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Resilience components of the supply chain in the apparel sector of Pakistan throughout COVID-19

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ABSTRACT

This study examines the significant impact of COVID-19 on Pakistan's apparel industry, which has faced severe challenges due to global supply chain disruptions and the cancellation of $2.1 billion in export orders by major international buyers. As a key contributor to Pakistan's economy and a major source of employment, especially for women, the apparel sector has been severely strained, with brands like H&M and Walmart reducing business. This has led to factory closures and widespread job losses. Using an explanatory research design and deductive approach, the study focuses on supply chain resilience in the garment sector during the pandemic. Data were collected through a structured questionnaire targeting HR and administrative personnel familiar with company policies and strategies. A sample of 150 respondents was surveyed to assess vulnerabilities, operational sustainability, capabilities, and supply chain resilience. Statistical analyses were conducted using SPSS (version 26), supported by data from newspapers, online sources, and observations. A pilot study confirmed the reliability of the questionnaire. The study highlights the need for greater collaboration among governments, international buyers, and textile organizations to support the industry during crises. It also identifies the health risks faced by workers and emphasizes the importance of policy measures such as stronger labor protections and continued government support. The findings provide valuable insights for policymakers and industry leaders to enhance resilience and sustainability in the global garment industry.

Keywords: *Resilience, Supply chain resilience, supply chain management, Covid-19, Pandemic, Disruptions, SPSS, Quantitative research*

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1. Introduction

Even though mankind has an imperative background of being infected through the virus, recent and continuing observations and indications of infection through the spreading of COVID-19 have at present surpassed both the chronological suggestion and the disaster (Baloch & Rashid, 2022). China was the world's first affected country. Following the first infection of an unidentified cause that appeared at Wuhan Central Hospital in 2019, the spread of the virus throughout the domain continued until the beginning of May and still continues. The World Health Organization “WHO” declared in 2020 a worldwide pandemic because of the spreading of the virus, named Corona-Virus Disease.COVID-19 has affected in excess of 200 countries and regions around the domain. This unbalanced spread was the reason for the effect on trade and commerce from place to place in the world, and a 200 billion total GDP loss was estimated. Pakistan is no different and is developing on this scene. The apparel industry is facing the main challenges, with a lot of buyers cancelling large numbers of export orders because of the unpredicted spreading and grades of COVID-19. Through the 1st export of tens thousands of dollars during the late 1970's, the apparel sector in Pakistan gained 513.53 billion in exports in the 2017-18 financial year, which is about 57% of the country's total export earnings. Pakistan's apparel exports are three times higher than in 2008, and in 2019, they were worth more than 512.526 billion. It is the 7th largest global exporter of ready-made garments then there is China. The RMG sector serves as a pivotal compound for Pakistan's social and economic development. Due to the sudden onslaught of COVID-19 and the relevant reactions of buyers, RMG has been facing unprecedented results. As the supply chain is severely affected, industry and policymakers are increasingly concerned about how to avoid this present and upcoming setback.

The supply chain is a group of organizations, their workplaces, activities, and capabilities involved in producing and delivering goods and services (Rasheed & Rashid, 2023). Strong resiliency in the supply chain promotes an important location, and all the related stakeholders from various phases of supply chain management interchange quickly into the growing fashion age. Compliance factories in the apparel sector in Pakistan, in particular, have moved to a challenging and competitive platform where they can confirm high-quality and low-cost products in the shortest conceivable time. Industries and organizations are progressively moving resources around the world to components of their generation in order to achieve competitive priorities (Rasheed et al., 2023; Rasheed et al., 2024a). Factories are constantly striving to adopt an efficient supply chain to provide the required products. However, the majority of the industries in Pakistan are unclear about the supply chain due to a lack of knowledge and its importance. As the organization’s SCM moves towards Industry 4.0, supply chain transparency in the garment industry is a requirement. In addition to this endless pressure to compete in the worldwide market, COVID-19 is creating an additional burden all over. Many Pakistani people do not have sufficient savings to afford the current pandemic situation. Due to the cancellation of arrangements and the disappointment of buyers, more than 3 million workers in the Pakistani apparel and textile industries have so far been laid off. In the event of a large-scale crisis, the apparel classes revealed that there is no protective bundle to meet workers' pay rates and seek government assistance to pay them immediately (Rasheed et al., 2024b).

The global economy has already begun to be affected by COVID-19. Many countries are implementing the lockdown. The apparel and textile sectors have to bear the brunt of the continuing coronavirus eruption. The disruption began in China in January 2020, when China was home to many raw material and equipment importers and restricted exports due to epidemics. Pakistan had a garment industry operation with raw material inventory storage of about two months. However, most buyers have been gradually cancelling their booked and unbooked orders, and maximum ongoing production is postponed, particularly in the West affected by COVID-19. Notable European brands such as H&M Inditex, Inc, Macy's, and major North American retailers such as Levie’s, Columbia Sportswear, Walmart, GAP, and Nike they have already changed their strategy and reduced their global business

and trade due to the country-wise lockdown. Therefore, all inspected orders were also being given up for loss and cancellation, and most of the finished goods and products were not able to ship by any platform of air or sea. The survival of factories and manpower is in danger (Khan et al., 2022).

