Manufacturing, 51, 1290–1297. doi:10.1016/j.promfg.2020.10.180 [103]	literature review + based on data	■
Olatoye, D. (2013). Sustainability Risks in the Supply Chain—The Nigerian Content Challenge. SPE Nigeria Annual International Conference and Exhibition. doi:10.2118/167570-ms [104]	case study	▲
Zu, L. (2016). Sustainability Risk and Crisis Management: A Taoism’s Perspective. In Cultural Roots of Sustainable Management (pp. 65–88). Springer, Cham. [105]	literature review	■ ● — ♣
Ziolo, M., Bak, I., Cheba, K., & Spoz, A. (2020). The relationship between banks and company business models-sustainability context. Procedia Computer Science, 176, 1507–1516. [106]	based on data	■
Zhang, D., Wang, H., & Wang, W. (2022). The Influence of Relational Capital on the Sustainability Risk: Findings from Chinese Non-State-Owned Manufacturing Enterprises. Sustainability, 14(11), 6904. [107]	based on data	■ ● ♣
Yilmaz, A. K., & Karakoc, T. H. (2010). Enterprise Risk Management Perspective. In Global Warming (pp. 423–437). Springer, Boston, MA. [108]	literature review	■ ● ♣
Ye, Y., & Lau, K. H. (2022). Competitive Green Supply Chain Transformation with Dynamic Capabilities—An Exploratory Case Study of Chinese Electronics Industry. Sustainability, 14(14), 8640. [109]	case study	■ ◇ ●
Trubetskaya, A., Horan, W., Conheady, P., Stockil, K., Merritt, S., & Moore, S. (2021). A methodology for assessing and monitoring risk in the industrial wastewater sector. Water Resources and Industry, 25, 100146. [110]	case study	■ ◇
Tobescu, C., & Seuring, S. (2015). Internal enablers for the implementation of sustainable supply chain risk management systems. In Logistics Management (pp. 17–26). Springer, Cham. [111]	experts’ opinion	▲ ■ ●
Thöni, A., Madlberger, L., & Schatten, A. (2013). Towards a data-integration approach for enterprise sustainability risk information systems. In Proceedings of the 7th International Conference on Research and Practical Issues of Enterprise Information Systems, Linz. [112]	literature review, based on data	▲ ■

Table 17. Cont.

Authors and Title	Type of Publication	How ESG Risk Is Incorporated?
Sutrisno, A., Kumar, V., Handayani, D., Arief, R. K., Virdhian, S., & Punuhsingon, C. (2019, July). Categorization of supply chain sustainability risks in SMEs: A preliminary evidence from a developing country. In Proceedings of the International Conference on Industrial Engineering and Operations Management Pilsen, Czech Republic (pp. 23–26). [113]	literature review	▲ ■ ●
Sutrisno, A., & Kumar, V. (2022). Supply chain sustainability risk decision support model using integrated Preference Selection Index (PSI) method and prospect theory. Journal of Advances in Management Research. [114]	case study	▲ ■
Sutrisno, A., & Kumar, V. (2022). Supply chain sustainability risk assessment model using integration of the preference selection index (PSI) and the Shannon entropy. International Journal of Quality & Reliability Management. [115]	case study	▲ ■
Smith, A. D. (2011). Strategic aspects of contingency planning in chaotic environments and systems: multi-case study. International Journal of Business and Systems Research, 5(5), 423–442. [116]	case study	◇ ● ♣
Shaheen, R., Ağa, M., Rjoub, H., & Abualrub, A. (2020). Investigation of the pillars of sustainability risk management as an extension of enterprise risk management on Palestinian insurance firms' profitability. Sustainability, 12(11), 4709. [117]	based on data	■
Sezer, M. D., & Selim, H. (2021). Analysis of Product Sustainability by Using a Risk-Oriented System Dynamics Model. Advanced Sustainable Systems, 5(9), 2100065.	case study	■ ◇ — ♣
Sepetis, A. (2022). Sustainable finance and circular economy. In Circular Economy and Sustainability (pp. 207–226). Elsevier. [118]	literature review	● ○
Schulte, J., Villamil, C., & Hallstedt, S. I. (2020). Strategic sustainability risk management in product development companies: Key aspects and conceptual approach. Sustainability, 12(24), 10531. [119]	experts' opinion	■ ◇ — ♣
Schulte, J., & Knuts, S. (2022). Sustainability impact and effects analysis-A risk management tool for sustainable product development. Sustainable Production and Consumption, 30, 737–751. [120]	case study	●
Schulte, J., & Hallstedt, S. I. (2018). Company risk management in light of the sustainability transition. Sustainability, 10(11), 4137. [121]	case study	■ ● —
Schulte, J., & Hallstedt, S. (2017). Challenges for integrating sustainability in risk management-current state of research. In 21st International Conference on Engineering Design, ICED, Vancouver, Canada, 21 August 2017 through 25 August 2017 (No. DS87-2, pp. 327–336). The Design Society. [122]	literature review, case study	■ ●
Rodrigue, M., Diouf, D., & Gendron, Y. (2022, April). On the use of framing strategies by the Big Four accounting firms: bringing sustainability risks into the mainstream. In Accounting Forum (pp. 1–25). Routledge. [123]	literature review	■ ◇
Raian, S., Ali, S. M., Sarker, M. R., Sankaranarayanan, B., Kabir, G., Paul, S. K., & Chakraborty, R. K. (2022). Assessing sustainability risks in the supply chain of the textile industry under uncertainty. Resources, Conservation and Recycling, 177, 105975. [124]	case study	▲ ■
Palousis, N., Luong, L., & Abhary, K. (2008). An integrated LCA/LCC framework for assessing product sustainability risk (Doctoral dissertation, WIT Press). [125]	case study	■ ◇ ●

Symbols meaning: ▲ Sustainable (green) supply chain; ■ ESG risk management; ◇ ESG risk in decision-making/investment processes; ● ESG risk in business model; — Communication with stakeholders; ○ Circular economy; ♣ Risk culture.

The methods of incorporating ESG risk into a sustainable business model, identified on the basis of the literature review, were verified on the basis of the examples of selected companies from the energy industry, i.e., RWE, Enel S.p.A., and Neste.

