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Exploring the Interplay of Agile Methodologies, Resilience, and ESG in Supply Chains: a Bibliometric Review and Qualitative Analysis

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Abstract: In recent years, increased competitiveness and the risk of value chain disruption have highlighted the importance of traditional themes like agile methodologies and resilience. In addition, the adoption of ESG frameworks in investment decision-making gained momentum in 2018. However, ESG practices are still limited in many companies, and their relationship with internal areas such as the supply chain lacks sufficient research. The exploration of how ESG and agility affect supply chain resilience is in its preliminary stages, leading to a lack of

extensive literature on the subject. This study aims to conduct a bibliometric review and qualitative content analysis to explore the interplay between concepts that have not been integrated so far. A total of 58 articles published between 2013 and October 2022 were subjected to descriptive and content analysis, resulting in the main trends, research gaps, and future research directions, alongside the classification of the study approach for the authors and their correlation between ESG pillars. The qualitative analysis of the content revealed that the most eligible articles classified the resilience–agility concepts as interdependent, emphasizing the common aspects of these concepts. Regarding ESG, the analysis shows the focus of existent research relies on financial performance and operational performance within the supply chain. Each study approach highlights one pillar of ESG, the dependent study approach emphasizes the significance of financial performance, while the independent approach places a stronger focus on operational performance.

Keywords: agile, resilience, ESG, supply chain, review.

1. Introduction

In today's global business landscape, organizations face increasing competitiveness and the risk of value chain disruptions, especially during and after the COVID-19 pandemic, when the shortage of several raw materials raised traditional themes such as agility and resilience as hot topics in academy and practice, aiming to prevent the disruption and assess hazards and turn the value chain sustainable at any circumstances (Frederico, 2021). As a result, organizations are increasingly recognizing the need to build resilient supply chains that can adapt and respond effectively to these challenges.

Supply chain resilience and agility are usually studied together due to the theme's similarity (Calvo et al., 2020; Christopher & Rutherford, 2004). Glicor et al. (2019) elucidated the common themes between resilience and agility, which refers to the ability to accelerate operations, scan the environment to anticipate scenarios and adjust accordingly, bringing flexibility to the value chain. These recurring themes align with the strategies proposed by Ali et al. (2017) for mitigating supply chain disruptions. The ability to anticipate situations is a key element of an initiative-taking strategy, typically employed in the pre-disruption phase. Meanwhile, the ability to respond and adapt effectively corresponds to the during-disruption phase. Lastly, the ability to recover and learn from disruptions should be incorporated into the reactive strategy, typically applied in the post-disruption phase.

The interconnection between resilience and agile methodologies contributes to the overall ability of a supply chain to navigate uncertainties and challenges (Glicor & Holcomb, 2012; Hohenstein et al., 2015). Resilience provides a foundation for agility by ensuring that the supply chain is prepared to manage disruptions and recover swiftly (Bhamra et al., 2011). By implementing resilience strategies such as redundancy, diversification of suppliers, or robust risk management practices, organizations could enhance their ability to respond to unforeseen events and maintain operational continuity (Maharjan & Kato, 2022; Purvis et al., 2016).

Agility, in turn, complements resilience by enabling the supply chain to react quickly and effectively to changes in demand patterns (Fayezi et al., 2017), market conditions (Qi & Sheu, 2011), or disruptions (Shekarian et al., 2020). Agile supply chains are characterized by their ability to reallocate resources, adjust production schedules and processes, collaborate with partners, or adopt innovative technologies to meet changing customer needs and market requirements (Tarafdar & Qrunfleh, 2017). Agility allows organizations to seize opportunities, respond rapidly to customer demands, and adapt to volatile and uncertain business environments (Akkaya & Tabak, 2017; Walter, 2021).

Simultaneously with the strategies to provide a sustainable value chain, the adoption of Environmental, Social, and Governance (ESG) frameworks has gained momentum in recent years, driven by the application of ESG frameworks in investment decision-making (Park & Jang, 2021; Kluza et al., 2021). ESG refers to the three central factors that measure the sustainability and societal impact of an organization's operations (Huang, 2021). Environmental factors consider the organization's impact on the environment, including resource consumption, waste management, carbon emissions, and ecological preservation. Social factors examine the organization's relationships with stakeholders, employees, communities, and human rights. Governance factors focus on the organization's leadership, accountability, transparency, and ethical practices (Huang, 2021).