Order cancellation losses by the end of May 2020 were $2.1 billion, while shipment cancellation volume was estimated at 857 million pieces. About 400 garment factories, with in excess of 0.5 million employees struggling to thrive or survive in Pakistan, are expected to generate at least $6 billion in trade revenue this fiscal year amid the cancellation of some of the world's largest brands. Factories have been forced to respond to the government's imposition of lockdowns by retailers, even though it has been declared a public holiday in the domain and delays in cancellation orders and payments by major brands. Due to requests, many owners of industries could not pay the employees because of repeated cancellations of orders, which led to a decrease in a wages (Khan et al., 2021). There is also disturbance in many industries. Many industries have announced the cost of jobs in their units. As per the labor's rights policy, approximately 35,000 employees from various factories in Karachi, Lahore, and Faisalabad have been evacuated from various locations. Many sections of the industry have not received their compensation, and many of the effects of the epidemic on the garment industry are encouraging the researchers to study the flexible phases of the SCM. This important study is objective, especially in the context of the RMG industry in Pakistan.

Some researchers have begun to explore the potential factors contributing to the vulnerabilities of the garment and apparel sector in Pakistan. However, these factors have not yet been fully established, making this an area needing further study. Additionally, there has been insufficient research on the impact of COVID-19, particularly in the ready-made garment sector. As a result, this study could be replicated in similar sectors in other countries, where it could have significant implications for industries worldwide.

1.1 Background of the Study

Pakistan's readymade garment sector employs at least 15 million people, of whom 40% are women, which is a sign of contributing to women's empowerment in the division, accounting for 80% of Pakistan's total exports and 8.5% of GDP. It comes from the medical (RMG) sector, Pakistan's largest industrial division. The apparel sector has expanded women's working share as full-time wage occupations, as the annual progress rate for two decades has exceeded 15%. The majority of garment item producers are small to medium. Around three-quarters of the industries have decreased by 500 workers. Most RMG factories are located in Karachi, and about 60% of the total export volume is from European customers' brands, compared with US buyers. Similar co-product types are knitwear, denim, and woven (Agha et al., 2021; Haque et al., 2021).

1.2 Problem Statement

Retailers in North America and Europe, which are sources of products for Pakistan, have adopted an inventive methodology to improve working conditions by forming an association of coal safety employees in Pakistan. With the agreement and association in Pakistan, the government, local and international initiatives, global trade union federations, non-governmental organizations (NGOs), and multinational apparel companies have formed a cluster. They are working to improve the factory atmosphere so that workers have a safer place and a better image (Das et al., 2021).

The proportional advantages of the Pakistani garment industry include extreme and punishing overtime, late sitting working hours, low wages, and risky job security for worldwide retailers and brands. These measures have generated more interest in related studies. The supply chain of ready-made garment industries needs to increase its sustainability and performance requirements in the present market. The flexibility aspect of the COVID-19 event has also come to be measured as one of the related research topics for the ready-made garment industry.

1.3 Purpose of the Study

The ready-made garment and textile industries serve as an important catalyst for Pakistan's economic and social development. Because of the severe effects of COVID-19, the garment sector is facing an unprecedented trend. As the supply chain is severely affected, industry and policymakers are worried about how to avoid the troubles caused by the epidemic. Accordingly, the purpose of this study is to explore the potential and weak factors in the apparel sector in Pakistan, their associations, and how these variables impact the resilience of the supply chain.

1.4 Significance of the Study

According to a general review, Moran et al. (2021) summarized four flexibility capabilities of supply chain management (SCM): speed, cooperation, visibility, and adaptability. These capabilities are severely affected during crises, such as financial disasters. Flexibility helps industries shift to alternative, cost-effective supply chains. Speed aids in identifying untapped regional demands, while visibility assists industries in managing supply by distributing materials and information to prepare for any potential delivery disruptions. Cooperation across the supply chain ensures smooth operations. These capabilities are equally effective during pandemics such as COVID-19. When even one component of the system, such as production, supply, transportation, demand, or distribution of raw materials, is unavailable, the supply chain experiences immediate negative effects. The COVID-19 outbreak has highlighted the need to advance research and develop methods for enhancing supply chain resilience under normal and abnormal conditions.

China's flexibility in inquiry and industry has focused more on experimental than conceptual investigations. In the context of COVID-19, these studies may offer regulatory guidance and help address supply chain challenges while preparing for future emergencies. Lessons learned from these studies can reduce the need for repeated learning in similar situations. The importance of creating flexibility in supply chains through travel risk assessment emphasises the common goals shared by individuals, interests, and adaptability in applying current information and practices. Supply chain management (SCM) that adapts to the Industry 4.0 era can benefit from greater accountability, especially in response to the challenges posed by COVID-19. Such adaptability can lead to better responses to predictable obstacles. Moreover, disruptive technologies like big data analytics enhance supply chain flexibility. Hewitt et al. (2020) suggest that these technologies provide valuable insights to help map the relationship between stakeholders, resources, and leaders' strategies.

Industries and their supply chains must improve flexible capabilities, both responsible and active, for enhancing the positive level of availability, response, and repossession capability between pre- and post-disaster stages. A researcher, Papadopoulos et al. (2017), suggests that research shows that rapid trust, participatory management, and public-private organizations are key capabilities for flexibility in the supply chain system. An organization with a more modern background, implicit or straight, is more flexible than anxious. Ivanov and Dolgui (2020) suggested that while the conflict over unusual barriers should be effectively measured, a new research perspective on supply chain resilience is important for the future development of the garment sector. Pakistan's public and private sectors should strengthen the update by incorporating their special benefits. Government employees will face long-term effects, especially health problems, financial difficulties, and failure to pay for basic ideologies, such as future employment opportunities during the COVID-19 pandemic.

