

2023

Impact of supply chain robustness and resilience on firm performance: A perspective of Pakistan textile industry

Aalyan Munir
Air University, Islamabad

Aamer Hanif
Air University, Islamabad

Nimra Afzal
Air University, Islamabad

Follow this and additional works at: <https://ir.iba.edu.pk/businessreview>



Part of the Business Administration, Management, and Operations Commons, Operations and Supply Chain Management Commons, and the Risk Analysis Commons



This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/).

Recommended Citation

Munir, A., Hanif, A., & Afzal, N. (2023). Impact of supply chain robustness and resilience on firm performance: A perspective of Pakistan textile industry. *Business Review*, 18(1), 91-106. Retrieved from [10.54784/1990-6587.1502](https://ir.iba.edu.pk/businessreview/vol18/iss1/5)

This article is brought to you by *iRepository* for open access under the [Creative Commons Attribution 4.0 License](https://creativecommons.org/licenses/by/4.0/) and is available at <https://ir.iba.edu.pk/businessreview/vol18/iss1/5>. For more information, please contact irepository@iba.edu.pk.

Impact of supply chain robustness and resilience on firm performance: A perspective of Pakistan textile industry

Aalyan Munir · Aamer Hanif* · Nimra Afzal

Abstract This study investigates the impact of supply chain resilience and robustness on firm performance and also examines the significance of supply chain risk management (SCRM) in minimizing the consequences of disruptions on supply chain performance in the context of the COVID-19 pandemic. Data was gathered using convenience sampling technique through a survey from management staff (n=409) working in textile companies operating in Pakistan. Using SPSS software for data analysis, this study proposes a mediation model where risk management practices are proposed as a mediator between supply chain resilience, robustness and firm performance. The findings highlight that supply chain resilience and robustness have positive significant effect on firm performance. The results also revealed that supply chain risk management mediates the relationships between supply chain resilience, robustness and firm performance. The findings show that managers should focus more on improving supply chain risk management operations and prioritize their SC resilience and robustness competencies for better firm performance. Furthermore, this is among the few quantitative studies dealing with supply chain risk management procedures, SC resilience and robustness in the context of the Covid-19 pandemic. The research limitations have been identified and suggestions for future research have been provided.

Keywords Supply Chain, Resilience, Robustness, Risk Management, Firm Performance

Aalyan Munir
Air University, Islamabad.

Aamer Hanif
Air University, Islamabad
E-mail: ahanif@mail.au.edu.pk
*corresponding author

Nimra Afzal
Air University, Islamabad
©Munir, Hanif and Afzal, 2023

1 Introduction

Supply chain risks are primarily divided into operational and disruptive risks according to numerous authors in past studies (Ivanov et al 2018; Xu et al 2020). The operational risks are related to common disruptions in supply chain (SC) activities, which include lead-time and order variations, while the disruption risks are primarily related to incidents that occur seldom but have severe consequences (Kinra et al 2020). In terms of duration (long-term), extreme uncertainty, and dissemination of unforeseen consequences, epidemic breakouts are a unique type of supply chain risk (Ivanov 2020). During the recent decade, research on the epidemic's consequences on the supply chain has emerged (Natarajathinam et al 2009; Scott and Rutner 2019) revealing wide range of risks to the enterprises' existence. Similarly, studies have shown that disruptions produced by unusual events like a pandemic can jeopardize resilience and robustness of a supply chain as well (Kumar and Chandra 2010; Le Hoa Vo and Thiel 2011).

Moreover, SC networks are extremely vulnerable due to internal interruption, for instance, financial turmoil, challenges caused by the decline of main consumers, emerging technologies, and quality of infrastructure, all of which have a detrimental impact on the market as a whole, and these types of events can likely to negatively impact the industries' potential for further development. According to (El Baz and Ruel (2021)), the SC's performance relies on the businesses' resilience and robustness to handle difficulties from their internal as well as external settings. The capacity of SC to restore its capability to operate effectively after a disruptive event is referred to as SC resilience and robustness. Being SC resilient and robust positively impacts the business's operations and performance, especially when firms face unexpected risks and events (Hendijani and Norouzi (2023)).

Existing investigation on SC resilience has mostly focused on mature markets and well-developed nations (Tukamuhabwa et al (2015)). Unfortunately, recent research indicates that SC resilience breakdowns have the most negative impact on underdeveloped and developing nations (Lopes et al (2022)), and a few studies explored the impact of supply chain resilience components on SC performance (Chowdhury et al (2023); Juan et al (2022)), and firm performance (Abeysekara et al 2019), 2019) and highlighted the importance of SC resilience in a firms development. However, these studies are limited to the specific regions and have not explored the effect of SC robustness on overall firm performance.