Investors are recognizing the financial relevance of considering ESG factors when making long-term decisions, as they could affect a company's performance, reputation, and risk profile (Giese et al., 2019; Eccles et al., 2017). Organizations are also recognizing the importance of addressing ESG factors as part of their corporate social responsibility and sustainability efforts (Baid & Jayaraman, 2022; Broadstock et al., 2020).

While both supply chain resilience and ESG practices have acquired individual attention in research and industry, their relationship and interplay within the context of supply chain management remain understudied. Studies on ESG reporting for disruptive events have increased due to the COVID-19 pandemic (SAVIO et al., 2023), and academics' focus has

shifted from general concepts related to the financial and/or economic impacts of the crisis to a more comprehensive performance measurement (ARVIDSSON and DUMAY, 2022; LA TORRE et al., 2020), such as the Global Reporting Initiative (GRI) (RÜGER and MAERTENS, 2022), sustainability reporting assurance (CASTELO et al., 2014), and risk assessment (DILLING and HARRIS, 2018), establishing a connection with the concept of resilience, which has been relatively unexplored until now (COMOLI et al., 2023). However, there is limited research on the application of these principles within internal areas of the value chain, such as logistics and procurement, or studies that examine the relationship between such practices and resilience and agility. Understanding how ESG practices could enhance supply chain resilience and how agile methodologies are able to contribute to both ESG integration and supply chain resilience is crucial for organizations aiming to build sustainable and robust supply chain systems.

To address this gap, the aim of this study is to study the relationship between ESG practices, agile methodologies, and supply chain resilience, also bringing theoretical and managerial contributions. By conducting a comprehensive bibliometric review and qualitative content analysis, this study seeks to provide valuable insights into the current state of research, identifying trends, influential authors, and geographic concentrations, and analyzing the literature approaches and areas of focus.

A key contribution of this paper is that enables analysis of the potential of resilience improvement through the relationships of established paradigms, such as agility, and recent tools, such as ESG, by evaluating and categorizing the study approach available in the existing literature. The paper contributes to a better understanding of the concepts interplay in supply chains and has both theoretical and practical implications. Hence, the current study focuses on four major research questions:

1. How do agile strategies and ESG premises impact supply chain resilience?
2. Are agile strategies and ESG premises independent?
3. What is the ESG focus inside the supply chain?
4. What are the international trends in research involving ESG and resilience in the supply chain?
5. What are the gaps found in the related research topics?

The paper has the following structure. Section 2 presents the research methodology, Section 3 reports the bibliometric findings, followed by Section 4 discusses the qualitative analysis content and classification of the selected articles. Finally, Section 5 presents the conclusions

which include directions for further research and the main gaps identified in the bibliometric and qualitative analysis.

2. Methodology

To perform the bibliometric analysis, a systematic search was conducted adapted from the PRISMA Methodology (Moher et al., 2010) to identify interconnection between the five parameters which are: Who (authors), What (keywords), Where (countries), When (publication year), and With Whom (affiliation), and evaluate quantitatively and in networks the patterns, trends, and gaps of a research topic. We extracted the data from the Web of Science and Scopus databases. Aiming to cover the maximum number of publications classified as articles or conference articles, the date range of publication had no restriction.

On the other side, we restricted the field of research to Business, Engineering, Operations, Environmental Science, Science Technology and Other topics, Computer Science, Transportation, Food Science Technology, Automation Control Systems, and Mathematics to portray the overall research landscape of supply chain resilience achievement through agility methodologies, linked with ESG pillars. The literature mapping also used a combination of the keywords: Supply Chain, Logistics, Resilience, Agile, and ESG, and the number of publications as shown in Table 1, together with the steps of document selection for the following study.

We applied the inclusion and exclusion criteria for the review. The inclusion criteria were: *i*) The document is published or formally accepted in journals listed in the researched databases; *ii*) Documents categorized as articles or conference papers; *iii*) The subject of interest is the central theme of the article; *iv*) The subject of interest is one of the topics addressed in the document. The exclusion criteria were: *i*) Duplicated title; *ii*) The document is categorized as a review; *iii*) The article uses search keywords merely in the title and provides no insight into the subject; *iv*) The article uses a systematic review purely without other contributions; *v*) Articles purely about finance with ESG associate; *vi*) Documents without full access; *vii*) Exclude articles not written in the English language.

Table 1. Document selection steps for bibliometric and quantitative review of articles using the Web of Science and Scopus database.