RWE is a leading European energy company. Its business activities are focused on the production of electricity. Initially, RWE was perceived as an operator of nuclear power plants and lignite mines. However, for several years, the company has been consistently phasing out nuclear and coal energy, basing its portfolio on offshore and onshore wind energy, solar, hydro, hydrogen energy, energy storage, and also biomass and gas. RWE plans to become climate neutral (including the entire value chain) by 2040. The way to achieve

this goal is ‘green growth’. By 2030, RWE wants to double the energy generation capacities of its wind energy, photovoltaics, and storage technologies, while increasing its flexible backup power plants and electrolyzers for hydrogen production. The company decreased its CO₂ emissions by more than 55% in years 2012–2021. It supports a secure energy supply with a flexible fleet of power plants and is working on sustainable storage technologies.

The concept of sustainability has been incorporated into the company’s strategy and business model. The company declares its involvement in climate protection activities. To this end, it not only reduces greenhouse gas emissions, but also takes measures to protect biodiversity in the locations where it operates. This applies in particular to the reclamation of mining areas and the construction, operation, and decommissioning of wind farms. RWE strives to reduce the consumption of natural resources and increase the recycling rate. It is also committed to upholding high social standards and promoting a diverse corporate culture. This diversity has many aspects. One of them is gender equality for leadership roles. In RWE, in 2021, women held 19% of managerial positions, but the company’s goal is to increase this share to 30% by 2030. The company makes an effort to increase the motivation and commitment of employees to work. It also cares for occupational health and safety by minimizing the risk of possible fatal accidents at work. RWE implements attractive and innovative solutions for its clients and business partners.

RWE has implemented an ERM system. Non-financial risk has been incorporated into the company’s risk management system in a way that includes environment (climate: extreme weather events), employee (fatal occupational accidents), and social aspects (negative public perception—as not a “green company”), human rights (negative impact on human rights in the supply chain), and anticorruption (occurrence of cases of corruption). The purpose of risk management at RWE is identifying, assessing, and managing risks at the earliest possible stage. Potential risks that could arise from the business activities of RWE or from its business relationships were identified. The level of risk (low, medium, and high) was determined in the context of its influence on RWE or one of its parts, and its relevance for stakeholders. In the case of the influence on an individual part of RWE, the highest risk level is assigned to fatal occupational accidents. Considering the influence on the whole company, the environmental risk is the highest, and, in the context of relevance for stakeholders, the most important risks are fatal occupational accidents and negative public perception (as “not a green company”). The latter risk can translate into a loss of reputation and a reduction or lack of investment in the company. Therefore, before establishing cooperation, the company becomes acquainted with all potential business partners (suppliers). Current business partners are also subject to the control process. The company’s goal is to create sustainable value throughout the supply chain. In the case of renewable energy sources (i.e., wind, solar, and hydro energy), the issue of the green supply chain ceases to matter, as renewable energy sources do not need to be supplied.

Enel S.p.A. is an Italian multinational manufacturer and distributor of electricity and gas. It was at first established as a public body in 1962, and then transformed into a limited company in 1992. Finally, it was privatized in 1999. The strategy of the company is to base its development on sustainability, as a key and essential element in the transition to a decarbonized economy.

The company pays great attention to the needs of stakeholders, trying to anticipate these needs and priorities in advance. This approach results from the awareness that the company’s activities impact the ecosystem it is a part of, and that achieving long-term sustainability requires people to consider the environment, the climate, the economy, and society as inseparable parts of the whole.

The company developed a sustainability plan for 2022–2024 based on six interrelated macro-areas that indicate strategic lines of action. The plan consists of the following objectives: to bring forward the Net-Zero objectives to 2040 (Net-Zero Ambition); to enable electrification for customers and to answer their energy demand by offering a reliable and sustainable service (Electrification), to create long-term value for all stakeholders, helping them to grow and meet challenges (People), to promote the protection of natural

capital and biodiversity (Nature), to accelerate sustainable progress through innovation, digitalization, and the circular economy (Growth accelerators), and to support the governance, respect and promotion of human rights, and continuous improvement in health and safety objectives (Backbones). Enel incorporated ESG factors into its business model and decision-making process. The company developed a method of analysing ESG factors and assessing their importance in terms of sustainable development based on the guidelines set out in international standards (including the Global Reporting Initiative—GRI, the UN Global Compact, the SDG Compass, etc.).

Enel has implemented an ERM system. This system includes a set of rules, procedures, and organizational structures designed to identify, measure, monitor, and manage key risks. As part of the risk management system, the Group Risk Committee and Local Risks Committees were established, a risk appetite framework was defined, and three lines of defence (management, control, and internal audit) and a reporting system were designated. The risks to which the company is exposed are defined in the risk catalogue and then mapped to facilitate their identification and the assessment of their impact on the company. In 2021, the company identified six risk categories. In each of the risk categories listed below, you can find non-financial risk. The risk categories identified cover the following types of risk:

- Strategic risk—strategic planning and capital allocation, macroeconomic and geopolitical trends, legislative and regulatory developments, innovation, competitive environment, and climate change (risk associated with delayed or inadequate strategic and operational initiatives for climate change adaptation and mitigation);
- Governance and culture risk—corporate culture and ethics (risk associated with the inadequate integration of the group’s principles of ethics, diversity, and equal opportunities in corporate processes and activities), corporate governance (risk associated with ineffective corporate governance rules and/or a lack of integrity and transparency in decision-making processes), reputation (risk of adversely impacting the public image of the group and prejudicing the relationship of trust with shareholders), stakeholders (risk of ineffective engagement with the main stakeholders in Enel’s strategic positioning in terms of sustainability and financial objectives, with potential adverse effects on its reputation and competitiveness);
- Digital technology risk—IT effectiveness, cyber security, digitalization, and service continuity;
- Financial risk—appropriate capital structure and access to financing, interest rate, commodity, currency, credit and counterparty, and liquidity;
- Operational risk—asset protection, business interruption, customer needs and satisfaction (risk associated with the failure to fully satisfy customer expectations and needs in terms of quality, accessibility, sustainability, and innovation), environment (risk of significant impacts on the quality of the environment and on the ecosystems involved following a violation of environmental regulations), health and safety (risk of potential impacts on the health and safety of employees and other parties following a violation of health and safety regulations), intellectual property, people and organization, process efficiency, procurement, logistics and supply chain, and service quality management (risk associated with the inability of third-party suppliers of internal services to meet the agreed service standards);
- Compliance risk—accounting compliance, antitrust and consumer rights compliance, corruption (risk of adverse impacts associated with wilful misconduct or corruption by persons within or outside the group in order to obtain an unfair or illegal advantage), personal data protection, external disclosure, compliance with financial regulations, compliance with tax regulations, and compliance with other laws and regulations.

ERM makes it possible to define a strategy for each risk while maintaining an integrated approach, to create and update measures, risk measurement models, and risk limits, and to define appropriate management and control arrangements. The company is also building a sustainable supply chain. In addition to maintaining the appropriate quality of

delivery, the supplier is obliged to adopt the best practices in terms of human rights and working conditions, workplace health and safety, and environmental responsibility.

