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EVALUATION OF SUPPLY CHAIN RESILIENCE IN A TEXTILE INDUSTRY IN PAKISTAN

Master thesis
MBA, International Business

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Tallinn 2021

I now declare that I have compiled the thesis independently, and all works, important standpoints and data by other authors have been properly referenced. The same paper has not been previously presented for grading.
The document length is 11741 words from the introduction to the end of the conclusion.

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ABSTRACT

Textile companies in Pakistan are striving hard due to supply chain disruptions. These disruptions affect the Pakistan textile companies. So, the companies need to cope with disruptions through supply chain resilience and its elements.

Previous work has failed to address the elements of resilience through qualitative research methods. So, the study aim is to find out the elements of supply chain resilience in Textile companies.

The study identifies the elements through qualitative research methods. The interview was used as a research instrument to gather factual information on supply chain resilience from the Textile organization Professionals. Specifically, thematic analysis reveals that textile organizations have less visibility with the suppliers and lack transparency in data sharing. Together, companies still rely on internal records to react to the changes to the external environment. Such outcome is most importantly showing that the textile organization gives small importance to supply chain resilience elements. So, the companies should adopt the technology to diminish the supply chain disruptions and increase the visibility in supply chain activities. Such action can support the textile organization to mitigate the disruptions, recover the companies from moving to a desirable state.

Keywords: supply chain resilience, visibility, data sharing.

INTRODUCTION

The textile industry is a palisade of Pakistan economy (Muhammad Fahim *et al.* 2021). Pakistan textile industry has a global presence because of its unique design, quality and pervasive cotton cultivation. Also, the country produces cotton annually over million hectares of land (Abbas, Halog 2021). Hence, it plays a key role in influencing its economy (Javed 2019). The industry considers to be the largest in Pakistan and is contributing 8.5 per cent of its GDP. Also, the textile industry contributes to nations overall export earnings by 60%.

Moreover, the industry contributes 38% of the labour workforce for employment (Tanveer, Zafar 2012). This sector is flourishing, and there is a fierce rivalry. The logistics network of the Pakistan textile industry is infirm and needs drastic improvement and enhancement to make the output well sound in the global market (Memon *et al.* 2020). To thrive and compete in the global textile standard, textile companies must produce garments based on standards. Globalization makes the industry face uncertainty and unpredictability in its supply chain activities (Mustafid *et al.* 2018; Giannakis, Louis 2016). Most firms are experiencing risks like late deliveries, long lead time, and stock out and overstock (Martino *et al.* 2015). All these risks make the supply chain activities susceptible to threats in the market (Vora *et al.* 2021). To sustain in the competitive market, organizations have to be resilient (Singh *et al.* 2019). Supply chain resilience is a key requirement to cope with uncertainty or disruptions (Stevenson, spring 2007). Hence, in the present day, many studies made so far on supply chain resilience. Supply chain resilience can eliminate traditional risks of companies (Fiksel 2015). SCR considers being a risk prevention and protection strategies to deal with the complexities of the global supply chain (Sheffi 2015). With the help of SCR, the supply chain can quickly return to the existing state or move to a desirable state (Waters 2011). Some elements are there to quickly direct resilience improvement to return to a state. Christopher and Peck (2004), Ponis and Koronis (2012), and Jabbarzadeh *et al.* (2014) discussed the elements of supply chain resilience from a general perspective. There are no specific studies on identifying SCR elements in the textile organization. Therefore, the researcher extends the research on identifying the elements and finding out how the elements suppress supply chain disruption in the textile organization.

The study aims to find out the elements of supply chain resilience in the Textile industry in Pakistan.

The objective of the study is to identify and evaluate the elements of supply chain resilience supports to suppress disruption in the textile industry in Pakistan.

Research questions

1) What are the recent developments in risk management practices?
2) What is the status of supply chain visibility in textile companies?
3) How does coordination & collaboration support the resilience of textile organizations?
4) How do textile organization evaluate their agility?
5) How do the textile organization reduce uncertainties, suppress disruption, and manage supply chain risks?

The purpose of the study is to find out the elements and how the elements suppress disruption in the textile industry in Pakistan. To find out the elements, research onion uses here to say the entire research process of the researcher. This study research philosophy is critical realism because it investigates the images of things in the real world. Next, the research approach and research strategies are qualitative research and interviews, respectively. In addition to the research process, samples pick out professional employees from the topmost textile organization in Lahore. Some of the top companies are Style Textile, Interloop Denim Limited, Nishat Mills Limited Cross Stitch, Sapphire Retail Limited. These are considered as medium and large enterprises in Pakistan and are the major suppliers for top international brands like Nike, Adidas, Gap, Levis, Guess & IKEA etc. So, currently these companies are playing most important role in the textile export to all over the world.

