South Asian Journal of Operations and Logistics
2022 Vol. 1, No. 1, pp. 1-13
Article: SAJOL-2201

Supply Chain Networks, Complexity, and Optimization in Developing Economies: A Systematic Literature Review and Meta-Analysis

Neelam Baloch[1*]
Aamir Rashid[2]

[*1]*Research Scholar, Department of Business Administration, Iqra University, 75500, Karachi, Pakistan*
[2]*Assistant Professor, Department of Business Administration, Iqra University, 75500, Karachi, Pakistan*

**Corresponding Author Email: balochneelam@gmail.com*

Article History

Received: 16 June 2022
Revised: 25 June 2022
Accepted: 27 June 2022
Published: 28 June 2022

JEL Classification:
R41
C61
D51
D12

ABSTRACT

By studying journal articles, the current study has benefited in assessing numerous significant issues, research trends, and breakthroughs in the supply chain management industry. The journals from renowned publishers, e.g. Emerald, Taylor and Francis, Elsevier, Wiley, and Cambridge, were considered for review purposes. All the articles included in this review were conducted in developing countries only. Articles published between 2019 and 2022 by the above publishers were considered for this review. For this review, only articles written in English were included; no articles written in other languages were considered. It is clear from the selected publications that many research areas remain unexplored, and the area is still in its early phases. Moreover, despite the articles' stated objectives and future directions, just a few studies attempted to fill the gaps. The notion of the supply chain has grown in relevance in developing nations and industrialized countries, and its popularity and awareness have increased in recent years. It has been embraced in developing countries due to increased outsourcing and its applicability across various industries. There are certain advantages to using SCM, such as the fact that it may be used in practically any industry sector. Adopting is critical for nations involved primarily in exporting to maintain international quality standards.

Keywords: *Supply chain, Networks, complexity, Product, Process, Environmental, Uncertainty, Demand*

Citation of this article:

Baloch, N. & Rashid, A. (2022). Supply Chain Networks, Complexity, and Optimization in Developing Economies: A Systematic Literature Review and Meta-Analysis. *South Asian Journal of Operations and Logistics, 1*(1), 1-13.

Supply Chain Networks, Complexity, and Optimization in Developing Economies: A Systematic Literature Review and Meta-Analysis

1. Introduction

In today's market, the competition among firms is increasing in an ever-changing business environment. Thus, to gain a competitive advantage in global trade, SCM has been defined as one of the most valuable strategies among the tools available to executives. To secure market position, it is now considered a powerful tool (Chowdhury et al., 2019). Although the supply chain is the most effective strategy, some issues create complexities. These complexities over the last decades have been increasing and have no desirable features. The supply chain negatively impacts operations by triggering disruptions and complicating decision-making (Piya et al., 2020).

A supply chain is a web of interconnected facilities. It is intended to buy, produce, and deliver items to clients in the appropriate amounts, places, and times. The information and material movement in the supply chain essentially associate operational uncertainties and structural variations with internal and external sources. These can be anticipated, unexpected predicted, and unpredicted (Bhat & Kumar, 2018). Complicated situations can arise for a variety of reasons. Complex circumstances are created by external variables such as geographic-specific law restrictions, market uncertainty, and cross-country trade commitments. On the consumer side, complexity leads to competition driven by client desires for individualized products and services, ever-changing customer demand, and sustainability preferences (Tarei et al., 2021).

The interconnected movements of resources, finances, and information contribute to the high degrees of complexity (Chand et al., 2018). The critical complexity drivers are uncertainty and a variety of material and information. Understanding a system's complexity is the first step toward comprehending the system's behaviour. Complexity is characterized, assessed, studied, decreased, and avoided to manage it effectively and efficiently (Chand et al., 2020). The focus company and its SCM must identify SCC drivers to manage risk, increase performance, and limit the likelihood of interruption. Supply chain monitoring and management will succeed more if SCC drivers are prioritized. A priority ranking of these drivers based on their effect on total SCC is crucial for supply chain strategic planning, which includes identifying, prioritizing, controlling, and reducing SCC drivers (Chand et al., 2018).
Firms must monitor their supply networks in real-time to succeed in today's competitive business climate. Furthermore, the expanding trend of market competitiveness, as well as more significant client needs and preferences, is generating a complex picture in the global corporate environment (Piya et al., 2020).

In addition, most collaborative innovation methods within a multiproduct supply chain network use the partners' expertise and resources to exploit assets in ways neither could do alone. As a result, companies may learn from one another and profit from new knowledge created through joint innovation efforts (Wang & Hu, 2020). In collaborative creative efforts, knowledge sharing frequently needs time, patience, and iterations (Fernando & Wulansari, 2020). Firms must regularly engage in joint innovation activities to benefit from increased knowledge exchange and performance levels. This will eventually help gain maximum optimization inside a supply chain (Wang & Hu, 2020). Finally, when it comes to the SC partners (Liao, 2020), firms can use their supply chain partners' aggregate knowledge and experience to learn, adapt, and respond in an integrated manner. They may adjust to environmental circumstances and improve performance. Understanding culture and widespread cooperation, which might be crucial to creating and implementing skills, enable the capacity to adapt effectively and fulfil increased consumer expectations in developing economies (Iyer et al., 2019). Therefore, to understand the outcomes and findings of the recent literature regarding supply chain networks, complexity and optimization in developing economies.