Neste is a Finnish company that has been operating since 1948 and was founded to secure the supply of crude oil in Finland. Today, it is the world's leading producer of sustainable aviation fuel, renewable diesel, and renewable feedstock solutions for various polymers and chemicals industry uses. Neste has integrated sustainability into its business strategy as the key to the long-term success of its business. The company's sustainability vision is an integral part of its transformation towards a carbon neutral and nature positive value chain. Neste aims to achieve aspirational goals for biodiversity, human rights, supply chain, and raw materials.

Neste considers risk management an integral part of good management practice and an essential component of good corporate governance. Identification and risk management allow Neste to run its business and achieve its goals in a constantly changing environment. The framework and principles for risk management have been defined in the Neste Corporate Risk Management policy and are aligned with the COSO: Enterprise Risk Management: Integrating with Strategy and Performance and ISO 31000:2009 Standard. The defined rules and procedures also apply to the sustainability risk. Sustainability risk is identified and assessed twice a year to determine its impact on the company's financial results, reputation, and achievement of strategic goals. As part of its sustainability risk, Neste identified climate-related risks and opportunities, the risk of negative environmental impacts from emissions to air and water, the risk of leaks, explosions and other chemical hazards, the risk of adverse environmental impact from procurement of raw materials for refining, the risk of adverse human rights impacts, and the risk of corruption and bribery.

The company also focuses on social issues. It respects equality and nondiscrimination and always provides career and development opportunities to employees who are most qualified, without allowing any personal attributes such as gender, ethnic background, nationality, age, pregnancy, sexual orientation or gender identity, disability, religion, or political opinions to influence the decision making. The company is also attentive to issues related to the human rights. This risk is identified not only at the enterprise level but also in its supply chain. In 2021, the company conducted a human rights audit among its suppliers to prevent, mitigate, and, where necessary, remediate adverse human rights impacts. Such audits will become an annual practice at Neste, enabling the better management of risks to human rights in all of its business activities. To ensure the sustainability of its supply chains, Neste identifies and selects appropriate partners. Ensuring the sustainability of the supply chains begins before closing the deal or accepting the delivery of materials, products, components, or services. All business partners and suppliers are expected to uphold Neste's sustainability policies and principles, including their Supplier Code of Conduct, a key element in Neste's supplier management system. As part of expanding awareness and sensitivity to sustainability issues among suppliers, Neste conducts sustainability workshops to create the opportunity to discuss sustainability-related matters.

The way of integrating sustainability risk in the above-described companies is presented in Table 18.

Table 18. The way of integrating sustainability risk in the selected companies.

Company	The Way of Integrating Sustainability Risk in Companies' Business Models
RWE	ESG risk included in risk management ■, ESG incorporated in business model ●, Sustainable (green) supply chain ▲
Enel S.p.A.	ESG risk included in risk management ■, ESG incorporated in business model ●, Sustainable (green) supply chain ▲
Neste	ESG risk included in risk management ■, ESG incorporated in business model ●, Sustainable (green) supply chain ▲

Symbols meaning: ▲ Sustainable (green) supply chain; ■ ESG risk management; ● ESG risk in business model.

All of the companies presented that integrated sustainability risk into their business models undertook a similar set of actions, but the importance of the individual actions

was different. The activities of companies in the energy sector towards sustainability are undoubtedly stimulated by pressure from stakeholders. The legal regulations implemented in the area of sustainability are also of great importance.

5. Conclusions

The article summarizes the state of the research on ESG risk in enterprises. The incorporation of ESG considerations by companies is essential to the research area. There are many publications in this field. However, only some deal with the topic from the perspective of business models, so this paper fills that gap. In particular, the paper fills the research gap in terms of reviewing the literature, listing the results, and diagnosing the main research trends and methodologies.

The main purpose of the paper is to systematically review the literature and examine how companies incorporate ESG into their business models. The business model perspective is the original contribution of the study. The paper reaches the goal, and, according to the main findings, the way that companies incorporate ESG into their business models is determined by each company's sector, size, and geographical location.

The main object of the study was to show the existing state of knowledge in the area of incorporating ESG considerations into companies' business models. The detailed objectives were related to the analysis of how the researchers conduct such studies (methodology perspective) and what are the main ways in which companies adjust to corporate sustainability according to the companies' sizes, locations, and sectors. The study reached all of the objectives and formulated implications for stakeholders. Policymakers need to know how companies react to ESG and transform their business models toward sustainability. Based on this knowledge, the support and financial incentives system adjusted towards ESG are worth reconsidering. Financial institutions also benefit from learning about companies' sustainable business models in the contexts of financial services and products and ESG scoring and rating. Finally, companies use knowledge to further the adaptation process toward corporate sustainability.

It was established that, broadly, the leading research concerned the spheres of corporate governance, corporate sustainability, ESG and sustainable finance, and the narrow approach covered the trends of ESG risk, risk culture, and green supply chains. The study's methodology was dominated by a system based on qualitative methods such as case studies and literature reviews.

Our research stated that, during the 22 years covered by the analysis, 2244 articles on sustainability and sustainability risk in enterprises were produced, and the narrowly outlined research on ESG risk showed 130 publications in this area.

The application of statistical methods made it possible to determine the relationship between the variables from the Academic Database of Elsevier Scopus and the Web of Science database. For example, a clear relationship was identified between publications on developed countries and a variable that includes ESG risks in decision making. On the other hand, publications on developing countries show a clear relationship with the variable "Developing Countries and ESG Risk in Decision Making/Investment". Thanks to the multidimensional correspondence analysis, it was possible to identify groups of scientific articles that were similar in terms of the issues they analyzed.

As a result of these analyses, it was diagnosed that SMEs and large enterprises take ESG risk into account at every level in their risk management systems, that is, identification, monitoring, and mitigation. Small enterprises and start-ups do not include ESG risk in their risk management systems.

In Europe, Asia, and Australia, the most common practice is to have ESG risk in the risk management system at all levels; the companies from Latin America are the least likely to do so. In developing countries, companies in the service sector are more likely to include ESG risk than in the manufacturing, production, and industry sector.

As a result, the research questions were positively answered, showing differences in the behaviour of companies with respect to ESG risk depending on their size, location, and type. The conducted research is comprehensive and generalizing.