Supply chain flexibility is influenced by the ability of the administration's intricate people, and the superior administration calculates the number of competitors. Practical and action-oriented opportunities are related to the moderation strategy (Govindan et al., 2020). The atomized and digital technology may strengthen the practice's ability to be flexible in advancing patient safety (Rubio-Romero et al., 2020). The flexible supply chain is not dependable on all industries within but can depend on the organization that can rearrange the assets to control the barrier. Negative outcome of supply chain risk events must have the potential for reducing the weakness of supply chain, ensuring better condition or at least recovery in the past. However, the writers experiential that really weak

supply chains may be somewhat flexible, which means that more or less flexibility is not certainly connected to the risk level. Miroudot (2020) argue it isn't necessary the return to an already disrupted supply chain after a disruption, but to be able to learn to adapt. Researchers from a variety of fields are increasingly focusing on their ideas. For flexibility as it can be a complicated conception. Subsequent and pre-obstruction include resilience, which is a fundamental approach to disaster emergency management and preparedness (Miroudot, 2020). Researcher Tang et al. (2021) proposed enhancing the three universally recognized strengths of supply chains adaptation, alignment, and agility to achieve sustainable competitiveness despite challenges. Their approach emphasizes high-level cooperation in identifying and managing risks, immediate responses to unexpected events, and a solid commitment to the philosophy of risk management (Albhirat et al., 2024).

As a result of climate change, the supply chain is becoming increasingly complex, making it more challenging to understand the dynamics of globalization, leading to greater turbulence and complexity. To address these challenges, flexibility in supply chain research requires the development of more comprehensive theories. Risk management within the supply chain aims to reduce its vulnerabilities. China's approach to flexibility focuses on enhancing adaptive capabilities to respond to unprecedented events and overcome future obstacles (Hewitt et al., 2020). Flexibility in supply chain management is an essential tool for enhancing routine risk management within industries, even though not all risks can be avoided (Miroudot, 2020). The effectiveness of supply chain flexibility depends on how outcomes are managed. Constraints in supply chains, particularly those that are globalized, present unique challenges, such as factory closures, increased outsourcing, rising demand, and technological fluctuations. While supply chain managers are often more concerned with the risks, these barriers can also present opportunities. Addressing these weaknesses can lead to improvements in supply chain efficiency.

2. Literature Review

2.1 Theoretical Review

Based on a general review, summarize that four supply chain flexibility, capabilities, visibility, cooperation, and speed are severely affected by barriers. In times of crisis, for example, a financial crisis, flexibility helps the industries transform into a substitute economic supply source, and speed helps find undiscovered provincial demands. Visibility helps the industry decide on sharing information and collaborating across supply chains to prepare for possible transmission failure and ensure smooth work (Moran et al., 2021). These capabilities appear to be equally effective during epidemics such as COVID-19. When one or more system components, such as demand, distribution, production, supply, or transportation of the raw materials, are unavailable, the supply chain has immediate negative effects. Due to the spread of COVID-19, there is a need to advance research and methods of supply chain flexibility between abnormal and non-abnormal conditions (Ivanov & Dolgui, 2020).

The center's efforts in open spaces to close the gap between supplies about the China flexibility inquiry and industry bone. More attention, less imagination, and more experimental investigations of opportunities surrounding COVID-19 may offer support. Administrators can address supply chain challenges and provide necessary support by applying lessons learned from research. Preparing for future emergencies is crucial. The journey toward flexibility in supply chain risk assessment requires a focus on shared interests, the alignment of common goals, and the practical application of information and materials. Supply chain management, especially in the context of Industry 4.0, can be strengthened by advancements in these areas.

What could be the better answer for accountability and understandable concerns?

However, disruptive knowledge such as big data analytics plays a pivotal role in supply-chain flexibility. Hewitt et al. (2021) suggested that they provide pieces of information to complement versatility in order to map associations between sharpeners, assets, and shapes controlled by the chief

organizations and their supply chains requirements to be flexible and have both active and responsible abilities to increase a certain level of availability, response, and maintenance capability. The stages before and after the catastrophe Papadopoulos et al. (2017) suggest that the investigation has come to recommend that partnerships in management and public-private organizations are key to flexibility. The supply chain structures a factory with a more sophisticated situation, directly or through it, with more flexibility for effects and influence, suggesting when there should be resistance to unusual obstacles, considering the scale of rationality. The supply chain is a new angle of resilience research for both the public and private sectors to develop the garment sector in the critical future.

Pakistan should strengthen the update by adding its special benefits. Garment employees, in particular, will face the long-term effects of their health problems, financial difficulties, and failure to meet basic principles such as food and the future. The flexibility of supply chain employment opportunities during the COVID-19 epidemic is based on the ability of the person's involvement, counting competitors in administration and broad management (Shelton et al., 2019) the possibility of interruption in the supply of the buyer is strongly linked to their buffer selection, action-based risk management strategies, and inclinations towards action-based opportunity moderation strategies. Automotive technology may strengthen the ability to practice flexibility in advancing patient protection (Rubio-Romero et al., 2020).