The study (meta-analysis) would be used to determine the significant importance and to produce a more comprehensive knowledge to understand the current trends related to the supply chain complexities. Also, the research gives us a more in-depth look at the risks, safety data, and advantages. Moreover, the study has aggregated the findings of numerous selected randomized controlled trials that would represent the highest level of evidence on the evidence hierarchy, followed by systematic reviews, which examine all known research on a subject. The work adds to the body of knowledge in the recent literature regarding supply chain networks, complexity and optimization in developing economies. Furthermore, this is the first empirical study to look at the recent literature regarding supply chain networks in emerging economies. The findings will be used by various stakeholders interested in future work regarding SC networks and their complexity.

2. Literature Review

2.1 Supply Chain Networks

A supply chain network, which assesses the programs and policies that impact the supply chain, describes the movement of goods and information. A successful SC is desired by most of a company's business divisions (Dubey et al., 2020). A supply chain network design records these contacts, monitors progress and establishes long-term objectives. To optimize earnings and remain ahead of the competition, businesses use supply chain network designs (Díaz-Reza et al., 2020). The present supply chain's ability to adapt to changes is critical. Significant infrastructure modifications may be required due to new procedures (Zhao et al., 2021). Supply chain networks simulate the current state of the supply chain and a future one that incorporates cost-cutting, time-saving, and product delivery enhancements. New warehouses and suppliers may be used to solve resource and geographical restrictions (Dubey et al., 2020).

Table 1: Various definitions of SC networks

1	SCNs are a complex network structure with various contexts for each relationship inside it (Fernando et al., 2020).
2	SCNs are a collection of interconnected SCs that depict the whole flow of products and services from original suppliers to end customers as viewed through the eyes of a focused business (Dubey et al., 2020).
3	SCN is described as the efficient fulfilment of customer demand through the forward network's production and distribution of products and the safe management of products through the reverse network (Kavilal et al., 2018).
4	SCNs are "exchange relationships" between suppliers, customers, and their partner firms, which are required to manufacture and distribute products and services to the market (Liao, 2020).
5	An SCN is a collection of suppliers, manufacturing plants, warehouses, and distribution routes dedicated to acquiring raw materials, converting them into completed goods, and delivering them to customers (Felipe et al., 2020).
6	SCNs are a larger group of collaborating companies, both upstream and downstream, that work together to deliver high-value products to customers (Wang & Hu, 2020).
7	SCNs are complex systems composed of various sub-networks that correlate to different products that firms supply to the market (El Baz et al., 2018).
8	An SCN is a collection of interdependent partners (and their decisions) interacting in a form that reflects the supply chain's overall interdependence structure (Prajogo & Sohal, 2013).
9	An SCN is a collection of related companies whose various operations and activities generate value (Pham & Doan, 2020).
10	SCN is a network of interconnected supply chains connecting suppliers to end customers (Zhao et al., 2021).

2.2 Supply Chain Complexity

The largely abstract nature of what constitutes "complexity" has made it challenging to theories reaction repertoires and provide managerial direction (Piya et al., 2020). Supply chain complexity is an increasingly important problem that organizations must manage to mitigate its adverse effects while supporting and embracing the creation of competitive advantage (maybe counterintuitively). Researchers in the field of SCM has been working to improve their understanding of supply network complexity and the range of possible responses (Turner et al., 2018). SC complexity is influenced by various factors, including the number of suppliers, the degree of diversification among them, delivery

lead time and supplier reliability, the amount of global sourcing, the level of inter-relationship among them, and so on. Identifying and prioritizing the sources of SC complexity is the first step toward SC complexity management (Piya et al., 2020).

Table 2: Various definitions of SC complexity

1	SCC is described as any property of a supply chain that increases complexity, and it may be characterized as static, dynamic, or decision-making depending on how it is generated (Chand et al., 2020).
2	The number of participants and product lines in a focus firm's supply chain network is referred to as supply chain complexity (SCC) (Anin et al., 2021).
3	The amount of detail and dynamic complexity displayed by SC items, processes, and interactions (Turner et al., 2018).
4	SCC describes all operational uncertainties and structural changes along the supply chain that are known, unknown, expected, unexpected, forecast, or unpredicted due to internal or external factors via information and material flows (Kavilal et al., 2017).
5	SCC is described as a set of operational, structural, and behavioural changes caused by uncertainties and variations that occur both expectedly (predicted) and unexpectedly (unpredicted) as a result of internal and external drivers of the SC system (Sopha et al., 2021).
6	The unpredictability created by demand volatility and interactions within the supply network is known as SCC (Roscoe et al., 2020).
7	The extent to which an organization's supply chain is made up of various elements that interact unexpectedly is referred to as SCC (Fernando & Wulansari, 2020).
8	The interconnection and interdependencies across a network, where a change in one element can affect other elements, are referred to as SCC (Tse et al., 2021).
9	SCC is called the unpredictability of a system's behaviour to a given set of inputs (Piya, Shamsuzzoha, Khadem, et al., 2020).
10	SCC is described as internal differences or variations impacted by the number of subsystems or the level of interaction in the organization (Budiono et al., 2021).