Future work will involve a detailed study of companies from selected industries and locations. We especially intend to study the incorporation of ESG factors into the business models of mining industry companies, as they are one of the more challenging sectors in the ESG transition and a sector which is one of the most exposed to ESG risks. The role of policymakers and financial institutions in supporting the mining industry in its ESG transition and incorporation of ESG factors is also a part of the planned study. It will be helpful to have further research on sustainable behaviour spreading to the so-called dirty sectors. The most significant limitation of the study is the availability of quantitative databases comparable to those in the study. Also, the extended scope of the literature in the field creates a risk of missing some literature, but we did our best to analyse the state of knowledge in the best possible way. As a result, the findings and assumptions are limited to the scope of the available data. Finally, the generalisability of research results might be limited.

Author Contributions: Conceptualization, M.Z., I.B. and A.S.; methodology, I.B.; software, I.B.; validation I.B.; formal analysis, M.Z., I.B. and A.S.; investigation, M.Z., I.B. and A.S.; resources, M.Z., I.B. and A.S.; writing—original draft preparation, M.Z., I.B. and A.S.; writing—review and editing, M.Z., I.B. and A.S.; visualization, M.Z., I.B. and A.S.; supervision, M.Z.; project administration, M.Z.; funding acquisition, M.Z. All authors have read and agreed to the published version of the manuscript.

Funding: Free of charge publication. Research results are a part of a research project financed by the National Science Centre Poland (NCN), grant number OPUS16 2018/31/B/HS4/00570.

Data Availability Statement: No new data were created or analysed in this study.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Friede, G.; Busch, T.; Bassen, A. ESG and Financial Performance: Aggregated Evidence from More than 2000 Empirical Studies. *J. Sustain. Financ. Investig.* **2015**, *5*, 210–233. [CrossRef]
2. Duque-Grisales, E.; Aguilera-Caracuel, J. Environmental, Social and Governance (ESG) Scores and Financial Performance of Multilatinas: Moderating Effects of Geographic International Diversification and Financial Slack. *J. Bus. Ethics* **2021**, *168*, 315–334. [CrossRef]
3. Ziolo, M.; Escrig-Olmedo, E.; Lozano, R. (Eds.) *Fostering Sustainable Business Models through Financial Markets*; Springer International Publishing: Cham, Switzerland, 2022; ISBN 978-3-031-07397-7.
4. Pérez-Cornejo, C.; de Quevedo-Puente, E. How Corporate Social Responsibility Mediates the Relationship between Corporate Reputation and Enterprise Risk Management: Evidence from Spain. *Eurasian Bus. Rev.* **2022**, 1–21. [CrossRef]
5. Aldowaiash, A.; Kokuryo, J.; Almazyad, O.; Goi, H.C. Environmental, Social, and Governance Integration into the Business Model: Literature Review and Research Agenda. *Sustainability* **2022**, *14*, 2959. [CrossRef]
6. Clementino, E.; Perkins, R. How Do Companies Respond to Environmental, Social and Governance (ESG) Ratings? Evidence from Italy. *J. Bus. Ethics* **2021**, *171*, 379–397. [CrossRef]
7. Aevoae, G.M.; Andrieş, A.M.; Ongena, S.; Sprincean, N. ESG and Systemic Risk. *Appl. Econ.* **2022**, 1–25. [CrossRef]
8. In, S.Y.; Rook, D.; Monk, A. Integrating Alternative Data (Also Known as ESG Data) in Investment Decision Making. *Glob. Econ. Rev.* **2019**, *48*, 237–260. [CrossRef]
9. Sharma, U.; Gupta, A.; Gupta, S.K. The Pertinence of Incorporating ESG Ratings to Make Investment Decisions: A Quantitative Analysis Using Machine Learning. *J. Sustain. Finance Investig.* **2022**, 1–15. [CrossRef]
10. Chen, L.; Zhang, L.; Huang, J.; Xiao, H.; Zhou, Z. Social Responsibility Portfolio Optimization Incorporating ESG Criteria. *J. Manag. Sci. Eng.* **2021**, *6*, 75–85. [CrossRef]
11. Renn, O. Concepts of Risk: A Classification. In *Social Theories of Risk*; Krimsky, S., Golding, D., Eds.; Praeger: New York, NY, USA, 1992; Volume 14, pp. 53–79.
12. Bernstein, P.L. *Against the Gods: The Remarkable Story of Risk*; John Wiley & Sons: Hoboken, NJ, USA, 1996; ISBN 0471121045.
13. Rostamzadeh, R.; Ghorabae, M.K.; Govindan, K.; Esmaeili, A.; Nobar, H.B.K. Evaluation of Sustainable Supply Chain Risk Management Using an Integrated Fuzzy TOPSIS-CRITIC Approach. *J. Clean. Prod.* **2018**, *175*, 651–669. [CrossRef]
14. *Overview of Enterprise Risk Management*; Casualty Actuarial Society, 2003. Available online: <https://erm.ncsu.edu/az/erm/i/chan/m-articles/documents/CasualtyActuarialSocietyOverviewofERM.pdf> (accessed on 29 December 2022).

