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The focus of the South Asian Journal of Operations and Logistics is on the management of operations and supply chains. The aim of the journal is to enhance the field of SCM and develop generalizable theory, typically through the identification, analysis, and theorization of real SCM/OM problems. South Asian Journal of Operations and Logistics seeks research that can help the audience develop a better conceptual base for understanding SCM/OM. The focus of articles for the South Asian Journal of Operations and Logistics should be on the managerial situation or the theory being studied rather than the solution techniques being developed or used. The highest priority is thus given to studies that are anchored in the real world and build, extend or test generalizable theories or frameworks of managerial significance.

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Editorial Note

I am pleased to introduce the "***South Asian Journal of Operations and Logistics***" *(SAJOL)*, a rapid peer-reviewed Journal under SAG Publishing. We have been started in the year 2022 and are growing continuously. We are pleased to announce that our first issue has been published online on time. All published articles in this journal are included in the indexing and abstracting coverage of various scientific databases. The submissions to the journal are subjected to the peer review process by the editorial board members or external subject experts. The complete editorial processing of the manuscript is done through the SAG Publishing submission system for greater transparency and faster article throughout. During this calendar year 2022, Editorial Board and Advisory Board comprise prominent expert Editors and Reviewers who joined *SAJOL* and contributed their valuable services to the journal's quality.

I would like to express my gratitude to all the authors, reviewers, the SAG publishing, Assistant Editors, and the Editorial Board of *SAJOL*. With their support, we have released Vol. 1 and Issue 1 for the calendar year 2022. This is the first issue in Vol. 1, and we look forward to bringing out the next issue in December.

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

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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*

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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).

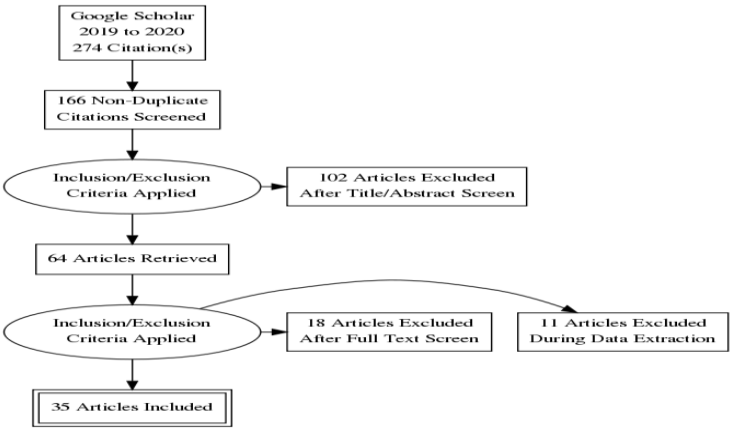

Figure 1: PRISMA model

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.

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Quality Management and Operational Performance: A Case Study from Pakistan

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ABSTRACT

The primary purpose of this study was to find the effect of quality management on organization performance in the garment sector. The reason for choosing the garment industry was its rapid growth and the use of quality management in operational performance. A deductive approach followed by a quantitative research method was used. The data was collected through survey questionnaires on a five-point Likert scale using a random sampling technique from 131 employees working in various garment factories in Karachi. Further, the IBM® SPSS® V22.0 was utilized as a statistical tool. The findings found that the hypothesis was supported by narrating that quality management significantly and positively influences operational performance. The study can help researchers and practitioners realize the imperative role of quality management for operational performance and, eventually, sustainable organizational growth.

Keywords: *Garment, Quality management, Operational, Performance, Supply chain management, Textile*

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Quality Management and Operational Performance: A Case Study from Pakistan

1. Introduction

For a long, quality management has been a vital topic of all renowned authors and researchers as they believe this has influenced a significant uprising in organizational performance. Every organization focuses on this and tries to ensure quality management is implied in their system (Demirbag et al., 2006). It is a fact that once world-class standards are met, the company will achieve more production (Kennerley & Neely, 2002). Moreover, small companies are mostly trying to find themselves with quality management. Further, the organizations believe that better quality management increases performance efficiency. Quality and efficiency tools encompass the organization's quality (Kennerley & Neely, 2002). Also, when we go into details of quality management, the definition will become broader as it will focus on continuous improvement. Regardless, the service and manufacturing industries' concepts of quality management are the same as they share common characteristics (Kumar et al., 2009).

Manufacturing companies in today's era are very complex due to standards and the organization structures of their hierarchy. In this case, we can mention the garment industry, which is very complex due to the hierarchical structure and its leadership (Sardana, 2008). The product line of the garment industry is very complex due to seasonal changes. The same can be said of the garment industry where quality management has become necessary due to changes in the demand of orders. As a result, many sewn companies are looking into establishing quality management in their organization to meet the quality performance and eventually improve the logistics performance of the company (Wilson & Collier, 2000). Further, in an industry like a garment one, everyone from top leadership to a lower level of organization and quality management is necessary to meet that particular company's goals and requirements (Matthews & Marzec, 2015). In addition, it is also to ensure the product the customer receives at the right time and in the suitable condition. This can only happen when there is a proper quality management process (Fernandes et al., 2017).

The garment industry is one of the most prominent sectors of Pakistan. Further, in the garment industry, people spend millions on new clothes and designs. This industry can be further categorized into small sections: frocks, maxi, lengha, sharara, and gharara. Even further, this categorization can be boy's designs, shalwar kameez, dhotis and sherwani. The main reason for purchasing these various products is that the customers want something extraordinary. Various ceremonial events throughout the year make people spend a considerable amount. Per surveys in 2019-2020, the textile industry constituted 46% of Pakistan's total share in the garment industry. This means this market is one of the most prominent sectors in Pakistan. Therefore, quality management is vital for the success of the garment industry. In addition, this industry has the most employed people (Abdullah et al., 2009). The top-notch competitors are SANA Safinaz, Khaadi, FTA, and Sania Maskatiya. These competitors have targeted the market of lower to high-class people who instead go to the shops to purchase rather than use online services to purchase services. This study measures the effect of quality management on operational performance in the garment industry.

2. Literature Review

According to Baloch and Rashid (2022), operational optimization is crucial. Therefore, quality management has a significant contribution to operational performance. The reason is that major development and living standards have increased the point's importance. Karia and Asaari (2016) conducted a study to investigate the influence of quality management practices, and they compared it with an Australian garment company (Bastas & Liyanage, 2018). The results showed that delivery time was one of the few factors that positively impacted the product's quality. Last but not least, it further showed that improving quality in a manufacturing or garment industry is more complex than in logistic

firms (Hashimi et al., 2020).

Another research found how strategies in the garment industry were implemented to check quality management. The researcher used three variables to conduct this study, evaluation, awareness of quality, and operational performance (Lin et al., 2005). The sample size that the researcher used was 120. This company used ten steps in order to implement quality management. These ten steps included management, quality, quality improvement, operational performance, quality awareness, manager and supervisor training, effort cause and continuous improvement (Fynes et al., 2005). Further, this study indicated the integration of the entire department to ensure everyone follows the same rules and regulations. The result of this setup was that all the employees from the different departments had a mindset that there is no compromise of quality, and each and every department has to follow that (Beerens et al., 2012). Furthermore, if we take another aspect of Yu et al. (2017) surveyed how important operational performance is (Vanichchinchai & Igel, 2011). The sample consisted of 110 people belonging to a logistics department in the garment industry. The sample was from performance measures, customer expectation, and customer expectation and satisfaction. The results showed there had been an enormous amount companies locally using quality management in order to improve their performance. There were also a few companies who were not willing to convert their business into quality management as it is financially expensive to implement, but they do have in their mindset and plan to establish proper quality management in upcoming years (Teoman & Ulengin, 2017).

Further, there have been multiple researchers who have quoted on how to improve the operational performance of an organization. These include just in time, supply chain management and quality management on how they influence business performance. Kannan (2005) empirically found that the above measures influence performance. Based on the empirical evidence, the following hypothesis was developed to test the influence of quality management (QM) on operational performance (OP).

H1: Quality Performance has a significant Impact on Logistics Performance.

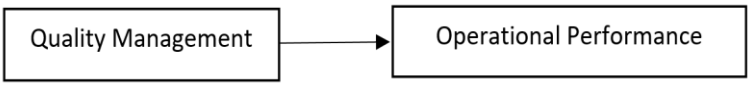

Figure 1: Research model

3. Research Methodology

A deductive approach followed by a quantitative research method was used to test the study hypothesis (Rashid, 2016; Rashid et al., 2019; Hashmi et al., 2021). The data was collected through survey questionnaires on a five-point Likert scale (Hashmi et al., 2020a, b; Khan et al., 2022; Rashid et al., 2020; Rashid et al., 2021). The data was collected using a random sampling technique from 131 employees working in various garment factories in Karachi. According to Hashmi et al. (2021), a sample of 100 is adequate to test study variables. Further, the IBM® SPSS® V22.0 was utilized as a statistical tool (Hashmi & Tawfiq, 2020; Hashmi et al., 2020; Khan et al., 2022; Rashid & Amirah, 2017).

4. Research Analysis

Before regression analysis, the reliability test was performed to analyze the consistency of items. Table 1 expresses the Cronbach Alpha (α) value of 0.823, more significant than 0.60. According to Hashmi et al. (2021), the α value greater than 0.60 is considered adequate. Later, regression analysis indicated that quality management significantly and positively affects operational performance. The adjusted R Square estimate is 0.712, meaning the independent variable (quality management) impacted the dependent variable (operational performance). Further, ANOVA results express that significance for

the model = 0.000 < 0.05, which means the model predicts the study variables significantly. The *F* value is 5.180, which is more fantastic than four and expresses that the model is fit. The coefficient results show a significant and positive effect of quality management on operational performance. Hence, hypothesis *H1 (There is a significant effect of quality management on operational performance)* is supported.

Table 1: Regression analysis

			Model Summary		ANOVA		Coefficients		
	N	***α***	*R*	Adjusted R Square	*F*	Sig.	Std. Beta Coefficient	*t*	Sig.
LP	131	0.823	0.778	.712	5.180	.049		6.172	.000
QM	131						.139	1.321	.035

*Note: α=Cronbach Alpha; Constant=OP; Predictors (QM); *Standardized beta coefficient (Dependent Variable = OP); QM=Quality management*

5. Discussion and Conclusion

Objective 1: H1 (there is a significant effect of quality management on operational performance). The findings highlighted that quality management is imperative for any organization as it will help the company achieve efficiency in today's dynamic world. Better quality means a company with increased efficiency with better customer value (Agha et al., 2021). The reason is that the organization will be more effective and efficient in the market and be a leader in the market. Quality management will also mean fewer designs are sent to the outlet, which is defected, and the company can gain operational performance significantly. Further, it shows that fewer defective pieces will be sent to the customers, which will reduce the operational cost of picking up the product from the customer. Moreover, when a company starts to work on improving the operational performance through quality management effectively, it can improve drastically, leading to market leader.

It is prescribed for the company to effectively consider these variables in the future decision-making of an organization. This research can help companies to give more attention to these variables because the findings suggest that quality management significantly and positively affects operational performance.

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The Influence of Inter-Organizational System Use and Supply Chain Capabilities on Supply Chain Performance

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ABSTRACT

This study is explored the influencing factor that is pivotal in the supply chain. More explicitly, the main emphasize of this research was on IOS use and supply chain management capabilities, and supply chain performance. A quantitative approach was adopted for this study, and a multi-item measurement scale was adapted from previous studies; a structured questionnaire was used to collect primary data. Two hundred thirty-six responses were collected from supply chain employees in various textile sectors. Further, regression analysis was applied for hypothesis testing. The analysis of employees' responses collected from various firms reveals that the use of IOS increases the level of supply chain performance and directly enhances the capabilities of SCM. In addition, it was observed that the influence of SCM capabilities on supply chain performance was very insightful, influential, and even more significant than the impact of IOS use on SC performance. This research study can be helpful for supply chain managers and decision-makers. It gives them guidance for enhancing the supply chain resilience of an organization. It provides a framework containing Communication, Intelligence, Information exchange, Integration, Coordination, and Responsiveness to enhance supply chain performance.

Keywords: *Communication, Intelligence, Information exchange, Integration, Coordination, Responsiveness, Supply chain performance*

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The Influence of Inter-Organizational System Use and Supply Chain Capabilities on Supply Chain Performance

1. Introduction

Organizations use and implement the inter-organizational system (IOS), a network-based enterprise system that allows external firm-related entities. That allows SC partners to instantly share business-related information to collaborate with their supply chain members (Zhang & Cao, 2018). Organizations use the IOS system in their firm by deploying it in multiple ways like vendor-managed inventory, collaborative planning, electronic data interchange (EDI), and estimating & replenishment for the real-time communication between the firm and its SC members to share quality information. IOS also play an essential role for firms in effective decision-making (Asamoah et al., 2019). IOS is an effective tool to deal with firms' competitive conditions without interruption. Therefore, the firms need to follow this kind of technology-based development. Otherwise, it becomes difficult to survive in a competitive business atmosphere (Okano & Fernandes, 2019).

The selection and assigning of technology are now essential to successful businesses. Implementing effective technology is usually necessary, but sometimes it becomes mandatory, as it regulates according to the market's demand (Okano et al., 2017)**.** IOS provide a medium for firms to effectively manage their tasks and activities by following the trend of coordination and integration to achieve competitive benefits to challenge their rivals (Asamoah et al., 2019).

Resource-based view (RBV) theory clarifies that only those organizations that achieve competitiveness in the market manage and effectively combine their unique, valuable & incomparable assets and resources (Shan et al., 2019). An inter-organizational system allows a firm to enhance and expand its internal resources and capabilities with the external resources to achieve the mutual goals of the partners of the SC network (Falcone et al., 2020). They are adopting the IOS system in firms that have just transformed many industries' business environments. In the present era of information and knowledge, a considerable amount of data is generated and exchanged through the IOS between supply chain partners. IOS helps firms to manage the exchange of data and information between the sender and receiver of the SC network. In developed countries, the outcomes achieved after implementing IOS in business are more mature and practical than in developing countries (Agbenyo et al., 2018). But according to, the research studies that were done in the context of developed countries show that the effects of IOS use in business present effective results (Agbenyo et al., 2018; Asamoah et al., 2019)

1.1 Problem statement

The adoption of inter-organizational system n firms allows them to enhance their capabilities and resources with the assets of their SC members to achieve mutual goals and benefits. Past research related to the inter-organizational system proposes that implementing IOS In firms has significant and positive impacts on the overall performance of the supply chain system (Asamoah et al., 2019). In addition, practitioners of manufacturing firms also appeal for the opening of the SC black box and put efforts into a further investigation into how the usage of IOS becomes more effective (Agbenyo et al., 2018; Yu et al., 2018). The current research study mainly concentrates on external usage of IOS in SCM & second is IOS firm management capabilities through the perspective of SCM. Studying the relationship between usage of IOS and capabilities of SCM in improving the performance of the supply chain increase understanding of management about operational dynamics of IOS in a firm. In this research study, we investigate the complex relationship between IOS usage, SCM capabilities and performance of SC. Thus, sharing capabilities and resources through the supply chain is crucial as it increases SC capabilities required to achieve competitiveness at the firm level (Ganbold et al., 2020). The capabilities of SC act as the main element for managing supply chain operations and are a vital element of a firm's success and existence (Matwiejczuk, 2020). These SC capabilities and competencies can be influenced by integrating SC processes all over the SC system (Ataseven & Nair, 2017), resulting

in improved SC flexibility (Pettit et al., 2019). Therefore, the current study focus on testing a framework to enhance the supply chain performance through adopting the inter-organizational system (IOS) and supply chain capabilities in the manufacturing sector.

1.2 Research Objectives and Research Questions

The primary objective of this study is to find the effect of IOS use and supply chain capabilities on supply chain management performance. Therefore, on the bases of research problem and research objectives, this study will specifically focus on the below research questions:

RQ1: To what extent does IOS use influence SC performance?
RQ2: To what extent does Communication influence SC performance?
RQ3: To what extent does Intelligence influence SC performance?
RQ4: To what extent does Information Exchange influence SC performance?
RQ5: To what extent does Integration influence SC performance?
RQ6: To what extent does Coordination influence SC performance?
RQ7: To what extent does Responsiveness influence SC performance?