2.3 Supply Chain Optimization

Supply chain optimization makes the most of technology and resources like blockchain, AI, and IoT to improve efficiency and performance in a supply network. A company's supply chain is a critical business function that assures a great customer experience (Wang & Hu, 2020). Customers get what they want, when and where they want it, thanks to a high-performing supply chain that is both lucrative for the company and helps to supply chain sustainability (Wang & Hu, 2020). Supply chains are complicated, but they pay off in terms of technology, particularly when block chain is integrated with AI and IoT (Wang & Hu, 2020).

Table 3: Various definitions of SC optimization

1	SCO refers to the most efficient utilization of resources in completing client orders across a network of organizations subject to limits and limitations on resource consumption and flow (Hassini, 2008).
2	SCO, which is a significant factor of strategic resource mobility along the value-added chain, enables each participant in the global network to maximize their unique strategic competency (Yoo et al., 2010).
3	The supply chain operation is the fundamental business. 4PL firms offer complete system solutions for businesses supply chain needs, leveraging third-party logistics service providers' transportation, warehousing, and other activities to create logistics solutions. SCO refers to the optimal operation of a production and distribution supply chain. This entails optimizing inventory placement along the supply chain while minimizing operational expenses, including manufacture, shipping, and distribution. Using computer software to use mathematical modelling approaches is common in optimization (Li et al., 2012).
4	SCO is the process of combining resources in an SC to eliminate bottlenecks and other difficulties that slow down the process and allow the supply chain to run more smoothly, quickly, and efficiently (Khayyat, 2015).
5	The formulation of policies that improve the performance of the supply chain as a whole while guaranteeing enough incentives for each member is what SCO involving many firms is all about (Gjerdrum et al., 2001).
6	SCO is more important than ever before for the success of industrial organizations. SC optimization involves reducing costs and inventories through optimizing a company's R&D, material supply, production, and distribution operations. The concept of optimization has laid the groundwork for large-scale optimization of a company's supply, production, and distribution activities to minimize costs and inventories (Garcia & You, 2015).

3. Methodology

The current study used a quantitative approach. Quantitative may be characterized as a data collection method based on numerical or statistical data (Glesne, 2015; Khan et al., 2022; Rashid et al., 2020; Rashid et al., 2021; Hashmi & Tawfiq, 2020; Hashmi et al., 2020a, b; Rashid et al., 2019; Rashid & Amirah, 2017; Rashid, 2016). This approach was chosen because it was simple to plan and carry out the data collection process, allowing for the statistical analysis of enormous amounts of data. Furthermore, the outcomes of a quantitative method may be applied to various scenarios (Saunders et al., 2009; Hashmi et al., 2020; Hashmi et al., 2021). Cross-sectional studies collect data on several variables during a short period, whereas longitudinal studies collect data over a longer period (Mednick et al., 1984). Another thing to remember is that, unlike cross-sectional research, longitudinal studies allow for variations in measurement and explanation over time (Menard, 2007). Following these considerations, the researchers decided on a cross-sectional time frame and data collection based on a single period, assuming that the relationship between variables would remain constant across time.

3.1 Selection of Articles

PRISMA stands for Preferred Reporting Items for Systematic Reviews and Meta-Analyses (SLR). It is evidence-based and a minimum set of elements for systematic reviews and meta-analyses. PRISMA is used to inform reviewers and readers about what the authors did and discovered, enhance reporting quality, and speed up the review process (Abelha et al., 2020). PRISMA diagram provides the number of articles reviewed at each level. Include information on the included research characteristics, the risk of bias (quality assessment), and the outcomes across studies. Summarize the major conclusions, including the strength of the evidence and the review's limitations (Oláh et al., 2020).

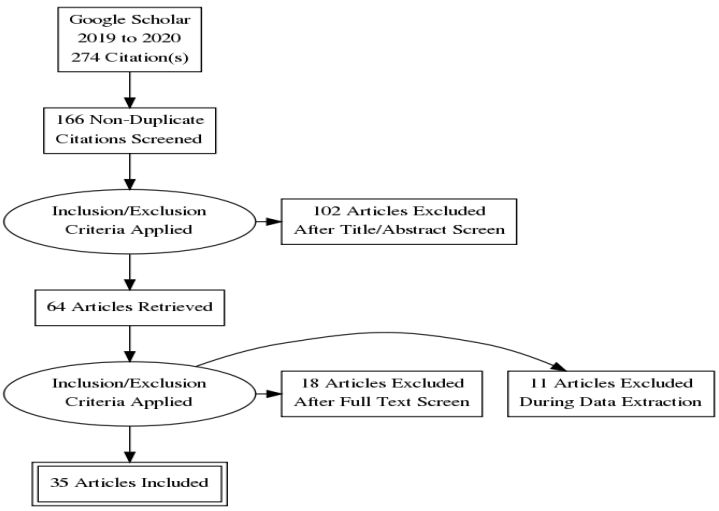

Figure 1: PRISMA Model

Google Scholar was used to finding 274 citations from the years 2019 to 2022. Through screening, 108 citations were duplicated, while the remaining 166 were found non-duplicated. Then, using an inclusion and exclusion criterion, 102 papers were screened and excluded based on their titles and abstracts, and 64 articles were retrieved. After that, 18 articles were excluded based on full-text screening, and 11 were excluded during data extraction, according to the inclusion and exclusion criteria. Hence, in total, 35 articles were selected for this research.