These studies suggested conducting the investigation in different regions for a better understanding of SC resilience and robustness in a complex environment. Furthermore, after a thorough examination of the theoretical literature currently in circulation, it was also discovered that SC resilience and robustness relationship with firm performance is limited in terms of theoretical arguments and the context of Pakistans manufacturing industry. The argumentative theories on the relationship between SC resilience and robustness and firm performance via SC risk management have not been presented by different authors (Alshahrani and Salam 2022; Siagian et al 2021) in recent times. They have instead emphasized hypotheses about SC resilience, robustness and business performance in terms of production and marketing/sales. In order to improve overall company/firm

performance, this study will bridge the theoretical gap by describing how SC resilience should address weaknesses and how businesses should create robust models using SC risk management. This will not only serve as an example for professionals but will also advance academic understanding of supply chain dynamics.

The Coronavirus epidemic has recently had an impact on the performance of several global supply chains. COVID-19 disrupted the world economy and paralyzed major industries (Araz et al 2020; Ivanov 2020). After the Covid-19 pandemic attack, supply chain vulnerabilities were exposed. Although Covid-19 pandemic attack disturbed supply chains globally, its impact on a developing country like Pakistan was worse specifically in the mainstream textile industry where performance was negatively impacted across upstream to the downstream process. This pandemic attack brought up a dire need to reformulate supply chains to make them resilient and robust to sustain risks to downgraded performance.

Therefore, the main objective of this study is to explore the effect of supply chain risk management in mitigating the disruption in supply chain resilience and robustness and also identify the impact of SC resilience and robustness on firm performance. The textile industry of Pakistan was selected for this study since it is one of the largest local industries and is interlinked with worldwide supply chains involving import and exports all over the world. Pakistan is the eighth highest exporter of textile products all across Asia and third biggest purchaser of cotton so it is worthwhile to research the textile industry and to evaluate the implication of supply chain resilience and robustness to counter risks.

The significant contributions of this study are manifold. First, we respond to directions for future work suggested by numerous experts for further quantitative research on supply chain risk management in the context of COVID-19 (Ivanov 2020; Ivanov and Dolgui 2020). Secondly, in terms of textile firm performance, the research findings are expected to provide a better understanding of supply chain risk management in improving resilience and robustness. When engaging in management activities for increasing firm performance within textile companies, management will be able to modify procedures and enforce strategies to minimize losses due to disruptions. The study also will help SC managers better grasp how to assess the merits of various initiatives related to SC resilience and robustness and how to apply such initiatives in a complicated business model to reduce unanticipated hazards brought on by substandard SC networks that affect the company's performance.

2 Literature review

2.1 Supply chain Resilience and Firm Performance

SC resilience is the capacity to respond to an unexpected disturbing impact and after that reestablish operation to normal (Rice and Caniato 2003). Resilience

refers to a multi-dimensional and multi-disciplinary idea that starts from brainstorming and is then applied to the Supply chain (Pettit et al 2010; Ponomarov and Holcomb 2009). SC Resilience is the capacity in which a firm is to bounce back from troublesome circumstances. Supply chain resilience characterizes the systems flexible capability to persevere brief troublesome occasions (Soni et al 2014). Supply chain resilience diminishes the probability of negative interruption impacts on the performance of firms and operations.

Supply chains are then ready to quickly distinguish the event of a disturbance, and quickly recover and even improve their earlier presentation level through suitable items and recovering techniques (Hosseini et al 2019). There are vital irregularities between these SC Resilience events which can destroy the overall SC system (Jüttner and Maklan 2011). Frequently, SC reliability components are among different sources and these sources help to make a better environment to work. SC Resilience is characterized as a one-dimensional design through its creators (Ambulkar et al 2015). Multiple scholars have discussed that quality can be accomplished fundamentally through flexibility as well as vigorous (Wieland and Wallenburg 2012).

On the other hand, a firm performance can be defined as an organizations ability to meet both its market-oriented and financial objectives. Many organizations use financial indicators to assess their performance and compare it to that of other companies in the market. Good company performance is often viewed as a competitive advantage over the competition in the market. This has been supported by prior research which has used both financial and market-related factors to assess business success (Kannan and Tan 2005).

However, on behalf of a well-founded company, the supply chain ought to be agile, versatile, and adjusted (Lee 2002). Meanwhile, the resilient competence reflects suitable ability progresses and rebuilding assets in businesses, which upraise a contention that should accomplish over entire supply network resilience practices. Typically resilient competencies are a design of cooperative, united exercises and key schedules over which partnerships can alter polishes to accomplish unused asset setups and support and pick up an economic benefit (Teece et al 1997). Overall supply chain adaptability makes a contrasting influence in a firm to execute in a way that results in clients advantage, financial benefits, and overall growth. A resilient environment can only help to deal with unwanted pandemics. Otherwise, the performance of the firm can never be stable. Hence, we propose the following hypothesis:

Hypothesis 1: Supply Chain Resilience has a significant positive effect on firm performance.