From these companies, samples pick out using purposive sampling. This study approaches fifteen participants from the respective companies; ten samples actively participate in the interviews, and the overall sample size is ten. Later fixing the sample size, asynchronous interviews were conducted through E-mail and gathering the opinion in the respective software. The motivation of using interviews is to identify the patterns for supply chain resilience. Next, the transcript of all the interviews is made in a text document and transformed into separate themes. A detailed description of the theme of interviews presents in Chapter-3.

The first chapter is the theoretical background of the study. It has sections like a covid-19 crisis, Supply chain in the textile industry, supply chain resilience, supply chain risk management, studies relating to supply chain resilience, risk management and supply chain performance, and research gap. The second chapter is the research methodology. It includes research onion, philosophy, approach, method, time horizons, population, samples, target area, sampling technique, data collection, and ethical considerations. The third chapter is data analysis and interpretation. The fourth chapter is findings, discussion, and conclusion.

1. THEORETICAL BACKGROUND OF THE STUDY

1.1. Supply chain resilience

The supply chain faces severe disruptions owing to complex networks, globalization and external effects (Fan, Stevenson 2018; Lechler *et al.* 2019). Most of the external effects arise out from natural disasters and political interventions. Recently, companies faced constraints like suppliers finding it difficult to meet delivery obligations, strict hygiene standards, and unpredictable customer demand (Ivanov 2020). It affected the company performance in terms of sales, delivery delays, diminishes in service level and customer satisfaction which damage company reputation (Kara *et al.* 2020; Chae 2015). All the above consequences make the supply chain resilience the centre of interest because it considers a risk mitigation mechanism (Alfarsi *et al.* 2019; Reeves, Whitaker 2020). Supply chain resilience refers to "the ability of supply chain to return to normal operating performance within an acceptable period, after being disturbed" (Christopher, Peck 2004). In another definition, it refers to the adaptive capability of a supply chain in preparing for unexpected events, responding to disruptions, and recovering from maintaining continuity of operations at the desired level of connectedness and control over structure and function (Ponomarov, Holcomb 2009). Supply chain resilience is the system's ability to recover from its original state within an acceptable period after being disturbed (Brandon-Jones *et al.* 2014).

SCR's objective is to rapidly recover supply chain disruptions and even improve supply chain performance (Hohenstein *et al.* 2015). If the companies were under severe disruptions, they found it difficult to reap a competitive advantage. In such a situation, rebounding supply chain disruptions can direct the organization to gain a competitive advantage and rebound as more successful than competitors (Dubey *et al.* 2021; Rajesh 2016).

The study discussed the elements of supply chain resilience. Some studies found that collaboration, agility, flexibility, trust, visibility, innovation, leadership and information sharing elements of supply chain resilience (Christopher, Peck 2004; Ponis, Koronis 2012;

Jabbarzadeh *et al.* 2014). Supply chain resilience includes efficiency, collaboration, flexibility, velocity, visibly, robustness and redundancy (Scholten, Schilder 2015). Out of the above elements, popular elements of supply chain resilience were collaboration, velocity, visibility and flexibility (Chowdhury, Quaddus 2016; Jüttner, Maklan 2011; Pettit *et al.* 2013; Johnson *et al.* 2013; Zsidisin, Wagner 2010; Lee, Rha 2016). These elements illustrate in the figure. The subsequent section describes all the studies in detail.

