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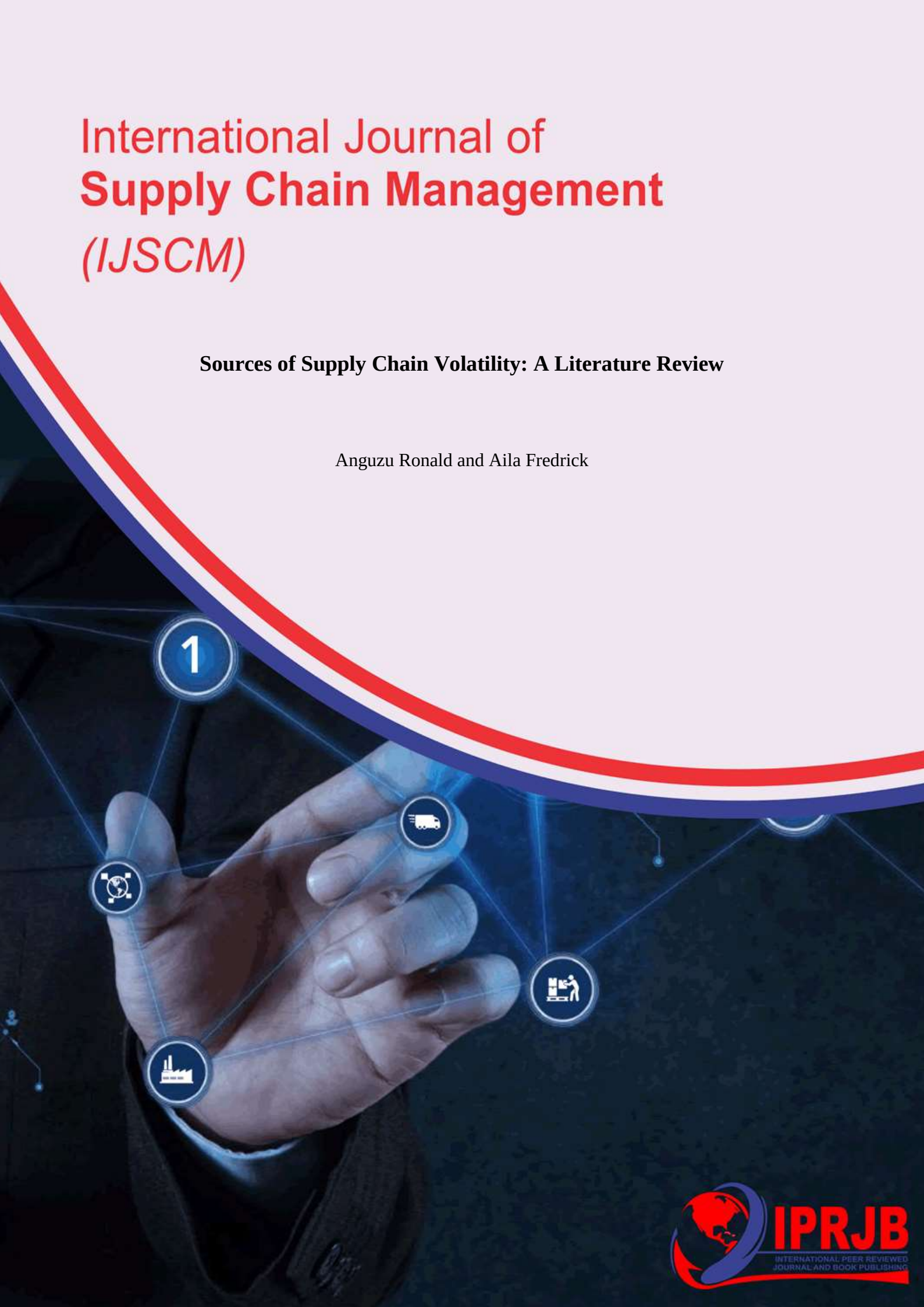

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Sources of Supply Chain Volatility: A Literature Review

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Abstract

Purpose: The purpose of this study was to identify the main source of supply chain volatility based on empirical literature, addressing the gap in existing research where consensus on this matter has been lacking.

Methodology: Employing an interpretivist approach, this study utilized a bibliographic and qualitative research method. The researchers systematically reviewed literature from top publishing sites and journals, focusing on titles and abstracts containing the keyword 'supply chain volatility' spanning from 2013 to 2023. Through this process, a taxonomy of 15 articles was developed to synthesize existing knowledge on the subject.

Findings: The results of the study indicate that demand variability emerges as the primary source of supply chain volatility, with 60% of the analyzed articles highlighting its significance. This finding underscores the critical role of demand fluctuations in driving supply chain disruptions and challenges.