2.2 Supply chain Robustness and Firm Performance

Supply chain robustness is defined as a dynamic approach implemented by a business ahead of time to enable a supply chain for resisting change while maintaining acceptable performance (Nair and Vidal 2011). The term supply chain robustness refers to the level at which the supply chain can perform its tasks

while being damaged. Over the years, robustness has been observed to turn into a central necessity at each level of the creation order from the cycle/machine level, through the framework and undertaking levels, up to the level of supply chains and organizations. SC robustness is observed as a dynamic methodology to manage uncertainties, disorders, or disturbances (Ivanov and Dolgui 2020; Simchi-Levi et al 2018). A major method to expand the robustness of producing frameworks is basically to dispense in time areas. However, another assembly of approaches depends on various things like strong, responsive, prescient responsive, proactive, agile and supply chain performance regarding cost, quality, and robustness (Kannan and Tan 2005).

Furthermore, robustness is a symbol that describes the agility/flexibility retained as an option to open up a wide range of possibilities for later choices (Khorasani 2018). However, agility is not necessary only for making SC resilient but also for making SC robust, agile processes are needed in the internal environment of an organization. It also aims to cope with outside disturbances that nearly always happen and to rapidly and adaptably meets immediate needs (Shafiq and Soratana 2019; Zhang and Wang 2011). Due to agility/flexibility, SC robustness tackles most of the problems which can affect a firms processes to develop a specific product (Jain et al 1991). According to (Charles et al 2010; Gligor et al 2019), unpredictable requirements, supply-demand imbalances, and other disturbances have an adverse effect on the SC's capacity to function without a high degree of agility and flexibility.

Agility can boost company productivity and agility is considered the best solution for dealing with low-likelihood and high impact risks conditions (Shafiq and Soratana 2019; Swafford et al 2008). On the other hand, supply chain development conclusions can be seen as requiring interchange between bigger versus smaller consumers to the objective of enhancing the organizations moderate reaction. Robust project competency deals with the possibility to improve satisfactory items to widen object sections, circumstances, and situations with prices balanced by determined and expected corporation benefits (Bettis and Hitt 1995). The advancement of a robust supply network expands the capacities of a firm prompts improved firm performance (El Baz and Ruel 2021). Hence, we propose the following hypothesis:

Hypothesis 2: Supply chain Robustness has a significant positive effect on firm performance.

2.3 Mediating Role of Risk Management Practices between Supply Chain Resilience and Firm Performance.

Risk management is defined as the process of reducing risk exposure and lowering the likelihood of an accident (Barrot et al 2019). Risk management is important in effectively identifying the sources of SC hazards and influencing the outcomes of subsequent forms in SCRM (El Baz and Ruel 2021). Supply side risks have a significant influence on organizational performance, particularly when it comes to not fulfilling the essential production and sales targets. This

is due to risk events disrupting operations and business functions, resulting in poor performance (Kt and Sarmah 2021). For example, the catastrophic event at a supplier site could cause delays in supplying goods to producers, affecting final customers and resulting in additional costs to ensure targeted delivery and customer satisfaction (Fiksel and Fiksel 2015).

Unforeseen risk occurrence is widely believed to have a significant impact on any industry's worldwide supply chain, resulting in a fall in firm performance (Gunessee et al 2018; Wagner and Neshat 2010). Generally, SC risk management has been a useful method for dealing with difficult situations that are immediately identifiable (Zineb et al 2017). Continuous inspection & tracking of risks improves the supply networks, allow them to deal with uncertainty, and improve the firm performance (Barrot et al 2019). So, basically, SC risk management reduces the disruptions in SC resilience for the purpose of firm performance enhancement. Hence, we propose the following hypothesis:

Hypothesis 3: Risk management practices will mediate the link between SC resilience and firm performance.

2.4 Mediating Role of Risk Management Practices between Supply Chain Robustness and Firm Performance

SCRM is described as the execution of techniques to manage both ordinary and exceptional risks throughout the supply chain, based on continuous risk analysis, with the purpose of decreasing vulnerability and assuring consistency (Wieland and Wallenburg 2012). Several authors show a relationship between SCRM and SC robustness in businesses (Bode et al 2011; DuHadway et al 2019). Firms must implement methods like SCRM to reduce SC susceptibility in order to build SC resilience, which includes screening for risks and coping with them before they occur (Azadegan et al 2013; Tang 2006). Firms that evaluate their network to uncover vulnerabilities can also tolerate disruptions better and recover more quickly (Ivanov and Sokolov 2013). Firms that understand how to assess dangers from their SC environment might improve their responsiveness to SC disruptions by developing proactive capabilities (Blackhurst et al 2011; Bode et al 2011; DuHadway et al 2019).

Basically, SC risk management plays an important part in identifying, managing risks and making SC robust. Utilizing and rearranging resources becomes essential for recovering from interruption and maintaining performance. As a result, in a disruptive circumstance such as the COVID-19 epidemic, enterprises' reconfiguration and deployment of resources/capabilities via SCRM assist them in coping with disruption repercussions and maintaining SC robustness. Hence, we propose the following hypothesis:

Hypothesis 4: Risk management Practices will mediate the link between SC robustness and firm performance.