2. Relevant Theory

2.1 Resource-Based View

The resource-based view of an organization proposes that organizations which have rare, valuable, non-substitutable and unique resources can accomplish maintainable competitive benefits by applying strategies in a firm which are difficult and complex for rivals or challengers to duplicate (Barney, 1991; Peteraf, 1993; Wernerfelt, 1984). The theory of resource-based view considers a set of resources and competencies Wernerfelt, (1984), and this point of view is considered an impactful theoretical framework for knowing how strong financial performance and competitive advantage are accomplished (Corbett & Claridge, 2002). Usually, the element of capabilities is mainly linked to the abilities of an organization to utilize its assets and resources "to affect the desired end" and are equivalent to the intermediate goods that are produced or manufactured by the organization through various firm processes to deliver "improved resource productivity" (Amit & Schoemaker, 1993). In opposition to resources, capabilities are surrounded by the interactions of more than one source of knowledge and information. They are more specific to the organization and less exchangeable, ultimately leading to a competitive advantage for the firm (Peng et al., 2008). The firm's capabilities can be classified into basic functional activities performed by the firm and those that guide it to improve and renew its functions or activities (Collis, 1994). The resource-based view holds the perspective that an organization have various resources and different level of capabilities regarding the utilization of resources. The survival of an organization is based on the capability to come up with new resources, builds upon existing competencies and make all the capabilities more unique and distinctive(Peteraf, 1993).

2.2 Literature Review

2.2.1 Supply Chain Performance

The parameters of supply chain performance are the bundle of factors that are mainly used to determine the effectiveness and efficiency level of the SC system (Asamoah et al., 2019). So many scholars in their literature have mentioned many parameters that can judge the performance level of the supply chain system. In those parameters, qualitative and quantitative measures are included. Qualitative measures of SC's performance include customer satisfaction, information integration, material flow integration, quality of risk management and performance of suppliers (Fernando et al., 2018). Supply chain performance measures that are quantitative include an increase in sales, cost reduction, increase in return on investment, increase in fill rate, minimize the time of product delivery, reduce the time of customer response and less lead time (Lima-Junior & Carpinetti, 2017). There are also other parameters of supply chain performance that are accuracy of the material, projecting and

planning, the capability of delivering product on time, reliability & consistency of delivery, precise SC cost knowledge & control, quick customer response, management of inventory, validation & responsiveness, the synchronized flow of product exact from supplier to the distribution store (Govindan et al., 2018; Hashmi et al., 2021; Mani et al., 2018; Hüseyinoğlu et al., 2020).

2.2.2 Inter-Organizational System (IOS) Use

The inter-organizational system (IOS) relates to the application of information technology used to complete the transaction process between supplier and buyer and the relationship between them (Asamoah et al., 2021). The literature on IOS discloses more than one goal and aims to encourage its utilization in firms. IOS enables an organization to fulfil multiple goals, which include, necessity refers to the fulfilling monitoring requirement, asymmetry, which refers to the exerting control over other rivalry firms, reciprocity, which refers to following mutual goals, efficiency, creativity, agility, rightfulness and steadiness (Aros & Gibbons, 2018). To describe the negative results of IOS, the utilization of IOS has been hypothesized as depth, volume, scope, diversity and intensity (Zhang et al., 2017). However, it was observed that these hypotheses are not enough to capture the usage of IOS systems that is encouraged by various objectives, which afterwards lead to negative results even when the situation of IOS system usage and technology are the same (Subramani, 2004). The research defines the concept of IOS appropriation as trends, fashions, modes, and patterns. A researcher, Saeed et al. (2005), built a research framework that postulates features of IOS as the primary ancestor of an integrated supply chain whereby the IOS feature includes integration of IOS and intelligence of IOS. By adopting the above work according to the perspective of SC collaboration, the current research study presents two main components of IOS appropriateness: Communication and intelligence

The utilization of the IOS system for the means of Communication is mainly responsible for maintaining the flow of messages and contacts between members of supply chain firms. The primary technologies and applications accountable for maintaining Communication between two parties include channel management, communication network, message service & protocol and specific communication standards (Chi & Holsapple, 2005). There are specific examples of channel management that maintain contact between SC parties, including electronic fund transfer, call centres, wireless devices, websites, and point of sales; on the other hand, the example of technologies for message service include instant messaging service, voice mail, controlled posting, and E-bulletin board. Essential Communication depends on networks which consist of wireless networks, broadband, internet & extranet (Zhang & Cao, 2018).

The use of an inter-organizational system relates to the utilization of IOS for increasing the learning and creation of information and knowledge between SC partners. The application and technology of IOS for the intelligence that exists between two firms could exchange data warehouse and text mining, shared warehouse database & decision support systems, shared digital documents & archives and shared acquisition of information and knowledge, search of knowledge, navigation and recovery, group decision support system and software agents.

2.2.3 Supply Chain Capabilities

The concept of supply chain capabilities relates to the ability of the firm to recognize, utilize and adapt both external and internal information and resources to enable the whole processes and activities of the supply chain (Yu et al., 2018). A research study observed the SC capabilities as a second-order construct which include four approaches and dimensions: the exchange of information, cooperation and coordination, integration in activities within the firm and responsiveness of the supply chain system (Asamoah et al., 2021). These four dimensions are the main approaches because they cover all the essential activities involved in the supply chain processes. Moreover, various studies highlight the dynamic nature of capabilities that allows an organization to learn and effectively and timely respond to the ecological changes of the firm. Researchers believe that the capabilities and competencies of the supply chain show a higher level in the order of firm capabilities, in which they require an extensive range of information integration, as highlighted above (Ferreira et al., 2020). It is believed that this kind of high-order capability is challenging to accomplish; therefore firm experiences a high level of protection in defence of competitive actions (Alnawas & Hemsley-Brown, 2019). Supply

chain capabilities can hold the quality of valuable sources (Hong et al., 2019).

The supply chain's capabilities are essential for organizations to get a high range of benefits from their inter-organizational use (Zhu et al., 2018). The supply chain capability of information technology includes four comprehensive SC capabilities between two. First are named sharing of information, integration between two firms, SC responsiveness & synchronization (Wu et al., 2006). In various research studies, these capabilities are adapted. The capability of exchange of information in an SC firm relates to an organization's ability to share information and knowledge with its SC partners efficiently and effectively (Wu et al., 2006). Organizations must use the information exchange capability effectively to make every supply chain system effective by delivering the correct information at the right time to their suppliers (Nova & Bitencourt, 2020). The capability of integration in SC relates to an organization's ability to arrange its activities, technologies, and applications with its members for strategic advantages (Wu et al., 2006). The coordination capability of the supply chain relates to the ability of an organization to efficiently manage and coordinate various processes and activities of the supply chain and do transactions with their SC members (Sahin & Robinson, 2002). The capability of responsiveness in SC mainly relates to the degree to which members of SC can quickly respond to the changes and variations arising from the SC partners and corporate atmosphere (Um et al., 2017).

2.3 Conceptual Framework

The proposed conceptual framework shows in given below Figure 1. According to the framework, two significant independent variables are IOS and supply chain capabilities. These variables are further divided into sub-variables which include communication (C), Intelligence (I), Information exchange (IE), Integration (INT), Coordination (CO) and Responsiveness (RS). On the other hand, there is only one dependent variable: supply chain performance (SCP).

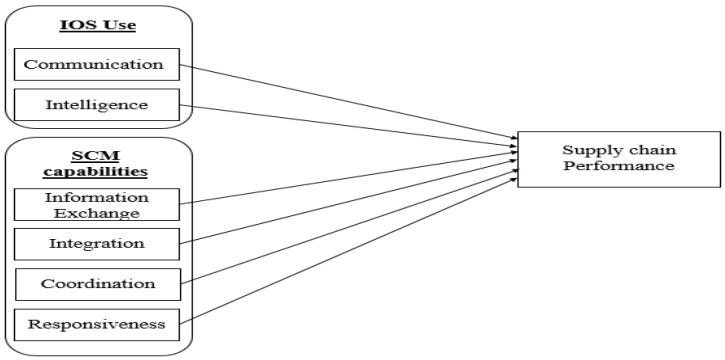

Figure 1: Research model

2.4 Hypothesis Development

2.4.1 IOS USE & supply chain performance

Inter-organizational systems act as a resource for firms that help firms in achieving high-performance levels in many ways. Initially, an IOS system can be deemed as a comprehensive information system that works in the firm and across the firm that can be maximized for recognizing the streams that can generate more revenue and profit from the system of the supply chain (Agbenyo et al., 2018; Hartono et al., 2010). Moreover, IOS can work as a tool through which organizations can integrate their resources effectively to achieve an adequate level of performance. Moreover, IOS can act as a source through which firms can access the quality resources of external parties.

To achieve a high level of performance in operations, IOS provide the capability to the firm to provide quality information to their members (Hartono et al., 2010). The utilization of IOS empowers the firm for the exchange of real-time information. In that way, the partners of the SC firm can effectively respond to the market and environmental variations. The IOS can be used to gain the element

of coordination in activities & planning of the supply chain that permit the firm to reduce the inventory level throughout their supply chain (Lee et al., 2014; Zhang & Cao, 2018). Organizations achieve flexibility in their operations & also enable themselves to fulfil customers' requirements and act as reliable partners for their supply chain network. For example, by implementing IOS use in a firm, organizations can gain higher visibility in the levels of stock of their key distributors and vendors. These IOS provide an opportunity to avoid stock-outs that lower the performance of the supply chain (Lee et al., 2014). The proper usage of IOS in the firm is to exchange accurate information about customers' and suppliers' demands. Organizations protect themselves from the problem of demand distortion through IOS (Kim et al., 2012; Lee et al., 2014). Overall enhance the performance level of the firm's operations and reduce the level of incompetence.

IOS system is a kind of information system that works and exceeds the boundaries of a firm (Weiqing, 2021). IOS act as a resource that mainly relates to the pair of associations because pairs of relationship must participate in the IOS through several ways like investment, sharing of knowledge, and synergistic creation of value (Lee et al., 2014). In some scenarios, IOS participate in various activities that exist between two firms, and those activities include; IOS works as an interconnected asset between firms and provides an electronic medium and network through which organizations can rapidly observe the information of their SC member without paying any cost for a transaction or any exchange of information. The association of firms based on IOS can attain relational rents by minimizing errors of contact and Communication, lessening the cost of the total value chain and developing a high level of product differentiation (Baloch & Rashid, 2022; Khajouei et al., 2018). For instance, a supply chain firm with an effective information sharing system can compete more effectively in the market than low-quality information sharing systems.

2.4.1.1 Communication and supply chain performance

Business communication is the primary and essential function that synchronizes the mutual interchange of knowledge and information and flows of product & association-based capabilities and resources among supply chain members (Ali et al., 2021). Communication is the glue in business processes as it has a notable effect on the social dimension of associations that also play a role in creating and keeping the trust between supply chain partners (Kaya & Schoop, 2020). In corporate associations, the collaborating dimension of Communication explains that the primary relational vector between the organization and their environment permits the initiation of mutual adaptation of processes among the partners, ultimately supporting the stability of the long-term relationships and associations (Hänninen & Karjaluoto, 2017). Therefore the variable of Communication is considered the key element to developing the relationship and maintaining coordination within the firms and between two organizations (Iankova et al., 2019).

As discussed above, at the corporate level, the element of Communication plays the role of glue and vector of information that mainly supports the formation of culture & adjusting inside the organization that also plays the leading role in the management of identity in the supply chain system. For this reason, face-to-face interaction and Communication are most particularly beneficial to negotiating and exploring a trade-off among several sensitivities and anticipation of stakeholders mainly involved in the supply chain management. In strategic decision-making, the face to face communication also plays an active role in lowering the problems and issues of the long-term supply chain system. At the strategic level of businesses, the Communication factor increases the firm's competitiveness and the strategic level of supply chain processes by supporting the image building of the supply chain from inside and outside (Koval et al., 2018). In addition, internet-based Communication is used in a firm to communicate with partners and other actors in the supply chain for sharing information.

According to the perspective of operational performance, the results of studies reveal that the Communication factor keeps and endures the process of procurement that acts at two levels of firms (Cheptora et al., 2018). At the level of intra-organization, the communication factor synchronizes internal flows of information that are mainly related to the identification of vendors' selection & the meaning of procurement strategies (Nizamova et al., 2021). At the inter-firm level, the communication factor mainly supports the negotiation process based on shared values between two organizations and

their SC members, which include (suppliers, service providers and sub-suppliers). Communication is also responsible as it activates the collaborative processes to enhance knowledge development through arranging priorities and sensitivities with supply chain members (Naqshbandi & Jasimuddin, 2018).

H1: Communication has a significant effect on supply chain performance.

2.4.1.2 Intelligence and supply chain performance

In today's competitive environment of businesses, the firms need to have strong integration and coordination among partners of SC (Jermsittiparsert et al., 2019). The environment all over the world is affected by the enhancement of globalization & outsourcing, unions, advanced technologies and business through the internet that forces firms to approve new ideas for running businesses in the market (Kumi et al., 2021). The intelligence of the supply chain provides a broad perspective of competitive intelligence on the dynamic association of SC integration for providing better decisions related to business (Belhadi et al., 2021). The supply chain's intelligence influences the firm's internal processes and the external environment, including supply chain partners (Belhadi et al., 2021). Swain and Cao (2019) defines supply chain intelligence as the art of presenting, analyzing, refining, and acquiring information and knowledge about the competition of SC and then receiving actionable findings about significant improvements of the firm. According to the study of Sambasivan and Jacob (2008), the results were based on eighty-five organizations exposed that those organizations with advanced intelligence systems to control their environment displayed a higher level of profitability than those organizations that do not use this kind of advanced systems in their firms. At the same time, it was observed that some studies displayed positive results in the supply chain intelligence and firm operational performance. On the other hand, it was also discussed that there are not enough studies that are re-done on the topic of SCI appropriateness and also not studied mainly determine the impact of SC performance (Swain & Cao, 2019).

H2: Intelligence has a significant effect on supply chain performance.

2.4.2 Supply chain management capabilities and supply chain performance

Supply chain capabilities facilitate the whole supply chain system by assimilating external and internal information and other resources. Supply chain capability works as the ability of the firm to recognize, utilize and assimilate external and internal resources (Yu et al., 2018). A study conceptualizes the variable of supply chain capabilities as a construct of 2nd-order that includes four dimensions, information exchange, coordination, integration between firms and responsiveness of SC. These four activities are selected because they mainly show the ability to execute cross-functional activities between two firms that are mainly required in Supply chain management. Moreover, they show the dynamic nature of SC capabilities, allowing an organization to learn and respond to ecological changes (Aslam et al., 2018).

2.4.2.1 Information exchange and supply chain performance

The concept of the exchange of information relates to the ability of an organization to share information with its members of the supply chain in a very effective manner. In a supply chain collaborative system, the shared information includes all the knowledge and information that is exchanged between partners directly and across the whole supply chain system (Raweewan & Ferrell, 2018). It is essential to use the information and exchange it among partners when required. For sharing quality information with the partners, it is essentially required to achieve the information from a reliable source and in an acceptable format (Yu & Huo, 2018). Effective exchange of information has been considered one of the most fundamental capabilities in supply chain systems (Nuruzzaman & Singh, 2019).

H3: Information exchange has a significant effect on supply chain performance.

2.4.2.2 Integration and supply chain performance

Organizations integrate their processes and activities internally and externally across their

supply chain network. In organizations, serval integration occurs, from which two are discussed here, interfirm technology integration and activity integration. Technology integration relates to the level of technology arrangement with network partners; on the other hand, activity integration is conceptualized as the degree to which an organization synchronize its strategic channel process and activities like planning and forecasting with its members of the supply chain (Ganbold et al., 2020).

H4: Integration has a significant effect on supply chain performance.

2.4.2.3 Coordination and supply chain performance

The coordination between two firms relates to the capability of an organization to coordinate activities related to transactions with partners of the supply chain (Zhang & Yousaf, 2020). Coordination with supply chain members includes the arrangements of materials, workforce, money and capital tools, from taking an order to following the order (Yan et al., 2017). Enhanced coordination and synchronization between partners in the supply chain can help minimize the cost of transactions and enhance the efficiency of operations among SC partners. In that way, it acts as the leading indicator in assessing the capabilities of SC of a firm (Zhao et al., 2017).

H5: Coordination has a significant effect on supply chain performance

2.4.2.4 Responsiveness and supply chain performance

Responsiveness in a firm's supply chain is explained as the degree to which members of the channel respond supportively against environmental variations. It produces the dynamic nature of SC capabilities that permit the firm to develop and reintroduce organizations' specific competencies and also enable the firm to respond to environmental changes better (Jermsittiparsert et al., 2019). In the complex marketplace, it is essential to require a reliable, collaborative and efficient response from the whole supply chain system (Giannakis et al., 2019). To be able to take action & react afterwards to collecting information is the ultimate way of learning (Dissanayake & Cross, 2018). Therefore, we consider the supply chain's responsiveness as one of the critical dimensions of firm supply chain capabilities.