15. Dafikpaku, E.; Eng, B. The Strategic Implications of Enterprise Risk Management: A Framework. In Proceedings of the Enterprise Risk Management Symposium Monograph, Chicago, IL, USA, 14–16 March 2011; pp. 1–55.
16. Leo, M.; Sharma, S.; Maddulety, K. Machine Learning in Banking Risk Management: A Literature Review. *Risks* **2019**, *7*, 29. [CrossRef]
17. Boulwood, B. How to Develop an Enterprise Risk-Rating Approach. Available online: <https://www.garp.org/risk-intelligence/culture-governance/how-to-develop-an-enterprise-risk-rating-approach> (accessed on 27 December 2022).
18. *Cambridge Taxonomy of Business Risks*; University of Cambridge: Cambridge, UK, 2019.
19. Cheasty, G. Integrating ESG Risk into a Risk Management Framework. Available online: <https://www2.deloitte.com/ie/en/pages/financial-services/articles/esg-risk-management-framework.html> (accessed on 29 December 2022).
20. Karwowski, M.; Raulinajtys-Grzybek, M. The Application of Corporate Social Responsibility (CSR) Actions for Mitigation of Environmental, Social, Corporate Governance (ESG) and Reputational Risk in Integrated Reports. *Corp. Soc. Responsib. Environ. Manag.* **2021**, *28*, 1270–1284. [CrossRef]
21. Zhang, R.; Andam, F.; Shi, G. Environmental and Social Risk Evaluation of Overseas Investment under the China-Pakistan Economic Corridor. *Environ. Monit. Assess* **2017**, *189*, 253. [CrossRef]
22. Shea, M.; Hutchin, J.W. The Importance of Environmental, Social, and Governance Risks to Surety Underwriters. *Asia-Pacific J. Risk Insur.* **2018**, *12*, 20170016. [CrossRef]
23. Escrig-Olmedo, E.; Fernández-Izquierdo, M.; Ferrero-Ferrero, I.; Rivera-Lirio, J.; Muñoz-Torres, M. Rating the Raters: Evaluating How ESG Rating Agencies Integrate Sustainability Principles. *Sustainability* **2019**, *11*, 915. [CrossRef]
24. *Recommendations of the Task Force on Climate-Related Financial Disclosures. Final Report*; Task Force on Climate-Related Financial Disclosures (TCFD), 2017. Available online: <https://assets.bbhub.io/company/sites/60/2021/10/FINAL-2017-TCFD-Report.pdf> (accessed on 27 December 2022).
25. Annamalah, S.; Raman, M.; Marthandan, G.; Logeswaran, A. Implementation of Enterprise Risk Management (ERM) Framework in Enhancing Business Performances in Oil and Gas Sector. *Economies* **2018**, *6*, 4. [CrossRef]
26. Poon, A.E.; Roslan, N.H.; Othman, J.; Anuar, A.; Nejad, M.Y. The Effect of Enterprise Risk Management (ERM) Implementation on SMEs Performance in Malaysia. *Malays. J. Soc. Sci. Humanit. (MJSSH)* **2022**, *7*, e001460. [CrossRef]
27. Xie, J.; Nozawa, W.; Yagi, M.; Fujii, H.; Managi, S. Do Environmental, Social, and Governance Activities Improve Corporate Financial Performance? *Bus. Strategy Environ.* **2019**, *28*, 286–300. [CrossRef]
28. Sun, Y.; Yang, Y.; Huang, N.; Zou, X. The Impacts of Climate Change Risks on Financial Performance of Mining Industry: Evidence from Listed Companies in China. *Resour. Policy* **2020**, *69*, 101828. [CrossRef]
29. Haninun, H.; Lindrianasari, L.; Sarumpaet, S.; Komalasari, A.; Gunardi, A. Environmental Disclosure on Cost of Capital: Environmental Risk as a Moderator Variable. *J. Environ. Manag. Tour.* **2019**, *10*, 530–537. [CrossRef]
30. Pizzutilo, F.; Mariani, M.; Caragnano, A.; Zito, M. Dealing with Carbon Risk and the Cost of Debt: Evidence from the European Market. *Int. J. Fin. Studies* **2020**, *8*, 61. [CrossRef]
31. Cohen, G. ESG Risks and Corporate Survival. *Environ. Syst. Decis.* **2022**, *8*, 61. [CrossRef] [PubMed]
32. Lupu, L. The Concept of Social Risk: A Geographical Approach. *Quaest. Geogr.* **2019**, *38*, 5–13. [CrossRef]
33. Lock, I.; Seele, P. Analyzing Sector-Specific CSR Reporting: Social and Environmental Disclosure to Investors in the Chemicals and Banking and Insurance Industry. *Corp. Soc. Responsib. Environ. Manag.* **2015**, *22*, 113–128. [CrossRef]
34. McDonnell, M.-H.; King, B.G.; Soule, S.A. A Dynamic Process Model of Private Politics. *Am. Sociol. Rev.* **2015**, *80*, 654–678. [CrossRef]
35. Muñoz-Torres, M.J.; Fernández-Izquierdo, M.Á.; Rivera-Lirio, J.M.; Escrig-Olmedo, E. Can Environmental, Social, and Governance Rating Agencies Favor Business Models That Promote a More Sustainable Development? *Corp. Soc. Responsib. Environ. Manag.* **2019**, *26*, 439–452. [CrossRef]
36. van Greuning, H.; Brajovic Bratanovic, S. *Analyzing Banking Risk (4th Edition): A Framework for Assessing Corporate Governance and Risk Management*; World Bank: Washington, DC, USA, 2020.
37. Elamer, A.A.; Alhares, A.; Ntim, C.G.; Benyazid, I. The Corporate Governance–Risk Taking Nexus: Evidence from Insurance Companies. *Int. J. Ethic Syst.* **2018**, *34*, 493–509. [CrossRef]
38. Wong, A. Corporate Sustainability through Non-Financial Risk Management. *Corp. Gov.* **2014**, *14*, 575–586. [CrossRef]
39. Wijethilake, C.; Lama, T. Sustainability Core Values and Sustainability Risk Management: Moderating Effects of Top Management Commitment and Stakeholder Pressure. *Bus. Strategy Environ.* **2019**, *28*, 143–154. [CrossRef]
40. Bui, B.; de Villiers, C. Business Strategies and Management Accounting in Response to Climate Change Risk Exposure and Regulatory Uncertainty. *Br. Account. Rev.* **2017**, *49*, 4–24. [CrossRef]
41. Aziz, N.A.A.; Manab, N.A.; Othman, S.N. Exploring the Perspectives of Corporate Governance and Theories on Sustainability Risk Management (SRM). *Asian Econ. Financ. Rev.* **2015**, *5*, 1148–1158. [CrossRef]
42. Anderson, D.R.; Anderson, K.E. Sustainability Risk Management. *Risk Manag. Insur. Rev.* **2009**, *12*, 25–38. [CrossRef]
43. Saeidi, P.; Saeidi, S.P.; Sofian, S.; Saeidi, S.P.; Nilashi, M.; Mardani, A. The Impact of Enterprise Risk Management on Competitive Advantage by Moderating Role of Information Technology. *Comput. Stand. Interfaces* **2019**, *63*, 67–82. [CrossRef]
44. Anton, S.G. The Impact of Enterprise Risk Management on Firm Value: Empirical Evidence from Romanian Non-Financial Firms. *Eng. Econ.* **2018**, *29*, 151–157. [CrossRef]
45. Welford, R. (Ed.) *Corporate Environmental Management 3*; Routledge: London, UK, 2016; ISBN 9781315825106.