Unique Contribution to Theory, Practice and Policy: This study makes a unique contribution to existing literature by providing empirical evidence and consensus on the main source of supply chain volatility. By synthesizing and categorizing findings from diverse sources, it advances theoretical understanding of the factors underlying supply chain disruptions. The identification of demand variability as the primary source of supply chain volatility offers valuable insights for practitioners seeking to enhance supply chain resilience and mitigate disruptions. Understanding the central role of demand dynamics can inform strategic decision-making and risk management practices within organizations. The findings of this study have implications for policy-makers involved in shaping regulatory frameworks and industry standards related to supply chain management. By recognizing demand variability as a key driver of volatility, policymakers can tailor interventions and incentives to promote stability and efficiency in supply chains.

Keywords: *Supply Chain, Volatility, Systematic Review*

INTRODUCTION

Managing supply chain volatility (SCV) is an important practice in Supply Chain Management (SCM). SCM is an important tool for improving performance of organizations for effectiveness and better realization of organizational goals such as enhanced competitiveness, better customer care and increased profitability. According to Craighead, Ketchen & Darby (2020), SCM refers to a set of activities undertaken by an organization to promote effective management of its supply chain. Koberg & Longoni (2019) referred to SCM practices as a multi-dimensional construct that includes both upstream and downstream sides of the supply chain. Moreover, SCM can be looked at as the approaches in order to integrate and managing the matching of supply and demand sides in order to satisfy clients in an effective way (Wong, Arlbjorn, & Johansen, 2005). They are tangible activities and technologies with the relevant role of collaborating the focal firm with her suppliers' final consumers (Vaart & Donk, 2008). It is an approach of involving suppliers in decision making, information sharing among chain partners and looking for new ways to integrate upstream activities. As a consequence, it involves developing customer contacts by customer feedback to integrate the downstream activities and delivering orders directly to customers. The understanding and practicing of supply chain management (SCM) has become an essential prerequisite for staying competitive in the global race and for enhancing profitability.

Supply chain management is viewed as a viable initiative to enhance sustainable competitive advantage under the increased national and international competition. The study by Stadtler (2015) found out that supply chain management practices are frugal in improving the organization success. For instance, strategic sourcing is an important practice which results to reduction in costs of operations, improvement in the quality of merchandise, efficient delivery and overall improvement in the firm's financial performance. Furthermore, Craighead *et al*. (2020) explains that supply chain firms which adopt effective inventory control management system accrues cut throat benefits in terms of releasing tied up inventory, storage efficacy, efficient material handling, and reduction in costs of operations. In the same vein, Koberg & Longoni, (2019) indicated that value chain analysis are often used for competitive scales formulation, knowing sources of competitive scales, while at the same time developing the networks and relationships between activities that create value (Koberg & Longoni, 2019). The study by Unam (2012) in a detailed discussion showed that that m materials handling and management positively impacts firm profitability in Nigeria's bottling plants.

Supply chains can be full of inefficiencies some due to poor policies and strategies by suppliers which results to hidden costs such as stock-outs, carrying costs of overstocking, incorrect payments of invoices, slow acknowledgement and reporting of shipment and lost sales which in turn affects productivity, quality issues, increased wasteful costs (extra inspections, additional freight fees, overtime, buffer stocks, obsolete inventory, multiple sourcing) and slow movement of goods which can be improved by supplier evaluation and better communications between buyers and suppliers. Inefficiencies in supply chains are however results of volatilities (Ketchen, 2020).

In a supply chain, relationships are not only used for connecting the firm with a partner, but also used to connect the firm throughout the supply chain by avoiding disruptions (Hsu, Kannan, Tan, & Leong, 2008). Supplier relationships are a part of supply chain relationships (Lemke, Goffin, & Szwejczewski, 2002). Minimum two parties are involved in a relationship, in order to produce mutual benefits (Walter, Ritter, & Gemunden, 2001).

Supply Chain Volatility

In the words of Christopher & Holweg (2017), SCV refers to the unintended differences both the upstream and downstream material flows. Where there is inadvertent material flows, there will a mismatch in demand and supply and this has the effect of resulting into losses. Ding, Cui, Wu & Du (2022) however says that volatilities in the supply chain can be said to be basically anything outside ambits of how supply chains were designed to work. In this essence, Ding *et al*. (2022) refers to the disruptions that may occur in the supply chain, either intentional or rather artificial, and naturally caused. Ketchen (2020) however looked at supply chain volatility from a different angle by dissecting it from variability

In the last couple of years, supply chain volatility (SCV) has appeared important more than ever in SCM and the research community has developed an incessant interest in the subject matter. It is recognized that managing volatility is an antecedent of a firm's sustainability, and hence contribution to the United Nations Sustainable Development Goals. Even though, managing volatility remains a frugal challenge of modern supply chains in the current century (Nitsche, Straube & Verhoeven, 2019). The research in SCV has changed drastically among scholarly works, from explaining the sources of volatilities among chains (Nitsche & Durach, 2018), to developing frameworks and strategies for managing volatilities (Nitsche *et al*., 2019). Many scholars have therefore suggested different approaches in underpinning the source of volatilities in supply chains. Due to the existence of divergent approaches, questions still exists on the main sources of SCVs.