Organizations within the supply chain, perhaps within the company that can recreate assets to control disruption (Moran et al., 2021) are experimental. If the supply chain reduces undesirable or negative elasticity, it ensures better conditions or maintenance of supply chain risk events. At least in the past, the ability should have been to reduce the supply chain weakness. However, the authors argue that there could be very weak supply chain flexibility to any extent, which indicates that more or less flexibility should not be related to its weakness levels (Pete et al., 2010). They argue that advance withdrawal is not necessary. It would be beneficial to disrupt the supply chain after the disruption and learn how to adopt research from various fields, increasingly focusing on their ideas for flexibility, as it may be a multifaceted theory. Subsequent barriers and pre-barriers include flexibility, the basic approach to disaster emergency management and preparedness. Tang et al. (2021) advised increasing the strength of the supply chain, usually threefold. Supply Chain: alignment, adaptability, agility, and achieving sustainable competition despite some setbacks.

(1) Flexibility can be created before a system is disrupted.

(2) There is a need for high-level cooperation in identifying and managing risks.

(3) Prompt response to unforeseen events.

(4) Culture and philosophy of risk management.

2.1.1 The present situation was of the apparel sector during the start of COVID-19

The government has taken a significant step in dealing with the range of innovation. COVID-19 announced a public holiday that forced garment industries to close immediately on March 24, 2020. The government had asked employers not to lay off workers until the end of the year. On March 30, 2020, the government of Pakistan permitted a financial motivation bundle of 1.2 trillion rupees, including 100 billion rupees, as a supplemental contribution to the "Residual and Emergency Relief Funds" to help alleviate the special effects of the sudden shutdown of the industry. Revocation of orders the purpose of this financial aid was to keep wages going for three months; the factory gets a six-month grace period. The payment will start on the 7^{th} month of receipt. There were also selected private initiatives by the government, PRGMEA, and the government regarding the payment and protection of workers against COVID-19. The PTEA will monitor all these activities under the governance of the Ministry of Labor. In terms of the flexibility of the supply chain, COVID-19 has destabilized the supply chain. On the contrary, the garment industry is mired in a volatile environment.

2.1.2 Vulnerability of the supply chain

As a result of climate change, supply chains are becoming more multifaceted to understand the dynamics of globalization and, instability and complications. Supply Chain Flexibility research has the need for a comprehensive theory. Supply Chain Risk Management (SCRM) aims to mitigate the vulnerabilities within supply lines, while supply chain flexibility focuses on developing unprecedented processes and adaptive capabilities to overcome and recover from future obstacles (Hewitt et al., 2020; Rashid et al., 2024a; Rashid et al., 2024b). Flexibility management in the supply chain is a crucial tool that enhances and complements an organization's routine risk management, even though not all risks are avoidable. Tang et al. (2021) suggest that the effectiveness of supply chain flexibility depends on how well it can manage the resulting consequences. Supply chain constraints, such as global supply chains, specialized industries, and fluctuations in demand, increased outsourcing, and technological advancements, present unique challenges. In this era, supply chain managers are increasingly concerned about these risks; however, they also recognize that barriers can present opportunities. Addressing these weaknesses, such as by increasing supply chain efficiency, is essential to understand and strengthen the supply chain's overall resilience.

2.1.3 Sustainability of the supply chain

For performing well together in the common situation and in fast recovery afterward interruptions,

Tang et al. (2021) proposed nine strategies for the supply chain:

a) Supply base
b) Flexible transportation
c) Management
d) Economic supply incentives
e) Buying and selling
f) Strategic stocks
g) Deferred
h) Dynamic rating planning
i) Soundless-product rollover

For example, a led off-extension (Miroudot, 2020) suggested a comprehensive philosophy and clarified that supply chain flexibility is decreasing weaknesses and will grow with increasing capabilities.

2.2 Underpinning and Supporting Theories/Model

Figure 1 illustrates the capabilities and vulnerabilities (research model) of this research.

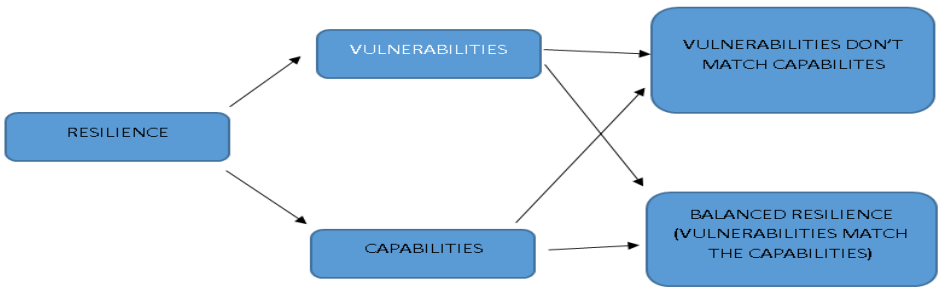

Figure 1: Capabilities and Vulnerabilities

Source: Author's own creation

Two factors of deep concentration: weakness and strength. Developing the best capabilities to overcome supply chain weaknesses strikes an equilibrium between risk and investment, which is titled "balance flexibility" however profit reduction as well as high risk are being unbalance the flexibility. Flexibility of Supply chain, a multifaceted and categorized construction, contains of three elementary dimensions: functional capacity, reaction capacity and supply chain design quality. Twelve of mentioned three elementary dimensions support the supply chain (Rashid et al., 2024c). flexibility of the Supply scale the chain of supplies better predicts operational weakness and performance, which is also in line with the fitness standards of the energetic capability principle. In positions of computable variables, the supply chain flexibility framework defines flexibility. First Miroudot (2020) describes the framework management capabilities of inherent weaknesses in supply chain design are balanced and recognize the need to do what the environment does. The author also identifies 14 unique capabilities that help increase the supply chain flexibility.