Steps	Action	Documents (#)
Web of Science and Scopus preliminary research	Keywords search: (Supply Chain OR Logistics) AND (Resilience) AND (Agile) – 138 documents	252

	+ (Supply Chain OR Logistics) AND (ESG) – 113 documents + (Supply Chain OR Logistics) AND (ESG) AND (Resilience) – 1 document	
	Research field filter application	
Application of filters	The appliance of inclusion and exclusion criteria	94
Pre-selection	Title and abstract reading	70
Final selection	Article reading	58

Through this search procedure, we selected 58 papers from 2013 to October 2022, and the dataset was exported in BibTex format and analyzed in R® software, applying the RStudio tool (Bibliometrix package and Biblioshiny visualization tool). The key bibliometric indicators were extracted to allow the performance of citation analysis which comprehends: *i*) scientific production, *ii*) most influence corresponding author, *iii*) countries and affiliation with more documents published and citations received, *iv*) more influent journals, and *v*) the co-citation analysis, which shows the overall intellectual structure of the research, indicating the association between authors, topics, and keywords. Finally, we addressed a content analysis to answer the research questions.

3. Bibliometric Findings

This section shows the key findings from the conducted bibliometric analysis. Based on the search methodology, we extracted 58 published documents from 41 sources (books, conferences, journals, etc.) associated with 112 Institutions from 24 countries during the period from 2013 to October 2022. Without any filter regarding publication year, the searched articles present an average age of 3.16 years, as shown in Table 2. The main bibliometric indicators point out that the total author's number among the selected documents is 179, culminating in 3.34 authors per document on average, with 6.12 average citations, and only six documents single-authored suggesting scientific collaboration.

Table 2. Overview of main bibliometric results.

Title 1	Title 2
Documents	58
Articles	49

Conference paper	8
Proceedings paper	1
Time frame	2013:10/2022
Cited references	1185
Journals	41
Authors	179
Institutions	112
Countries	24

3.1. Citation Analysis

In this section, we deliberate citation analysis on articles published per year, most cited authors, journals, affiliations, and countries. The trend of publications per year regarding the subject from 2013 to 2022 and reveals a stagnant production between 2011 to 2017. However, from 2018 to October 2022 the publication number increased significantly, culminating in the highest document number published in 2021 (15 documents), pointing out an annual growth rate of 32.98%. Traditional themes such as resilience and agile methodologies were revisited during the COVID-19 pandemic (Golan et al., 2020; Ozdemir et al., 2022), due to the demand for readjustment of industrial value chains in order to avoid ruptures, something witnessed by some segments due to the difficulties to obtain and transport raw materials at that time (Paul et al., 2021). In addition to the demands arising from the pandemic, the mentioned period also displays the evolution of ESG research, reporting strong publications since 2018 (Luo et al., 2022), when it was adopted as an important framework for the investment decision-making process (Park & Jang, 2021). We found one paper approaching Supply Chain, ESG, and Resilience resulting from the keywords preliminary search. It was published in 2021 by Liao and colleagues (Liao & Pan, 2021) and focused on a bibliometric review about enhancing Resilience through ESG, and the intersection of resilience, human rights, and digital opportunities in the supply chain. The findings reveal a shift towards resilience as a key focus in supply chain management, driven by themes like big data analytics, sustainability, and flexibility. The study emphasizes the significance of integrating ESG concerns into the digital transformation of supply chains and highlights the importance of resilience and human rights in ensuring supply chain performance and security.

Table 3 displays the most contributing authors in terms of the number of documents published and the citations received. Rajesh, Cruz-Machado, Azevedo, and Carvalho are better ranked in the total number of articles published, although the citation hit only 54 for Rajesh and 93 for

Cruz-Machado, Azevedo, and Carvalho. The most cited authors, Sarkis, and Wang are responsible for publishing the oldest article regarding the theme. The paper was released in 2013 with the title "Investigating the Relationship of Sustainable Supply Chain Management with Corporate Financial Performance", which received 157 citations by now. In fact, the top five authors with influence are responsible for only three papers.

USA and Europe concentrated on the scientific production regarding the research topic. Only 2 of 24 (8.3%) countries have published more than five articles, the USA is revealed as the most productive country, with eight articles published in the field. Looking at the total citations, the USA also comes up as the top influential country, second and third places belong to European countries: the United Kingdom and Portugal. Asian countries such as India, China, Iran, and Pakistan still do not reach a substantial number of citations on the research topic, representing only 2% of the total analyzed citations.

Table 3. Top 10 authors with influence.