46. Spedding, L.S.; Rose, A. *Business Risk Management Handbook: A Sustainable Approach*, 1st ed.; CIMA Publishing: Burlington, VT, USA, 2007.
47. Leopizzi, R.; Iazzi, A.; Venturelli, A.; Principale, S. Nonfinancial Risk Disclosure: The “State of the Art” of Italian Companies. *Corp. Soc. Responsib. Environ. Manag.* **2020**, *27*, 358–368. [CrossRef]
48. Shad, M.K.; Lai, F.-W.; Fatt, C.L.; Klemeš, J.J.; Bokhari, A. Integrating Sustainability Reporting into Enterprise Risk Management and Its Relationship with Business Performance: A Conceptual Framework. *J. Clean. Prod.* **2019**, *208*, 415–425. [CrossRef]
49. Farrell, M.; Gallagher, R. The Valuation Implications of Enterprise Risk Management Maturity. *J. Risk Insur.* **2015**, *82*, 625–657. [CrossRef]
50. Bohnert, A.; Gatzert, N.; Hoyt, R.E.; Lechner, P. The Drivers and Value of Enterprise Risk Management: Evidence from ERM Ratings. *Eur. J. Financ.* **2019**, *25*, 234–255. [CrossRef]
51. ISO 31000:2018; Risk Management-Guidelines. ISO: Geneva, Switzerland, 2018.
52. Ferreira de Araújo Lima, P.; Crema, M.; Verbano, C. Risk Management in SMEs: A Systematic Literature Review and Future Directions. *Eur. Manag. J.* **2020**, *38*, 78–94. [CrossRef]
53. Antoncic, M. Why Sustainability? Because Risk Evolves and Risk Management Should Too. *J. Risk Manag. Financ. Inst.* **2019**, *12*, 206–216.
54. Gardiner, T.; Endicott, M. ERM and Sustainability: Beyond Buzzwords. Available online: <https://www.canadianunderwriter.ca/features/erm-and-sustainability-beyond-buzzwords/> (accessed on 27 December 2022).
55. Zu, L. Sustainability Risk Management. In *Encyclopedia of Corporate Social Responsibility*; Idowu, S.O., Capaldi, N., Zu, L., Das Gupta, A., Eds.; Springer: Berlin/Heidelberg, Germany, 2013; pp. 2395–2407, ISBN 978-3-642-28036-8.
56. *Sustainability Risk Management. Powering Performance for Responsible Growth*; Deloitte Southeast Asia Ltd., 2019. Available online: <https://www2.deloitte.com/content/dam/Deloitte/my/Documents/risk/my-risk-sdg12-sustainability-risk-management.pdf> (accessed on 27 December 2022).
57. Jollands, S.; Akroyd, C.; Sawabe, N. Core Values as a Management Control in the Construction of “Sustainable Development”. *Qual. Res. Account. Manag.* **2015**, *12*, 127–152. [CrossRef]
58. Hörisch, J.; Freeman, R.E.; Schaltegger, S. Applying Stakeholder Theory in Sustainability Management: Links, Similarities, Dissimilarities, and a Conceptual Framework. *Organ. Environ.* **2014**, *27*, 328–346. [CrossRef]
59. Mangla, S.K.; Kumar, P.; Barua, M.K. Prioritizing the Responses to Manage Risks in Green Supply Chain: An Indian Plastic Manufacturer Perspective. *Sustain. Prod. Consum.* **2015**, *1*, 67–86. [CrossRef]
60. Song, W.; Ming, X.; Liu, H.-C. Identifying Critical Risk Factors of Sustainable Supply Chain Management: A Rough Strength-Relation Analysis Method. *J. Clean. Prod.* **2017**, *143*, 100–115. [CrossRef]
61. Wang, Z.; Sarkis, J. Investigating the Relationship of Sustainable Supply Chain Management with Corporate Financial Performance. *Int. J. Prod. Perform. Manag.* **2013**, *62*, 871–888. [CrossRef]
62. Henriksson, R.; Livnat, J.; Pfeifer, P.; Stumpp, M.; Zeng, G. ESG Literature Review. *SSRN Electron. J.* **2018**, 1–14.
63. Li, T.-T.; Wang, K.; Sueyoshi, T.; Wang, D.D. ESG: Research Progress and Future Prospects. *Sustainability* **2021**, *13*, 11663. [CrossRef]
64. Linnenluecke, M.K. Environmental, Social and Governance (ESG) Performance in the Context of Multinational Business Research. *Multinat. Bus. Rev.* **2022**, *30*, 1–16. [CrossRef]
65. Huang, D.Z.X. Environmental, Social and Governance (ESG) Activity and Firm Performance: A Review and Consolidation. *Account. Financ.* **2021**, *61*, 335–360. [CrossRef]
66. Khan, M.A. ESG Disclosure and Firm Performance: A Bibliometric and Meta Analysis. *Res. Int. Bus. Financ.* **2022**, *61*, 101668. [CrossRef]
67. Hvidkjær, S. *ESG Investing: A Literature Review*; Dansif: Copenhagen, Denmark, 2017.
68. Gerard, B. ESG and Socially Responsible Investment: A Critical Review. *Beta* **2019**, *33*, 61–83. [CrossRef]
69. Matos, P. *ESG and Responsible Institutional Investing around the World: A Critical Review*; CFA Institute Research Foundation: Charlottesville, VA, USA, 2020.
70. Gillan, S.L.; Koch, A.; Starks, L.T. Firms and Social Responsibility: A Review of ESG and CSR Research in Corporate Finance. *J. Corp. Financ.* **2021**, *66*, 101889. [CrossRef]
71. Zysno, P.V. The Modification of the Phi-Coefficient Reducing Its Dependence on the Marginal Distributions. *Methods Psychol. Res. Online* **1997**, *2*, 41–52.
72. Albatineh, A.N.; Niewiadomska-Bugaj, M.; Mihalko, D. On Similarity Indices and Correction for Chance Agreement. *J. Classif.* **2006**, *23*, 301–313. [CrossRef]
73. Greenacre, M. Multiple and Joint Correspondence Analysis. In *Correspondence Analysis in the Social Sciences*; Greenacre, M., Blasius, J., Eds.; Academic Press: San Diego, CA, USA, 1994; pp. 141–161.
74. Pacheco, F.A.L. Application of Correspondence Analysis in the Assessment of Groundwater Chemistry. *J. Int. Assoc. Math. Geol.* **1998**, *30*, 129–161. [CrossRef]
75. Wolska, G.; Bak, I.; Kizielewicz, J. The Implementation of CSR Concept in Tourist Companies in Pomerania Euroregion Based on the Multiple Correspondence Analysis. *Przedsiębiorczość Zarz.* **2019**, *20*, 215–232.
76. Abdel-Basset, M.; Mohamed, R. A Novel Plithogenic TOPSIS-CRITIC Model for Sustainable Supply Chain Risk Management. *J. Clean. Prod.* **2020**, *247*, 119586. [CrossRef]