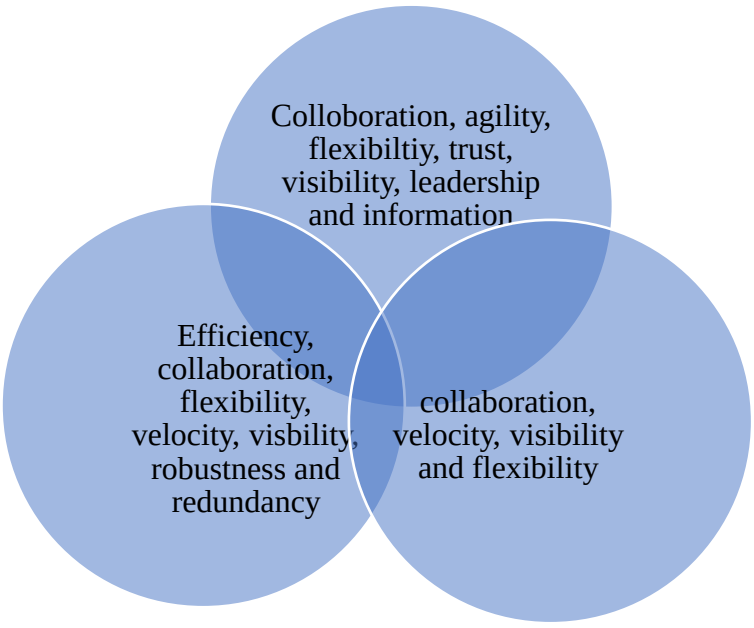

Figure 1. Elements of Supply chain resilience
Source: Own calculation

Zsidisin and Wagner (2010) discuss how supply chain professionals perceive risks and how frequently risks occur in supply chain disruption. The purpose of the study is to test how supply chain resilient practices moderate disruption frequency. To assess the objective, the researcher adopted quantitative research methods. The study utilized a questionnaire as a research instrument, gather opinions through online surveys. Assessment of respondents' opinions showed that perception of risks is negatively associated with disruption frequency. Also, supply chain resilient practices of flexibility and redundancy did not moderate the relationship with disruption frequency. Flexibility and redundancy did not act as predictors; rather, the suppliers can improve the resilient practices to avoid disruptions. Thus, the study gives valuable knowledge to the researcher that flexibility and redundancy represent supply chain resilience

practices. Moreover, it provides knowledge that suppliers act as a backbone to improve the resilience faced by the firms.

Johnson *et al.* (2013) mention the enablers of supply chain resilience. Jüttner and Maklan directed to take four capabilities of supply chain resilience. Flexibility is followed by velocity, collaboration and visibility. After determining the enablers, the study aimed at how the dimensions of social capital acted as an enabler for supply chain resilience. The authors had assessed the aspects through qualitative research methods. Findings of the study highlighted that the social capital dimensions impacted enablers of supply chain resilience. Moreover, it has the potential of mutually reinforcing activities. The researcher observes the four important elements of supply chain resilience from the study. It directs the researcher to analyze the opinions related to supply chain resilience elements.

Pettit *et al.* (2013) propose that the instant and lingering effects of the outbreak, supply chain disruptions induced concerns over supply chain resilience. Hence, the study focused on developing a tool to measure supply chain resilience. To do so, grounded theory development developed with empirical evidence. System theories are used to identify the impact, interaction of vulnerability factor and capability factor with the environment. The study had applied mixed research methods. Case study methodology used in qualitative analysis. However, online surveys are used in quantitative analysis. The findings of the study showed that the vulnerabilities of the global supply chain were external pressures and connectivity. Capability strengths were recovery, market position and financial strength. Sponsors were forced to improve resilience whenever higher-rated vulnerabilities were integrated with capabilities. The researcher observes that recovery is the most significant element of supply chain resilience from the study. The study gives an insight that recovery can improve resilience greatly. Therefore, the aspects are also considered.

Jüttner and Maklan (2011) discuss concepts relating to supply chain resilience. The objective of the study was to find out the relationship between supply chain vulnerability and supply chain risk management. The authors measured the concepts through qualitative research methods. A case study was utilized as a data analysis technique to determine the relationship between the concepts. Analysis of the journals revealed a positive effect of supply chain risk on supply chain resilience elements. Elements were flexibility, collaboration, velocity and

visibility. Supply chain risks existing in activities can enhance all the elements, and at the same time, it diminishes the supply chain visibility. From the study, the researcher knows that elements of supply chain resilience improve supply chain resilience. Also, the researcher can gather the elements of supply chain resilience for the study.

Chowdhury and Quaddus (2016) show that existing studies theoretically and empirically validated the elements of supply chain resilience. But there were no studies made to measure dimensions of supply chain resilience. Hence, the author identified the gap and directed the study to determine the measurement dimensions of supply chain resilience. The study used a qualitative approach in the field study, whereas a quantitative approach in survey research. The study revealed that flexibility, redundancy, visibility, collaboration, response, recovery were the dimensions of supply chain resilience. Out of all the variables, the highest important dimensions were flexibility, collaboration and visibility. From the study, the researcher can know the importance of dimensions of supply chain resilience. Also, the elements can be useful for the supply chain partners to reduce uncertainties.

Scholten and Schilder (2015) mention the importance of collaboration and its effect on supply chain resilience. The author measured the aspects through an exploratory case study through qualitative analysis. The findings of the study showed that collaborative activities could accelerate supply chain resilience. Collaborative activities were information sharing, knowledge, communication and relationship. All the collaborative elements increased resilience through visibility, flexibility and velocity. Thus, the study gives an insight into the interdependencies of supply chain resilience elements on supply chain networks. Also, it helps to know the formative element of collaboration in supply chain resilience.