Carvalho et al. (2012) suggested a diagramming framework for improving the flexibility, which allows proof of identity of surviving the operation of supply chain and possible transition conditions, including risks. Although factories will obviously have more potential for both strengths and weaknesses, it is more likely that companies will combine these strengths. Companies should choose where it's greatest for them for investing in limited particular, in view of asset targets and competitive components properties.it can be analyze in attached figure 2 the main matrix for competencies and weaknesses, which are characteristics of understandable positions that companies can find for themselves with respect to the modified levels of these features.

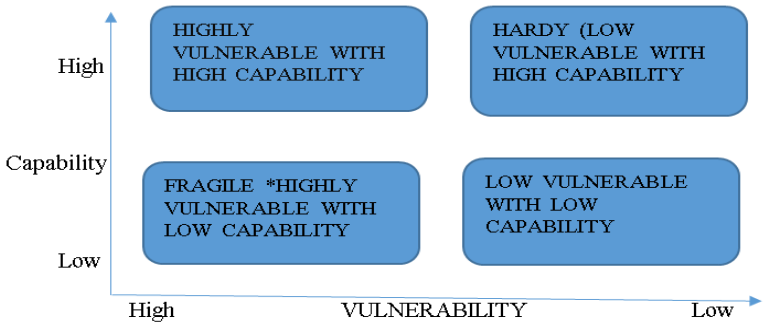

Figure 2: Capabilities and Vulnerabilities Matrix

Source: Literature

2.3 Empirical Reviews

Shahbaz et al. (2019) classified probable justification strategies using supply chain and descriptive organizational modeling techniques. Mzougui et al. (2022) utilized the Fuzzy Analytical Hierarchy Process (FAHP) to measure risks in Halal food supplies. Moktadir et al. (2022) assessed supply chain risks in automotive organizations through Failure Mode, Effects, and Criticality Analysis (FMECA). Chand et al. (2015) measured common risks in supply chain sustainability by applying the Best-Worst Method (BWM) technique. They also suggested the Analytical Network Process (ANP) model for selecting the best supply chains based on risk assessment. Most studies focus on risk evaluation rather than recommending strategies for managing supply chain disruption risks. While some studies have categorized risk mitigation strategies in the supply chain, they haven't modeled the impact of these strategies on addressing the effects of disruptions on supply chain management (SCM). To highlight certain effects, this study employs the gray model and matrix methods of degradation to evaluate supply chains in the context of the COVID-19 pandemic."

2.4 Research Framework

The framework identifies balanced and unbalanced strengths with competency

components and explores the relationship between strengths and weaknesses in the fashion industry. By building a network of flexibility with four understandable situations, industries may search themselves by their natural weaknesses and potential components.

2.5 Hypotheses

According to literature review the two hypotheses are developed:

Hypothesis 1 (H1): *Vulnerabilities impacts on the supply chain resilience.*

Hypothesis 2 (H2): *Operational sustainability' impacts on the supply chain resilience.*

Hypothesis 3 (H3): *Capabilities impacts on the supply chain resilience.*

3. Research Method

3.1 Research Approach

It is an examined explanatory research and a deductive-approach (Rashid & Rasheed, 2023; Rashid et al., 2023). In this research, we have used the technique of quantitative analysis to understand the facts as faced in apparel sectors (Rashid et al., 2021), both physically and online and after a pertinent questionnaire is forwarded to the HR and administrative departments of the companies in the apparel sector's people, and those people who are mindful of industrial's policies, values, and strategies and have good information correlated to industries may be respondents to the questionnaire (Rashid & Rasheed, 2024; Rashid et al., 2024d). Moreover, the qualitative method poses trustworthiness issue (Haq et al., 2023). Therefore, the quantitative method is suitable for explanatory nature of research/

3.2 Research Design

The research strategy proposed here is quantitative in nature; the aim is to discover the resilience of the garment industry in Pakistan among the 19 epidemics for which the case study was selected as per this study, the focus is on the research methods utilized in quantitative strategy (Rashid et al., 2024e). Explain that the study is an explanation of the past and present, as proved by various sources and bases. The study can retrieve statistics from private or public databases in addition to direct observations and systematic interviews (Ngah et al., 2024a). The study is characterized by its capacity to deal with a large variability of evidence, samples, documents, observations, and interviews (Ngah et al., 2024b). Considering the several resources of evidence that are a feature of the study, the study was monitored by a two-stage data processing group. At the beginning of the research process, websites and daily newspapers are used to investigate the extent of the barriers caused by COVID-19 in Pakistan's garment sector. Newspapers have become a valuable resource for research. The ability to browse articles in daily newspapers according to the user's needs makes them an excellent source of information. Modern media, including newspapers, provides essential data for scholars and researchers to collect and analyze information. Although researchers may not always use the web for direct data collection, they can still draw on the information from newspapers to develop ideas and support their research. Paper is used daily during inquiries, despite sometimes being unreliable and inaccurate.

3.3 Sampling Design

A size of a sample of discussed research was the respondent of 150 peoples and the respondents were asked patterned open end questions for investigating their capabilities to raise the resilience of supply chain (Rashid et al, 2024f).