Based upon the above review of the literature, the research model based upon the identified variables is proposed in Figure 1. The structural framework used in this study is depicted in Figure 1 and is in line with the findings of

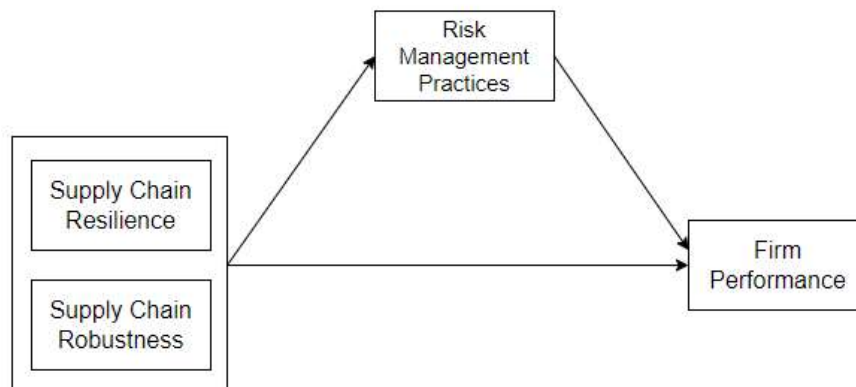


Fig. 1: Research Model

the literature. SC resilience and robustness represent the independent variables, the dependent variable is the firm performance with mediator SC risk management. As a result of ongoing economic challenges, businesses constantly rely on a complex network of international associates to deliver goods and services in the appropriate quantity, just at the perfect time, and in the right location, that is the reason why corporations need a robust and resilient network to distribute their goods in any pandemic situation. Existing literature shows that firms' resilience is their capacity to resume regular production after market turmoil within a certain amount of time (Nikookar and Yanadori 2022). At the same time, a robust network is also necessary for the maximization of production and overall operating performance. Robust means being prepared for change before it occurs (Ji et al 2020; Wieland and Wallenburg 2012). For the whole supply chain network of every firm, SC robustness and resilience are essential. However, SC risk management also serves as a bridge between the SC network and overall performance and is crucial for dealing with difficult situations that can be seen right away (Zineb et al 2017). In light of the aforementioned arguments, we therefore presented the model.

3 Research Methodology

This study employed a cross-sectional design using a survey questionnaire to investigate the relationship between supply chain resilience/robustness and firm performance in the textile industry of Pakistan with the mediating role of risk management practices. Ethical considerations were also considered, and the survey participants were informed about the study's purpose and confidentiality. Informed consent was obtained from all participants before completing the survey questionnaire.

3.1 Data Collection

The textile industry is one of Pakistan's fastest growing industries and contributes to national economy. This research study's population consisted of employees from textile sector and the unit of analysis was management staff working in textile manufacturing companies in Pakistan. Data was collected using convenience sampling technique through questionnaires. A Google form was prepared to collect data which was electronically distributed to concerned professionals. The responders were requested to take part and provide data for our study. The cover letter made it clear that the research was being done for scholarly purposes. A total of 450 responses were received back out of which 409 were usable since the rest had issues like incomplete and unengaged responses. Hence the final sample size of the study was 409 was the final sample size.

3.2 Research Instrument

A 5-point Likert scale was used (1= strongly disagree, 5= strongly agree) to measure variables. For SC Robustness 4-item scale of (Golgeci and Y. Ponomarov 2013; Wieland and Wallenburg 2012) was used. One sample item is Without adaptations being necessary, our supply chain performs well over a wide variety of possible scenarios. And the Cronbach alpha reliability of this scale was 0.73. For SC resilience 4-item scale of (Golgeci and Y. Ponomarov 2013; Wieland and Wallenburg 2012) was used. One sample item is We can cope with changes brought by the supply chain disruption. And the Cronbach alpha reliability of this scale was 0.75. For risk management 6-item scale of (Chowdhury and Quadus 2017) was used. One sample item is In the course of our risk analysis for all suppliers and SC partners, we select applicable observation fields for supply risks. And the Cronbach alpha reliability of this scale was 0.76. For firm performance 5- item scale of (Klein 1998) was used. One sample is Value-added per employee in our company is well above the industry average. And the Cronbach alpha reliability of this scale was 0.81.

3.3 Analysis Techniques

SPSS software and Hayes Process macro were used for data analysis. Various steps like data exploration, analysis for outliers and missing values, descriptive statistics, reliability of scale, regression analysis and mediation modeling were performed on the collected data.

4 Results

Demographic information for the collected sample is provided in Table 1. Top-level & middlelevel management positions indicated that only supervisors, man-

Impact of Supply Chain Robustness and Resilience..

agers and executives are responsible for looking at all the activities related to the supply chain and job experience also indicated that employees who have experience of more than 5 years are responsible for the supply chain management.