77. Aziz, N.A.A.; Manab, N.A. Does Risk Culture Matter for Sustaining the Business? Evidence from Malaysian Environmentally Sensitive Listed Companies. *Int. J. Manag. Sustain.* **2020**, *9*, 91–100. [[CrossRef](#)]
78. Jahankhani, H.; Jamal, A.; Lawson, S. *Cybersecurity, Privacy and Freedom Protection in the Connected World*; Springer International Publishing: Cham, Switzerland, 2021; ISBN 978-3-030-68533-1.
79. Bathrinath, S.; Dhanasekar, M.; Dhanorvignesh, B.; Kamaldeen, Z.; Santhi, B.; Bhalaji, R.K.A.; Koppiahraj, K. Modeling Sustainability Risks in Sugar Industry Using AHP-BWM. *Mater. Today Proc.* **2022**, *50*, 1397–1404. [[CrossRef](#)]
80. Brockett, A.M.; Rezaee, Z. Corporate Sustainability: Integrating Performance and Reporting. In *Corporate Sustainability*; John Wiley & Sons, Ltd.: Hoboken, NJ, USA, 2012; pp. i–xix, ISBN 9781119202899.
81. Caputo, L. It's All about Your People [New York Power Authority]. In Proceedings of the IET Conference Proceedings, Birmingham, UK, 4–5 June 2013.
82. Chatzitheodorou, K.; Tsalis, T.A.; Tsgarakis, K.P.; Evangelos, G.; Ioannis, N. A New Practical Methodology for the Banking Sector to Assess Corporate Sustainability Risks with an Application in the Energy Sector. *Sustain. Prod. Consum.* **2021**, *27*, 1473–1487. [[CrossRef](#)]
83. Choirun, A.; Santoso, I.; Astuti, R. Sustainability Risk Management in the Agri-Food Supply Chain: Literature Review. *IOP Conf. Ser. Earth Environ. Sci.* **2020**, *475*, 12050. [[CrossRef](#)]
84. Dumay, J.; Hossain, M.D.A. Sustainability Risk Disclosure Practices of Listed Companies in Australia. *Aust. Account. Rev.* **2019**, *29*, 343–359. [[CrossRef](#)]
85. Hajmohammad, S.; Shevchenko, A. Mitigating Sustainability Risk in Supplier Populations: An Agent-Based Simulation Study. *Int. J. Oper. Prod. Manag.* **2020**, *40*, 897–920. [[CrossRef](#)]
86. Hossan Chowdhury, M.M.; Quaddus, M.A. Supply Chain Sustainability Practices and Governance for Mitigating Sustainability Risk and Improving Market Performance: A Dynamic Capability Perspective. *J. Clean. Prod.* **2021**, *278*, 123521. [[CrossRef](#)]
87. Juettner, U.; Windler, K.; Podleisek, A.; Gander, M.; Meldau, S. Implementing Supplier Management Strategies for Supply Chain Sustainability Risks in Multinational Companies. *TQM J.* **2020**, *32*, 923–938. [[CrossRef](#)]
88. Kazancoglu, Y.; Ozkan-Ozen, Y.D.; Mangla, S.K.; Ram, M. Risk Assessment for Sustainability in E-Waste Recycling in Circular Economy. *Clean Technol. Environ. Policy* **2022**, *24*, 1145–1157. [[CrossRef](#)]
89. Kim, S.; Wagner, S.M.; Colicchia, C. The Impact of Supplier Sustainability Risk on Shareholder Value. *J. Supply Chain. Manag.* **2019**, *55*, 71–87. [[CrossRef](#)]
90. Kimanzi, M.K.; Gamede, V.W. Embracing the Role of Finance in Sustainability for SMEs. *Int. J. Econ. Financ.* **2020**, *12*, 453–468.
91. Klute-Wenig, S.; Refflinghaus, R. Integrating Sustainability Aspects into an Integrated Management System. *TQM J.* **2015**, *27*, 303–315. [[CrossRef](#)]
92. la Torre, M.; Leo, S.; Panetta, I.C. Banks and Environmental, Social and Governance Drivers: Follow the Market or the Authorities? *Corp. Soc. Responsib. Environ. Manag.* **2021**, *28*, 1620–1634. [[CrossRef](#)]
93. Lau, C.K.; Chen, H. Stakeholder Perceptions on the Risk Factors, Challenges and Benefits of Business Sustainability Practices in the Singapore Construction Industry. *Prop. Manag.* **2022**, *40*, 149–168. [[CrossRef](#)]
94. Lenssen, J.-J.; Dentchev, N.A.; Roger, L. Sustainability, Risk Management and Governance: Towards an Integrative Approach. *Corp. Gov.* **2014**, *14*, 670–684. [[CrossRef](#)]
95. Maloni, M.J.; Hiatt, M.S.; Astrachan, J.H. Supply Management and Family Business: A Review and Call for Research. *J. Purch. Supply Manag.* **2017**, *23*, 123–136. [[CrossRef](#)]
96. Manab, N.A.; Aziz, N.A.A. Integrating Knowledge Management in Sustainability Risk Management Practices for Company Survival. *Manag. Sci. Lett.* **2019**, *9*, 585–594. [[CrossRef](#)]
97. Manab, N.A.; Aziz, N.A.A.; Jadi, D.M. Sustainability Risk Management: An Integrative Framework to Evaluate Emerging Risks and Other Non-Quantifiable Risks Affecting Company Survival. *World Rev. Sci. Technol. Sustain. Dev.* **2020**, *16*, 87–104. [[CrossRef](#)]
98. Manab, N.; Othman, S.N.; Md Jadi, D. Analysing the Critical Factors of Sustainability Risk Management (SRM) Implementation in Managing the Emerging Risks and Non-Quantifiable Risks on Corporate Survival Using Pls-Sem Path Modelling. *Int. J. Econ. Res.* **2017**, *14*, 463–475.
99. Mittal, M.; Pareek, M.; Sharma, S.; Chohan, J.; Kumar, R.; Singh, S. A Sustainable Environmental Change and ESG Initiatives by the Manufacturing and Others Service Industries during COVID19 Pandemic. *IOP Conf. Ser. Earth Environ. Sci.* **2021**, *889*, 12081. [[CrossRef](#)]
100. Muff, K. Learning from Positive Impact Organizations: A Framework for Strategic Innovation. *Sustainability* **2021**, *13*, 8891. [[CrossRef](#)]
101. Namchoochai, R.; Kiattisin, S.; Darakorn Na Ayuthaya, S.; Arunthari, S. Elimination of FinTech Risks to Achieve Sustainable Quality Improvement. *Wirel. Pers. Commun.* **2020**, *115*, 3199–3214. [[CrossRef](#)]
102. Nogueira, F.G.; Lucena, A.F.P.; Nogueira, R. Sustainable Insurance Assessment: Towards an Integrative Model. *Geneva Pap. Risk Insur.-Issues Pract.* **2018**, *43*, 275–299. [[CrossRef](#)]
103. Oduoza, C.F. Framework for Sustainable Risk Management in the Manufacturing Sector. *Procedia Manuf.* **2020**, *51*, 1290–1297. [[CrossRef](#)]
104. Olatoye, D. Sustainability Risks in the Supply Chain—The Nigerian Content Challenge Paper. In Proceedings of the SPE Nigeria Annual International Conference and Exhibition, Lagos, Nigeria, 30 July–1 August 2013. [[CrossRef](#)]