3.4 Data Collection Instrument

A detailed questionnaire was adopted for the collection of the data. For estimation, we have used a five-point likert scale from the 150 respondents for three independent variables; Vulnerabilities, Operational Sustainability, and Capabilities, and one dependent variable, supply chain resilience. And all variables were mentioned in the questionnaire: (1) strongly disagrees, (2) disagree, (3) neutral, (4) agree, and (5) strongly agree, and all the statements are attached in the appendix section.

3.5 Data Collection Procedure

The questionnaire of the survey is a collection procedure, and the questionnaire was provided to all the respondents throughout the provided social survey platforms (Rashid et al., 2024g).

3.6 Statistical Technique

All the relevant data was examined using the SPSS software (26 ver.). Demographic, descriptive frequency, reliability test, ANOA, correlation, and regression analyses are used to understand the techniques (Rashid et al., 2024h).

3.7 Development the Survey questionnaire

For assimilating the key phases of the model: vulnerability, operational sustainability, capability, and supply chain, overall total of 12 questions were developed for understanding the field of study.

3.8 Pre-testing the Questionnaire

Some researchers have begun to explore the potential factors contributing to the vulnerabilities of the garment and apparel sector in Pakistan, though these factors have not yet been fully established, making this an area in need of further study (Rashid et al., 2022a; 2022b). Additionally, there has been insufficient research on the impact of COVID-19, particularly in the ready-made garment sector. As a result, this study could be replicated in similar sectors in other countries, where it could have significant implications for industries worldwide.

3.9 Pilot Study

In the form of a pilot study of a survey, which was designed and conducted subsequent to the authorization of the data applicability, Field and study-related organization's supply chains and other operational and non-operational staff and managers were discussed for the collection of data. In total, 150 responses were collected from the pilot study.

4. Results and Findings

4.1 Data Descriptive Profile

Gender: The descriptive summary of data is examined from side to side using different methods. You can see in Table 1 all the respondents were classified as (86) male and (64) female.

The age group: is classified as follows: (12) respondents were between 20 and 25 years, (55) between 26 and 30 years, (45) were between 31 and 35 years, (30) were between 36 and 40 years, and (8) were between 41 and 50 years, respectively. Further you can check in Table 1.

Qualification: As per the classification in Table 2 of education, 80 were found to be graduates or bachelors, 60 were Masters, 6 were M.Phil, and 4 were PhD holders.

Professional Experience: You can see in Table 2 respondents professional experience is classified as (36) having 1–3 years, (36) having 4–7 years, (45) having 8–12 years, and (33) having above 12 years of experience.

Table 1: Demographic Profile of Gender and Age

Gender		Frequency	Percentage
Valid	Male.	86.0	57.30.
	Female.	64.0	42.7.0
	Total.	150.0	100.00.
Age		Frequency	Percent
Valid	20-25	12	8.0
	26-30	55	36.7
	31-35	45	30.0
	36-40	30	20.0
	41-50	8	5.3
	Total	150	100.0

Source: SPSS output

Table 2: Demographic Profile of Qualification and Prof. Experience

(Qualification)		Frequency	Percent
Valid	Bachelors	80	53.3
	Masters	60	40.0
	M. Phil	6	4.0
	PhDs	4	2.7
	Total	150	100.0
Prof. Experience		Frequency	Percent
Valid	1 - 3 Yrs.	36	24.00
	4 - 7 Yrs.	36	24.00
	8 - 12 Yrs.	45	30.00
	Above 12 Years	33	22.00
	Total	150	100.00

Source: SPSS output

Table 3 shows the statistical data.

Table 3: Des. Statistical Data

	Mean	Std. Deviation	No.
Sup.Ch.Res	3.7733	.80853	150
Vulnerability	3.9889	.75817	150
Op.Sustain	3.7333	.81192	150
Capability	4.0156	.77270	150

Source: SPSS output

4.2 Model Validation

For checking the constancy in models the reliability tests were applied for a set of total 12 variables as 4 variables 3 items for each variable. As per Straub (1989), if the value of Cronbach's alpha is greater than 0.70 (Hashmi et al., 2021a; 2021b) as shows in the reliability of model in table 4 than the test is acceptable.

Table 4: All Variable Statistical Data of Reliability

Cronbach's Alpha.	(Cronbach's) Alpha) Based) on Standardized) Items.	No. Of Items.

.932.0	.934.0	12.0

Source: SPSS output

Table 5 shows the items statistics.

Table 5: Item Statistics

	Mean	Std Deviation	N
Vulnerabilities	(3.70	.975	150
Vulnerabilities	4.02	.847	150
Vulnerabilities	4.25	.851	150
Operational Sustainability	3.70	.975	150
Operational Sustainability	3.96	.955	150
Operational Sustainability	3.54	1.027	150
Capabilities	3.78	1.098	150
Capabilities	4.02	.847	150
Capabilities	4.25	.851	150
Sup.Chain.Resilience	3.54	1.027	150
Sup.Chain.Resilience	4.00	.920	150
Sup.Chain.Resilience	3.78	1.098	150

Source: SPSS output

Table 6 shows the reliability statistics of vulnerabilities.