3.2 Inclusion Criteria

The study has specifically included original journal articles published by renowned publishers, i.e. Emerald, Taylor and Francis, Elsevier, Wiley, and Cambridge, based on developing countries only. The study has also considered articles published between 2019 and 2022, while papers in the English

language were explicitly considered for SLR and meta-analysis. The study has considered the keywords of SC networks, SC optimization, and SC complexity (i.e. product complexity, process complexity, environmental complexity, supply uncertainty, demand uncertainty, environmental uncertainty) for search strategy.

3.3 Exclusion Criteria

The study has excluded conference papers, proceedings, theses and unpublished research, while SLRs and meta-analyses were not taken into analysis. The study also excluded published articles based on developed economies; longitudinal research was not considered. Lastly, the current SLR and meta-analysis have excluded articles with secondary sources (for instance, annual reports, databases, etc.) and studies related to the COVID-19 pandemic/epidemic.

4. Analysis

4.1 Different Perspectives of Supply Chain Networks

Organizations are becoming more competitive in today's market in an ever-changing commercial climate. SCM is one of the most effective ways for executives seeking a competitive edge in global commerce. As a result, the SC is increasingly seen as a significant weapon for securing market position (Chowdhury et al., 2019). Managing SC is a critical issue in every business area since an organization's success or failure greatly depends on its ability to manage its SC network. Companies must monitor their SC networks in real-time to succeed in today's competitive economic climate (Piya et al., 2020). SC improves profitability, adds value to consumers, and gives businesses a competitive advantage globally. It has become more critical as businesses recognize their core capabilities and seek synergies with their partners. SC businesses must deliver high-quality items in sufficient quantities (Gokarn & Kuthambalayan, 2019). SC enterprises have begun implementing SC methods to combat the turbulent market environment to improve their competitiveness. Product demand, diversity, and life cycle are all factors that impact the SC environment, making it more dynamic and unpredictable (Zimmermann et al., 2020).

4.2 Effective Supply Chain Networks Across Industries

Supply chain networks would become effective with the help of efficient supply chain management. The management of connections with consumers and suppliers with the objective of profitability for all members of the SC networks defines the success of SC enterprises through upstream and downstream communication (Chowdhury et al., 2019). SC techniques are frequently founded on research goals, experiences, and viewpoints, and they include dynamic and intrinsic complexities that help all sectors (Wu et al., 2019). Managing the SC is critical for gaining a competitive edge. Identifying, prioritizing, monitoring, and regulating the drivers or causes of supply chain complexity are all ways to manage supply chain complexity efficiently. Decision makers can apply appropriate solutions for managing complexity by examining and comprehending the complexity drivers and their interactions (Kavilal et al., 2018). When it is SSCM, the supply chain will be effective and efficient. The SC may achieve maximum sustainability by recognizing diverse factors, prioritizing mutual relationships, and including managers in decision-making. Firms should focus on stakeholder pressure, consumer pressure, and SC collaboration to achieve supply chain sustainability (Chand et al., 2020).

4.3 Antecedents of Supply Chain Complexity

While organizations must promote and embrace the creation of competitive advantage, SC complexity is recognized as an increasingly critical concern that must be addressed to limit its negative impact. A supply chain's product, operations, and interactions demonstrate a high degree of intricacy and dynamic complexity (Turner et al., 2018). Changes in the business environment contribute to the complexity of the businesses. These shifts are linked to increased product diversity, shorter product life cycles, and rising product development costs since they force businesses to explore beyond their

borders. The expanding trend of market competitiveness and increased client demand with more choices is creating a challenging picture in the global business environment (Piya et al., 2020).
Moreover, for several reasons, supply chain complexity has also been increasing. A global supply chain faces complex challenges due to external forces such as market uncertainty, cross-country trade commitments and geography-specific legal restrictions. Therefore, it has become essential for effective management of the supply chain in order to increase performance and customer satisfaction (Tarei et al., 2021). They are because inter-connected flows of materials, funds and information have a high level of complex results. The uncertainty and variety of materials and information create the main complexity drivers. Thus, to understand the system's behaviour, the first step is to understand the system's complexity (Chand et al., 2018).

4.4 Supply and Demand Uncertainty

Customers' requirements might differ. Supply and demand unpredictability can only be addressed by identifying unique demands and providing the appropriate items to fulfil various clients. Businesses must save operating costs by reallocating resources and eliminating duplicate work (Wang et al., 2020). Operational risk and disruption risks are the two forms of SC hazards. Cost uncertainties and internal variables are operational hazards that arise from challenges coordinating demand and supply. If the quality of raw materials, machine and labour availability, and utility and fuel prices fluctuate, demand shifting, and quality risk occur (Chowdhury et al., 2019). The firm's delaying mindset can handle customer expectations. When organizing the business's operations and supplier base to adapt to client requests, the firm using modularity will include it as a parameter. Suppliers must take a broader approach to mitigate demand uncertainty in an increasingly complicated and unpredictable competitive market (Wu et al., 2019). The need for individualized, tailored products and services is another element that contributes to demand and supply instability. On the customer side, constantly changing customer demand and preferences for sustainability have intensified global supply chain rivalry (Tarei et al., 2021).