H6: Responsiveness has a significant effect on supply chain performance

3. Methodology

3.1 Research Approach

The research approach is defined as the plan and procedure of research. According to Bell et al. (2018) and Rashid et al. (2021), there are three research approaches are deductive, inductive and abductive. These research approaches distinguish on the base of hypothesis applicability. In the deductive approach, hypotheses and assumptions are tested, and these hypotheses are developed through reviewing existing theories. In the inductive approach, the researcher will explore new concepts and theories (Bell et al., 2018). Moreover, the deductive approach deals with the "surprising facts" or "puzzle", while the study's objective is to explain these facts. In the current study, the deductive research approach was used because the research model of this study was based on existing theories and variables, and the hypothesis was developed to delve into the association between dependent and independent variables.

3.2 Data Collection Source

As the paper manufacturer required a tree as a raw material for paper, the data also plays a vital role in the information enhancement. The data collection sources for research are divided into two types: primary and secondary. The primary data is initially collected by a researcher or newly collected data, whereas secondary data has already been gathered for some other purpose (Mesly, 2015). Moreover, primary data is considered accurate and objective data, while secondary data is just interpretation and explains the primary data. The primary source of data collection in the current research study was used

because the researcher initially collected data.

3.3 Population and Target population

The overall group of individuals who can give information related to research is known as the study population (Saunders et al., 2009; Agha et al., 2021). Asiamah et al. (2017) state that this population is further divided into three categories; general population, target population and accessible population. The general population is defined as the whole population, i.e. in the current study, the general population are the textile sector employees. Further refinement of this population to narrow down toward the required most relevant group of individuals is termed as the targeted population, i.e. in the current study, the employees related to the supply chain are in the group of the targeted population. As it is not possible or feasible to cover the whole target population, the third part is termed accessible individuals, and the data was collected from these respondents.

3.4 Sample and Sampling Procedure

Due to the limited time and resources, it is impossible to consider the whole target population, so sampling must be used to cope with this issue. The sampling consists of probability sampling and non-probability sampling (Hashmi & Tawfiq, 2020; Rashid et al., 2021; Shaheen, 2022; Saunders et al., 2009). Probability sampling is defined as the observer already knows choosing an individual for a sample, and it has various types such as simple random, systematic, stratified and cluster sampling. Whereas non-probability sampling, all the individuals can participate in response; it has different types such as convenience, judgment and quota sampling. The present study's sampling procedure was based on the non-probability sampling technique, and the type of non-probability sampling was convenient sampling.

3.5 The Sample

The sample is defined as the group of individuals chosen from the target population, which represents the whole population. Alternatively, it can be termed as the number of participants from the target population from which the researcher collects data (Rashid et al., 2021). Hair et al. (2018) stated that the sample size should be error-free and reliable. In the current study, the sample size was calculated using G*power software based on statistical tests and research objectives (Faul et al., 2009). G*power identified a minimum sample size of 146 respondents. Therefore, this study will collect data from more than 146 respondents.

3.6 Instrumentation and Data Management

A structured questionnaire having close-ended questions was developed by adapting constructs from previous studies of Asamoah et al. (2021). These constructs include Communication (C) four items, Intelligence (I) four items, Information exchange (IE) four items, Integration (INT) three items, Coordination (CO) three items, Responsiveness (RS) four items, and Supply Chain Performance (SCP) three items. After collecting data, it was recorded on an MS excel worksheet and then transferred to the SPSS worksheet. That data was analyzed using SPSS and SmartPLS to perform various statistical analysis.

4. Data Analysis and Results

Statistical analysis for this study included some data examination tests, i.e. descriptive statistics, reliability analysis, and correlation analysis (Hashmi et al., 2020a; Hashmi et al., 2021; Rashid et al., 2020; Victory et al., 2022). After checking the data, the hypothesis was tested (Rashid & Amirah, 2017; Rashid et al., 2019; Tabachnick & Fidell, 2007).

Two hundred fifty questionnaires were sent to the targeted population via email and physical dropping the questionnaire. A total of 236 responses were reverted, which is a 94.4% response rate. The respondents were related to the textile sector and also working in the supply chain department. The selected companies include Gul Ahmed, Khadi, Siddique sons, Pak Denim, Bari textile, Star textile, Arabian textile, Lucky textile, Royal textile, Orient textile, and Western textile industry.

4.1 Demographic Profile of participant

The demographic profile of the respondents is shown in table 1, which states that a significant proportion was male respondents along with all other significant percentage of different demographic attributes. Further, the study recognized that the various demographic attributes of respondents did not affect the study analysis (Rashid, 2016).

Table 1: Demographic profiles

Demographic variable	Category	Frequency	Percentage
Gender	Male	198	83.9
	Female	38	161
Age	Less than 25 years	66	28
	25- 30 years	136	57.6
	36-40 years	34	14.4
	Above 40 years	0	0
Experience	less than three years	120	50.8
	3 to 6 years	88	37.3
	7 to 10 years	28	11.9
	above ten years	0	0
Designation	Executive	102	43.2
	Assistant Manager	94	39.8
	Manager	38	16.1
	Senior Manager	0	0
	Director	2	0.8
Income	25,000- 40,000	82	34.7
	41,000- 70,000	96	40.7
	71,000- 100,000	44	18.6
	Above 100,000	14	5.9
Education	Diploma	15	6.4
	Intermediate or less	61	25.8
	Graduation	92	39
	Masters	62	26.3
	M Phil/PhD	6	2.5

Source: SPSS output

4.2 Descriptive Statistics and Reliability Test

Descriptive statistics were applied to check the univariate normality, including mean, standard deviation, skewness and kurtosis. Hair et al. (2018) stated that the value of skewness and kurtosis should not be increased from -3 to +3. The summarized results of descriptive analysis are presented in Table 2. The consolidated outcomes presented in the table given above show that the highest skewness value (sk=0.741) is for construct supply chain performance (SCP) (M=3.45, SD=0.75) while the minimum skewness value (sk=0.370) is for construct intelligence (I) (M=3.50, SD = 0.72). Beside this, the maximum kurtosis value (k=1.277) is for construct supply chain performance (SCP) (M=3.45, S.D=0.75) and the minimum kurtosis value (k= 0.076) is for construct Communication (C) (M=3.30, S.D=0.73). These findings illustrate that all the skewness and kurtosis values are not greater than ± 3, so all adapted constructs achieve the acceptable requirement of univariate normality.

Table 2: Descriptive statistics

Construct	Mean	Std. Dev.	Skewness	Kurtosis
Communication	3.30	0.73	-.508	.076
Intelligence	3.50	0.72	-.370	.245
Information exchange	3.56	0.62	-.391	.566
Integration	3.52	0.75	-.615	.020
Coordination	3.50	0.75	-.785	.778
Responsiveness	3.48	0.74	-.415	.316
Supply chain performance	3.45	0.75	-.751	1.277

Source: SPSS output

4.2 Construct Validity

The critical purpose of accretion construct validity is confirmation of data accuracy that supports the analysis for hypothetical results. The convergent, discriminant, and convergent were carried out to analyze the construct validity for this study (Hair et al., 1998).

4.2.1 Convergent Validity

Convergent validity states that the assumption and theoretical two constructs are inter-linked and inter-linked in reality (Hair et al., 1998; Khan et al., 2022; Khan et al., 2022). There are three criteria to measure and test the convergent validity. Hsieh and Hiang (2004) and Khan et al. (2022) stated that the factor loadings are not less than 0.40. Secondly, the composite reliability (CR) criteria stated that the value of CR for each construct should not be less than 0.70. The third criteria stated that each construct's average variance extracted (AVE) should not be less than 0.50 (Fornell & Larcker, 1981). The summarized outcomes for mentioned above three criteria are presented in given below in Table 3.

Table 3: Convergent validity

Construct	Items	Factor loading	AVE	Composite reliability(CR)	Cronbach's alpha
Communication	C1	0.662	0.584	0.807	.880
	C3	0.853			
	C5	0.767			
Intelligence	I1	0.763	0.607	0.822	.861
	I3	0.808			
	I4	0.766			
Information exchange	IE3	0.651	0.537	0.775	.872
	IE4	0.691			
	IE5	0.843			
Integration	INT1	0.738	0.605	0.859	.861
	INT2	0.790			
	INT3	0.860			
	INT4	0.717			
Coordination	CO1	0.698	0.510	0.838	.867
	CO2	0.747			
	CO3	0.724			
	CO4	0.651			
	CO5	0.747			
Responsiveness	RS1	0.712	0.537	0.823	.858
	RS3	0.739			
	RS4	0.716			
	RS5	0.763			
Supply chain performance	SCP1	0.693	0.511	0.862	.860
	SCP2	0.724			
	SCP3	0.701			
	SCP4	0.761			
	SCP5	0.734			
	SCP6	0.674			

Source: SmartPLS output

The consolidated outcomes presented in given above convergent validity table (Refer to Table 3) illustrate that the highest factor loading value is (0.860) and the minimum value of factor loadings is (0.661), indicating that no factor loading value is less than 0.40 so the first standard was fulfilled. In addition, the highest value of AVE is (0.607), which is for construct intelligence, while the minimum

AVE (0.510) is for construct Coordination. However, the AVEs for all constructs are more significant than 0.50, so the second acceptable standard was also achieved by all constructs. Lastly, the minimum composite reliability value is (0.775) for construct information exchange, and the maximum CR value is (0.862) for construct supply chain performance. These CR results indicate that all the constructs have the acceptable CR value (i.e. at least 0.70). Since the results fulfilling all three convergent validity standards, all construct has no issue with convergent validity.

As the collected data might have some errors related to data collection or respondents' bias, so to eliminate these errors and test the internal consistency of data, Hair et al. (2018) recommended the reliability analysis. The recommended acceptable range for reliability is not less than (0.60) (Rashid et al., 2020; Hashmi et al., 2020). According to the summarized results presented in table 3, the construct Communication (C) has the maximum reliability value (Alpha = 0.880). Meanwhile, the construct responsiveness (RS) has the minimum reliability value (0.58). Since these results indicate that the reliability values for all constructs are not less than 0.60, all constructs are reliable for this research study.

4.2.2 Discriminant Validity

Compared to convergent validity, discriminant validity states that the concepts or measurement scales assumed to be distinct are measures of distinct concepts (Hulland, 1999). In this study, discriminate validity was accumulated by the method given by (Fornell & Larcker, 1981). According to this method, the square root of AVEs should be greater than the correlation among each construct pair. The given below Table 4 shows the summarized results for discriminant validity.

Table 4: Discriminant validity

Construct	T_C	T_CO	T_IE	T_INT	T_I	T_RS	T_SCP
Communication	0.764						
Coordination	0.322	0.714					
Information exchange	0.459	0.412	0.733				
Integration	0.405	0.564	0.542	0.778			
Intelligence	0.508	0.479	0.406	0.49	0.779		
Responsiveness	0.437	0.582	0.454	0.496	0.496	0.733	
Supply chain performance	0.405	0.607	0.439	0.566	0.547	0.656	0.715

Source: SmartPLS output

The diagonal of the given above matrix shows the square root of AVEs. According to calculated results, the square root AVEs is greater than the correlation among each pair of constructs. Thus the discriminant validity stated was established (Hashmi et al., 2020b).

4.3 Testing Overall Model

The proposed, tested model has six independent variables: Communication, Intelligence, Information exchange, Integration, Coordination and Responsiveness, whereas there is one dependent variable: supply chain performance. The give below Figure 2 shows the SEM path model. The proposed model has six independent variables: Communication, Intelligence, Information exchange, Integration, Coordination and Responsiveness and one dependent variable (supply chain performance).

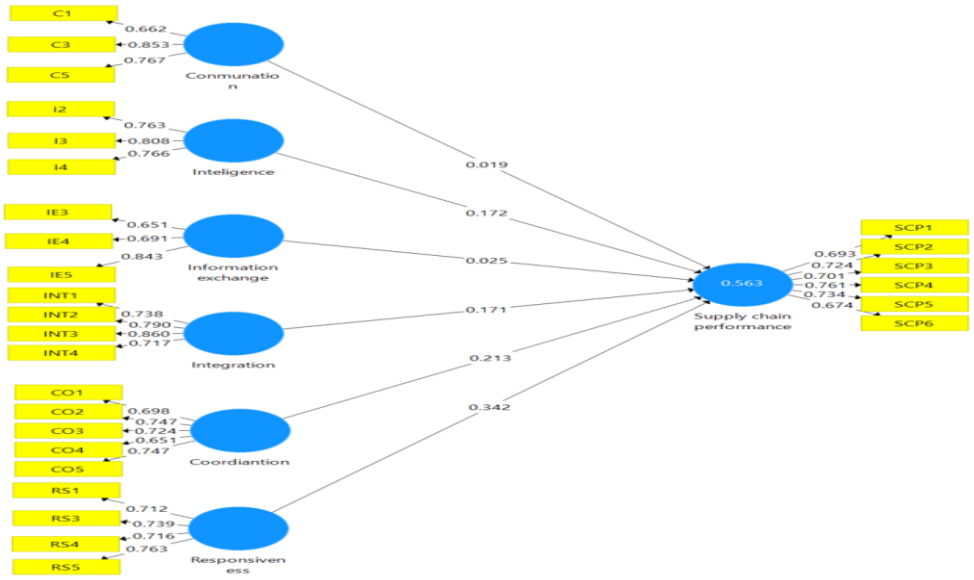

Figure 2: SEM path diagram

According to calculated path coefficient values in Table 5, intelligence significantly and positively influences supply chain performance (β=0.172, p-value <0.05), which supports the *hypothesis two (H2)*. Integration positively and significantly influences supply chain performance (β=0.171, p-value <0.05, which supports *hypothesis four (H4)*. Coordination also has a significant and positive relationship with supply chain performance (β=0.213, p-value <0.05) that supports *hypothesis five (H5)*. The path coefficient results for responsiveness also show that responsiveness has a positive and significant relationship with supply chain performance (β=0.342, p-value <0.05), which supports *hypothesis six (H6)*. The results for *hypothesis one (H1)* and *hypothesis three (H3)* were insignificant.

Table 5: Results of the structural model

	Path coefficient	**T statistics**	***p*-value**	**Hypothesis**	**Support yes/No**
Communication -> Supply chain performance	0.019	0.29	0.772	*H1*	No
Intelligence -> Supply chain performance	0.172	2.418	0.016	*H2*	Yes
Information exchange -> Supply chain performance	0.025	0.457	0.648	*H3*	No
Integration -> Supply chain performance	0.171	3.067	0.002	*H4*	Yes
Coordination -> Supply chain performance	0.213	2.946	0.003	*H5*	Yes
Responsiveness -> Supply chain performance	0.342	4.516	0.000	*H6*	Yes

Source: SmartPLS output

The significance of the relationship among these variables was tested by applying bootstrap using PLS. The bootstrapping results found significant and Summarized results are presented in given Table 6, which expresses that the P-value is less than 0.05, meaning the overall relationship among independent and dependent variables is statistically significant. However, the value of the adjusted R-square is (0.552), which indicates that the predictors of Communication, Intelligence, Information exchange, Integration, Coordination and Responsiveness can significantly predict a 55.2% variance in supply chain performance.

Table 6: Bootstrapping results

Construct	**Adjusted R-Square**	**T- statistics**	**P-value**
Supply chain Performance	0.552	14.478	0.000

Source: SmartPLS output

5. Summary and Conclusion

5.1 Conclusion and Discussion

The research study explored the relationship between IOS use and supply chain management capabilities with firms' supply chain performance. This study was mainly based on the responses of employees that belong to the supply chain departments of firms in the textile sector located in Karachi, Pakistan. The research framework of the study is mainly based on SCM capabilities & IOS use that considered as a predictor to test its influence on SC performance. A sample size of the research population was measured by using G*power software & found a sample size of 146 respondents Whereas, this study utilized 236 respondents that is greater than 146. A structured questionnaire was developed to collect data, and close-ended questions were developed by adapting constructs from previous studies. A questionnaire technique was used to collect data from the SC employees of the firm. After collecting data from respondents, it was analyzed by using SPSS and Smart PLS software. After analyzing the data, it was observed that all the hypotheses (*H2, H4, H5, H6*) were retained and had a positive & significant relationship with firm performance except *H1* and *H3*. The analysis of employees' responses collected from various firms reveals that the use of IOS increases the level of supply chain performance and directly enhances the capabilities of SCM. In addition, it was observed that the influence of SCM capabilities on supply chain performance was very insightful, influential, and even more significant than the impact of IOS use on SC performance. The study's results explore the great significance and importance of managing SCM capabilities when an organization uses IOS.