Rank	Authors	Citation	Doc published	Average cited times
1	Sarkis J (2013)	157	1	157
2	Wang Z (2013)	157	1	157
3	Azevedo S (2014;2016)	93	2	47
4	Carvalho H (2014; 2016)	93	2	47
5	Cruz-Machado V (2014; 2016)	93	2	47
6	Rajesh R (2018; 2020; 2022)	54	3	18
7	Ashley R (2018)	7	1	7
8	Fearne A (2021)	7	1	7
9	Loseby D (2021)	7	1	7
10	Mcdougall N (2021)	7	1	7

Regarding the number of documents published by the institution, only one (01) university has 5 articles released about the research theme: the University of Lahore from Pakistan, followed by Cardiff University from the United Kingdom, with 4 articles, and the City University of London also from the United Kingdom, La Rochelle Business School from France, University of Pavia from Italy, and University of Wollongong from Dubai with 3 articles published each.

European and Asian affiliations authors have contributed the most toward the research topic. However, it is worth noting that United States universities do not appear on the rank, which suggests a pulverized production among North American universities.

According to Dzikoeski (2018), the number of studies published by a particular journal, and the citations received by the journal represent the impact of the most productive journal. Regarding the most productive journals in the field, only 6 journals have published 23 papers (~47,9%) (Sustainability – 8 documents; International Journal of Production Research – 4 documents; Journal of Cleaner Production – 4 documents; International Journal of Production Economics – 3 documents; Production Planning & Control – 2 documents and Total Quality Management & Business Excellence – 2 documents), indicating a centralization around key journals for the research topic. Additionally, four of six of these sources originated from the United Kingdom, and 100% are European, showing a geographic centralization of the most relevant journals in this theme.

3.2. Co-citation Analysis

The co-citation analysis shows the overall intellectual structure of the research, indicating the association between authors, topics, journals, and keywords (Pilkington & Liston-Heyes, 1999). Figure 1a shows the geographic regions for research collaborations. It is possible to see the three main networks: the USA, highlighted in green, the United Kingdom, in red, and China, highlighted in blue.

The red network exhibits the United Kingdom as the major contributor in collaboration with Australia, Switzerland, Iran, and Netherlands. The USA network in green, shows collaboration with Finland and Austria but also reveals an indirect collaboration with Denmark. China shows a high-density lattice, bringing connections between Asian and European countries. Despite the three major lattices identified, the networks are still restricted by a few countries, and the main countries have restricted connections, reinforcing the knowledge centralization of the research topic.

The author's lattice repeats the country collaboration pattern, as seen in Figure 1b. The exemplification of the scientific production connection is comprised of several small networks representing the cooperation between them, and in which each node represents an author, the color refers to the lattice, and the thinness of the bond is indicative of the strength of collaboration in terms of articles published where larger equals more articles. The biggest

network in brown represents a Portuguese research group, as well as the green one. An Indian research group, with four collaborators, represents the second-largest network. The other lattices could appear as the Pakistan group in purple and the Chinese group in blue. Overall, this indicates a strong local partnership, especially between Portuguese authors, corroborating the number of authors per document mentioned in the earlier sections of 3.34 authors per document. The next step for research in this theme could be pointed out in the direction of becoming a global connection and bringing other countries and scholars into the research topic.

The analysis of the co-occurrence of the author's keywords mentioned in the articles selected for the bibliometric revision allows for the identification of key research topics of related areas. Figure 1c shows seven main networks and the correlation between them and displays that besides the keywords applied in the search, such as "Supply Chain", "Logistics", "Resilience", "ESG", and "Agile", other keywords appear in the literature associated with them.

The red network indicates that "sustainability", "logistics", "financial performance" and "ESG" are words almost invariably associated with "Supply Chain Management" in the literature. The Resilience lattice, indicated by green, highlights the traditional topics often associated with the automotive industry, such as "lean", "green" and "agility". The blue network shows studies that approach the main pillars of ESG (environment, social, and governance) isolated by themselves. Other highlights of Figure 1c reside in the isolation of the "Industry 4.0" node, and the few connection points between the nodes of "Agile" and Resilience" in green, "Supply Chain Management and financial performance" in red, and the "ESG pillars" in blue, indicating an important research gap that is addressed in the article.

Figure 1

Co-citation analysis

Figure 1a

Country collaboration.