Problem Statement

Volatility has played an important role in supply chains, hence in management. However, managing volatilities among firms has been tipped as a major challenge in modern supply chains. It is evident that when volatility exists, processes and practices will disintegrate and failure of firms to adapt to such changes will result to losses spanning from dented sales, increased costs, reduced profits and reduced market share. The Procurement Tactics Report, 2022 show that worldwide, 12% of supply chain retailers were faced with dense volatilities while 32% had a disruption in their supply chains. This indicate that many of the firms were unable to meet their objectives of right time, place, source and price as products failed to be delivered to the end consumer when and where required. Additionally, it is indicated that supply chain volatility is an antecedent of poor quality of products. Thus, firms setting out to manage volatility must first identify their sources Previous empirical works have focused on ways of managing volatilities (Nitsche, & Straube, 2020) and the effects of volatilities (Ding, Cui, Wu, & Du, 2022). There is no consensus on the sources as studies recommend different sources and firms adopt any in the management of volatilities. The purpose of this study was to identify sources of supply chain volatility and establish the main source.

Objectives of the Study

The objective of the paper was to identify sources of supply chain volatility and suggest the main source based on a systematic review.

Research Question

i. What are the sources of supply chain volatility?
ii. What is the main source of supply chain volatility?

LITERATURE REVIEW

Supply chain volatility sources can be categorized into two main groups, as identified by Wagner and Bode (2008): internal volatility, also known as operational volatility, and external volatility, often referred to as disruption volatility (Olson and Wu, 2011). Internal volatility encompasses operational aspects such as information volatility, capacity-related challenges, fluctuations in customer demand, and issues related to product quality. External volatility, on the other hand, arises from factors outside the organization and may include competition, economic fluctuations, political instability, natural disasters, and terrorist attacks (Ravindran and Warsing, 2013).

Various perspectives have been proposed for understanding the sources of volatility in supply chains. One approach categorizes these sources into three clusters: environmental volatility (external to the supply chain), network-related volatility, and organizational volatility, which are unpredictable and affect supply chain outcomes (Shahbaz, Sohu, Khaskhelly, Bano and Soomro, 2019). Similarly, volatility sources can be classified into three groups: those internal to the firm, those external to the firm but internal to the supply chain, and those external to the supply chain itself. The identified volatility sources include supply issues, process issues, demand issues, environmental issues, and control issues (Christopher and Peck, 2004).

Combining these perspectives and categories, researchers have delineated four main groups of volatility sources: those internal to the organization, those external to the organization, those internal to the supply chain, and those external to the supply chain (Shahbaz et al., 2018). Many studies focus on either internal or external volatility sources or provide a general overview. Thus, supply chain volatility is often approached from three perspectives: organizational factors (internal to the organization), industry factors (external to the organization but internal to the network), and environmental factors (external volatility). These volatility sources are further classified into four primary categories: supply volatility, process volatility, demand volatility, and environmental volatility (Basole et al., 2016; Shahbaz et al., 2018).

The literature review on supply chain volatility and resilience reveals several key factors. Zhao (2017) identifies various risk sources in agri-food supply chains, including antibiotics resistance, weather-related risks, and unethical issues. Briano (2009) emphasizes the importance of building a resilient supply chain, particularly in the face of common threats. Assefa (2015) highlights the transmission of price volatility in food supply chains, underscoring the need for further research on contextual factors. Calvo (2020) discusses the need for supply chains to adopt new strategies, such as resilience and agility, to respond to market changes and disruptions. These studies collectively underscore the need for a more comprehensive understanding of the sources of supply chain volatility and the strategies to mitigate its impact.

Theoretical Review

Managing SCV in supply chains and it being depicted as one of the challenges in supply chain management has been researched extensively in previous scholarly works. SCV was first looked at as the ‘forrester effect’ (Hernes & Sobieska-Karpińska, 2019) later on researched as bull whip effect (Yang, Lin, Liu & Zhou, 2021). The bull whip effect in the supply chain refers to too much increase in unexpected increase in demand which results into order differences up in the supply chain. The bull whip effect studies were however short lived as the concept did not disclose disruptive materials and stages in the supply chain, and this resulted in a glut of

sources on the sources of SCV. Perhaps, this was the background on scholarly thinking on the sources of SCV (Nitsche & Straube, 2020). A glut of researchers have tried to establish the sources of supply chain volatility, spanning from, variabilities in lead time, demand variability, poor quality of materials among others.