All the proposed hypotheses were consistent with existing studies, and four hypotheses were also retained. The hypothesis that "Intelligence has a positive influence on Supply chain performance" was retained and answered research question 1b: Does Intelligence influence SC performance? "Was matched with existing literature". For instance, the researcher explained that supply chain intelligence provides a comprehensive perspective of competitive intelligence on the dynamic association of SC integration for better business decisions (Belhadi et al., 2021). The intelligence of the supply chain influences the firm's internal processes and the external environment, including partners of the supply chain (Belhadi et al., 2021). The hypothesis that "Integration has a positive influence on Supply chain performance" was retained and answered to research question 2b: Does Integration influences SC performance? Was it match with existing literature? For instance, the researcher explained that in organizations serval kind of integration occurs, from which two are discussed here, interfirm technology integration and activity integration. Technology integration relates to the level of technology arrangement with network partners; on the other hand, activity integration is conceptualized as the degree to which an organization synchronize its strategic channel process and activities like planning and forecasting with its members of the supply chain (Ganbold et al., 2020). The hypothesis that "Coordination has a positive influence on Supply chain performance" was retained and answered to research question 2c: Does coordination influence SC performance? Was it match with existing literature? For instance, the researcher explained that The coordination between two firms relates to the capability of an organization to coordinate activities related to transactions with partners of the supply chain (Zhang & Yousaf, 2020). The hypothesis that "Responsiveness has a positive influence on Supply chain performance" was retained and answered research question 2d: Does Responsiveness influence SC performance? Was matched with existing literature? For instance, the researcher explained that in the present complex marketplace, it is essential to require a reliable, collaborative and efficient response from the whole supply chain system (Giannakis et al., 2019). To be able to take action & react afterwards to collecting information is the ultimate way of learning (Dissanayake & Cross, 2018). Therefore, we consider the supply chain's responsiveness as one of the critical dimensions of firm supply chain capabilities.

5.2 Limitations & Recommendations

This particular research study has certain limitations and recommendations for future research, i.e. The data of this research was utilized only in one context, as it was discussed only through the firms in the textile sector in Karachi, Pakistan. Therefore, future research may discover the same concept that

is discussed in this research from multiple perspectives. Future research can further explore the compatibility and complementarity of SC's inter-organizational use and capabilities in enhancing the supply chain's performance level. The complementarity influence of IOS use may not be directly influential, and other indirect associations would help provide extra understanding about this phenomenon. In future research, the conceptual framework of this study can be expanded by adding more constructs and variables (mediating variables). Results can be more reliable by using a large population through a large sample size.

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Role of Logistical Practices in Quality Service Delivery at Supermarkets: A Case Study from Pakistan

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ABSTRACT

Logistical practices and customer service delivery are moderately new fields in emerging nations. The respondents in this research comprised of workforce who are logistics supervisors, transportation chiefs, and acquisition officials, or they are comparable in supermarkets in Pakistan. The survey in this paper comprised 200 respondents who were drawn from different supermarkets across Pakistan. The deductive approach followed by the quantitative research method was used to test the study hypotheses through IBM SPSS version 24 as a statistical tool. Data analysis was performed by evaluating the regression model and correlation. The findings of this study demonstrate that supermarkets in Pakistan have taken on the accompanying logistical practices: using environmentally friendly fuels to abstain from harming the climate and reusing materials. Even though the paper was fruitful, it encountered a few restrictions from respondents who could not fill in the survey because they dreaded that the data would be revealed to their rivals. Additionally, because the supermarkets are exceptionally occupied during the weekdays, the officials who responded were reluctant to take off time. Supermarkets and SMEs can also benefit from this research findings and adopt the recommended logistical practices for quality customer service delivery.

Keywords: *Logistics, Supply chain management, Collaboration, Recycling, Service quality*

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Role of Logistical Practices in Quality Service Delivery at Supermarkets: A Case Study from Pakistan

1. Introduction

The term logistics suggests a level of association and command oversupply developments that main modern innovation might have created. It has become one of the main advancements in the transportation business. When assembled, the two words propose a harmless to the ecosystem and proficient vehicle and dispersion framework (Giuliano et al., 2019; Victory et al., 2022). Logistics are a significant capacity of modern transport frameworks. Contemporary innovative and spatial advancements have worked on the expense, productivity and unwavering quality of cargo and traveller transport frameworks. Simultaneously, the adverse natural effects of transportation have acquired wide acknowledgement and are at the centre of maintainability issues, particularly in metropolitan regions. Since logistics uses are mainly specific to the productivity of transport frameworks, it has been recommended that logistics are harmless to the ecosystem, according to the idea of green logistics. The interest for harmless products to the ecosystem has expanded throughout the long term, as is the moving of un waveringness of customers. The steadily expanding expenses of energy and sources of info have constrained businesses to observe better approaches to decrease energy use to lessen costs. Inventory management has been recognized to affect the indigenous habitat essentially. Therefore, organizations are profoundly attempting to green their inventory network by presenting green systems in their associations and the production network. This has created a developing requirement for coordinating ecological thinking in production networks (Kim et al., 2021; Baloch & Rashid, 2022; Hunaid et al., 2022).

Today, natural contamination presents an amazingly perplexing issue, and numerous earth cognizant individuals are turning out to be progressively mindful of this reality. For the duration of the existing pattern of items, from the dispatch of a plan to the withdrawal of an old item, adverse consequences are delivered and reflected in the climate. The number of associations thinking about coordinating ecological practices into their essential plans and everyday tasks is constantly expanding. The overall financial development has brought about an immense utilization of products, while globalization has prompted enormous surges of merchandise from one side of the planet to the other. The creation, transportation, stockpiling and utilization of items have made enormous ecological issues. States, activity gatherings and organizations are requesting measures to counter this danger. Thus, there has been an unreasonable measure of strain on firms to lessen the natural effect of their logistic activities. In an ongoing a long time, for example, organizations have made and embraced techniques that are in better arrangement with the well-being of the climate, like planning for recyclability, utilization of sustainable power, zero waste creation and planning items that do not hurt the climate (Bianchi et al., 2021).

Keleş and Güngör (2021) show that the transportation of merchandise adversely affects the neighbourhood's air quality, creates air pollution, prompts mishaps and, in its entirety, makes an essential contribution to an unnatural weather change. The effect of logistics on climate change has called for expanding consideration as of late, to some extent, because expanding controls on contamination and street well-being upgrades have mitigated the other natural issues. With the Kyoto Agreement being applied worldwide and the pragmatic utilization of green logistics, most nations have implemented ecological enactment for organizations to put social obligation regarding green production, garbage removals, and reverse logistics, including utilized items.

The ascent of stores in agricultural nations has received significant consideration recently (Khan, 2021). It is contended that stores are spreading rapidly in metropolitan regions and that store chains are modernizing their item obtainment and production network the board frameworks, separating them from those utilized by customary retailers and wholesalers. The Pakistani food & grocery retail market had total revenues of $53.0bn in 2020, representing a compound annual growth rate (CAGR) of

8.3% between 2016 and 2020. Booth et al. (2021) show that grocery stores are developing at a yearly pace of 18% and generally have a 20% portion of the metropolitan food market. In the metropolitan regions (Karachi, Lahore) are the bigger organization stores (hypermarkets) and the bigger chains. In the more modest towns and primary intersection towns, more modest organization stores and more modest chains have arisen. The express growth of the retail sector, while mainly reflecting the positive aspects of the evolution of the Pakistani economy, also indicates a few worrying features that must be addressed urgently. The development of the Pakistan retail market and the benefits that this has spawned have so far mainly been seen in some areas of the country instead of being true across the board. Grocery stores in Pakistan assume a huge monetary part. The development of general stores has provided a considerable number of occupations to many individuals in the country who might somehow be jobless. By giving business, they are helping the public authority to lighten destitution among the residents. The stores have additionally improved different organizations in the towns where they are set up. The administrations related to this incorporate financial administration and other related organizations.

The need to secure the climate has prompted the execution of green practices in different ventures across the globe. By carrying out green logistics, associations are managing the issue of maintainability in the supply network. There are expanded constraints from lobby groups for associations to direct their exercises in an all the more harmless to the ecosystem way. Mellita et al. (2020) contended that if merchandise conveyance approaches do not change to such an extent that calculated administrators can utilize the benefits of every method of transport all the more soundly, substantial goods vehicle traffic alone will increase by 50%. This increment in substantial goods vehicle traffic will probably increase carbon dioxide emissions by 50% more. Patella et al. (2020) give a valuable show of the targets of Green Logistics. As indicated by their paper, the three directing columns for the future improvement of green logistics are maintainability, portability and openness. This way supports more explicit objectives like ecological friendliness and energy preservation. Nag and Ferdausy (2021) considered the sensibility to stretch out these destinations to all logistics parts, for example, request handling, transportation, bundling, warehousing, material taking care of, correspondence, reverse logistics, preparing, training and innovation. Environmental change because of ozone-depleting substances has financial and social ramifications just as regrettable externalities related to logistics frameworks. Externalities, for example, gridlock, asset wastage, the utilization of non-sustainable fuel, the impacts of byproducts, for example, tires and oil petroleum product, biological system annihilation and species, adverse general well-being effects of contamination eradication, crop obliteration, wounds and passing coming about because of auto collisions, commotion, visual interruption, clog deflecting traveller travel, loss of green field locales and crumbling of structures foundation influence general society assuming associations neglect to put in place a professional ecological friendly green practices.

Mellita et al. (2020) likewise suggested this in a review on Supply Chain Management. The review focused on the essential exploration and practices. The review discovered that dissemination and outbound logistics are vital in the green supply network. Painting logistics "green" is not difficult. As people generally turn out to be more mindful of natural issues and unnatural weather changes, buyers will pose more inquiries about the items they are buying. Organizations should expect inquiries regarding how green their assembling cycles and inventory network are, their carbon impression and how they reuse. Based on this current gap, this study tries to analyze the green practices among supermarkets in Pakistan. The study will empirically examine the influence of *"collaboration in transport, limited use of carbon-based fuels, and recycling of material for green logistics"* on *"quality of customer service"*.

2. Literature Review

A client might be characterized as somebody who has a close relationship with or is straightforwardly impacted by the office and who gets or depends on at least one of the office's administrations or items. Three rules should be observed to accomplish great client support (Shaheen, 2022). The primary standard is uprightness. It is identified with the aim or means behind one's activities. It requires administration conveyance that is fair and expert and guidance that is plain, unopinionated

and in light of thorough examination that considers objective direction. The following rule is regard for clients that is shown by treating them with nobility, reasonableness and affectability, per their conditions and precise necessities. Responsibility is the last standard, and it is about reasonable and reliable navigation, where inventive arrangements are looked for, and issues of classification are regarded. The degree of client assistance will decide the degree of consumer loyalty. Consumer loyalty is a popular expression today; everybody utilizing this present consumer loyalty is impacted by the significance put by the clients on every one of the perspectives of the item/administration. Consumer loyalty estimation permits an association to comprehend the key drivers that make fulfilment or disappointment; and what is truly driving their fulfilment during a helpful insight. Consumer loyalty is the perspective clients have about an organization when their assumptions have been met or surpassed over the lifetime of the item or administration. It is likewise the feeling or disposition of a client towards an item or administration after it has been utilized. Kou and Vigil (2021), fulfilment seems to intervene in changes between pre- and post-openness attitudinal parts. It is a significant result of showcasing action, which fills in as a connection between the different phases of customer purchasing conduct (Altinay et al., 2019). When clients pay cash to purchase assistance, they have some base assumptions from the exchange. These assumptions from the buyer must be met generously, if not wholly, for the client to turn into a reliable client of help (Munawar et al., 2021).

2.1 Empirical Review

There are various examinations that have focused on genuine practices in the field of supply networks. A few detailed examinations related to this subject have been published. They comprise essentially contextual analyses and studies. Most contextual investigations manage green plans (item and coordination) and green tasks (remanufacturing, reusing, RL, and so forth). As indicated by Tippayawong et al. (2016), an ecologically cognizant inventory network, also called a green inventory network, is another idea in ongoing literary works. Albeit this ecological issue has been acknowledged as vital for business, my first experience with supply chain management has just grown as of late. The writing about the naturally cognizant inventory network is highly restricted. "Sustainable Development" was the critical idea of the “Earth Summit” in 1992, where state-run administrations and worldwide associations conceded to make a move to ensure the climate as a necessary piece of long-haul financial turn of events. Ecologically dependable utilization and creation are viewed as fundamental pieces of the procedure to work on natural quality, lessen neediness and achieve monetary growth, with resultant upgrades in well-being, working conditions, and supportability, and are the present featured Agenda.

Hebaz and Oulfarsi (2021) concentrated on Green supply chain management: tensions, practices and execution inside the Chinese car industry in which they saw that expanding pressures from an assortment of bearings have made the Chinese car store network chiefs consider and start the execution of green practices to work on both their monetary and ecological exhibition. Developing some prior work researching general green practices in China, the creators investigated the GSCM pressures/drivers (inspirations), drives and execution of the auto store network utilizing a detailed examination of 89 car manufacturers inside China. In another review, Asghari and Al-e-Hashem (2021) presented Green vehicle routing problem: A state-of-the-art review in which they imagined that heightening ecological worries with predominant transportation modes had prompted an expanded interest in the reception of "green", maintainable practices in the space of inventory network the executives. As a piece of a general green inventory network technique, the measure of carbon emission coming because of the transportation component of a production network is a developing worry for production network administrators and corporate leaders. Boutkhoum et al. (2016) additionally led an observational review dependent on six components of green supply chain management: eco configuration, green assembling and bundling, ecological cooperation, green showcasing, stock and providers. The outcomes construed that the organizations focusing on promoting green had been effective contenders against the opponents. Slašťanová et al. (2019) also investigated ecologically vital administration ideas. They connected them to supply chain management practices like seller evaluation, communitarian supply methodologies, setting up natural acquirement strategies and working with suppliers to empower enhancements. Based on the literature study presented earlier, the following research hypotheses have been developed for this study:

H_1: Collaboration in transport significantly influence the quality of customer service delivery.

H_2: Limited use of Carbon-based fuels significantly influence customer service delivery.

H_3: Recycling of material for green logistics significantly influence customer service delivery.

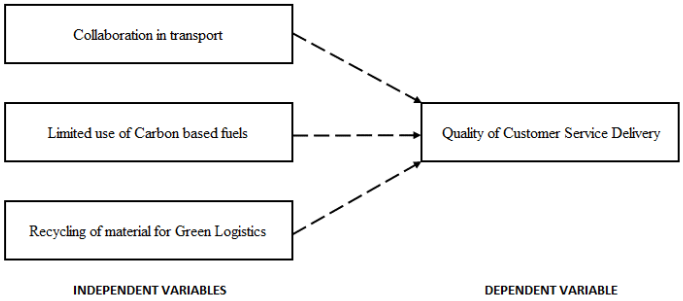

Figure 1: Conceptual research model

3. Research Methods

The explanatory research approach was used to investigate the study variables (Rashid & Amirah, 2017; Rashid et al., 2019; Khan et al., 2022; Khan et al., 2022). Explanatory research helps to determine the cause of the occurrence of a specific phenomenon (Hashmi & Mohd, 2020; Hashmi et al., 2020a; Khan et al., 2022; Rashid et al., 2020). This method usually describes a situation and problem in a causal relationship relative to the quantitative method. This method's prime objective is finding issues and critical variables in a specific problem. The researcher characterizes paradigm as a fundamental arrangement of consistent convictions, a bunch of settlements on how issues ought to be deciphered, and in this manner, lead research (Creswell, 2003; Rashid et al., 2021). The difficulty is that the prescribed technique for characterizing research observes its paradigm (Hashmi et al., 2020b; Khan et al., 2021). This is fundamental because the decision of a particular worldview does not fit with the logical information of the researchers. Further, the research strategy portrays a strategy for information assortment and its explanation with an unmistakable arrangement of destinations. This method is an ordinary course of action, for example, tending to the research queries (Hashmi et al., 2020; Hashmi et al., 2021). Further, this study used a survey as a research strategy with a deductive method. The survey provides information from organized polls or meetings (Agha et al., 2021: Alrazehi et al., 2021; Das et al., 2021: Haque et al., 2021).