Table 1: Demographic information (n=409)

#		Frequency	Percentage
1	Gender		
	Male	250	61%
2	Position		
	Top-level	246	60%
	Middle-level	152	37%
3	Experience		
	Less than 2 years	45	11%
	2 to 5 years	40	10%
	6 to 9 years	81	19%
	Over 10 years	243	60%

The values of mean, standard deviation, and correlation are presented in Table 2. Descriptive statistics, reliability statistics (Cronbach alpha) and VIF values are provided in Table 2. All values indicate that the scale is reliable and there were no issues related to multicollinearity in the study variables.

Table 2 : Descriptive Statistics and Reliability Analysis

	Mean	S.D	Cronbach Alpha	VIF
SC Robustness	4.001	0.442	0.73	2.82
SC Resilience	3.998	0.468	0.75	3.19
Risk Mgt	4.042	0.407	0.76	2.2
Firm Performance	4.007	0.442	0.81	2.41

The correlation matrix is provided in Table 3. All correlation values were statistically significant and there were no issues related to multicollinearity as already established.

Table 3. Correlation Matrix

	1	2	3	4
SC Robustness (1)	1			
SC Resilience (2)	.765**	1		
Risk Mgt (3)	.645**	.682**	1	
Firm Performance (4)	.704**	.688**	.705**	1

The result of the four hypotheses is presented in Table 4. The direct effect indicated that SC resilience (effect= .36, $p < .05$) and SC robustness (effect .426, $p < .05$) have a positive significant link with firm performance, so H1 and H2 were supported. H3 and H4 were also supported where risk management acts as a mediator between SC resilience, robustness and firm performance. The indirect effect of both SC resilience and SC robustness revealed that risk management successfully mitigates the disruptions in the supply chain and enhance the firm performance. SC risk management significantly mediated the relationship between SC resilience and firm performance (effect .284, $p < .05$). SC risk management also significantly mediated the relationship between SC robustness and firm performance (effect = .277, $p < .05$).

Table 4. Results of Mediation Analysis

	Effect	SE	p	LLCI	ULCI
Firm performance (outcome)					
SC Resilience (predictor)					
Risk mgt (mediator)					
Direct effect	0.364	0.041	0.000	0.282	0.446
Indirect Effect	0.284	0.059	0.000	0.177	0.407
SC Robustness (predictor)					
Risk mgt (mediator)					
Direct effect	0.426	0.04	0.000	0.346	0.506
Indirect Effect	0.277	0.064	0.000	0.173	0.421

5 Discussion

The outcome of this study revealed that SC resilience significantly influences firm performance. SC resilience refers to a company's ability to recover from adversity. SC resilient refers to a system's adaptive ability to tolerate transitory disruptions (Soni et al 2014). Organizations should assess potential hazards and weaknesses that can affect their business ahead of time so that they can assess their sensitivity level to manage interruptions (Pettit et al 2010). SC must be agile, adaptable, and aligned (3As) in order for a company to obtain a competitive advantage (Ivanov 2020). The SC management proposes that everyone focus on building a resilient SC because disruptions and disasters can happen at any time and everyone must be prepared to deal with them. According to the finding, initiatives should include a resilience element for increased performance. Resilience is a constant factor in increasing profitability and decreasing vulnerabilities (Barrot et al 2019).

The second outcome of this study indicated that SC robustness significantly influences firm performance. The more SC robust, the firm performance will increase. The ability to handle processes during a pandemic is referred to as robustness (Brandon-Jones et al 2014). According to our research, robustness

has a significant impact on a firm's overall performance. The notion of robust design was developed in order to reduce the effects of interruptions during the manufacturing process. It is noted that robustness is always essential in dealing with the disruption caused by any situation (Klibi et al 2010,?; Wieland and Wallenburg 2012). According to the H2 result, firms must concentrate on the SC in order to improve overall performance in day-to-day situations or during pandemic attacks.

SCRM involvement in absorbing interruption consequences and increasing SC resilience and robustness was investigated in this study. The result revealed that SC risk management fully mediates the relationship of both SC resilience and SC robustness with firm performance. Resilience is vital in supply chain risk management since it entails addressing issues that begin with a lack of hazard management expertise (Scholten and Schilder 2015; Wieland and Wallenburg 2012). Although there has been a lot of focus on measures to improve supply network adaptability (Tukamuhabwa et al 2015), Resilience is also seen as a dynamic attribute in a framework with self-organizational levels (Mackay et al 2020).

During Covid-19, it was found that risk management is a key factor for every enterprise and that it has a significant impact on making an SC robust, allowing it to handle all of the disruptions that may occur during any uncertain pandemic. Risk management is frequently described as an iterative process, with risk documentation, computation, treatment, and monitoring/communication all being included (Barrot et al 2019; El Baz and Ruel 2021). The findings show that risk management helps in the creation of a robust and resilient environment. The implementation of a robust risk management system could improve the firm's image and shareholder value (Klibi et al 2010). SC risk management supports organizations and increases shareholder value by reducing pricing variance, lowering out-of-pocket expenses, and increasing efficiency (Bohnert et al 2019). According to findings, SCRM successfully mediates the relationship between SC robustness and SC resilience, which effectively improves the textile industry's performance.