4.5 Technological Aspects

Big data is used to find significant hidden values from large data sets that are varied, complicated, and large in scale. It is a collection of methods and technology that necessitate a new level of integration. However, due to big data technology and its application, new information techniques can be provided, which would help improve the current decision-making process (Wang et al., 2020). With technical innovation and market growth, supply chain complexity rises as companies are forced to incorporate new materials, products, processes, and supply chain, partners. The expense of addressing these complexities would decrease profit margin (Bhat & Kumar, 2018). Information technology is required by businesses to adapt quickly to changing environments. One of the drivers in inventory management is IT capabilities, which aid industrial industries in achieving effective company performance. Furthermore, supply chain organizations require IT to become more competitive since it serves as a tool for controlling hardware, software, service, management practices, and talents (Fernando et al., 2020).

4.6 Interlinkage between Risk and Complexity

Risk is increasing in today's complicated world. Manufacturers may routinely seek revisions to a new product to meet fast-changing customer requirements or to want enhancements to an existing product. Requests are necessary to reduce risk and uncertainty since they include modifications to product characteristics, manufacturing methods, and raw material components (Wu et al., 2019). The complexity was worsened by the risk of a lack of strategic coordination across SC stakeholders, who must be adaptable, agile, and cohesive. As a result, it is vital to enhance company SC management to decrease complexity while improving product design and development procedures (Piya et al., 2020). Because it must cope with elements such as currency volatility, heterogeneity of markets, cyclicality of markets, seasonality of markets, logistical needs, and unanticipated interruptions, operational complexity will arise in SC. As a result, the frequency of SC interruptions and complexity have a

positive connection (Tarei et al., 2021).

4.7 Product, Process and Environmental Complexity/Uncertainty

Environmental uncertainty comes under the term of disruption risks. It may arise from natural disasters, labour or political strikes, economic uncertainties and acts of purposeful agents such as terrorists. Environmental and safety issues can disrupt the supply network as they are significant concerns for suppliers (Chowdhury et al., 2019). Customer responsiveness is one of the end goals of an end-to-end supply chain, and responsiveness is now regarded as an essential performance parameter of competitive capabilities. As a result, as a critical element of the supply chain, businesses must adjust to product and market changes. In addition, company responsiveness is critical in attaining supply chain customer response (Ortega-Jimenez et al., 2020). Regardless of any type, complexity in the SC will negatively impact operations, trigger disruptions and complicate the decision-making process. Manufacturing a diverse range of components, subgroups, and finished products, as well as the requirement to distribute them to varied clients in various methods, adds complexity (Piya et al., 2020).

4.8 Enablers of Supply Chain Optimization

Supply base optimization reduces the complexity raised by the high number of suppliers and the use of blanket orders and inventory buffers as they are a sound barrier against supply uncertainty. Also, optimization of stock points will be resulted in by reduction in the warehouses. Also, a significant reduction can be seen in supply chain risk by well-defined freight routes and a reduction in channel inventories (Kavilal et al., 2018). Supply chain optimization can also be attained through organizational resilience. The organization can develop preventive capacity in order to face any unexpected disruptions. Also, it helps in taking the necessary and quick actions to respond and recover from that disruptions to ensure business continuity (Jia et al., 2020).

4.9 Barriers/Hindrance to Supply Chain Optimization

Many inhibitors of supply chain sustainability have impacted the supply chain's mutual interactions and overall performance. External and internal are the two categories of supply chain inhibitors depending on the origin and overall impact on the organization (Tarei et al., 2021). Supply chain optimization is required to execute maximum tasks; however, due to a lack of flexibility, the supply chain firms can face a multitude of challenges as the flexible supply chain can be effectively adapted to supply disruptions and changes in demand while maintaining customer service levels (Díaz-Reza et al., 2020). Another major obstacle to the development of the supply chain is the inability to collaborate and trust. Because it often needs sensitive information, a high rate of collaboration failure often results from it. Firms often lack an understanding of how different levels of information sharing can accommodate demand variance, which also becomes a setback in obtaining optimization (Fernando et al., 2020).

5. Discussions

The current study has aided in the exploration of various significant challenges, research trends, and advances in the supply chain management sector by examining published publications. It is clear from the selected publications that many research lines remain unexplored, and the area is still in its early phases. In addition, despite the articles' declared goals and future directions, just a few studies sought to fill in the gaps. The notion of sustainability has grown in relevance in developing nations and industrialized countries, and its popularity and awareness have increased in recent years. It has been embraced in developing countries due to increased outsourcing and its applicability across various industries. There are certain advantages to using SSCM, such as the fact that it may be used in practically any industry sector. Adopting is critical for nations involved primarily in exporting to maintain international quality standards. From the data attained from published articles supply chain has been discussed under several headings. The perspective of a supply chain, in addition to its effectiveness, complexities, technological aspects, uncertainties, risk and optimization, has been discussed. The

findings suggested that supply chain management is essential to gain a competitive advantage in the ever-dynamic and volatile business environment. However, solely adopting a supply chain is of no use to the business if complexities related to it are not controlled. Also, due to the era of digitalization and the fact that the supply chain effectively works when information flow is good, technology integration is essential in the supply chain. With the help of technology such as big data, the flow of information throughout the process becomes feasible. Moreover, risk related to product, processes and environment has been highlighted, but these could be prevented if supply chain management focused on optimization. In order to attain optimization, supply chain firms should develop strategies through which flexibility, responsiveness, collaboration and resilience could be gained.