A sample size might depict more items or people than a researcher determines. Simultaneously, sampling is the technique of choosing a part of the population for an assessment to gauge an individual's perspectives, convictions, and qualities (Rashid & Rasheed, 2022). Sampling speeds up data collection and acquires exact outcomes. Regarding choosing the sampling technique, it relies upon the idea of the review or is possible to incorporate commonsense and hypothetical intimations. In this study, we have used convenience sampling as a non-probability technique where the information is promptly accessible. This technique assists researchers with getting reactions or completing meetings in a savvy way. It has a wide-running conversation on sample size in scholarly writing. Picking the correct selected size is, at this point, pursued by researchers as the measurable strategies are all together and sensitive to test size and pick correctly. This research has a sample size of 200 supply chain professionals working at supermarkets. According to Hashmi et al. (2021), a sample size of 200 is adequate enough to generalize the test results. This research has an organization as a unit of analysis. The questionnaire used a five-point Likert scale. A Likert scale is generally utilized in survey examination to evaluate perspectives and perceptions. Such evaluating scales incorporate more than five response classifications and get advantages and disadvantages of their own. Writing demonstrates that the Likert information is generously less dependable where the scale surpasses seven or drops 5.

4. Data Analysis

4.1 Descriptive Analysis

Data analysis was performed using IBM Statistical Package for Social Science (SPSS) version 24. The descriptive and inferential statistical analysis was carried out to test the study hypothesis. For analysis of the demographic variables, which include Gender (Male/Female), Age, and logistics experience. The total number of respondents was 200 from supermarkets across Pakistan, of which 135 (67.5%) were male and 65 (32.5%) female. 60 (30%) respondents were between the age of 25 to 30 years, 85 (42.5%) respondents were between the age of 31 to 35 years, and 55 (27.5%) respondents were between the age of 36 to 40 years this indicates less number of supply-chain experienced professionals with 10+ years are present in the industry, whereas 42.5% are young supply-chain professionals who are gaining experience from others' experience had been in the industry for around 6-10 years, and 30% are the entrants to this profession due to its growing demand are between 01-05 years of experience.

Table 1: Demographic table

Gender		Age (Years)			Experience (Years)		
Male	Female	25-30	31-35	36-40	01-05	06-10	10+
135	65	60	85	55	60	85	55
68%	33%	30%	43%	28%	30%	43%	28%

Source: SPSS output

4.1.1 Quality of Customer Service Delivery

Quality of customer service delivery is the first and the only dependent variable that was analyzed by asking answers on a Likert scale for 09 questions. The researcher wanted to establish whether logistical practices enhance the quality of customer service delivery. 22 of 200 respondents strongly disagreed with the statement that logistical increases the cost of products and has affected customer service standards, 19 of 200 respondents disagreed with the statement that logistical increases the cost of products and has affected customer service standards, 10 of 200 stayed neutral to the statement that logistical increases the cost of products and has affected customer service standards, 143 of 200 respondents agreed & 6 of 200 respondents strongly agreed to the statement that logistical increases the cost of products and has affected customer service standards which means that departing from the traditional ways of handling product movements within the supply chain to a more environment-friendly movement is cost intensive especially when there is inadequate training and communication among personnel in the logistics department. Further, 10 of 200 respondents strongly disagreed to the statement that green logistics lead to longer lead times that affect customer service, 30 of 200 respondents disagreed to the statement that logistical lead to longer lead times that affect customer service, 36 of 200 stayed neutral to the statement that logistical lead to longer lead times that affect customer service, 26 of 200 respondents agreed & 98 of 200 respondents strongly agreed to the statement that logistical operations lead to longer lead times that affect customer service which means that when implementing green logistics, the time the customers take to place an order and the time it takes for the customer to receive the product is longer. 13 of 200 respondents strongly disagreed to the statement that environmental friendly packaging of material improves customer, 31 of 200 respondents disagreed to the statement that environmental friendly packaging of material improves customer, 80 of 200 stayed neutral to the statement that environmental friendly packaging of material improves customer, 24 of 200 respondents agreed & 52 of 200 respondents strongly agreed to the statement that environmental friendly packaging of material improves customer which means that materials used for packaging can be reused and recycled.

18 of 200 respondents strongly disagreed with the statement that it is easy for the customer to find their desirables products easily in the supermarket, and 31 of 200 respondents disagreed with the statement that it is easy for the customer to find their desirables products easily in the supermarket, 36 of 200 stayed neutral to the statement that it is easy for the customer to find their desirables products easily in a supermarket, 107 of 200 respondents agreed & 28 of 200 respondents strongly agreed to the

statement that it is easy for the customer to find their desirables products easily in the supermarket which means that it saves their time and money too, and how well the supermarket is designed to make customer deliverables easy. Then, 03 of 200 respondents strongly disagreed with the statement that using fuel management technology reduces transportation costs and enhances customers, 15 of 200 respondents disagreed with the statement that using fuel management technology reduces transportation cost and enhances customers, 49 of 200 stayed neutral to the statement that using fuel management technology reduces transportation cost and enhances customer, 98 of 200 respondents agreed & 35 of 200 respondents strongly agreed to the statement that using fuel management technology reduces transportation cost and enhances customer. However, 6 of 200 respondents strongly disagreed with the statement that supermarkets give individual attention to the customer, 24 of 200 respondents disagreed with the statement that supermarkets give individual attention to the customer, 61 of 200 stayed neutral to the statement that supermarkets give individual attention to the customer, 87 of 200 respondents agreed & 35 of 200 respondents strongly agreed to the statement that supermarkets give individual attention to the customer.

6 of 200 respondents strongly disagreed with the statement that supermarkets use respective &appropriate transport that delivers large loads to make availability of products easy, 26 of 200 respondents disagreed with the statement that supermarkets use respective &appropriate transport that delivers large loads to make availability of products easy, 61 of 200 stayed neutral to the statement that supermarkets use respective &appropriate transport that delivers large loads to make availability of products easy, 87 of 200 respondents agreed & 20 of 200 respondents strongly agreed to the statement that supermarkets use respective &appropriate transport that delivers large loads to make availability of products easy as supermarkets make bulk purchases for every item to be made available at the supermarket. 6 of 200 respondents strongly disagreed with the statement that they prefer supermarkets due to their locations, possibly due to being located far from their home or being located near heavy traffic areas; 13 of 200 respondents disagreed with the statement that they prefer supermarkets due to their locations, 47 of 200 stayed neutral to the statement that they prefer supermarkets due to their locations, 106 of 200 respondents agreed & 28 of 200 respondents strongly agreed to the statement that they prefer supermarkets due to their locations. 03 of 200 respondents strongly disagreed with the statement that communication with customers is maintained in order to make them realize the importance of environmentally friendly products, 24 of 200 respondents disagreed with the statement that communication with customers is maintained in order to make them realize the importance of environmentally friendly products, 46 of 200 stayed neutral to the statement that communication with customers is maintained in order to make them realize the importance of environmentally friendly products, 94 of 200 respondents agreed & 33 of 200 respondents strongly agreed to the statement that communication with customers is maintained in order to make them realize the importance of environmentally friendly products.

4.1.2 Collaboration in Transport

The researcher wanted to establish whether collaboration in transport affects or enhances efficient customer service delivery. 08 of 200 respondents strongly disagreed with the statement that they use lead-free fuels to avoid any damage to the environment, 35 of 200 respondents disagreed with the statement that they use lead-free fuels to avoid any damage to the environment, 63 of 200 stayed neutral to the statement that they use lead-free fuels to avoid any damage to the environment, 81 of 200 respondents agreed & 13 of 200 respondents strongly agreed to the statement that they use lead-free fuels to avoid any damage to the environment as in Pakistan, the fuel that is available is free from lead. 01 of 200 respondents strongly disagreed with the statement that their logistics practices comply with the National Environmental Policy of Pakistan as they may have outsourced logistics, 12 of 200 respondents disagreed with the statement that their logistics practices comply with the National Environmental Policy of Pakistan, 50 of 200 stayed neutral to the statement that their logistics practices comply with National Environmental Policy of Pakistan, 85 of 200 respondents agreed & 52 of 200 respondents strongly agreed to the statement that their logistics practices comply with National Environmental Policy of Pakistan. 03 of 200 respondents strongly disagreed with the statement that they are limiting the use of carbon-based fuels, 09 of 200 respondents disagreed with the statement that

they are limiting the use of carbon-based fuels, 37 of 200 stayed neutral to the statement that they are limiting the use of carbon-based fuels, 106 of 200 respondents agreed & 35 of 200 respondents strongly agreed to the statement that they are limiting the use of carbon-based fuels. 09 of 200 respondents strongly disagreed with the statement that their organization uses fuel management technology that reduces transportation costs and enhances customer service, 07 of 200 respondents disagreed with the statement that their organization uses fuel management technology that reduces transportation costs and enhances customer service, 22 of 200 stayed neutral to the statement that their organization uses fuel management technology that reduces transportation costs and enhances customer service, 112 of 200 respondents agreed & 50 of 200 respondents strongly agreed to the statement that their organization uses fuel management technology that reduces transportation costs and enhances customer service as they have their own transport fleet to save cost and use it on benefitting customers.

Further, 07 of 200 respondents strongly disagreed with the statement their organization optimizes transport cargo distribution, 56 of 200 respondents disagreed with the statement their organization optimizes transport cargo distribution, 34 of 200 stayed neutral to the statement their organization optimizes transport cargo distribution, 76 of 200 respondents agreed & 27 of 200 respondents strongly agreed to the statement their organization optimizes transport cargo distribution for meeting customer and market demand. 04 of 200 respondents strongly disagreed with the statement that the full truckload system is applied to increase the effectiveness of product delivery, 24 of 200 respondents disagreed with the statement that the full truckload system is applied to increase the effectiveness of product delivery, 27 of 200 stayed neutral to the statement that the full truckload system is applied to increase the effectiveness of product delivery, 94 of 200 respondents agreed & 51 of 200 respondents strongly agreed to the statement that the full truckload system is applied to increase the effectiveness of product delivery. 02 of 200 respondents strongly disagreed with the statement that the delivery vehicles are well checked & maintained as per plan, 33 of 200 respondents disagreed with the statement that the delivery vehicles are well checked & maintained as per plan, 38 of 200 stayed neutral to the statement that the delivery vehicles are well checked & maintained as per plan, 99 of 200 respondents agreed & 28 of 200 respondents strongly agreed to the statement that the delivery vehicles are well checked & maintained as per plan. 01 of 200 respondents strongly disagreed with the statement that the delivery routes are determined to save fuel and reduce pollution, 21 of 200 respondents disagreed with the statement that the delivery routes are determined to save fuel and reduce pollution, 24 of 200 stayed neutral to the statement that the delivery routes are determined to save fuel and reduce pollution, 91 of 200 respondents agreed & 63 of 200 respondents strongly agreed to the statement that the delivery routes are determined to save fuel and reduce pollution. 05 of 200 respondents strongly disagreed with the statement that the temperature & other conditions of the trailer are measured with the system w.r.t supply of dry & frozen items, 21 of 200 respondents disagreed with the statement that the temperature & other conditions of the trailer are measured with the system w.r.t supply of dry & frozen items, 33 of 200 stayed neutral to the statement that the temperature & other conditions of the trailer are measured with the system w.r.t supply of dry & frozen items, 95 of 200 respondents agreed & 46 of 200 respondents strongly agreed to the statement that the temperature & other conditions of the trailer are measured with the system w.r.t supply of dry & frozen items to keep them fresh and deliverable when received at the supermarket.

4.1.3 Limited use of Carbon Fuels

Limited use of Carbon Fuels is the two of three independent variables that were analyzed, asking answers on the Likert scale for 03 questions. Where 03 of 200 respondents strongly disagreed with the statement that their fleet uses lead-free fuel to avoid damaging the environment, 31 of 200 respondents disagreed with the statement that their fleet uses lead-free fuel to avoid damaging the environment, and 49 of 200 stayed neutral to the statement that their fleet uses lead-free fuel to avoid damaging environment, 93 of 200 respondents agreed & 24 of 200 respondents strongly agreed to the statement that their fleet uses lead-free fuel to avoid damaging environment. 02 of 200 respondents strongly disagreed with the statement that the delivery routes are determined to save fuel and reduce pollution, 20 of 200 respondents disagreed with the statement that the delivery routes are determined to save fuel and reduce pollution, 36 of 200 stayed neutral to the statement that the delivery routes are

determined to save fuel and reduce pollution, 85 of 200 respondents agreed & 57 of 200 respondents strongly agreed to the statement that the delivery routes are determined to save fuel and reduce pollution. 04 of 200 respondents strongly disagreed with the statement that the supermarket is concerned about the fuel spent during the delivery process and the amount of released CO_2, 13 of 200 respondents disagreed with the statement that the supermarket is concerned about the fuel spent during the delivery process and the amount of released CO_2, 33 of 200 stayed neutral to the statement that the supermarket is concerned about the fuel spent during the delivery process and the amount of released CO_2, 104 of 200 respondents agreed & 46 of 200 respondents strongly agreed to the statement that the supermarket is concerned about the fuel spent during the delivery process and the amount of released CO_2.

4.1.4 Recycling of Material for Green Logistics

Recycling of Material for Green Logistics is the last of three independent variables that were analyzed, asking answers on a Likert scale for 07 questions. 98 of 200 respondents strongly disagreed with the statement that the packaging used at the supermarket is reused, 06 of 200 respondents disagreed with the statement that the packaging used at the supermarket is reused, 08 of 200 stayed neutral to the statement that the packaging used at the supermarket is reused, 47 of 200 respondents agreed & 41 of 200 respondents strongly agreed to the statement that the packaging used at the supermarket is reused. 02 of 200 respondents strongly disagreed with the statement that the purchased raw material by the supermarkets can be reused or recycled, 04 of 200 respondents disagreed with the statement that the purchased raw material by the supermarkets can be reused or recycled, 85 of 200 stayed neutral to the statement that the purchased raw material by the supermarkets can be reused or recycled, 109 of 200 respondents strongly agreed to the statement that the purchased raw material by the supermarkets could be reused or recycled. 124 of 200 respondents strongly disagreed with the statement that the products from the customer are recycled, 30 of 200 respondents disagreed with the statement that the products from the customer are recycled, 23 of 200 stayed neutral to the statement that the products from the customer are recycled, 14 of 200 respondents agreed & 09 of 200 respondents strongly agreed to the statement that the products from the customer are recycled. 51 of 200 respondents strongly disagreed with the statement that their packaging materials are environmentally friendly, 85 of 200 respondents disagreed with the statement that their packaging materials are environmentally friendly, 10 of 200 stayed neutral to the statement that their packaging materials are environmentally friendly, 18 of 200 respondents agreed & 36 of 200 respondents strongly agreed to the statement that their packaging material is environmentally friendly.

36 of 200 respondents strongly disagreed with the statement that recycling materials enable them to provide better customer service, 32 of 200 respondents disagreed with the statement that recycling materials enable them to provide better customer service, 113 of 200 stayed neutral to the statement that recycling materials enable them to provide better customer service, 12 of 200 respondents agreed & 07 of 200 respondents strongly agreed to the statement that recycling materials enable them to provide better customer service. 19 of 200 respondents strongly disagreed with the statement that their supermarkets provide means for recycling their materials, 14 of 200 respondents disagreed with the statement that their supermarkets provide means for recycling their materials, 59 of 200 stayed neutral to the statement that their supermarkets provide means for recycling of their materials, 82 of 200 respondents agreed & 26 of 200 respondents strongly agreed to the statement that their supermarkets provide means for recycling of their materials. 35 of 200 respondents strongly disagreed with the statement that recycling decreases supermarket disposal costs, 93 of 200 respondents disagreed with the statement that recycling decreases supermarket disposal costs, 26 of 200 stayed neutral to the statement that recycling decreases supermarket disposal costs, 29 of 200 respondents agreed & 17 of 200 respondents strongly agreed to the statement that recycling decreases supermarket's disposal cost.

4.3 Reliability Statistics

As per the standard ratio, the reliability has to be greater than 0.70, assuring the reliability of the questionnaire and the data collected (Hashmi et al., 2020). The reliability ratio in the research for saving behaviour study is 0.738, above the standard ratio. As this statistical data summary shows that

our sample size is 200 and there are no missing data, and all questionnaires have been filled out by the respondents working in supermarkets across Pakistan.