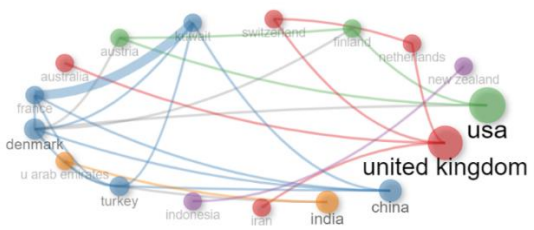


Figure 1b

Author's collaboration.

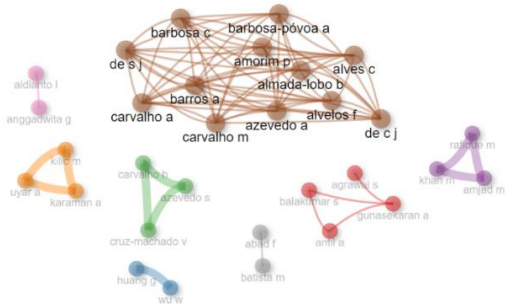
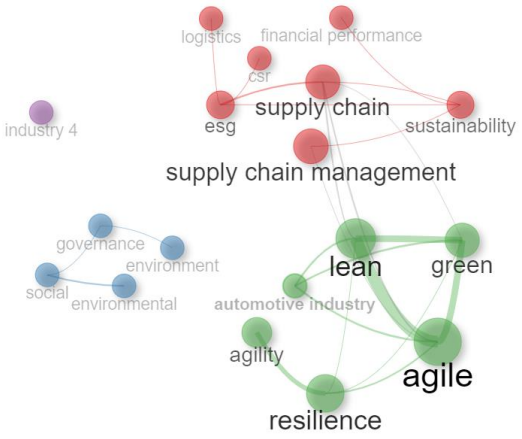


Figure 1c

Co-occurrence of author's keywords.