105. Zu, L. Sustainability Risk and Crisis Management: A Taoism's Perspective. In *Cultural Roots of Sustainable Management*; Habisch, A., Schmidpeter, R., Eds.; CSR, Sustainability, Ethics & Governance; Springer: Berlin/Heidelberg, Germany, 2016; pp. 65–88.
106. Ziolo, M.; Bak, I.; Cheba, K.; Spoz, A. The Relationship between Banks and Company Business Models-Sustainability Context. *Procedia Comput. Sci.* **2020**, *176*, 1507–1516. [[CrossRef](#)]
107. Zhang, D.; Wang, H.; Wang, W. The Influence of Relational Capital on the Sustainability Risk: Findings from Chinese Non-State-Owned Manufacturing Enterprises. *Sustainability* **2022**, *14*, 6904. [[CrossRef](#)]
108. Kucuk, Y.A.; Karakoc, T.H. Enterprise Risk Management Perspective. In *Global Warming: Engineering Solutions*; Dincer, I., Hepbasli, A., Midilli, A., Karakoc, T.H., Eds.; Springer: Boston, MA, USA, 2010; pp. 423–437, ISBN 978-1-4419-1017-2.
109. Ye, Y.; Lau, K.H. Competitive Green Supply Chain Transformation with Dynamic Capabilities—An Exploratory Case Study of Chinese Electronics Industry. *Sustainability* **2022**, *14*, 8640. [[CrossRef](#)]
110. Trubetskaya, A.; Horan, W.; Conheady, P.; Stockil, K.; Merritt, S.; Moore, S. A Methodology for Assessing and Monitoring Risk in the Industrial Wastewater Sector. *Water Resour. Ind.* **2021**, *25*, 100146. [[CrossRef](#)]
111. Tobescu, C.; Seuring, S. Internal Enablers for the Implementation of Sustainable Supply Chain Risk Management Systems. In *Logistics Management*; Jan, D., Haasis, H.-D., Kopfer, H., Kotzab, H., Schönberger, J., Eds.; Springer International Publishing: Cham, Switzerland, 2015; pp. 17–26.
112. Thöni, A.; Madlberger, L.; Schatten, A. Towards a Data-Integration Approach for Enterprise Sustainability Risk Information Systems. In Proceedings of the 7th International Conference on Research and Practical Issues of Enterprise Information Systems, Prague, Czech Republic, 11–13 September 2013.
113. Sutrisno, A.; Kumar, V.; Handayani, D.; Arief, R.K.; Virdhian, S.; Punuhsingon, C. Categorization of Supply Chain Sustainability Risks in SMEs: A Preliminary Evidence from a Developing Country. In Proceedings of the 3rd IEOM European International Conference on Industrial Engineering and Operations Management, Pilsen, Czech Republic, 23–26 July 2019.
114. Sutrisno, A.; Kumar, V. Supply Chain Sustainability Risk Decision Support Model Using Integrated Preference Selection Index (PSI) Method and Prospect Theory. *J. Adv. Manag. Res.* **2022**, *19*, 316–346. [[CrossRef](#)]
115. Sutrisno, A.; Kumar, V. Supply Chain Sustainability Risk Assessment Model Using Integration of the Preference Selection Index (PSI) and the Shannon Entropy. *Int. J. Qual. Reliab. Manag.* **2022**. ahead-of-print. [[CrossRef](#)]
116. Smith, A.D. Strategic Aspects of Contingency Planning in Chaotic Environments and Systems: Multi-Case Study. *Int. J. Bus. Syst. Res.* **2011**, *5*, 423–442. [[CrossRef](#)]
117. Shaheen, R.; Ağa, M.; Rjoub, H.; Abualrub, A. Investigation of the Pillars of Sustainability Risk Management as an Extension of Enterprise Risk Management on Palestinian Insurance Firms' Profitability. *Sustainability* **2020**, *12*, 4709. [[CrossRef](#)]
118. Sezer, M.D.; Selim, H. Analysis of Product Sustainability by Using a Risk-Oriented System Dynamics Model. *Adv. Sustain. Syst.* **2021**, *5*, 2100065. [[CrossRef](#)]
119. Schulte, J.; Villamil, C.; Hallstedt, S. Strategic Sustainability Risk Management in Product Development Companies: Key Aspects and Conceptual Approach. *Sustainability* **2020**, *12*, 10531. [[CrossRef](#)]
120. Schulte, J.; Knuts, S. Sustainability Impact and Effects Analysis—A Risk Management Tool for Sustainable Product Development. *Sustain. Prod. Consum.* **2022**, *30*, 737–751. [[CrossRef](#)]
121. Schulte, J.; Hallstedt, S. Company Risk Management in Light of the Sustainability Transition. *Sustainability* **2018**, *10*, 4137. [[CrossRef](#)]
122. Schulte, J.; Hallstedt, S.; Schulte, J. Challenges for Integrating Sustainability in Risk Management—Current State of Research. In Proceedings of the 21st International Conference on Engineering Design (ICED 17) Volume 2: Design Processes, Design Organisation and Management, Vancouver, BC, Canada, 21–25 August 2017; Volume 2, pp. 327–336.
123. Rodrigue, M.; Diouf, D.; Gendron, Y. On the Use of Framing Strategies by the Big Four Accounting Firms: Bringing Sustainability Risks into the Mainstream. *Account. Forum* **2022**, 1–25. [[CrossRef](#)]
124. Raian, S.; Ali, S.M.; Sarker, R.; Sankaranarayanan, B.; Kabir, G.; Paul, S.K.; Chakraborty, R.K. Assessing Sustainability Risks in the Supply Chain of the Textile Industry under Uncertainty. *Resour. Conserv. Recycl.* **2022**, *177*, 105975. [[CrossRef](#)]
125. Palousis, N.; Luong, L.; Abhary, K. An Integrated LCA/LCC Framework for Assessing Product Sustainability Risk. In *Risk Analysis VI*; WIT Press: Southampton, UK, 2008; pp. 121–128.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.