Table 2: Reliability test

Cronbach's Alpha	*N* of Items
.738	28

Source: SPSS output

4.4 Correlations

The accompanying scores of Pearson correlation assess the strength and course of the straight association between the two elements. The correlation coefficient goes from - 1 to +1, moving from the ideal negative relationship to consummating the positive relationship, and 0 shows no connection by any means. (A variable related to it-self-will consistently have a correlation coefficient of 1.) The correlation coefficient advises the degree to which the worth of one variable can be speculated, given the worth of the other variable. The Sig**.** (2-tailed) is the *p-value* related to the correlation. The reference under the correlation table clarifies what the single and double asterisks signify. *N* is a number of cases that are utilized in the correlation. As there are no missing data in this informational index, all correlations were based on all 200 cases in the data set. Be that as it may, if a couple of variables had missing qualities, there would have been different qualities for *N's*. Cohen (1992) proposed the recommended values of a correlation coefficient:

Table 3: Correlations matrix

		CST	LUFT	REGT	CITRATE
CST	Pearson Correlation	1	.367**	.117	.345**
	Sig. (2-tailed)		<.001	.099	<.001
	N	200	200	200	200
LUFT	Pearson Correlation	.367**	1	.093	.525**
	Sig. (2-tailed)	<.001		.188	<.001
	N	200	200	200	200
REGT	Pearson Correlation	.117	.093	1	-.018
	Sig. (2-tailed)	.099	.188		.797
	N	200	200	200	200
CITRATE	Pearson Correlation	.345**	.525**	-.018	1
	Sig. (2-tailed)	<.001	<.001	.797	
	N	200	200	200	200

**. Correlation is significant at the 0.01 level (2-tailed).

Source: SPSS output

Note: QCSDT: Quality of customer service delivery (Dependent Variable), Independent Variables: LUCFT: Limited use of carbon-based fuels, REGLT: Recycling of material for green logistics, CITRT: Collaboration in Transport

Size of Correlation	Interpretation
-0.3 to +0.3	Weak
-0.5 to -0.3 or 0.3 to 0.5	Moderate
-0.9 to -0.5 or 0.5 to 0.9	Strong
-1.0 to -0.9 or 0.9 to 1.0	Very strong

Cohen (1992). Power Primer. Psychological Bulletin, 112(1) 155-159; Rule of Thumb for Interpreting the Size of a Correlation Coefficient

4.5 Regression Analysis

Variables Entered is the list of all the variables used in the process for regression analysis. Here four variables are used for testing regression analysis. Rashid (2016) suggested that variables removed enlisted if any variable is omitted or removed from the regression process, where none in this case happened. This column only gets filled when only stepwise regression is done. The method describes the procedure for running the regression. "Enter" defines that all independent variables are entered the usual way, and no particular criterion is followed. Any entry in this column will be defined if a stepwise

regression is done.

4.5.1 Model Summary

The model defines the number of the model being reported. R is the square root of R^2 and is the correlation between the observed and expected values of the dependent variable. It shows a 42.0% of correlation between the observed and expected values of the dependent variable. R-Square is the part of the variance in the dependent variable (quality of customer service delivery) expected from the independent variables (collaboration in transport, limited use of carbon-based fuels & recycling of material for green logistics). This value defines that 17.6% of the variance in quality of customer service delivery can be predicted from collaboration in transport, limited use of carbon-based fuels & recycling of material for green logistics, & the rest 82.4% can be due to any other factors that remained hidden during the research. This is a measurement of the overall strength of association and does not show to what level any particular independent variable is associated with the dependent variable. For the big picture, the R^2 value in combination with other items should be considered, including statistics and deep knowledge of the research area. R-Square is also called the coefficient of determination. Small R-square values are not always problematic, and the higher ones cannot always be good. Getting R-value for any change is impossible to determine. A good model can have a low R-Square value, whereas a biased one can have greater R-Square values, and in some situations value of R-Square can be window dressed toward the higher side.

Table: 06 Model Summary

Model	R	R Square	Adjusted R Square	Std. The Error in the Estimate
1	.420[a]	.176	.164	.49550

a. Predictors: (Constant), CITRT, REGLT, LUCFT

Adjusted R-square, as indicators are added to the model, every indicator clarifies some difference in the dependent variable because of possibility. One could keep adding indicators to the model, which would keep on improving the capacity of the indicators to clarify the dependent variable, albeit a portion of this increment in R^2 would be basically because of chance variation in that specific example. The adjusted R^2 endeavors to convey the more legitimate incentive for assessing the R^2 for the populace. The value of R^2 was 0.176, while the value of Adjusted R^2 was .164. This shows that 16% of the variety in the result is because of the indicators utilized in the model. One can see that when the quantity of observations is small and the quantity of indicators is enormous, there will be a lot more prominent distinction between R-square and adjusted R^2.

Additionally, when the quantity of observations is huge contrasted with the number of indicators, the worth of R^2 and adjusted R^2 will be a lot nearer. As R^2 consistently increases and never diminishes, causing it gives off an impression of being a better fit with different terms in the model. The standard error of the estimate, additionally called root mean square Error, is the σ of the error term and is the square base of the Mean Square Residual (or Error). The standard error of 0.49550 estimates the accuracy of the model. A little SE means that the sample means a more precise impression of the simple populace means.

4.5.2 Statistical Significance

The Total variance is divided into the variance, one that can be explained by the free factors (Regression) and the other that is not explained by the self-governing components (Residual, sometimes called error). The Sums of Squares for the Regression and Residual add up to the total showing how the total is apportioned into Regression and Residual difference. The Sum of Squares is related to the three sources of variance, Total, Model and Residual. SS Regression/SS Total is equivalent to 0.176, the worth of R^2. This is because R^2 is the degree of the distinction explained by the free factors, which subsequently can be figured by SS Regression/SS Total. DF is related to the sources of variance. The total variance has N-1 degrees of freedom. In this case, there were N=200 students, so the DF for the total is 199. The model degrees of freedom correspond to the number of predictors minus 1 (K-1). It is

imagined that this would be 4-1 (since there were three independent variables in the model, collaboration in transport, limited use of carbon-based fuels & recycling of material for green logistics). However, the intercept is automatically included in the model (unless explicitly omitting the intercept). Including the intercept, there are four estimators, so the model has 4-1=3 degrees of freedom. The Residual degree of freedom is the DF total minus the DF model; 199 – 3 is 196.

Table 7: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression (2)	10.308	3	3.436	13.995	<.001[b]
	Residual (2)	48.123	196	.246		
	Total (2)	58.431	199			

a. Dependent Variable: QCSDT, b. Predictors: (Constant), CITRT, REGLT, LUCFT

Source: SPSS output

Mean Squares; the Sum of Squares divided by their respective DF.

i. For the Regression: 10.308/3=3.436
ii. For the Residual: 48.123/196=0.246

These are processed to figure the F proportion, dividing the Mean Square Regression by the Mean Square Residual for testing the significance of the predictors in the model. The F-value is the Mean Square Regression (3.436) divided by the Mean Square Residual (0.246), yielding F=13.995. The p-value related to this F value is extraordinarily little (<0.001). These values are utilized to address the "Are independent variables dependably foreseeing the dependent variable?" The p-value is contrasted with the alpha level (typically 0.05) and, if smaller, it can be concluded that "Indeed, the independent factors are dependably anticipating the dependent variable". The *F-test* in the ANOVA table portrays whether the overall model is a good fit or not. The table shows that the independent variables statistically significantly predict the dependent variable, $F(3, 196) = 13.995$, $p (<.001) < 0.05$, justifying that the model is a good fit for the data.

One might say that the gathering of factors collaboration in transport, limited use of carbon-based fuels & recycling of material for green logistics can be utilized to dependably anticipate the quality of customer service delivery (the dependent variable). Suppose the p-value were more significant than 0.05. In that case, it tends to be said that the gathering of independent variables does not show a statistically significant relationship with the dependent variable, and the independent variables are not reliably predicting the dependent variable. This is an overall significance test assessing whether the group of independent factors, when utilized together, dependably foresee the dependent variable and does not address the capacity of any of the particular independent variables to predict the dependent variable. The limit of every individual independent variable to foresee the dependent variable is tended in the table under which every one of the individual variables is listed.

4.5.3 Statistical Significance

The statistical significance of each independent variable tests whether the standardized or unstandardized coefficients are equal to zero or not in the given population. If $p < 0.05$, the coefficients are statistically significant to 0 (zero). The test is useful for checking the exploratory variable presence in the model. It was found that LUCFT; $p (.002) <0.05$, CITRT; $p(.004)<0.05$, are significant, but no *REGLT* $p(.133)>0.05$. This means that the exploratory variable recycling of material for green logistics is no useful variable in the model. However, we cannot completely agree with this, as already stated above, due to the different thinking and mentality of the respondents, the results were not what was expected and with this importance of recycling cannot be denied in any aspect of life. From the above result, we conclude that collaboration in transport & limited use of carbon-based fuels impacts the quality of customer service delivery more substantially than recycling material for green logistics. The beta coefficients value shows that these are the values for the regression equation for predicting the dependent variable from the independent variable. These are called unstandardized coefficients estimated in their standard units. The coefficients could not measure up to each other to figure out which

is more compelling in the model since they can be estimated on various scales. The regression equation can be presented in many different ways, for example:

$$iii. \quad Y\ predicted = b_0 + b_1*x_1 + b_2*x_2 + b_3*x_3 + b_3*x_3$$

The column of estimates (coefficients or parameter estimates, from here on, labelled coefficients) provides the values for b_0, b_1, b_2, and b_3 for this equation. Expressed as far as the factors utilized in this model, the relapse condition is

$$iv. \quad Quality\ of\ Customer\ Service\ Delivery\ Predicted = 1.887 + .162*LUCFT + 0.103*REGLT + 0.215*CITRT$$

These assessments talk about the association between the independent factors and the dependent variable. These estimates tell the impact on quality of customer service delivery would be expected by a 1-unit extension in the pointer. For the independent factors that are not critical, the coefficients are not through and are not precisely equivalent to 0, which should be viewed while interpreting the coefficients. Constant 1.887 indicates the value for the dependent variable (quality of customer service delivery) if all the relative independent variables, collaboration in transport, limited use of carbon-based fuels & recycling of material for green logistics = 0. This will suggest that an average change in saving behaviour is 1.887. The coefficient (parameter estimate) for collaboration in transport is .215. So, for every change in collaboration with the transporter, a 0.215 change is expected in the quality of customer service delivery, holding all other variables constant. Alternatively, for every change point in the parental norm, the quality of customer service delivery is expected to be higher by 0.215. This is significantly different from 0.

The coefficient (parameter estimate) for the limited use of carbon-based fuels is 0.162. So, for limiting carbon-based fuels in the fleet, a 0.162 change is expected in the quality of customer service delivery which can make the delivery more timely and protect the environment, holding all other variables constant. Alternatively, for every change, one point in limiting carbon-based fuels, quality of customer service delivery is expected to be higher by .162. This is significantly different from 0. For each adjustment of recycling of material for green logistics, there is a 0.103 change in the quality of customer service delivery, holding any remaining factors steady. The variable recycling of material for green logistics is, in fact, not measurably essentially lower than 0, because the p-value is more prominent than .05. However, .133 is a path higher than .05, making it genuinely unimportant.

The standard errors are related to the coefficients. The standard error tests that the parameter is not the same as 0 by dividing the parameter estimate by the standard error giving a *t-value*. Beta is also called normalized coefficients. These coefficients are gained by normalizing the sum of the elements in relapse, including dependent and the entirety of the independent factors, and running the regression. By normalizing the components before running the regression, all variables are put on a comparative scale, which can be gauged by the degree of the coefficients clarifying which one has a more prominent measure of an effect. It will, in like manner, be seen that the greater betas are connected with, the greater t-values. Hence, in this case, *limited use of carbon-based fuels* is the highest contributing factor (0.242); the next is a *collaboration with transport* (0.220) for any change in the quality of customer service delivery: t and Sig. Sections give the t-worth, and 2-tailed followed *p- value* utilized in testing the invalid theory that the coefficient/boundary is 0. Utilizing a 2-tailed test, then, at that point, would contrast every p-value with your preselected worth of alpha. Coefficients having p-values not exactly like alpha are measurably critical. For instance, on the off chance that you picked alpha to be 0.05, coefficients having a p-worth of 0.05 or less would be statistically critical (i.e., you can dismiss the invalid theory and say that the coefficient is fundamentally not the same as 0). With a 2-tailed test and alpha of 0.05, we should dismiss the invalid theory that the coefficient for recycling material for green logistics is not quite the same as 0 since *the p-value = 0.99 is* not the same as 0.05. Be that as it may, having a large catch is intriguing only occasionally. Lastly, the coefficient for limited use of carbon-based fuels (0.162) was statistically significantly different from 0 using an alpha of 0.05 because its p-value is <0.001, which is smaller than 0.05. The coefficient for recycling of material for green logistics

(0.103) is not statistically significant at the 0.05 level since the p-value is more remarkable than .05. The coefficient for collaboration in transport (0.215) is statistically significant because its p-value of <0.001 is less than .05. Hence, the hypotheses *H1(Collaboration in transport significantly influence the quality of customer service delivery) and H2 (Limited use of carbon-based fuels significantly influence the quality of customer service delivery)* are supported; whereas the *H3 (Recycling of material significantly influence the quality of customer service delivery)* not supported.

5. Discussion

The review demonstrated that crafted by operations directors in the production network division needs abilities to be improved to prompt a more proficient and responsive inventory network office. Assuming this is done, it will additionally work on the nature of the store network staff giving groundbreaking plans to organizations, learning new advancements effectively, sharing information and utilising innovations to take care of the issue. The concentrate likewise affirmed that administrators have information on green operations. This implies that countless of the respondents are prepared and educated in green strategies the executives because of the requesting idea of the gig. Based on the previous studies and using SPSS, it was concluded that collaboration in transport and limiting the use of carbon-based fuels would lead to a better quality of customer service delivery. In contrast, recycling material for green logistics does not affect.

The individual examination discoveries demonstrated that most stores in Pakistan never utilized rail transport to limit fossil fuel byproducts; the elective vehicle has been utilized to convey items. This affirms the high outflow of carbon dioxide into the environment brought about by the utilization of heavy street transport vehicles to convey merchandise to the general stores; however, the situation is all changing now because of cutting edge nature of the fuel delivered by Oil organizations keeping in view the green projects drive. They kept up with that the requirement for green strategies expects associations to move cargo from modes with generally high carbon forces, like air and street, to those with much lower fossil fuel byproducts, similar to rail and water-borne administrations. It was likewise confident that stores in Pakistan utilized lead-free powers to stay away from obliteration the climate. This affirms that the grocery stores are moving towards using lead-free fuel in their activities. This training is steady with nations like the USA, China, Japan, and the European Union. There was proof from the review that grocery stores have never contracted providers who embraced green coordinated factors rehearses because of less consciousness of such projects in the business as a large portion of the vehicle administrators is of limited scope. This was an obvious sign that not every one of the grocery stores but some in Pakistan is working with providers that embrace natural reasoning in their coordinated factors the board. Like this, the stores have neglected to help the contention that organizations can't give green items except if they cooperate with providers. It was likewise clear that bundling materials utilized by general stores in Pakistan are harmless to the ecosystem. The act of utilizing recyclable and reusable bundling materials is in helps the administration of the climate, which influences the execution of green strategies works on during the planning phase of items.

The review stated that the interest for harmless ecosystem items has expanded throughout the long term, as is the moving of clients' steadfastness. Another significant finding from the review is that green strategies practice will make client care a costly endeavour among grocery stores. It was laid out that green strategies prompted longer lead times that influence client care among stores in Pakistan since it is difficult to come by such vehicle administrators following green calculated rehearses. This means that while carrying out green coordinated factors, the time the clients assume to position a request and the time it takes for the client to get the item is longer. This more extended lead time might be because of the absence of innovation and the reinforcement of associations with providers. Moreover, the discoveries affirmed that green coordinated operations prompt quality client administrations given by general stores in Pakistan.