6 Data and analysis

7 Conclusion

Risk management is essential for enterprises and supply chains to deal with global disruptive challenges. The Covid-19 pandemic attack exposed a wide range of vulnerabilities in businesses. A large number of studies have previously been conducted to polish procedures to improve firm performance. Furthermore, numerous studies have been conducted to make a supply chain robust, and resilient but after this pandemic, a study to make the supply chain strong is urgently required. In comparison, this research study uses both resilient and robust supply chain characteristics to improve firm performance. This pandemic demonstrates the critical need for having a resilient and robust SC to counter

disruptions and risk. Research demonstrated that the supply chain should be resilient to deal with any pandemic threats and disruptions, with no direct negative impact on the organization's performance. The result of the second hypothesis demonstrated that the supply chain must be robust to sustain and assure a healthy firm performance.

The findings also demonstrated that risk management is the key to a better supply chain. It also aids in improving the overall performance of the firm. This factor is especially important when comparing results to previous work in sustainable supply chain management to analyses because the examined relationships have not been empirically addressed in previous investigations. Finally, it was proven that effective hazard management procedures significantly mediated both the resilience and robustness of a supply chain. It can be inferred that risk management is important in general, not just when it comes to maintainability, and that these methods increase firm overall performance. Textile firms need to employ governance and monitoring mechanisms to mitigate risks in the supply chain besides identifying measures and improving processes to establish resilience and flexibility across the supply chain. All concerned stakeholders involved in the supply chain should meet periodically to identify new risks in the supply chain and enforce mitigation techniques.

7.1 Operational Implications

The study aimed to find solutions to difficulties in the Pakistani textile industry. The supply chain of the local textile industry has been severely harmed as a result of the pandemic attack in every performance metric. The local industry may be able to learn how to follow the proper practices to make their firm's performance lucrative as a result of this research. Local businesses will have to learn and adopt new ways to enable resilient supply chains to sustain operations. Any disruptions in operations due to supply chain issues can be overcome by adopting suggested actions of this research study. Risks in supply chains often lead to significant operational disruptions and corresponding financial losses. Supply chain managers need to develop robust risk management strategies that focus on proactive planning, monitoring, and mitigation. This includes identifying potential risks, developing contingency plans, and continuously monitoring and updating risk management processes. Additionally, collaboration and communication across stakeholders, including suppliers, customers, and internal departments is essential for a coordinated response to disruptive events.

7.2 Theoretical Implications

This study adds to the body of knowledge and fills gaps in the scant literature on the subject. This study is the first of its type to establish and investigate SC resilience breakdowns which have a detrimental effect on business performance in developing nations. This study emphasizes upon SC resilience, robustness

and business performance in textile industry. It bridges the theoretical gap by describing how SC resilience address weaknesses and how businesses create robust models using SC risk management.

7.3 Limitations and Future Research

Our study, like any other has limitations that provide opportunities for future research. First, our study uses a cross-sectional approach and focuses on the context of Pakistani textile enterprises. Hence, a direction for future research could be studies undertaken in other countries having different work culture and operating environments. Secondly, we only collected data at one point in time and did not use longitudinal data needed to investigate causality over a longer period. As a result, undertaking a longitudinal study may provide important insights into the connection between SCRM, disruption impacts, SC resilience, and robustness in the long term. Third, we employed SC risk management as mediating variable. Another research recommendation for future is to use other variables like firm size, certification in quality management systems etc. as moderating variables.

The authors declare no conflict of interest.

References

- Abeysekara N, Wang H, Kurupparachchi D (2019) Effect of supply-chain resilience on firm performance and competitive advantage: A study of the sri lankan apparel industry. *Business Process Management Journal*
- Alshahrani MA, Salam MA (2022) The role of supply chain resilience on smes performance: The case of an emerging economy. *Logistics* 6(3):47
- Ambulkar S, Blackhurst J, Grawe S (2015) Firm's resilience to supply chain disruptions: Scale development and empirical examination. *Journal of operations management* 33:111–122
- Araz OM, Choi TM, Olson DL, Salman FS (2020) Data analytics for operational risk management. *Decis Sci* 51(6):1316–1319
- Azadegan A, Patel PC, Zangouinezhad A, Linderman K (2013) The effect of environmental complexity and environmental dynamism on lean practices. *Journal of operations management* 31(4):193–212
- Barrot JN, Loualiche E, Sauvagnat J (2019) The globalization risk premium. *The Journal of Finance* 74(5):2391–2439
- Bettis RA, Hitt MA (1995) The new competitive landscape. *Strategic management journal* 16(S1):7–19
- Blackhurst J, Dunn KS, Craighead CW (2011) An empirically derived framework of global supply resiliency. *Journal of business logistics* 32(4):374–391
- Bode C, Wagner SM, Petersen KJ, Ellram LM (2011) Understanding responses to supply chain disruptions: Insights from information processing and resource dependence perspectives. *Academy of Management Journal* 54(4):833–856
- Bohnert A, Gatzert N, Hoyt RE, Lechner P (2019) The drivers and value of enterprise risk management: evidence from erm ratings. *The European Journal of Finance* 25(3):234–255
- Brandon-Jones E, Squire B, Autry CW, Petersen KJ (2014) A contingent resource-based perspective of supply chain resilience and robustness. *Journal of Supply Chain Management* 50(3):55–73