6. Conclusion

Previous reviews were studied as described earlier before conducting the literature review. It was observed that most of these articles focused on a particular theme instead of covering overall aspects of the SSCM research domain. Hence the study helps analyze the development of SSCM across several research threads. It is also observed that the highest adaptation of SSCM within the system is mostly by manufacturing firms. The findings suggested that globally, supply chain management has gained importance among firms. Because it acts as a strategy for gaining a competitive advantage, many firms across the globe have started to instigate it into their process. However, the supply chain must consider certain aspects to be effective. These include effective decision-making and information sharing.

Considering the risk, the findings indicated that since the supply chain is a process of providing products and analyzing data, certain complexities exist. These complexities are mostly related to customer, product, process, environment and collaboration. Out of these most important are supply and demand uncertainty. Demand uncertainty increases specifically when consumers require a personalized product. However, this could be controlled by implementing postponement and flexibility strategies. In the era of digitalization, technology has benefitted almost every sector, but it has become imperative for a supply chain to incorporate the technological method into the process. With the help of big data and other technological software, supply management has become efficient. Managers can now gain information within seconds as big data help gather large into short and precise form. Due to a volatile environment, risk increases among businesses. In the supply chain, risk leads to uncertainties. The primary reason that develops risk is the shifting of consumer requirements from an existing product to a new one. Subsequently, operational complexities along with uncertainties of product design developed. However, the study suggested that flexibility, responsiveness, resilience and collaboration can reduce risk and uncertainties among supply chain firms.

7. Identified Research Gaps

Drivers created by interactions between manufacturers, consumers, assemblers, distributors, and retailers create complications in the SC network. Many studies have been conducted to comprehend the intricacy of SCs better. In the literature, the phrase has been addressed from numerous perspectives (Piya et al., 2020). However, no previous research has attempted to comprehend the primary factors that cause complexity in SC and the link between one driver and the others in terms of complexity. The nature of processes and connections is more important in the empirical research of supply chain relationships (SC) than the influence of supply chain relationship quality on performance. As a result, prior research has focused chiefly on the interactions between characteristics of the supply chain relationship, such as trust, collaboration, and flexibility, rather than on understanding the outcomes and findings of the recent literature regarding supply chain networks, complexity and optimization in developing economies (Pham & Doan, 2020). Furthermore, the previous research has not explained the enablers of the supply chain.

Over the last several decades, SCRM has piqued the interest of Operations Management, with most research focusing on supply chain disruption (Tse et al., 2021). However, there is still a research gap in managerial action to reduce the negative impact of production quality risk, indicating that managers and researchers are not given enough guidance on the nature of SCQR or how to establish

appropriate risk management practices (Chand et al., 2020). As a result, there is a paucity of research on enhancing SCQM to lower SCQR (Tse et al., 2021).

8. Limitations and Future Research

This study has certain limitations. This study has only worked upon the three variables: SC network, SC optimization and SC complexity. Future researchers might consider other components apart from these. This study has only considered the papers of the past five years, whereas the potential researchers might work on papers other than the previous five years. Also, this research has only studied the developing economies, which constitutes another restriction. Future researchers should consider the developed countries as well for more authentic results.

Moreover, as we did not have quantifiable data and limited data from empirical studies, the study has not scrutinized the effects, results and modeling frameworks. Future studies must work on keywords for which the model frameworks are readily available. Also, the paper has not undertaken the theoretical perspective, so future researchers must take the content with the theoretical perspective while doing a meta-analysis.

References

Abelha, M., Fernandes, S., Mesquita, D., Seabra, F., & Ferreira-Oliveira, A. T. (2020). Graduate employability and competence development in higher education—a systematic literature review using PRISMA. *Sustainability*, *12*(15), 5900.

Anin, E. K., Boso, N., & Asamoah, D. (2021). Moderating effect of supply chain complexity in governance mechanisms and operational performance relationship: Evidence from a sub-Saharan African market. *Africa Journal of Management*, *7*(3), 400-422.

Bhat, S. A., & Kumar, A. (2018). An integrated fuzzy approach for prioritizing supply chain complexity drivers of an Indian mining equipment manufacturer by Kavilal, EG, Venkatesan, SP, Kumar, KDH,[Resour. Policy 51 (2017) 204–218]: Suggested modification. *Resources Policy*, *57*, 278-280.

Budiono, H. D. S., Nurcahyo, R., & Habiburrahman, M. (2021). Relationship between manufacturing complexity, strategy, and performance of manufacturing industries in Indonesia. *Heliyon*, *7*(6), e07225.

Chand, P., Thakkar, J. J., & Ghosh, K. K. (2018). Analysis of supply chain complexity drivers for Indian mining equipment manufacturing companies combining SAP-LAP and AHP. *Resources Policy*, *59*, 389-410.

Chand, P., Thakkar, J. J., & Ghosh, K. K. (2020). Analysis of supply chain sustainability with supply chain complexity, inter-relationship study using delphi and interpretive structural modeling for Indian mining and earthmoving machinery industry. *Resources Policy*, *68*, 101726.

Chowdhury, N. A., Ali, S. M., Mahtab, Z., Rahman, T., Kabir, G., & Paul, S. K. (2019). A structural model for investigating the driving and dependence power of supply chain risks in the readymade garment industry. *Journal of Retailing and Consumer Services*, *51*, 102-113.