The study by Nitsche & Durach (2018) became a highly cited researcher which attempted to establish the sources of supply chain volatility based on a review of 2, 789 peer reviewed documents with insights from 23 industry based practitioners. The writers found out that there exists 20 meta level sources of supply chain volatilities, summarized into five sources as organizational volatility, vertical volatility, behavioral volatility, market related volatility and institutional & environment volatility. Nitsche & Durach (2018) study can be said to be a 'much waited paper in in literature on the sources of supply chain volatility, as it is based on both empirical evidence and practical experience. The paper however fails to disclose the most predominant source of volatility, and further does not disclose the time framework in which the systematic literature review was limited to. The current study hopes to bridge this gap by presenting the sources of supply chain volatility and identifying the most predominant source based on a systematic literature review over the last decade. We bring current insights based on latest studies and present the most predominant source based on the frequency of adoption in literature.

METHODOLOGY

A systematic literature review (SLR) was carried out to establish a meta-analysis of article and documents with the view of identifying the sources of supply chain volatility. Articles and documents will be obtained from top 5 publishing sites and journals (Emerald, JSTOR, Science Direct, Springer, Taylor & Francis). In identifying the articles, the researchers were restricted to publications between the periods March 2013 to March 2023. The key word 'supply chain volatility' in the titles and abstracts of the articles was used in conducting the search through a structured synthesis process. Given that volatilities abound in both dyadic and multi –actor supply chains, the paper was based on both the supply chains. The writers then embark on retrieving the articles, with those articles disclosing source (s) of volatilities considered. The source appearing frequently was deemed the most predominant and discussed therein. Suggestions for further research will then provide therein

Table 1: Inclusion Exclusion Criteria

Inclusion criteria	Exclusion criteria
1. Articles Published between March 2013 to March 2023	1. Articles and documents published up to February 2013 and after 31st March 2023
2. Top publishing houses and journals Emerald, Science direct, Springer, JSTOR and Taylor & Francis	2. Nonacademic databases
3. Academic articles and journals	3. Books, thesis, masters documents and grey literature
4. Articles studying 'supply chain volatility' and reveling the sources of supply chain volatility	4. Articles studying any other supply chain management concept and/or articles studying other aspects of supply chain volatility other than sources

(Source: Review Data, 2023)

RESULTS AND DISCUSSION

The objective of the study was to identify the sources of supply chain volatility and suggest the main source based on a systematic literature review. In order to achieve this objective, data was mined from 6 top publishing sites and journals, with the key word 'supply chain volatility' in titles and abstracts guiding the search. The review was limited to articles which were published the last decade, from March 2013 to March 2023.

Our first mine revealed 31 articles from 6 publishing sites. The OECD, Taylor and Francis publishers did not have any article in the period of interest (2013- 2023). However, Emerald, JSTOR, Springer, Science direct and 'others' had articles. The researcher embarked on critical reading of the articles titles and abstracts in order to establish whether the articles captured the theme of the study 'supply chain volatility'. This exercise resulted into 16 articles. A further evaluation and in depth examination of the documents to reveal the sources of supply chain volatility and published as articles revealed 15 articles which were included in the final analysis.

Publishing Houses

Table 2: Publishing houses & sites

S/No	Journal	Included Articles	Excluded Articles	Total
1	Emerald	3	0	3
2	JSTOR	3	0	3
3	OECD	0	5	5
4	Science direct	7	1	8
5	Springer	1	10	11
6	Taylor & Francis	0	0	0
7	Others	1	0	1
	Total	**15**	**16**	**31**

Source: Review Data, (2023)

From the table above 2, it can be seen that Emerald publisher had 3 articles, JSTOR had 3 articles, OECD had no final article, Science direct had 7, Springer International had 1, Taylor & Francis had no final article and finally there was an article not identified by any publisher.

Database of Reviewed Articles

The Table 3 below show that there were 15 articles which were finally included in the final review analysis written by 15 scholars. Top publishing sites and journal (Emerald, JSTOR, Science direct, Springer, Taylor & Francis, OECD) and 'others' each published an article in the period under review.

Table 3: Information on Reviewed Articles

Author	Publisher	Journal	Article
1. Gaudencia *et al*. (2020)	Emerald	1. Supply Chain Management: An International Journal	1. Measuring the financial effects of mitigating commodity price volatility in supply chains
2. Nitsche & Durach (2018)		2. International Journal of Physical Distribution & Logistics Management	2. Much discussed, little conceptualized: supply chain volatility
3. Holweg (2017)		3. International Journal of Physical Distribution & Logistics Management	3. Supply Chain 2.0 revisited: A framework for managing volatility-induced risk in the supply chain
4. Humair et al (2013)	JSTOR	1. Interfaces	1. Incorporating Stochastic Lead Times Into the Guaranteed Service Model of Safety Stock Optimization
5. Taskin et al., (2015)		2. Interfaces	2. Mathematical Programming-Based Sales and Operations Planning at Vestel Electronics
6. Gligor et al., (2019)		3. Transportation Journal	3. Achieving Financial Performance in Uncertain Times: Leveraging Supply Chain Agility
7. Ding et al. (2022)	Science direct	1. Research in International Business & Finance	1. Supply chain management based on volatility clustering: The effects of CBDC volatility
8. Nitsche Straube (2020)		2. Procedia Manufacturing Journal	2. Efficiently managing supply chain volatility – a management framework for the manufacturing industry
9. Kazaz (2014)		3. Business Horizons	3. 1>2? Less is more under volatile exchange rates in global supply chains
10. Abolghasemi *et al.* (2020)		4. International Journal of Computer & Industrial Engineering	4. Demand forecasting in supply chain: The impact of demand volatility in the presence of promotion
11. Hu *et al.*, (2019)		5. Economic Modelling Journal	5. Price volatility spillovers between supply chain and innovation of financial pledges in China
12. Pellegrino *et al*. (2018)		6. Journal of Purchasing & Supply Management	6. Supply Chain Finance: A supply chain-oriented perspective to mitigate commodity risk and pricing volatility
13. Wong *et al.*, (2018)		7. Transportation Research Part D	7. Optimising truckload operations in third-party logistics: A carbon footprint perspective in volatile supply chains
14. Nitsche *et al.* (2019)	Springer	1. Production	1. Assessing the current state of supply chain volatility: development of a benchmarking instrument
	Taylor & Francis	None	None
	OECD	None	None
15. Nitsche (2019)	Others		1. Unraveling the complexity of supply chain volatility management