5.1 Summary, Conclusion, and Recommendations

The study established that most of the supermarkets in Pakistan are deficient in using rail

transport to minimize carbon emissions from road transport. Where this problem has been solved due to the evolution of Euro 4 Engines that are healthful for the environment, this may be because rail transport takes a long time to deliver products; it may be hard for supermarkets to access rail terminals, thus increasing carbon emissions resulting from the use of heavy road transport vehicles moving products along the supply chain. The supermarkets are also at a minimum in contracting suppliers who embrace green logistics; they have less collaboration in load transport due to a lack of awareness of green logistics and being stiff on transferring to new technology. On the other hand, the study found that several supermarket transporters in Pakistan use lead-free fuels to avoid environmental destruction. The use of recycling technology enhances the supermarket's concern about the impact of their various products on the environment. Moreover, the study established that packaging materials used by the majority of the supermarkets in Nairobi are environmentally friendly. The study further established that logistics managers working for the supermarkets hold a professional qualifications and all work in the supply chain departments of their respective entities. The study also recognized that green logistics practices enhance customer service delivery through collaboration in transport and the limited use of carbon-based fuels. Even though the practice of green logistics leads to the increasing quality of products delivered, the study documents that its implementation is expensive, results in a longer lead time, and increases the cost of products.

From the findings of the study, it can be concluded that to a more considerable extent, the majority of the supermarkets in Pakistan employ the following green logistics practices: use of lead-free fuels to avoid destruction to the environment, recycling of materials, complying with the Pakistan Environmental Policy requirements concerning environmental protection, using environmentally friendly packaging materials, limiting the use of carbon-based fuels and using fleet fitted with fuel management devises to avoid fuel wastage and unnecessary pollution to the environment. The impact of green logistics practices on customer service delivery among supermarkets in Pakistan is appreciable with few drawbacks. Green logistics leads to quality customer services provided by the supermarkets; it has made customer service an expensive undertaking among supermarkets in Pakistan and a longer lead time. Also, fuel management technology reduces transportation costs and enhances customer service delivery among supermarkets in Pakistan. Even though the study was successful, it experienced some limitations from respondents who could not fill in the questionnaire for fear that the information provided would be leaked to their competitors. Moreover, because the supermarkets are very busy on weekdays, the officers who responded were hesitant to take time off. Hence the data collection time frame extended well beyond the time expected.

Managers of supermarkets in Pakistan should consider green supply chain management as a cardinal factor to give them a competitive advantage through customers' loyalty. They should contract suppliers that consider protecting the environment and embrace greenness in their manufacturing processes. Collaboration in load transport was seen to be a challenge. Supermarkets in Pakistan should increase the transport of their products jointly using preferable means of reducing emissions and moving buck products as reduced costs. Finally, training, communication and technology should be enhanced within the supply chain departments of Pakistan supermarkets to promote personnel efficiency and reduce lead time in implementing green logistics practices. Since most respondents agreed that green logistics brings efficiency to customer delivery among supermarkets in Pakistan, all supermarkets should be encouraged to adopt this supply chain management practice since it will assist them in attaining efficiency in their customer sender initiatives. This study could only address green logistics practices among supermarkets in Pakistan. It will be necessary to carry out a study featuring other areas inside Pakistan, specifically any one supermarket, to find out if there are any similarities and differences. This study can be replicated after some time to find out whether the findings of this study have changed or they remain the same.

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Supply Chain Sustainability Through Green Practices in Manufacturing: A Case Study from Pakistan

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ABSTRACT

The study aimed to determine the effect of green warehousing, logistics optimizations, social values & ethics, and supply chain risk on supply chain sustainability leading to the economic performance of manufacturing firms in Pakistan. The natural resource-based view (NRBV) theory has been used to understand the phenomenon from a general perspective. Data was collected from 213 supply chain professionals through the purposive sampling technique. PLS-SEM approach has been used for data analysis using Smart PLS (version 3.2.9) and estimated measurement and structural model. Results showed that green warehousing, social values & ethics, and supply chain risk significantly positively affect supply chain sustainability. However, logistics optimization has a positive but statistically insignificant effect on supply chain sustainability. Managers should foster good investor views about the green management system. Managers should also support the use of a green management system, which may boost financial and non-financial performance, making the firm more competitive and increasing corporate value in various ways. Managers could gain a more holistic view of supply chain risk by understanding mature and emerging themes in the field, as well as tools into the scope of supply chain risk, and the significant growth in sustainable supply chain management reflects the need for new business models that are particularly focused on social and environmental issues.

Keywords: *Green supply chain, Social values, Ethics, Quantitative, Sustainability*

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Supply Chain Sustainability Through Green Practices in Manufacturing: A Case Study from Pakistan

1. Introduction

The emission of greenhouse gas, unsuitable waste management, non-biodegradable product manufacturing, and inappropriate usage of chemical products in supply chains (SC) have led to the destruction of the environment, climate change, global warming, and the end of human life (Le, 2020). Companies use green and social practices in their SCs to reduce their environmental impact, assure social security, increase efficiency, fulfil stakeholder demand, and obtain access to new products. These socially and ecologically aware strategies are employed to minimize greenhouse gas emissions, waste, resource, and energy consumption to safeguard workers' and other stakeholders' safety and good health (Raza et al., 2021). Similarly, supply chain management (SCM) has shifted to emphasize the environmental consequences of manufacturing and the preservation of earth resources due to rising environmental concerns, possible economic advantages, and legislative pressure. As a result, many managers are now using sustainable supply management (SSCM) to drive their supply networks (Govindan et al., 2020).

Likewise, storing, receiving, and transporting raw materials, work-in-progress, and finished goods are all included in green warehousing (GWH), an important part of the SSCM process. Companies that operate sustainable warehouses balance the warehouse's operational influence on the surrounding environmental and social issues and financial ones, such as ordering costs and holding prices. Because one element can influence another, social and environmental variables, a balance between economics must be maintained. Tree planting, carbon credits, and material handling equipment modification are three actions that may be used to decrease the environmental effect of warehouse operations (Torabizadeh et al., 2020). Logistical operations, in general, are environmentally unfriendly. Environmental pollution and greenhouse gas emissions significantly contribute to transportation and logistics activities. This demonstrates the negative impact of logistics operations on the environment and human lives (Mangla et al., 2020). Logistical activities must be improved to minimize negative environmental consequences and ensure environmental sustainability. Businesses must optimize their routes and use clean fuels to reduce pollution that affects human life (Mosteanu et al., 2020; Baloch & Rashid, 2022; Shaheen, 2022).

Additionally, performance is assessed to see how well share-holder funds entrusted to their care have been used to benefit all stakeholders. A company's performance has been measured from various angles (Zhu et al., 2017). Çankaya and Sezen (2019) defined performance as the financial and non-financial results of company processes, activities, policies, capabilities, and resources. Many factors determine firm success, the most significant of which is economic performance. Furthermore, "sustainability" is often used in all key corporate operations and among SC experts. According to Foo et al. (2018), adopting sustainable development principles may entail adjusting company operations and policies to mitigate negative social and environmental consequences. Agyabeng-Mensah et al. (2020) define supply chain sustainability (SCS) as quantifying the positive impact of social policies and green practices on energy and resource conservation and environmental preservation.

Moreover, demand, suppliers, cost, delivery, natural catastrophes, human mistakes, technological boundaries, and security incidents pose risks and uncertainties to SC, leading to significant societal losses. If not properly handled, sustainability risks can result in severe monetary and reputational damages (Fagundes et al., 2020). As a result, developing a sustainable SC requires firms to recognize risks, analyze and monitor how their suppliers manage those risks, and diversify their supplier portfolio to mitigate vulnerabilities (Chowdhury & Quaddus, 2021).

1.2 Problem Statement

Industrial operations have resulted in global environmental challenges and the loss of human lives. As a result of the growing severity of the global environmental crisis, several stakeholder groups, including policy experts and environmental activists, have been compelled to push for more rigorous government rules (Khan et al., 2018; Kumar & Dixit, 2018). Governments have reacted by establishing stronger laws and regulations requiring industries and enterprises to adhere to certain sustainability requirements (Bai et al., 2019). Responding to these multi-stakeholder concerns and demands is crucial for the sustainable development goal. As a result, businesses have begun to include sustainability in their operations and SC (Bai & Sarkis, 2018). Firms have begun to respond to these multi-stakeholder pressures by recognizing the benefits and necessity of sustainability in gaining a competitive edge (Bai et al., 2017). Organizations and SC are being forced to reconsider their processes, technology, goods, and business strategies as the pursuit for sustainability have begun to shift the competitive environment. Sustainable manufacturing and development (industrial ecology) is a path to sustainability. Organizations can use sustainable innovation methods to help them deal with sustainable challenges in their manufacturing processes and SC. On the other hand, firms are having difficulty implementing long-term SC innovation. These organizations encounter numerous obstacles when striving to innovate for long-term sustainability (Gupta et al., 2020). These obstacles must be identified and overcome for SCS ideas to be adopted, implemented, and scaled up. However, due to a lack of resources, it is almost difficult for these groups to simultaneously eradicate all of these hurdles. This necessitates that these organizations first identify the sources of these hurdles, examine the barriers, and then offer solutions to overcome them (Gupta & Barua, 2018).

Several researchers developed long-term SCM frameworks and underlined the necessity of long-term innovation in SSCM. There has been no research specifically attempting to define sustainable innovation implementation criteria for sustainable SC, nor have they been explored in an industrial setting (Kusi-Sarpong et al., 2019). Therefore, this study aimed to determine the effects of Green Warehousing (GWH), Social Values and Ethics (SVE), Logistics Optimizations (LO), and Supply Chain Risk (SCR) on Supply Chain Sustainability (SCS), leading toward the Economic Performance (EP) of the manufacturing firms of Pakistan. Further, the research question for this study is to find the effect of SVE, GWH, LO, and SCR on SCS in the manufacturing firms of Pakistan.

2. Literature Review and Development of Hypothesis

2.1 Green Warehousing and Supply Chain Sustainability

Internal and external logistics and distribution both rely on warehousing. Due to the numerous processes associated with warehouse operations, Abushaikha (2018) indicates that warehouses might be a source of non-value-added activities. In order to limit their negative influence on the environment and human life, warehousing activities create a substantial quantity of rubbish in the supply chain, necessitating the deployment of waste-reduction strategies and policies. This demonstrates that warehousing is a logistics sector in which SCS project implementers must pay special attention to fulfil stakeholder demands and acquire a competitive advantage (Abushaikha, 2018). Several scholars (Çankaya & Sezen, 2019) have recognized the importance of warehouse sustainability and advocated for using environmentally friendly energy sources and methods and energy-efficient handling technology to manage warehouses and related difficulties. Green packaging can also save money by lowering the materials needed and maximizing warehouse space utilization (Agyabeng-Mensah et al., 2020).

Further, Sukjit and Vanichchinchai (2020) determined the extent of GWH and its motives and the influence of motivations on GWH in Thailand. Two hundred sixty-one warehouse managers were polled for information. For data analysis, descriptive statistics and multiple regressions were used. The greatest score for GWH was utilities for GWH, while the lowest score was green management. Regarding motivations, the greatest score was for social duty, while the lowest was for law and

regulation. The commitment of top management has a big impact on GWH. Therefore, we propose:

H1: GWH has a significant impact on SCS.

2.2 Social Values & Ethics and Supply Chain Sustainability

Researchers have recently paid too much attention to the role of Social V&E in sustainable development. According to Dubey et al. (2017), the issue has sparked many controversies. Social V&E is acting ethically and socially acceptable behaviors to enhance SCS (Agyabeng-Mensah et al., 2020). Corporate sustainability programs require firm management to motivate employees by including them in company operations, allowing them to grasp the firm's most important issues and accept its freshly carved ideas. Ethical sourcing and buying, according to academics, leads to better environmental performance (Croom et al., 2018). Obtaining non-harmful items and inputs from ethically sound vendors is considered ethical purchasing. Ethical purchasing guarantees that the finest sourcing methods are used to protect the environment and human lives by selecting and acquiring new items and raw materials from suppliers who do not harm people or the environment (Agyabeng-Mensah et al., 2020). Engineering ethics is critical in designing and developing an environmentally SCS. Further, the impact of social values and ethics on SCS and economic performance was investigated by Agyabeng-Mensah et al. (2020). Data were collected from 200 managers of manufacturing businesses in Ghana as part of a quantitative research approach. PLS-SEM was used to evaluate the data. The data demonstrated that social values and ethics positively impact SCS and economic performance. Therefore, we propose:

H2: SVE has a significant impact on SCS.

2.3 Logistics Optimization and Supply Chain Sustainability

Operations involving logistics are an important element of the SC. In general, the nature of logistical activities renders them unfavourable to the environment. Transportation and logistics operations considerably impact pollution and greenhouse gas emissions (Khan et al., 2018). Due to increased demand for products and services, the amount of energy required to transport goods on the road is increasing faster, resulting in the creation of greenhouse gases that are harmful to human health and the environment (Hishan et al., 2019). This demonstrates that logistical activities negatively influence the environment and human lives. Logistical activities must be improved to reduce negative environmental effects and ensure environmental sustainability (Agyabeng-Mensah et al., 2019). The implementation of methods to reduce externalities and increase profitability in green SC operations is referred to as logistics optimization (LO). According to Agyabeng-Mensah et al. (2020), logistics optimization methods positively influence environmental and social performance, and firms may be required to share resources and expertise with SC partners to meet ecological and social sustainability objectives. Therefore, we propose:

H3: LO has a significant impact on SCS.

2.4 Supply Chain Risk and Supply Chain Sustainability

The rise of risk in the SC is not a new topic, and businesses are constantly faced with uncertainty over financing and timely delivery of their goods. The reliance of SC members on one another has grown in recent years; although such reliance has numerous benefits, it also has the potential to create hazards (Shahin et al., 2019). Environmental and organizational variables are factors in supply chain risk (SCR), and they depend on the supply chain. They are not always expected and have an impact on SC output variables. The apparent feature of SCR factors is that they rely on SC structure (Gouda & Saranga, 2018). SCR is a stumbling block for SSCM. SCR contributes to significant issues like tumultuous settings, unclear supply and demand, and unanticipated diseases, all too frequent nowadays (Shafiq et al., 2017). Many SC managers find it difficult to respond to these issues. SCRM research, according to Shahin et al. (2019), has mostly ignored the importance of sustainability problems. Many studies have been done on the SCR and SCS, independently, based on literature. Further, Shahin et al.

(2019) looked at how SCR affects SCS. Data was collected from senior and intermediate managers using a structured questionnaire. PLS-SEM was used to analyze the data, where SCR found a substantial effect on SCS. Therefore, we propose:

H4: SCR has a significant impact on SCS.

2.5 Theoretical Background

The RBV of the company asserts that a business's resources and competencies give a long-term competitive advantage when they are valued, uncommon, unique, and non-substitutable (Barney, 1991). At the same time, the NRBV considers the planet's natural resource limits (Hart, 1995). As a result, SCM operations should be re-engineered to achieve commercial and environmental sustainability simultaneously. Hart (1995) advocates three interconnected methods: pollution prevention, product stewardship, and sustainability for corporate and environmental sustainability. A pollution-prevention approach employs continual improvement strategies to minimize emissions (Hart, 1995). Internally, a company may take this approach by investing in production techniques that reduce waste and pollution (Hart, 1995). Also, environmentally aware suppliers must offer specified eco-friendly raw materials, and direct consumers must provide or recycle the final goods as part of the pollution prevention strategy. Consequently, upstream and downstream SCM partners must be completely committed for a focused firm to implement a pollution control strategy effectively. Environmental stakeholder concerns are included in a company's goods as product stewardship.

Furthermore, during the past 15 years, most NRBV applications have focused on pollution management, with little attention paid to empirical research on product stewardship or sustainable development techniques. Indeed, whether and under what conditions it pays to be green is a major topic in organizational and environmental studies (Berchicci & King, 2007; Hart & Ahuja, 1996). Furthermore, NRBV resources are intended to aid in the adoption of SSCM. The NRBV is a popular concept in SSCM, although it is not being used at a vast (Golicic & Smith, 2013), resulting in a gap between theory and practice (Hart & Dowell, 2011). Therefore, figure 1 expresses the research framework.