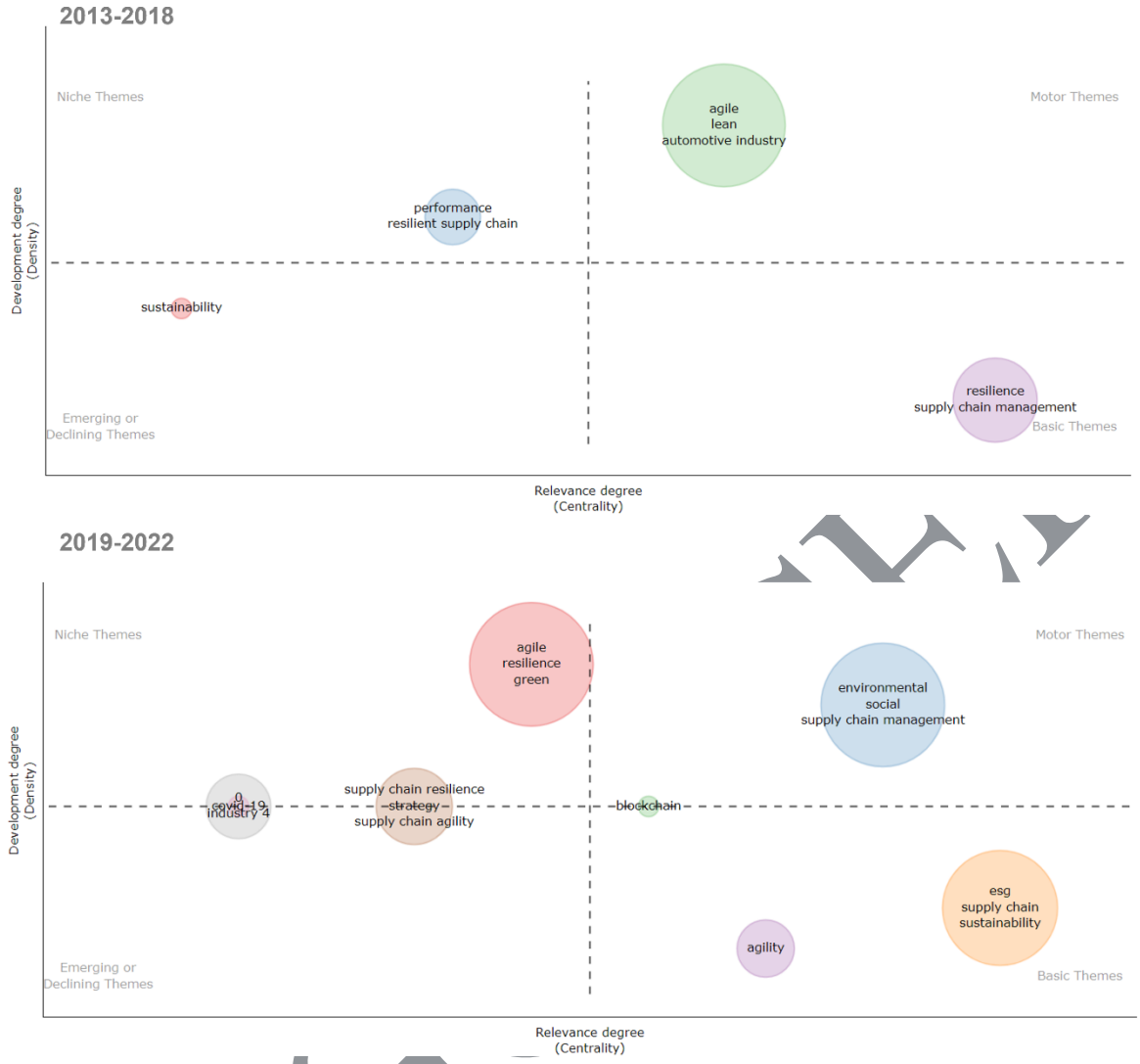


Source: Authors.

The diagram displayed in Figure 2 allows for highlighting four distinct types of topics. In one hand, higher values of centrality and density define the hot topics or motor themes, well developed and relevant for the structuring of the conceptual framework of the domain. On the other hand, lower values of density and centrality define the peripheral topics, not fully developed or marginally interesting for the domain. The other two quadrants are: basic themes with low density and high centrality, essential for the domain and multidisciplinary, and niche topics with high density and low centrality, strongly developed, but still under research (Aria et al., 2022).

Figure 2

Thematic evolution map from the author's keywords.



Source: Authors

Slice time #1 comprehend years from 2013 to 2018, prior to the COVID pandemic, showing that "sustainability" figured out into the peripheral topics, which indicates the emerging interest in the research line. Whereas "performance" and "resilient supply chain" were niche topics, with strong research development. Basic themes during the time were "resilience" and "supply chain management", displaying high relevance but still no structure for the domain. Hot topics studied at the time were "agile", "lean", and "automotive industry", rooted in the traditional industry segments.

Slice time #2 from 2019 to 2022, shows the industry establishing traditional methodologies as well as "agile", "resilience", and "green" as niche themes, which matches the strong foundation of such topics, but continuing being researched due to the recent association with industry 4.0, what could be highlighted by the emergence of new lines of research seeking technological solutions. Topics related to COVID-19 appear in the peripheral area, which suggests an

emerging topic for scholars and professionals during this period. The main pillars of ESG, "environment" and "social" along with "supply chain management" are inside the motor theme quadrant, on the other hand, "ESG" itself, together with sustainability is labeled as a basic theme, which could be attributed mostly due to the establishment of ESG as a framework for investments, revealing a maturity level regarding the subject, that is currently spreading to the topics linked to performance of value chain.

4. Qualitative Analysis Content

As Table 4 shows, we classified the documents selected for the review according to their approach regarding the resilience-agility relationship. The dependent approach utilizes agile methodologies to achieve resilience as the ultimate outcome, showing a dependency between the two concepts. On the other hand, the independent line of approach emphasizes that both agility and resilience are individual goals of equal importance. It is worth noting that most of the studied documents indicate a dependent relationship between resilience and agility, which could be regarding the common aspects related to those concepts. Glicor et al. (2019) uncovered their common aspects arguing that the adaptability in tactics and operations levels, the ability to expedite processes, and the capability to anticipate and assess the environment could fit into both resilience and agility themes. The independent approach identified in the 14 articles listed in Table 4, shows that resilience and agility concepts are often applied together, to enhance overall performance, which could be translated as operational efficiency or business sustainability practices. In despite of the importance of performance as a goal for documents adopting the dependent approach, their primary objective is to increase the resilience of the supply chain or the business itself, bringing to light a more operational character.

Articles usually exam ESG from a financial perspective as a means of assessing credit risk and investments. However, only recently authors have begun to explore and include ESG in the supply chains perspective, as evidenced by the bibliometric review in Session 3. Aiming to address Research Questions 1 and 2, we create a classification to uncover how the examined documents align with the pillars of ESG: environment, governance, and performance, which could be observed in Table 5. Operational performance is a prominent theme across both dependent and independent approaches, with 23 documents in the dependent approach and 13 documents in the independent approach examining this aspect, which suggests that ESG is still being applied with a performance focus. Additionally, two documents in the dependent approach and one document in the independent approach explore the intersection of financial and operational performance, highlighting the interconnectedness of these two aspects.