Source: Review Data, (2023)

The articles were also published in diverse journals including Production Journal, Journal of Purchasing & Supply Management, International Journal of Physical Distribution & Logistics Management, Supply Chain Management International Journal among others also published the reviewed articles.

Journal of Publication

Table 4: Journal of Publication

S/No	Journal	Article	No. of Articles	(%)
1	Supply Chain Management: An International Journal	1. Measuring the financial effects of mitigating commodity price volatility in supply chains	1	6.67
2	International Journal of Physical Distribution & Logistics Management	1.Much discussed, little conceptualized: supply chain volatility 2. Supply Chain 2.0 revisited: a framework for managing volatility-induced risk in the supply chain	2	13.33
3	Interfaces	1. Incorporating Stochastic Lead Times Into the Guaranteed Service Model of Safety Stock Optimization 2. Mathematical Programming-Based Sales and Operations Planning at Vestel Electronics	2	13.33
4	Transportation Journal	1. Achieving Financial Performance in Uncertain Times: Leveraging Supply Chain Agility	1	6.67
5	Research in International Business & Finance	1. Supply chain management based on volatility clustering: The effects of CBDC volatility	1	6.67
6	Procedia Manufacturing Journal	1. Efficiently managing supply chain volatility – a management framework for the manufacturing industry	1	6.67
7	Business Horizons	1. 1>2? Less is more under volatile exchange rates in global supply chains	1	6.67
8	International Journal of Computer & Industrial Engineering	1. Demand forecasting in supply chain: The impact of demand volatility in the presence of promotion	1	6.67
9	Economic Modelling Journal	1. Price volatility spillovers between supply chain and innovation of financial pledges in China	1	6.67
10	Journal of Purchasing & Supply Management	1. Supply Chain Finance: A supply chain-oriented perspective to mitigate commodity risk and pricing volatility	1	6.67
11	Transportation Research Part D	1. Optimizing truckload operations in third-party logistics: A carbon footprint perspective in volatile supply chains	1	6.67
12	Production Journal	1. Assessing the current state of supply chain volatility: development of a benchmarking instrument	1	6.67
13	Others	1. Unravelling the complexity of supply chain volatility management	1	6.67

Source: Review Data, (2023)

From Table 4 above, it can be noted that various scholars in the field of supply chain volatility have published in top journals both nationally and internationally. The majority (13.33%) was published in the International Journal of Physical Distribution & Logistics Management, and the same number was also published in the interfaces journal in the period under review. The Supply Chain Management International Journal, the Transportation Journal, the Journal of Research in International Business & Finance, the Procedia Manufacturing Journal, the Business Horizons Journal, the International Journal of Computer & Industrial Engineering, the Economic Modelling Journal, the Journal of Purchasing & Supply Management, the Transportation Research Part D journal, the Production Journal and 'others' each published an article on supply chain volatility in the period under review, this indicated by a 6.67%.