Table 6: Reliability Statistics (Vulnerabilities)

Cronbach's Alpha	(Cronbach's Alpha. Based on Standardized Items.)	No. of Items.
.807	.811	3

Source: SPSS output

Table 6 presents that the, (Cronbach's alpha) value showing as 0.807 and it is the greater than 0.70 (Hashmi et al., 2020a; 2020b) and added items of (I/V), Vulnerabilities were the reliable for every items.

Table 7: Reliability Statistics (Op. Sus.)

Cronbach's Alpha	(Cronbach's Alpha Based on Standardized Items	No. of Items
.763	.764	3

Source: SPSS output

Table 7 presents that, the (Cronbach's alpha) value showing as 0.763 and it is the greater than 0.70 (Rashid et al., 2020) and added items of (I/V), Operational sustain abilities were the reliable for every items.

Table 8: Rel. Statistics (Capability)

Cronbach's Alpha	Cronbach's Alpha Based on Standardized-Items.	No. of Items
.761	.776	3

Source: SPSS output

Table 8 presents that, (Cronbach's alpha) value showing as 0.761 and it is the greater than 0.70 (Khan et al., 2023a; 2023b; Rashid et al., 2019) and added items of (I/V), Capabilities were the reliable for every items.

Table 9: Reliability Statistics (V Sup. Ch. Res)

Cronbach's Alpha	Cronbach's Alpha Basedon Standardized Items.	No. of Items.
.708	.708	3

Source: SPSS output

Table 9 presents that, (Cronbach's alpha) value showing as 0.708 and it is the greater than

0.70 (Amirah et al., 2024; Hashmi & Mohd, 2020) and added items of (D/V), Supply Chain Resilience were the reliable for every items.

4.3 Testing of Hypothesis

All the Hypotheses were examined by linear regression test throughout the (SPSS V-26) software.

4.3.1 "R" R-square and adjusted R-square

The value of "R" is .973 in below table 10 represent the strong relationship concerning (I/V) and (D/V). The R-square proves the accurateness of regression and the values presents that 97.3 percent of variable in dependent variable is explained by (I/V). Adjusted R-square presents all the equitable accurateness of the regression value. There is 94.6 percent of equitable accurateness of the regression value (Rashid, 2016; Rashid & Amirah, 2017).

Table 10: Model Summary

Model	R.	R-Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R-Square Change	F Change.	(df1.)	(df2.)	Sig. F Change	
1	.973[a]	.947	.946	.18841	.947	865.993	3	146	.000	1.554

a. Predictors: (Constant), Capability, Op.Sustain, Vulnerability
b. Dependent Variable: Sup.Ch.Res

Table 11: ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression.	92.222	3	30.741	865.993	.000[b]
	Residual.	5.183	146	.035		
	Total.	97.404.0-	149.0-			

a. Dependent-Variable: Sup.Ch.Res
b. Predictors: (Constant), Capability, Op.Sustain, Vulnerability
Source: SPSS output

The sig value in above table 10 and 11 shows that the independent variables that are vulnerabilities Operational sustainability, capabilities are important to (D/V) that is the resilience of supply for the reason that the (p- value) showing (0.00) and it is less than the (0.05).

Table 12: Coefficients[a]

Model-		Unstandardized--Coefficients		Standardized-Coefficients	t	Sig.	95.0%-Confidence Interval-for-B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero--order	Partial-	Part-	Tolerance	VIF
1	(Constant)	.392	.084		4.651	.000	.225	.558					
	Vulnerability	-1.110	.059	-1.041	-18.687	.000	-1.227	-.993	.667	-.840	-.357	.117	8.514
	Op.Sustain	.995	.032	.999	30.819	.000	.931	1.059	.894	.931	.588	.347	2.885
	Capability	1.020	.052	.974	19.453	.000	.916	1.123	.767	.849	.371	.145	6.885

a. Dependent Variable: Sup.Ch.Res
Source: SPSS output

From sig values as analysis in above table (12) an interpretation showing that total variables have the importance. All the (I/V) have a significant impact on (D/V) and all the values of (Sig)

showing less than 0.05 (Rashid & Rasheed, 2022). The (VIF) values of collinearity presents that all (I/V) are less than (10) that means no multi collinearity was found, and the influences as defined by the model are justified and one's effect isn't distressing by the influence of other described independent variables.

4.3.2 Vulnerabilities

Table no 12 show the coefficients as indicated that the beta values is -1.041, which defined that the changing in independent variable i.e vulnerabilities by 01 unit would bring around the changing in the showed dependent variable i.e supply chain resilience by -1.04 units. Furthermore, the beta value is negative which indicates the negative relationship between vulnerabilities and supply chain resilience in other words we say that when Vulnerability increases by one unit the supply chain resilience decreases by -1.041 units.

4.3.3 Operational sustainability

Table no 12 show the coefficients as indicated that the beta values is 0.999, which defined that the changing in independent variable i.e operational sustainability by 01 unit would bring around the changing in the showed dependent variable i.e SUP CH RES **(**supply chain resilience) by -0.999 units. Furthermore, the beta value is positive which indicates the positive relationship between OP. SUS and supply chain resilience in other words we say that when operational sustainability Increases by one unit the sup chain will also increase by 0.999 units.

4.3.4 Capabilities

Table no 12 show the coefficients as indicated that the beta values is 0.974, which defined that the changing in independent variable i.e CAP **(**Capabilities**)** by 01 unit would bring around the changing in the showed dependent variable i.e supply chain resilience by -0.974 units. Furthermore, as presented in the beta value it is positive which specifies the positive relation between CAP and "SUP CH RES" and in other words we say that when Capability increases by one unit the supply chain resilience will also increase by 0.974 units.