Table 4. Approach for resilience-agility relationship classification.

Approach	Documents	Total
Independent	Sonar et al. (2022); Stewart & Ivanov (2022); Lotfi & Sodhi (2022); Lotfi & Saghiri (2018); Shqairat & Sundarakani (2018); Guo et al. (2021); Dubey et al. (2022); Salleh et al. (2020); Azevedo et al. (2016); Carvalho et al. (2014); Rolo et al. (2014); Rachid (2017); Anvari (2021); Ramirez-Peña et al. (2020).	14
Dependent	Purvis et al. (2016); Liao & Pan (2021); Hussain & Malik (2022); Ahmed & Huma (2021); Jedlínski (2021); Kazancoglu et al. (2022); Lücker et al. (2019); Ralston & Blackhurst (2020). Maryniak (2022); Cohen & Kouvelis (2021); Aldianto et al. (2021); Akbarzadeh et al. (2019); Fearne et al. (2021); Zaheer et al. (2020); Amjad et al. (2021); Miceli et al. (2021); Thomas et al. (2015); Gölgeci et al. (2020); Dai & Tang (2022); Sardanelli et al. (2022); Whitelock (2019); Sachin & Rajesh (2022); Rajesh (2020); Pernici et al. (2020); Uyar et al. (2020); Rodionova et al. (2022); Kim et al. (2021); Tamayo-Torres et al.	44

(2019); Jo & Kwon (2021); Govindan et al. (2021); Medina & Thomé (2021); Liu et al. (2022); Bellamy et al. (2020); Manocha & Srai (2020); Barbosa et al. (2019); Nowlan et al. (2021); Mamdouh et al. (2018); Miyamae et al. (2022); Saini et al. (2022); Rajesh (2018); Pathirana et al. (2018); Mugurusi & Ahishakiye (2022); Liu et al. (2021); Wang & Sarkis (2013).

In terms of the dependent approach, an important focus is placed on financial performance, with 13 documents specifically addressing this aspect. This suggests that these documents prioritize the financial implications through agile methodologies and enhance supply chain/business resilience. The independent approach does not show any document directly addressing the environment or governance pillars, indicating that the documents with the independent approach may have a stronger emphasis on operational performance rather than the broader ESG considerations. On the other hand, in the dependent approach, three documents address the environmental pillar. Additionally, two documents investigate internal governance, and one document studies external governance. This document analyzes the external regulatory and compliance frameworks impacting the organization, it relates the impact of corporate social responsibility in the business itself.

In relation to the social pillar of ESG, limited studies were identified, with most of them examining the link between social practices and financial performance. One notable study conducted by Tamayo et. al (2019) explored the relationship between the social and environmental dimensions of ESG practices and financial performance. Surprisingly, their findings revealed a negative correlation between social practices and a firm's market value, contrary to what we initially expected. Moreover, the study indicated that environmental practices do not necessarily lead to improved financial performance. The evidence further suggests that organizational policies aimed at enhancing social practices may diminish a firm's market value, indicating that investors tend to perceive such efforts negatively.

Table 5. Number of documents per approach for resilience-agility and ESG pillars.

ESG Pillars	Dependent Approach	Independent Approach
Environment	3	0
External Governance	1	0
Internal Governance	2	0
Financial Performance	13	0

Operational Performance	23	13
Fin and Op Performance	2	1
Total	**44**	**14**

We developed a correlation matrix (Table 6) to investigate the quantitative character of the relationship between ESG, Resilience, and Agile. The values represent the correlation coefficients, which indicate the strength and direction of the relationship between these topics. The negative coefficients for ESG-Agile and ESG-Resilience reveal an independent correlation among them, which could means that the topics are not researched together, with no association. Meanwhile, Agile and Resilience show a positive correlation, suggesting that Agile topic is frequently researched with Resilience, and vice versa. This corroborates with Figure 1c that shows the Co-occurrence of author's keywords.

Table 6. Correlation matrix between the main research topics.