Year of Publication

Table 5: Year of Publication

S/No	Author	Article	Year of publication	No. of Articles	%
1	Gaudencia *et al*. (2020)	1. Measuring the financial effects of mitigating commodity price volatility in supply chains	2020	3	20.00
2	Nitsche & Durach (2018)	1. Much discussed, little conceptualized: supply chain volatility	2018	3	20.00
3	Holweg (2017)	1. Supply Chain 2.0 revisited: A framework for managing volatility-induced risk in the supply chain	2017	1	6.67
4	Humair *et al* (2013)	1. Incorporating Stochastic Lead Times Into the Guaranteed Service Model of Safety Stock Optimization	2013	1	6.67
5	Taskin *et al*., (2015)	2. Mathematical Programming-Based Sales and Operations Planning at Vestel Electronics	2015	1	6.67
6	Gligor *et al*., (2019)	1. Achieving Financial Performance in Uncertain Times: Leveraging Supply Chain Agility	2019	4	26.67
7	Ding *et al*. (2022)	1. Supply chain management based on volatility clustering: The effects of CBDC volatility	2022	1	6.67
8	Nitsche Straube (2020)	1. Efficiently managing supply chain volatility – a management framework for the manufacturing industry	2020		
9	Kazaz (2014)	1. 1>2? Less is more under volatile exchange rates in global supply chains	2014	1	6.67
10	Abolghasemi *et al.* (2020)	1. Demand forecasting in supply chain: The impact of demand volatility in the presence of promotion	2020		
11	Hu *et al*., (2019)	1. Price volatility spillovers between supply chain and innovation of financial pledges in China	2019		
12	Pellegrino *et al*. (2018)	1. Supply Chain Finance: A supply chain-oriented perspective to mitigate commodity risk and pricing volatility	2018		
13	Wong *et al*., (2018)	1. Optimizing truckload operations in third-party logistics: A carbon footprint perspective in volatile supply chains	2018		
14	Nitsche *et al.* (2019)	1. Assessing the current state of supply chain volatility: development of a benchmarking instrument	2019		
15	Nitsche (2019)	1. Unraveling the complexity of supply chain volatility management	2019		

Source: Review Data, (2023)

Examining Table 5 above on the year of publication, 4 articles representing 26.67% were published in 2019. Furthermore, 3 articles representing 20% were published in the years 2020 and 2018 while 1 article representing 6.67% was published in 2014, 2022, 2017, 2013, and 2015 respectively.

Country of Publication

Table 6: Country of Publication

S/No	Country	Author	No. of Publication	Percentage
1	Italy	Gaudencia *et al*. (2020) Pellegrino *et al*. (2018)	2	13.33
2	Germany	Nitsche & Durach (2018) Holweg (2017) Nitsche Straube (2020) Nitsche *et al.* (2019) Nitsche (2019)	5	33.33
3	Pakistan	Humair *et al* (2013)	1	6.67
4	Turkey	Taskin *et al*., (2015)	1	6.67
5	USA	Gligor *et al*., (2019) Kazaz (2014)	2	13.33
6	China	Ding *et al*. (2022) Hu *et al*., (2019)	2	13.33
9	Australia	Abolghasemi *et al.* (2020)		
10	Hong Kong	Wong *et al*., (2018)	1	6.67

Source: Review Data, (2023)

The majority of the studies (5) originated from Germany making up 33.33% of the reviewed studies. Furthermore, the studies were carried out by only two (2) scholars (Nitsche *et al.*) and Holweg (2017) between the years 2017 to 2018. It is important to note that Nitsche has majorly and frequently written on supply chain volatility. On the same note, Italy, USA, and China contributed 13.33% of the articles each while Pakistan, Turkey, and Hong Kong contributed 6.67% of the articles each.

Industry of Publication

Table 7: Industry of Publication

S/No	Industry of Publication	Article	Unit of analysis	No. of Articles	%
1	N/A- Review Paper	1. Measuring the financial effects of mitigating commodity price volatility in supply chains	N/A	4	26.67
	N/A- Review Paper	1. Supply Chain 2.0 revisited: A framework for managing volatility-induced risk in the supply chain	N/A		
	N/A- Review Paper	1. Incorporating Stochastic Lead Times Into the Guaranteed Service Model of Safety Stock Optimization	N/A		
	N/A- Review Paper	1. Price volatility spillovers between supply chain and innovation of financial pledges in China	N/A		
2	Service Industry and Review Paper	1.Much discussed, little conceptualized: supply chain volatility	Supply Chain Managers	4	26.67
	Service industry	1. Efficiently managing supply chain volatility – a management framework for the manufacturing industry	Supply Chain Managers		
	Service Industry	1. Unraveling the complexity of supply chain volatility management	Supply Chain Managers		
	Service Industry and Review Paper	1. Achieving Financial Performance in Uncertain Times: Leveraging Supply Chain Agility	Supply Chain Managers		
3	Electronics sector	2. Mathematical Programming-Based Sales and Operations Planning at Vestel Electronics	N/A	1	6.67
4	Manufacturing industry	1. Supply chain management based on volatility clustering: The effects of CBDC volatility	Supply Chain Managers	3	20.00
	Manufacturing industry	1. 1>2? Less is more under volatile exchange rates in global supply chains	Production Managers		
	Manufacturing & Automotive industry	1. Assessing the current state of supply chain volatility: development of a benchmarking instrument	Production Managers		
5	Hotel & Foods Company	1. Demand forecasting in supply chain: The impact of demand volatility in the presence of promotion	Hotel & Food Managers	1	6.67
6	Fast Moving Consumer Goods	1. Supply Chain Finance: A supply chain-oriented perspective to mitigate commodity risk and pricing volatility	Consumer Goods Leaders	1	6.67
7	Logistics firms	1. Optimizing truckload operations in third-party logistics: A carbon footprint perspective in volatile supply chains	Fleet managers	1	6.67

Source: Review Data, (2023)

The results from Table 7 depict that majority of the studies were published in the service industry by targeting supply chain managers in the service firms. This were 4 articles which accounted for 26.67%. Therein, another 26.67% were review papers published either as Systematic Literature Reviews (SLR) or desk study reviews. The articles thus were not specific on industry or sector. Examining the results, 20% of the articles were carried out in

manufacturing firms, while Fast Moving Consumer Goods, Logistics, Hotel & Foods and the electronic sector made up 6.67% of the articles respectively.