4.3.5 Equation of the regression

From the above presented table the equation of regression is formed as below.

Supply chain resilience = 0.392 – 1.110 (Vulner.) + 0.999 (Op. Sust.) + 0.974 (Capabilities).

4.4 Hypotheses Assessment Summary

According to the model, overall 3 hypotheses recitation 3 relationships was established. The wide-ranging model as showing by Figure 1, comprises of the causes and variables discovered from both the literature review and the field of the study. Table 13 as below presented that all the discussed hypotheses were developed already, as these defined hypotheses were present in figure 1.

According to the model, in total, 3 hypotheses were established. Into the wide-ranging model, as presented in Figure 1, contains of variables & factors discovered as discussed in the literature review. Below table 12 represent the hypothesis summary.

Table 12: Hypothesis Assessment Summary

Hypothesis	Statement	Main sources

H1	Vulnerabilities influences on the resilience of supply chain.	Akhter, S., Rutherford, S., & Chu, C. (2019). Sufferings in silence: Violence against female workers in the ready-made garment industry in Bangladesh: A qualitative exploration. Women's Health (London, England), 15, 174550651989130. https://doi.org/10.1177/1745506519891302.
H2	Operational sustainability influences on the resilience of supply chain.	Ahmed, N. (2009). Sustaining ready-made garment exports from Bangladesh. Journal of Contemporary Asia, 39(4), 597–618. https://doi.org/10.1080/00472330903076891
H3	Capabilities influences on the resilience of supply chain.	Bell, E., Bryman, A., & Harley, B. (2022). Business Research Methods. Oxford University Press. Büyüközkan, G., & Göçer, F. (2018). Digital Supply Chain: Literature review and a proposed framework for future research. Computers in Industry, 97, 157–177. https://doi.org/10.1016/j.compind.2018.02.010

Source: Literature

5. Discussion, Implications, Limitations and Recommendations

5.1 Discussion

COVID-19 has had a profound impact on demand in the global supply chain and the garment sector. Leading exporters in Asia, such as China, Bangladesh, India, and Pakistan, are facing significant challenges, including difficulties in sourcing raw materials and a decline in orders. Overall, the performance of the apparel sector is increasingly fundamental to economies like those in Asia, Europe, and America. It is important to break into emerging markets and assess the demand-side situation. The conception of power is wider than integrated (SCM), risk management, coordination planning, or a combination of all the areas discussed. Despite the publication of some flexibility factors for the resilience of the supply chain throughout the world-wide epidemic, reliable and trustworthy assessing factors were still inappropriate. The framework of supply chain resilience is one of the key features of flexibility in terms of valuable factors.

This study thus generated the components of cognitive factors between principled infections. The background identifies the plans of the supply chain and the situation in which it works for adjusting to capability, sustainability components, characteristic flaws, and unequal flexibility. By emerging in a flexible matrix with four intelligible positions, industries can realize themselves with their capable components and innate vulnerabilities. It may be accustomed to subjective reflection with appropriate context for other countries' industrial sectors. As a result, it provides critical assurance to the literature. The examination was conducted in specific industries in Karachi. Our respondents are immersed in Pakistani culture. Subsequently, the discussed information reproduced the countrywide public and social trends. Apparel manufacturers are trying to find a way to be resilient during tragedies like the COVID-19 situation. Because there is so much uncertainty on both the demand and supply sides, which poses severe challenges to demand and supply, efforts from the government, including support from international buyers, textile organizations, and apparel organizations, are needed. However, a joint effort among the key stakeholders is unlikely, as the level of interest and direction varies between them.

5.2 Implications

During COVID-19, there was a lack of literature on the health risks of industrial workers. Therefore, the purpose of this study is to identify the current situation of workers in the garment industry in Pakistan during COVID-19. It is now imperative that support measures be taken so that workers do not face such difficulties during future pandemic crises. The study offers some recommendations that may be helpful to policy makers. In addition, there are lessons that can be helpful for learning about government in business organizations and for planning for the future.

5.3 Limitations and Recommendation

Due to the unconventional conditions, the buyers decided to definitely crush one or more of their seasons as a replacement for the standard season, as a result of which the entire chain of sectors is affected. Despite the statistic that some buyers are dedicated to resolving their misfortune with the producers, mostly in various ways, such as gradually acquiring the desired product or arranging more than the standard amount. COVID-19 has been declared a pandemic that has so far affected almost every country in the world. The garment industries are the most affected divisions in all other sectors. Retail stores are closed without revenue, leading to orders being cancelled by apparel manufacturers. As a result, workers are in tense circumstances. They do not receive any support from any of the stakeholders, along with their legal salary. They have to live a miserable life one day. Therefore, at least for the workers, it is important to think; however, it is a demand for their persistence. The government must enforce a law that no organization will be closed or fired without clearing the dues of the workers. Even if there is an emergency for the closure of the industry, the industry will ensure the payment of wages to the laborers while waiting for the situation to improve, and at the same time, no worker will be laid off. Buyers and brands can fund workers by continuing the orders and paying on time. Financial organizations can help all the relevant sectors by providing financial assistance and issuing loans and employers, retailers, governments, labor, and trade unions, among other relevant stakeholders, are in a state of emergency.

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