- Charles A, Laurus M, Van Wassenhove L (2010) A model to define and assess the agility of supply chains: building on humanitarian experience. *International Journal of Physical Distribution & Logistics Management*
- Chowdhury MMH, Quaddus M (2017) Supply chain resilience: Conceptualization and scale development using dynamic capability theory. *International Journal of Production Economics* 188:185–204
- Chowdhury MMH, Quaddus M, Chowdhury M (2023) Managing relational practices for performance improvement in a complex supply chain network: the mediating roles of proactive and reactive resilience in apparel industry of bangladesh. *The International Journal of Logistics Management* 34(1):34–59
- DuHadway S, Carnovale S, Hazen B (2019) Understanding risk management for intentional supply chain disruptions: Risk detection, risk mitigation, and risk recovery. *Annals of Operations Research* 283:179–198
- El Baz J, Ruel S (2021) Can supply chain risk management practices mitigate the disruption impacts on supply chains resilience and robustness? evidence from an empirical survey in a covid-19 outbreak era. *International Journal of Production Economics* 233:107,972
- Fiksel J, Fiksel J (2015) *From risk to resilience*. Springer
- Gligor D, Gligor N, Holcomb M, Bozkurt S (2019) Distinguishing between the concepts of supply chain agility and resilience: A multidisciplinary literature review. *The International Journal of Logistics Management*
- Golgeci I, Y Ponomarov S (2013) Does firm innovativeness enable effective responses to supply chain disruptions? an empirical study. *Supply Chain Management: An International Journal* 18(6):604–617
- Gunnessee S, Subramanian N, Ning K (2018) Natural disasters, pc supply chain and corporate performance. *International Journal of Operations & Production Management* 38(9):1796–1814
- Hendijani R, Norouzi M (2023) Supply chain integration and firm performance in the covid-19 era: the mediating role of resilience and robustness. *Journal of Global Operations and Strategic Sourcing* 16(2):337–367
- Hosseini S, Ivanov D, Dolgui A (2019) Review of quantitative methods for supply chain resilience analysis. *Transportation Research Part E: Logistics and Transportation Review* 125:285–307
- Ivanov D (2020) Predicting the impacts of epidemic outbreaks on global supply chains: A simulation-based analysis on the coronavirus outbreak (covid-19/sars-cov-2) case. *Transportation Research Part E: Logistics and Transportation Review* 136:101,922
- Ivanov D, Dolgui A (2020) Viability of intertwined supply networks: extending the supply chain resilience angles towards survivability. a position paper motivated by covid-19 outbreak. *International Journal of Production Research* 58(10):2904–2915
- Ivanov D, Sokolov B (2013) Control and system-theoretic identification of the supply chain dynamics domain for planning, analysis and adaptation of performance under uncertainty. *European Journal of Operational Research* 224(2):313–323
- Ivanov D, et al (2018) *Structural dynamics and resilience in supply chain risk management*, vol 265. Springer
- Jain D, Mahajan V, Muller E (1991) Innovation diffusion in the presence of supply restrictions. *Marketing Science* 10(1):83–90
- Ji L, Yuan C, Feng T, Wang C (2020) Achieving the environmental profits of green supplier integration: The roles of supply chain resilience and knowledge combination. *Sustainable Development* 28(4):978–989
- Juan SJ, Li EY, Hung WH (2022) An integrated model of supply chain resilience and its impact on supply chain performance under disruption. *The International Journal of Logistics Management* 33(1):339–364
- Jüttner U, Maklan S (2011) Supply chain resilience in the global financial crisis: an empirical study. *Supply chain management: An international journal* 16(4):246–259
- Kannan VR, Tan KC (2005) Just in time, total quality management, and supply chain management: understanding their linkages and impact on business performance. *Omega* 33(2):153–162
- Khorasani ST (2018) A robust optimization model for supply chain in agile and flexible mode based on variables of uncertainty. *Global Journal of Flexible Systems Management* 19(3):239–253