Díaz-Reza, J. R., García-Alcaraz, J. L., Avelar-Sosa, L., & Mendoza-Fong, J. R. (2020). The role of employees' performance and external knowledge transfer on the supply chain flexibility. In *Techniques, Tools and Methodologies Applied to Global Supply Chain Ecosystems* (pp. 25-51). Springer.

Dubey, R., Gunasekaran, A., Childe, S. J., Papadopoulos, T., Luo, Z., & Roubaud, D. (2020). Upstream supply chain visibility and complexity effect on focal company's sustainable performance: Indian manufacturers' perspective. *Annals of Operations Research*, *290*(1), 343-367.

El Baz, J., Laguir, I., & Stekelorum, R. (2018). Logistics and supply chain management research in Africa: A systematic literature review and research agenda. *The International Journal of Logistics Management*.

Felipe, C. M., Leidner, D. E., Roldán, J. L., & Leal-Rodríguez, A. L. (2020). Impact of IS capabilities on firm performance: the roles of organizational agility and industry technology intensity. *Decision Sciences*, *51*(3), 575-619.

Fernando, Y., & Wulansari, P. (2020). Perceived understanding of supply chain integration, communication and teamwork competency in the global manufacturing companies. *European Journal of Management and Business Economics*.

Fernando, Y., Abideen, A. Z., & Shaharudin, M. S. (2020). The nexus of information sharing, technology capability and inventory efficiency. *Journal of Global Operations and Strategic Sourcing*.

Garcia, D. J., & You, F. (2015). Supply chain design and optimization: Challenges and opportunities. *Computers & Chemical Engineering*, *81*, 153-170.

Gjerdrum, J., Shah, N., & Papageorgiou, L. G. (2001). Transfer prices for multienterprise supply chain optimization. *Industrial & Engineering Chemistry Research*, *40*(7), 1650-1660.

Glesne, C. (2015). *Becoming qualitative researchers: An introduction*. Pearson.

Gokarn, S., & Kuthambalayan, T. S. (2019). Creating sustainable fresh produce supply chains by managing uncertainties. *Journal of Cleaner Production*, *207*, 908-919.

Hashmi, A. R., & Tawfiq, A. M. (2020). The effect of disruptive factors on inventory control as a mediator and organizational performance in Health Department of Punjab, Pakistan. *International Journal of Sustainable Development & World Policy*, *9*(2), 122-134. doi: 10.18488/journal.26.2020.92.122.134.

Hashmi, A. R., Amirah, N. A., & Yusof, Y. (2020a). Organizational performance with disruptive factors and inventory control as a mediator in public healthcare of Punjab, Pakistan. *Management Science Letters, 11*(1), 77-86. doi: 10.5267/j.msl.2020.8.028.

Hashmi, A. R., Amirah, N. A., & Yusof, Y. (2020b). Mediating effect of integrated systems on the relationship between supply chain management practices and public healthcare performance: Structural Equation Modeling. *International Journal of Management and Sustainability*, *9*(3), 148-160. doi: 10.18488/journal.11.2020.93.148.160.

Hashmi, A. R., Amirah, N. A., Yusof, Y., & Zaliha, T. N. (2020). Exploring the dimensions using exploratory factor analysis of disruptive factors and inventory control. *The Economics and Finance Letters*, *7*(2), 247-254. DOI: 10.18488/journal.29.2020.72.247.254.

Hashmi, A. R., Amirah, N. A., Yusof, Y., & Zaliha, T. N. (2021). Mediation of inventory control practices in proficiency and organizational performance: State-funded hospital perspective. *Uncertain Supply Chain Management*. *9*(1), 89-98. DOI: 10.5267/j.uscm.2020.11.006.

Hassini, E. (2008). Supply chain optimization: current practices and overview of emerging research opportunities. In (Vol. 46, pp. 93-96): Taylor & Francis.

Iyer, K. N., Srivastava, P., & Srinivasan, M. (2019). Performance implications of lean in supply chains: Exploring the role of learning orientation and relational resources. *International Journal of Production Economics*, *216*, 94-104.

Jia, X., Chowdhury, M., Prayag, G., & Chowdhury, M. M. H. (2020). The role of social capital on proactive and reactive resilience of organizations post-disaster. *International Journal of Disaster Risk Reduction*, *48*, 101614.

Kavilal, E., Venkatesan, S. P., & Kumar, K. H. (2017). An integrated fuzzy approach for prioritizing supply chain complexity drivers of an Indian mining equipment manufacturer. *Resources Policy*, *51*, 204-218.

Kavilal, E., Venkatesan, S. P., & Sanket, J. (2018). An integrated interpretive structural modeling and a graph-theoretic approach for measuring the supply chain complexity in the Indian automotive industry. *Journal of Manufacturing Technology Management*.

Khan, S., Rashid, A., Rasheed, R., & Amirah, N. A. (2022). Designing a knowledge-based system (KBS) to study consumer purchase intention: the impact of digital influencers in Pakistan. *Kybernetes, 51*(1). https://doi.org/10.1108/K-06-2021-0497

Khayyat, M. (2015). *An Intelligent Multi-Agent Based Model for Collaborative Logistics Planning* Concordia University].