Methodology & Approach of the Article

Table 8: Methodology & Approach of Studies

S/No	Methodology & Approach	Article	No. of Articles	Percentage
1	Literature Review	1. Measuring the financial effects of mitigating commodity price volatility in supply chains	6	40
	Literature Review	1. Supply Chain 2.0 revisited: a framework for managing volatility-induced risk in the supply chain		
	Literature Review	1. Incorporating Stochastic Lead Times Into the Guaranteed Service Model of Safety Stock Optimization		
	Literature Review	1. Price volatility spillovers between supply chain and innovation of financial pledges in China		
	Literature Review	1.Much discussed, little conceptualized: supply chain volatility		
	Literature Review	1. Achieving Financial Performance in Uncertain Times: Leveraging Supply Chain Agility		
2	Conceptual Model	1. Efficiently managing supply chain volatility – a management framework for the manufacturing industry	5	33.33
	Conceptual Model	2. Mathematical Programming-Based Sales and Operations Planning at Vestel Electronics		
	Conceptual Model	1. 1>2? Less is more under volatile exchange rates in global supply chains		
	Conceptual Model	1. Assessing the current state of supply chain volatility: development of a benchmarking instrument		
	Conceptual Model	1. Supply chain management based on volatility clustering: The effects of CBDC volatility		
3	Exploratory study	1. Unraveling the complexity of supply chain volatility management	4	26.67
	Exploratory study	1. Demand forecasting in supply chain: The impact of demand volatility in the presence of promotion		
	Exploratory study	1. Supply Chain Finance: A supply chain-oriented perspective to mitigate commodity risk and pricing volatility		
	Exploratory study	1. Optimizing truckload operations in third-party logistics: A carbon footprint perspective in volatile supply chains		

Source: Review Data, (2023)

Examining the methodology and approach of articles from the table 8 above, majority of the studies were reviews accounting for 40% of all the studies. This were 9 of the 15 articles. This was followed by conceptual paper models which made up 33.33% of all the articles. Lastly, a paltry 26.67% of all the studies were exploratory studies.

Sources of Supply Chain Volatility

Table 9: The Sources of Supply Chain Volatility

S/No	Author	Study	Source of Volatility
1	Gaudencia *et al.* (2020)	1. Measuring the financial effects of mitigating commodity price volatility in supply chains	1. Price variation
2	Nitsche & Durach (2018)	1.Much discussed, little conceptualized: supply chain volatility	1. Unstable production 2. Organization misalignment 3. Inaccurate forecasting 4. Price Variation 5. Mis ordering 6. Mis coordination 6. Lead time variations 7. Mis visibility 8. Supply variability 9. Supply chain stakeholder misbehavior 10. Competition 11. Seasonality 12. Disruptive innovations 13. Short product life cycles 14. Firm financial instability 15. Environmental phenomena 16. Legal-political instability
3	Holweg (2017)	1. Supply Chain 2.0 revisited: a framework for managing volatility-induced risk in the supply chain	1. Disruptive innovations 2. Price variations 3. Demand variation 4. Political instability 5. Financial instability
4	Humair *et al* (2013)	1. Incorporating Stochastic Lead Times Into the Guaranteed Service Model of Safety Stock Optimization	1. Demand variability 2. Lead time variations
5	Taskin *et al*., (2015)	2. Mathematical Programming-Based Sales and Operations Planning at Vestel Electronics	1. Demand variability 2. Lead time variations
6	Gligor *et al*., (2019)	1. Achieving Financial Performance in Uncertain Times: Leveraging Supply Chain Agility	1. Environment uncertainty
7	Ding *et al*. (2022)	1. Supply chain management based on volatility clustering: The effects of CBDC volatility	1. Price variation 2. Production variations
8	Nitsche Straube (2020)	1. Efficiently managing supply chain volatility – a management framework for the manufacturing industry	1. Production variability
9	Kazaz (2014)	1. 1>2? Less is more under volatile exchange rates in global supply chains	1. Production variability
10	Abolghasemi *et al*. (2020)	1. Demand forecasting in supply chain: The impact of demand volatility in the presence of promotion	1. Demand variability
11	Hu *et al*., (2019)	1. Price volatility spillovers between supply chain and innovation of financial pledges in China	1. Price variations 2. Demand variability
12	Pellegrino *et al*. (2018)	1. Supply Chain Finance: A supply chain-oriented perspective to mitigate commodity risk and pricing volatility	1. Price variations 2. Demand variability
13	Wong *et al*., (2018)	1. Optimising truckload operations in third-party logistics: A carbon footprint perspective in volatile supply chains	1. Environment uncertainty
14	Nitsche *et al.* (2019)	1. Assessing the current state of supply chain volatility: development of a benchmarking instrument	1. Production variations 2. Organization misalignment 3. Inaccurate forecasting 4. Price Variation 5. Mis ordering 6. Mis coordination 6. Lead time variations 7. Mis visibility 8. Supply variability 9. Supply chain stakeholder misbehavior 10. Competition 11. Seasonality 12. Disruptive innovations 13. Short product life cycle 14. Firm financial instability 15. Environmental phenomena 16. Legal-political instability
15	Nitsche (2019)	1. Unaravelling the complexity of supply chain volatility management	1. Production variations 2. Organization misalignment 3. Inaccurate forecasting 4. Price Variation 5. Mis ordering 6. Mis coordination 6. Lead time variations 7. Mis visibility 8. Supply variability 9. Supply chain stakeholder misbehavior 10. Competition 11. Seasonality 12. Disruptive innovations 13. Short product life cycle 14. Firm financial instability 15. Environmental phenomena 16. Legal-political instability