	ESG	**Agile**	**Resilience**
ESG	1.00	-0.63	-0.61
Agile	-0.63	1.00	0.79
Resilience	-0.61	0.79	1.00

5. Research implications

This study has significant theoretical and managerial implications, which are explained below:

5.1.Theoretical implications

This study offers several theoretical insights in the field of supply chain management. Firstly, it enhances the understanding of the relationship between resilience and agility, presenting two distinct approaches: the dependent approach, where agility is considered a means to attain resilience, and the independent approach, which treats resilience and agility as separate yet equally crucial objectives. Secondly, it sheds light on the evolving role of Environmental, Social, and Governance (ESG) factors in supply chain research integrated with the other concepts. Although ESG has gained prominence, it is predominantly examined from a financial perspective, highlighting the need for more comprehensive theoretical models that encompass the environmental, social, and governance dimensions in supply chain decision-making. Furthermore, the limited attention given to the social pillar of ESG in the analyzed documents raises theoretical questions about its significance within supply chain management, prompting

a deeper exploration of social implications and their theoretical foundations. Finally, the correlation analysis reveals that ESG, Agility, and Resilience are often researched independently, suggesting the potential for further theoretical exploration of their interplay and dependencies.

5.2.Managerial implications

Supply chain managers must adopt a balanced approach, integrating resilience and agility to respond to disruptions while ensuring sustainability. Given the growing emphasis on ESG factors, they must incorporate these considerations into strategies to align with sustainability goals and meet stakeholders' expectations. Developing comprehensive performance metrics covering financial, operational, environmental, and social aspects is essential for insights and alignment. Conducting thorough risk assessments and mitigation strategies is crucial for business continuity. Additionally, addressing the social aspect of ESG, fostering collaboration, and recognizing long-term implications are vital. Managers must stay updated on ESG-related regulations, embrace continuous improvement, and invest in technology for enhanced visibility and decision-making.

6. Conclusions

In this study, we performed a bibliometric review and content analysis to answer the research question formulated priorly. Through this review, 58 documents published between 2013 and October 2022 were analyzed using the Bibliometrix tool, which revealed a scientific collaboration with an average of 3.34 authors per document. The number of publications on this topic notably increased from 2018 to 2022, driven by the urgency to adapt value chains due to disruptions, especially during the COVID-19 pandemic. ESG research has also seen a surge in publications since 2018, reflecting its relevance in investment decision-making, emphasizing environmental, social, and governance factors. The analysis revealed the USA and Europe as major contributors, with the USA leading in both publications and citations. Asian and European institutions made diverse contributions. The top journals were primarily based in the UK, indicating geographic centralization. Co-citation and co-occurrence analyses unveiled the intellectual structure, highlighting key topics and their interconnections.

The content analysis unveiled two approaches to the resilience-agility relationship: the dependent approach, where agility is seen to attain resilience, and the independent approach, treating both as equally important but separate goals. Most documents favored the dependent approach, emphasizing common aspects and interdependence between resilience and agility.

Regarding ESG, the authors primarily examined it from a financial perspective, focusing on operational performance within the supply chain. The dependent approach stressed financial performance, while the independent approach emphasized operational performance. The environmental and governance pillars of ESG received less attention. The correlation matrix revealed a negative correlation between ESG and both agility and resilience, indicating independent research, and confirming the observed gap between these subjects.

The international trends involving ESG and resilience in supply chain research reveal a growing interest in and focus on these topics. The COVID-19 pandemic was a catalyst for the reevaluation and adjustment of supply chain strategies, with an emphasis on building resilience to mitigate disruptions. This has led to a revisiting of traditional themes such as resilience and agile methodologies in supply chain management.

ESG (Environmental, Social, and Governance) factors have gained great attention in recent years, and this trend also emerges in supply chain research. Since 2018, there has been a notable increase in publications and studies exploring the integration of ESG frameworks into supply chain decision-making processes. ESG considerations are essential drivers for sustainable and responsible supply chain practices. Overall, the international trends demonstrate a recognition of the need for supply chains to adapt to changing circumstances and address environmental and social concerns. There is a growing emphasis on building resilience and incorporating ESG principles to create more sustainable and robust supply chain systems.

The gaps found in the related research topics on ESG, Agile, and Resilience in the supply chain can include the limited empirical studies that provide real-world evidence and practical insights since most studies rely on theoretical frameworks or conceptual models, lack of standardized metrics and measurement of ESG performance inside the supply chain, that could accurately capture the environmental, social, and governance aspects of supply chain operations, and long-term impact assessment. While there is research on the short-term effects of ESG and resilience strategies in supply chains, there is a lack of studies that assess the long-term impact and sustainability of these practices due to the recent implementation of ESG. Addressing these gaps would contribute to a more comprehensive understanding of the relationship between ESG, Agility, and Resilience, inside the value chain, and provide practitioners with valuable insights to drive sustainable and resilient supply chain practices.

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