Li, W., Wu, M. Y., & Mei, Q. (2012). The research of supply chain based on fourth party logistics optimization. Advanced Materials Research,

Liao, Y. (2020). An integrative framework of supply chain flexibility. *International Journal of Productivity and Performance Management*.

Mednick, S. A., Harway, M., & Finello, K. M. (1984). *Handbook of longitudinal research*. USAID Publisher.

Menard, S. (2007). *Handbook of longitudinal research: Design, measurement, and analysis*. Elsevier.

Oláh, J., Krisán, E., Kiss, A., Lakner, Z., & Popp, J. (2020). PRISMA statement for reporting literature

searches in systematic reviews of the bioethanol sector. *Energies*, *13*(9), 2323.

Ortega-Jimenez, C. H., Garrido-Vega, P., & Torres, C. A. C. (2020). Achieving plant responsiveness from reconfigurable technology: Intervening role of SCM. *International Journal of Production Economics*, *219*, 195-203.

Pham, T., & Doan, T. (2020). Supply chain relationship quality, environmental uncertainty, supply chain performance and financial performance of high-tech agribusinesses in Vietnam. *Uncertain Supply Chain Management*, *8*(4), 663-674.

Piya, S., Shamsuzzoha, A., & Khadem, M. (2020). An approach for analyzing supply chain complexity drivers through interpretive structural modelling. *International Journal of Logistics Research and Applications*, *23*(4), 311-336.

Piya, S., Shamsuzzoha, A., Khadem, M., & Al Kindi, M. (2020). Integrated analytical hierarchy process and grey relational analysis approach to measure supply chain complexity. *Benchmarking: An International Journal*.

Prajogo, D., & Sohal, A. (2013). Supply chain professionals: A study of competencies, use of technologies, and future challenges. *International Journal of Operations & Production Management*.

Rashid, A. (2016). Impact of inventory management in downstream chains on customer satisfaction at manufacturing firms. *International Journal of Management, IT and Engineering*, *6*(6), 1-19.

Rashid, A., & Amirah, N. A. (2017). Relationship between poor documentation and efficient inventory control at Provincial Ministry of Health, Lahore. *American Journal of Innovative Research and Applied Sciences, 5*(6), 420-423.

Rashid, A., Amirah, N. A., & Yusof, Y. (2019). Statistical approach in exploring factors of documentation process and hospital performance: a preliminary study. *American Journal of Innovative Research and Applied Sciences, 9*(4), 306-310.

Rashid, A., Amirah, N. A., Yusof, Y., & Tawfiq, A. M. (2020). Analysis of demographic factors on perceptions of inventory managers towards healthcare performance. *The Economics and Finance Letters, 7*(2), 289-294. doi: 10.18488/journal.29.2020.72.289.294

Rashid, A., Rasheed, R., Amirah, N. A., Yusof, Y., Khan, S., & Agha, A., A. (2021). A Quantitative Perspective of Systematic Research: Easy and Step-by-Step Initial Guidelines. *Turkish Online Journal of Qualitative Inquiry, 12*(9), 2874-2883.

Roscoe, S., Eckstein, D., Blome, C., & Goellner, M. (2020). Determining how internal and external process connectivity affect supply chain agility: a life-cycle theory perspective. *Production planning & control*, *31*(1), 78-91.

Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students*. Pearson education.

Sopha, B. M., Jie, F., & Himadhani, M. (2021). Analysis of the uncertainty sources and SMEs' performance. *Journal of Small Business & Entrepreneurship*, *33*(1), 1-27.

Tarei, P. K., Chand, P., Gangadhari, R. K., & Kumar, A. (2021). Analyzing the inhibitors of complexity for achieving sustainability and improving sustainable performance of petroleum supply chain. *Journal of Cleaner Production*, *310*, 127360.

Tse, Y. K., Zhang, M., Zeng, W., & Ma, J. (2021). Perception of supply chain quality risk: Understanding the moderation role of supply market thinness. *Journal of Business Research*, *122*, 822-834.

Turner, N., Aitken, J., & Bozarth, C. (2018). A framework for understanding managerial responses to supply chain complexity. *International Journal of Operations & Production Management*.

Wang, C., & Hu, Q. (2020). Knowledge sharing in supply chain networks: Effects of collaborative innovation activities and capability on innovation performance. *Technovation*, *94*, 102010.

Wang, S.-C., Tsai, Y.-T., & Ciou, Y.-S. (2020). A hybrid big data analytical approach for analyzing customer patterns through an integrated supply chain network. *Journal of Industrial Information Integration*, *20*, 100177.

Wu, Q., Liao, K., Deng, X., & Marsillac, E. (2019). Achieving automotive suppliers' mass customization through modularity: Vital antecedents and the valuable role and responsibility of information sharing. *Journal of Manufacturing Technology Management*.

Yoo, T., Cho, H., & Yücesan, E. (2010). Hybrid algorithm for discrete event simulation based supply chain optimization. *Expert Systems with Applications*, *37*(3), 2354-2361.

Zhao, X., Wang, P., & Pal, R. (2021). The effects of agro-food supply chain integration on product

quality and financial performance: Evidence from Chinese agro-food processing business. *International Journal of Production Economics*, *231*, 107832.

Zimmermann, R., Ferreira, L. M. D., & Moreira, A. C. (2020). How supply chain strategies moderate the relationship between innovation capabilities and business performance. *Journal of Purchasing and Supply Management*, *26*(5), 100658