- Kinra A, Ivanov D, Das A, Dolgui A (2020) Ripple effect quantification by supplier risk exposure assessment. *International Journal of Production Research* 58(18):5559–5578
- Klein A (1998) Firm performance and board committee structure. *The journal of law and Economics* 41(1):275–304
- Klibi W, Martel A, Guitouni A (2010) The design of robust value-creating supply chain networks: a critical review. *European Journal of Operational Research* 203(2):283–293
- Kt R, Sarmah SP (2021) Impact of supply risk management on firm performance: a case of the indian electronics industry. *International Journal of Productivity and Performance Management* 70(6):1419–1445
- Kumar S, Chandra C (2010) Supply chain disruption by avian flu pandemic for us companies: a case study. *Transportation Journal* 49(4):61–73
- Le Hoa Vo T, Thiel D (2011) Economic simulation of a poultry supply chain facing a sanitary crisis. *British Food Journal* 113(8):1011–1030
- Lee HL (2002) Aligning supply chain strategies with product uncertainties. *California management review* 44(3):105–119
- Lopes JM, Gomes S, Mané L (2022) Developing knowledge of supply chain resilience in less-developed countries in the pandemic age. *Logistics* 6(1):3
- Mackay J, Munoz A, Pepper M (2020) Conceptualising redundancy and flexibility towards supply chain robustness and resilience. *Journal of Risk Research* 23(12):1541–1561
- Nair A, Vidal JM (2011) Supply network topology and robustness against disruptions—an investigation using multi-agent model. *International Journal of Production Research* 49(5):1391–1404
- Natarajathinam M, Capar I, Narayanan A (2009) Managing supply chains in times of crisis: a review of literature and insights. *International Journal of Physical Distribution & Logistics Management*
- Nikookar E, Yanadori Y (2022) Preparing supply chain for the next disruption beyond covid-19: managerial antecedents of supply chain resilience. *International Journal of Operations & Production Management* 42(1):59–90
- Pettit TJ, Fiksel J, Croxton KL (2010) Ensuring supply chain resilience: development of a conceptual framework. *Journal of business logistics* 31(1):1–21
- Ponomarev SY, Holcomb MC (2009) Understanding the concept of supply chain resilience. *The international journal of logistics management* 20(1):124–143
- Rice JB, Caniato F (2003) Building a secure and resilient supply network. *SUPPLY CHAIN MANAGEMENT REVIEW*, V 7, NO 5 (SEPT/OCT 2003), P 22-30: ILL
- Scholten K, Schilder S (2015) The role of collaboration in supply chain resilience. *Supply Chain Management: An International Journal* 20(4):471–484
- Scott RA, Rutner S (2019) Revisiting the newsvendor and traveling salesman in a healthcare disaster or pandemic response. *Journal of Marketing Development and Competitiveness* 13(2):42–48
- Shafiq M, Soratana K (2019) Lean and agile paradigms in humanitarian organizations' logistics and supply chain management. *LogForum* 15(1):139–153
- Siagian H, Tarigan ZJH, Jie F (2021) Supply chain integration enables resilience, flexibility, and innovation to improve business performance in covid-19 era. *Sustainability* 13(9):4669
- Simchi-Levi D, Wang H, Wei Y (2018) Increasing supply chain robustness through process flexibility and inventory. *Production and Operations Management* 27(8):1476–1491
- Soni U, Jain V, Kumar S (2014) Measuring supply chain resilience using a deterministic modeling approach. *Computers & Industrial Engineering* 74:11–25
- Swafford PM, Ghosh S, Murthy N (2008) Achieving supply chain agility through it integration and flexibility. *International journal of production economics* 116(2):288–297
- Tang CS (2006) Robust strategies for mitigating supply chain disruptions. *International Journal of Logistics: Research and Applications* 9(1):33–45
- Teece D, Pisano G, Shuen A (1997) Dynamic capabilities and strategic management. *knowledge and strategy*, 18 (april 1991), 77–116
- Tukamuhabwa BR, Stevenson M, Busby J, Zorzini M (2015) Supply chain resilience: definition, review and theoretical foundations for further study. *International journal of production research* 53(18):5592–5623
- Wagner SM, Neshat N (2010) Assessing the vulnerability of supply chains using graph theory. *International journal of production economics* 126(1):121–129

A.Munir, A. Hanif and N. Afzal

- Wieland A, Wallenburg CM (2012) Dealing with supply chain risks: Linking risk management practices and strategies to performance. *International journal of physical distribution & logistics management*
- Xu S, Zhang X, Feng L, Yang W (2020) Disruption risks in supply chain management: a literature review based on bibliometric analysis. *International Journal of Production Research* 58(11):3508–3526
- Zhang X, Wang H (2011) Empirical research on associations among information technology, supply chain robustness and supply chain performance. *International Journal of Business and Management* 6(2):231
- Zineb E, Brahim B, Houdaifa A (2017) The impact of scrm strategies on supply chain resilience: A quantitative study in the moroccan manufacturing industry. *International Journal of Supply Chain Management* 6(4):70–75