Source: Review Data, (2023)

From Table 9, it can be seen that various studies have alluded many different sources of supply chain volatility. For example, Gaudencia *et al.* (2020) recoded price variability as the source of supply chain volatility in his articles. This was also shared by other previous studies (Nitsche & Durach, 2018; Holweg, 2017; Ding *et al*., 2022; Hu *et al*., 2019; Pellegrino *et al*., 2018;

Nitsche *et al.*, 2019; Nitsche, 2019) who also adopted price uncertainty as the source of volatility.

Demand variability was however used by majority of the studies in different contexts (Nitsche & Durach, 2018; Holweg, 2017, Humair *et al*., 2013; Taskin *et al*., 2015; Abolghasemi *et al*. 2020; Pellegrino *et al*., 2018; Nitsche *et al*., 2019; Nitsche, 2019) implying that it was the major source of supply chain volatility having been adopted by majority of the studies (9) based on the systematic review of the literature over the past decade between 2013 to 2023.

Demand Variability as the Major Source of Supply Chain Volatility

The systematic literature review results found out that demand variability as a source of supply chain volatility was used by majority of scholars, implying that it is a major source of volatilities in the supply chain. A total of 9 studies out of the 15 final articles that were included in the final analysis adopted demand variability as a source of volatility.

Table 10: Demand Variability as a Major Source of Supply Chian Volatility

Source of SCV	Authors
Demand variability	1.Nitsche & Durach, (2018) 2. Holweg, (2017) 3. Humair *et al*., (2013) 4.Taskin *et al*., (2015) 5. Abolghasemi *et al*. (2020) 6. Hu *et al*., (2019) 7. Pellegrino *et al*. (2018) 8. Nitsche *et al*. (2019) 9. Nitsche (2019)

Source: Review Data, (2023)

Abolghasemi *et al*. (2020) show that the variations in demand for products causes turbulence and volatility in the entire supply chain and this can be detrimental in achieving objective of a chain network. Hu *et al*. (2019) remarks that the rise in volatilities across a chain network results in the failure of the products to be delivered as per when and where they are required, meaning that this may result into firm-customer conflicts.

Conclusion

The study conducted a review of the sources of supply chain volatility between the year 2013 to 2023. From the results, it is evident that majority of studies in supply chain volatility were carried out in 2019. The major attention of the studies was carried out in the Germany with the International Journal of Physical Distribution & Logistics Management and the interfaces journal publishing the highest number of articles. The highest concentration of the articles was in service sector. It is also established that many of the reviewed articles in this paper carried out on the sources of supply chain volatility were review papers.

From the analysis of the reviewed articles and mined extant literature, 15 articles are mined and analyzed to pinpoint the sources of supply chain volatility employed by the studies. The paper presents a taxonomy of the sources of SCV for every study which has been found out. We present this studies in the field of SCV, giving a brief account of the papers in the context of the author, year of publication, type of study, the sector/industry of the study, the country of origin for the studies and the journal which published the studies. In the reviewed papers the

study presents findings that demand variability is the main source of SCV, is the highly adopted source of SCV and therefore advises stakeholders to pay attention in marching their demand and supply.

Recommendations and Research Agenda

It is found out that variability of demand in supply chain firms has been employed by majority of the reviewed articles as a source of supply chain volatility. It is therefore recommended that more study be done to explore the ways of managing demand variability in supply chain firms especially in service organization. There is a gap in literature for a research on challenges facing demand management in different contexts. In the same vein, we recommend that a study be carried out on the ways of managing demand and supply.

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