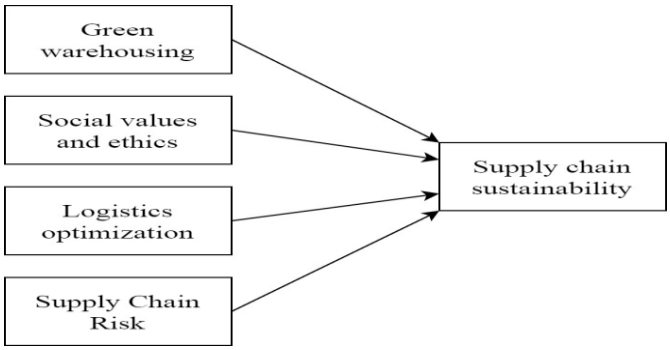

Figure 1: A research framework

3. Research Methodology

The quantitative research method was used to test the study hypotheses using a survey questionnaire (Rashid & Amirah, 2017; Rashid et al., 2019). The researcher can be benefitted from this approach as it enables to conduct theory development based on hypothesis-testing efficiently. This approach is useful in generalizing the results compared to the qualitative (Hashmi & Mohd, 2020; Rashid et al., 2021; Agha et al., 2021). Further, this study targeted SC professionals working in the manufacturing firms of Pakistan. The sample size estimation was done using the *50+8k* formula, in which *k* is the number of variables present in this research (Krejcie & Morgan, 1970). The research contains five variables; therefore, it must gather a minimum of 90 responses. Hence, the researcher has aimed to collect 150 sample responses ($150 > 50+8(4) = 90$) from the target population using purposive

sampling, which selects people from the target population purposefully (Rashid et al., 2021). The major advantage of this sampling is that it helps to target people with specific characteristics as those people can eventually provide meaningful data that can result in logic-based conclusions (Vehovar et al., 2016; Victory et al., 2022; Amjad, 2022; Hunaid et al., 2022).

The data was collected using a survey method through a close-ended questionnaire on a five-point Likert scale that increases the significance of the results and conclusion as well (Alrazehi et al., 2021; Baker, 2003; Rashid et al., 2020). Moreover, the study includes five research variables; where, "Green Warehouse" includes eight items, "Social Value and Ethics" consists of nine items, "Logistics Optimization" comprises six items, and "Supply Chain Sustainability" contains six items adopted from Agyabeng-Mensah et al., (2020). The nine items of "Supply Chain Risk" were adopted from Wang et al. (2020).

3.1 Statistical Technique

There are various analysis techniques in which regression analysis has been identified as a first-generation technique. This technique works effectively to examine the relationship between two variables, and it can easily handle a large sample size as well. The regression analysis is best applied for hypothesis-testing and generating the main results of research (Ranganathan et al., 2017). Reliability analysis has also been conducted in this research using Cronbach's alpha. This analysis focuses on examining the reliability of the research and its instrument based on Cronbach's alpha, whose threshold is ≥ 0.70 (Anwar, 2022; Bonett & Wright, 2015; Hashmi et al., 2020a).

4. Research Results

The PLS-SEM analysis technique generates an in-depth variance (Hair et al., 2019; Khan et al., 2022). In PLS-SEM, the measurement model identifies the research instrument's reliability, and the structural model conducts hypothesis-testing (Hair et al., 2019; Khan et al., 2022). As a result, PLS-SEM with SmartPLS version 3.2.9 was used to generate relatively more significant results (Khan et al., 2021). Before the measurement model, the instrument's internal consistency was assessed, followed by detailed discussions on data screening and the demographic profile of the respondents (Rashid & Amirah, 2017; Rashid et al., 2019; Hashmi et al., 2020b). Further, the measurement model comprising outer loadings, convergent validity, and discriminant validity using the PLS algorithm was assessed. The structural model using PLS-SEM encompassing path analysis and mediation analysis using PLS bootstrapping while predictive relevance using PLS blindfolding was used. Finally, the study validated the findings in the light of previous studies. The reliability of constructs was tested through Cronbach's Alpha values. Rashid and Rasheed (2022) and Khan et al. (2021) suggested that an alpha coefficient higher than 60 per cent should be considered substantially reliable for analysis. In this regard, all the constructs with a higher than 60 per cent alpha coefficient, such as the GWH with eight items, had alpha reliability of 0.671, LO with six items, had an alpha coefficient of 0.764, SCR with nine items, and alpha coefficient of 0.863, SCS with six items, had an alpha coefficient of 0.874, and lastly, SV&E with nine items, had alpha coefficient 0.796 (Das et al., 2021; Haque et al., 2021; Rashid et al., 2020b). Hence, all the constructs met the minimum level.

4.1 Data Screening

Among various data screening and cleaning techniques and methods, DeSimone et al. (2015) suggested that data screening and cleaning technique was followed by following a four-step process before data analysis, i.e. (1) out-of-range values, (2) missing value analysis, (3) univariate outliers, and (4) multivariate outliers. In this regard, the study has used frequency measures for out-of-range and missing value analysis and found zero out-of-range and missing values among the dataset of 213 responses. Furthermore, the study has used standardized value (Z-Score) analysis for detecting univariate outliers, and as Tabachnick et al. (2007) suggested, the Z-Score should range between +3.29 and -3.29. Therein, the study found zero univariate outliers in the dataset; hence, final 213 responses were used for multivariate outliers. Lastly, the study used Mahalanobis Distance (D^2) for multivariate

outliers based on the recommended threshold of $D^2 < 0.001$ (Tabachnick et al., 2007). Hence, the study has found no-multivariate outliers in the dataset, and finally, the study used 213 responses for data analysis.

4.2 Profile of the Respondents

The demographic profile of the 213 respondents was analyzed, where the highest proportion of firm size with employees between 250-500 was (64, 30%) than employees lowest proportion of employees between 500-1000 (22, 10.3%). All employees from different manufacturing sectors had different proportionate, like, pharmaceutical (33, 15.5%), food and beverage (33, 15.5%), Textile (84, 39.4%), automotive (32, 15%), and others (31, 14.6%). Likewise, all the employees were from managerial positions, with a far greater proportion of procurement managers (84, 40.4%) than supply chain managers (52, 24.4%), warehouse managers (33, 15.5%), and logistics managers (42, 19.7%). The work experience of all respondents was diverse, ranging from 33 (15.5%) with experience less than one year, 64 (30%) with 1-5 years, 96 (45.1%) with 5-10 years, and 20 (9.4%) with greater than ten years.

4.3 Measurement Model

4.3.1 Construct and convergent validity

The results of the measurement model for construct reliability and validity of the latent constructs are shown in Table 1. According to Khan et al. (2022), outer loadings greater than 0.70 are strong enough to indicate reliability. Whereas the outer loadings of 0.50 are adequate. Further, Cronbach's alpha should be greater than 0.70 for substantial internal consistency based on inter-item correlation, and composite reliability should be greater than 0.70 for constructs' composite internal consistency (Hashmi et al., 2020). Lastly, for a significant correlation between indicators and their latent constructs, AVE should be more than 0.50 (Rashid et al., 2020; Hashmi et al., 2021). Table 1 indicates the least indicator reliability of 0.546 for GW5, whereas "Green Warehousing" has the least alpha coefficient of 0.700 and composite reliability of 0.815, and the least AVE coefficient of 0.530. However, all constructs have higher values and sufficiently fulfilling the test assumptions. Therefore, it has been manifested that the measurement model has provided substantial results.

Table 1: Measurement model

Variables	Items	Loadings	Alpha	CR	AVE
Green Warehousing	GW4	0.682	0.700	0.815	0.530
	GW5	0.546			
	GW7	0.786			
	GW8	0.860			
Logistics Optimization	LO4	0.799	0.862	0.913	0.779
	LO5	0.926			
	LO6	0.918			
Supply Chain Risk	SCR4	0.743	0.871	0.904	0.655
	SCR5	0.927			
	SCR6	0.806			
	SCR8	0.757			
	SCR9	0.802			
Supply Chain Sustainability	SCS2	0.833	0.913	0.935	0.744
	SCS3	0.781			
	SCS4	0.897			
	SCS5	0.920			
	SCS6	0.874			
Social Values and Ethics	SVE1	0.640	0.872	0.900	0.564
	SVE3	0.672			
	SVE4	0.880			
	SVE5	0.727			
	SVE6	0.743			
	SVE7	0.810			
	SVE9	0.758			

Source: SmartPLS output

4.3.3 Discriminant validity using HTMT ratio

Henseler et al. (2015) suggested that the discriminant validity method of the Heterotrait-Monotrait (HTMT) Ratio test is widely used and recommended. Therefore, Table 2 shows the HTMT ratio results for discriminant validity using PLS-SEM. Henseler et al. (2015) suggested that "theoretically different constructs should have HTMT ratio below the threshold of 0.90 for considerable discriminant validity." Table 2 indicates that the highest HTMT ratio of 0.896 was found between SCS (supply chain sustainability) and SVE (social value and ethics). Hence, the study has achieved discriminant validity between latent constructs based on the HTMT ratio.

Table 2: Heterotrait-Monotrait ratio (HTMT)

	GW	**LO**	**SCR**	**SCS**	**SVE**
Green Warehousing					
Logistics Optimization	0.641				
SC Risk	0.864	0.843			
SC Sustainability	0.594	0.675	0.839		
Social Values and Ethics	0.785	0.705	0.880	0.896	

Source: SmartPLS output

4.3.4 Predictive relevance using PLS blindfolding.

In PLS-SEM, the predictive power of the outcome constructs in the structural model has been estimated based on R-Square using the PLS algorithm (Hair et al., 2011). While the predictive relevance of latent outcome constructs has been estimated based on cross-redundancy statistics (Q-Square) using PLS blindfolding (Geisser, 1975; Stone, 1974). Hair et al. (2011) indicated that a latent construct's predictive power (R^2) should be > 25% for significant predictability, while > 50% is moderate, and > 75% is considered strong predictability of the latent construct. Furthermore, Hair et al. (2013) proposed that in the structural model, Q^2 > 2% be estimated as having weak significance, > 15% as moderate, and > 35% considered as strong relevance in the structural model. Table 3 expresses that "Supply Chain Sustainability" has strong predictability relevance of 78.9 per cent.

Table 3: Predictive relevance

	R Square	R Square Adjusted	Q Square
Supply Chain Sustainability	0.789	0.785	0.578

Source: SmartPLS output

4.4 Structural Model

4.4.1 Path analysis

Table 4 explains the bootstrapping results of the research model for "Supply Chain Sustainability" using PLS bootstrapping at 5000 subsamples. SCS is positively reflected from the construct GWH, LO, SCR, and SVE. The results in Table 4 indicate that GWH has a positive and significant effect on SCS *(β = 0.0.175, p < 0.000)*, SVE *(β = 0.632, p < 0.000)*, LO *(β = 0.052, p < 0.089)*, and SCR *(β = 0.381, p < 0.000)*. Hence, hypotheses H^1, H^2, and H^4 are supported. Whereas hypothesis $H^3$is rejected.

Table 4: A path analysis

Hypotheses	**Path**	**Estimate**	***p***
H1	GWH -> SCS	0.175	0.000
H2	SVE -> SCS	0.632	0.000
H3	LO -> SCS	0.052	0.089
H4	SCR -> SCS	0.381	0.000

Source: SmartPLS output

5.1 Discussions and Conclusion

5.1.1 Objective one: green warehousing and sc sustainability

The findings suggested that GWH has a significant positive effect on SCS. The previous studies showed the same results as Agyabeng-Mensah et al. (2020). The findings found that the warehousing activities, such as vehicle mobility, increase environmental carbon dioxide emissions. Therefore, to gain a competitive advantage and to meet the stakeholder's requirements, the warehousing areas need serious attention so that SC sustainability can be undertaken. Similarly, Ali et al. (2020) suggested that the greatest impact on sustainability can be made with the help of a location of primary importance in green warehousing logistics activities. Many firms focus on GWH to save money and energy. Therefore, with the implementation of green warehousing, the cost is decreasing, which provides help in ensuring SC sustainability. Likewise, Trivellas et al. (2020) observed that green warehousing is important to improve the overall SC's efficiency. Since it is a critical component of a distribution network, it impacts SC sustainability directly. Thus, to improve and enhance SC sustainability, green warehousing is critically important.

5.1.2 Objective two: social values and ethics and sc sustainability

The study found that SVE had a significant positive impact on SCS. The findings are consistent with the findings of Dubey et al. (2017). Dubey et al. (2017) found that for SCS, employees must be involved in business activities that include the firm's newly cared vision as well as grasp the firm's primary concerns. Through SVE's successful application, employees' welfare and safety are secured. Similarly, Agyabeng-Mensah et al. (2020) found that social values and ethics play a huge role in ensuring sustainable developments. Engagement in morally and socially acceptable activities is important for enhancing SC sustainability as it comprises the social values and ethics. Likewise, Zhu et al. (2017) proposed improving green competitiveness, performance, and sustainability by including SVE in the design and development of an eco-friendly SC. Implementing such ethical and social values enhanced the SC sustainability as it offers a win-win opportunity for stakeholders.

5.1.3 Objective three: logistics optimization and sc sustainability

The study found that logistics optimization has an insignificant positive effect on SC sustainability. The findings indicate that optimizing logistics activities is necessary to avoid negative environmental effects and assure SCS at manufacturing firms in Pakistan. In other words, to enhance profitability and reduce externalities that would significantly impact SC sustainability, the firms have to adopt practices that improve logistics optimization. According to Agyabeng-Mensah et al. (2020) and Delmonico and Bezerra (2020), companies should optimize their activities to advance SC sustainability, such as building their warehouses to ensure eco-friendly transportation. Moreover, supplier and customer collaborative efforts can enhance SC sustainability when logistics optimization is properly implemented.

5.1.4 Objective four: sc risk and sc sustainability

Supply chain risk found a significant positive effect on supply chain sustainability. The findings of Wang et al. (2020) support the findings. That shows that if SC risks related to logistics and transportation operations arise, SCS can be reduced or negatively impacted. Due to unreliable and uncertain resources, the risk could be developed, which would affect the SC sustainability by creating SC interruption. Pinheiro et al. (2019) also argued similarly and indicated that logistics operations could be harmed and effective by delays, damages, and loss, categorized as impacts, consequences, and errors. Due to SC risk, the normal logistics activities get affected and subsequently affect SC sustainability as it acts as a threat.

5.2 Research Implications, Recommendations, and Limitations

This study has provided several managerial recommendations. Firstly, the advantages of a green management system improve the economic performance of manufacturing firms. Practitioners argued that the benefits of green management should be communicated to organizational decision-makers. As a result, this research will enlighten managers about the competitive benefit of a green management system. Managers should also foster good investor views about GMS since firms are more likely to take action in implementing a GMS if they feel it would result in positive consensus. The study also assisted in the development of GMS subjective norms. Firms are more willing to adopt GMS due to societal expectations, such as legal rules and social belonging. Managers should also support the use of GMS, which may boost financial and non-financial performance, making the firm more competitive and increasing corporate value in various ways. Second, the findings establish a logical basis for implementing SCS efforts such as GWH, LO, and SVE. Similarly, this study provides a blueprint and strong explanation for supply chain managers to push for adopting social and ethical policies and practices. Managers should encourage using LO, GWH, and SVE to improve SCS. Managers should also encourage companies to work with their suppliers and customers to share resources in the implementation of GWH, LO, and SVE to reduce waste and gas emissions, improve employee and community welfare, and increase sales, market share, and profitability, and return on investment.

Likewise, firms may effectively manage their relationships with SC members to transform them into competitive advantages and improve economic performance. Employees are more likely to build skills and green capabilities to help the firm achieve a competitive edge and increase EP while engaging with SC members (customers and suppliers) on green warehousing, logistics optimization, and social values and ethics. As a result, firms should not underestimate the benefits of working with suppliers and customers to adopt GHW, LO, and SVE. Managers should also use sustainable strategies that have both social and environmental effects. Moreover, information and communication technology is driving modern employment innovation by allowing individuals to engage, and it may also contribute to networked action in the area of firm social responsibility. As a result of managers' awareness of firm social responsibility, the concept of close communication and information exchange between internal stakeholders (workers, managers, owners) and external stakeholders (suppliers, consumers, society, government, etc.) has come to the fore. As a result, stakeholders may seek the most cost-effective global solutions to lower total expenses and increase profitability. Lastly, SC risk has grown in popularity as a study and practice topic. Using objective measurements such as co-word, co-citation, and coupling networks, managers may expose the field's literary identity and identify crucial areas where decision models and support systems are developed. As a result, managers should gain a more holistic view of SCR by understanding mature and emerging themes in the field, as well as tools into the scope of SCR, and the significant growth in SSCM reflects the need for new business models that are particularly focused on social and environmental issues.

To improve the generalizability of the findings, future research might gather data from other professionals in more nations and locations. Study findings may be improved by a future study using longitudinal data. Furthermore, empirical evidence in this field will aid researchers in rationalizing the causal linkages between the study variables.

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