Ponis and Koronis (2012) conceptualize supply chain resilience and how supply chain capabilities can suppress disruptions. The study measured the aspects through systematic analysis of journal articles. The author observed that the antecedents were agility, visibility, velocity, redundancy, availability, collaboration and utilization of resources. Thus, the study shows that the supply chain resilience surrounds the antecedents. Moreover, the study is useful in knowing the most significant antecedents of supply chain resilience.

Table 1: Supply chain resilience

Author	Objective	Methods	Results	Contribution
Zsidisin and Wagner, 2010	To test how supply chain resilient practices moderate disruption frequency	Quantitative research method	Supply chain resilient practices of flexibility and redundancy did not have a moderate relationship with disruption frequency	Flexibility and redundancy represent supply chain resilience practices
Johnson *et al.* 2013	How the dimensions of social capital were acting as an enabler for supply chain resilience	Qualitative research methods	Social capital dimensions had an impact on enablers of supply chain resilience.	Four important elements of supply chain resilience. Flexibility is followed by velocity, collaboration and visibility.
Pettit *et al.* 2013	Developing a tool to measure supply chain resilience	Mixed research methods	Sponsors were forced to improve resilience whenever higher-rated vulnerabilities were integrated with capabilities.	Recovery can improve resilience greatly
Jüttner and Maklan 2011	To find out the relationship between supply chain vulnerability and supply chain risk management	Qualitative research methods	There was a positive effect of supply chain risk on supply chain resilience elements.	Gets a detailed knowledge that elements of supply chain resilience improve supply chain resilience.
Chowdhury and Quaddus, 2016	Study to find out the measurement dimensions of supply chain resilience	Mixed research methods	Flexibility, redundancy, visibility, collaboration, response, recovery were the dimensions of supply chain resilience	Know the importance of dimensions of supply chain resilience. Also, the elements can be useful for the supply chain partners to reduce uncertainties.
Scholten and	Importance of collaboration and its effect on	Qualitative research methods	Collaborative activities can	It helps to know the formative

Schilder, 2015	supply chain resilience		accelerate supply chain resilience	element of collaboration in supply chain resilience.
Ponis and Koronis (2012)	Conceptualizing supply chain resilience and finding out how supply chain capabilities can support the suppression of disruptions.	Systematic analysis	Antecedents were agility, visibility, velocity, redundancy, availability, collaboration and utilization of resources.	Antecedents were the drivers of supply chain resilience.

Source: Own illustration

1.2. Collaboration

It refers to how two or more firms work effectively to achieve common goals (Cao *et al*. 2010). Collaboration enables developing synergy among SC partners, aids joint planning, and encourages sharing real-time information among buyers and sellers. It helps set up a resilient supply chain (Christopher, Peck, 2004; Jüttner, Maklan, 2011; Pettit *et al*. 2013). The basic foundation of collaboration is that the supply chain needs information, prepares it, responds to it, and recover from disruptions, which reduces the impact (Whipple, Russell 2007). The collaboration represents information sharing, making a strategic plan between two or more firms, and integrating operations (Daugherty *et al.* 2006). By the author, collaborative activities are resource sharing, information sharing and collaborative communication. Effective collaborative activity with suppliers should be driven by precise need and interest. It can reduce disruptions in supply chain activities (Scholten, Schilder 2015). Among the above stated collaborative activities, higher information sharing can make risk response faster (Skjoett-Larsen *et al*. 2007; Ergun *et al*. 2010). Information sharing is considered a mitigator, and hence, the variable has been taken into account (Ergun *et al*. 2010). Finally, the detailed description of collaboration in supply chain resilience presents below

Scholten Scholten (2015) described that the extent of collaboration affected supply chain resilience. These considerable extents of collaboration measures with the help of collaborative actives of supply chain and their mechanisms (visibility, velocity and flexibility). Such measurements were made in the form of an exploratory case study. The study provided the outcome that collaborative activities increased supply chain resilience. Some of the

collaborative activities of the supply chain were information sharing, mutually created knowledge, collaborative communication and joint relationship efforts. These activities preceded the visibility, flexibility and velocity of supply chain activities.

Banomyong (2018) mentions investigating the inter integration among supply chain collaboration, velocity, visibility and flexibility. In addition to the above, the study measured the effect of supply chain resilience on supply chain performance. These measurements were assessed through quantitative research methods; survey methods were used to gather the respective professionals' opinions. The outcome of the study revealed that collaboration, flexibility, velocity and visibility had a positive effect on supply chain resilience. Along with this, supply chain resilience positively affected supply chain performance.

Randall (2013) discussed that the collaborative relationship is a significant capability in enhancing supply chain resilience. As a result, the study empirically analyzed the impact of supply chain collaboration on supply chain resilience. The present measurement of variables employed a social network analysis approach. A self-structured questionnaire was utilized to measure the respondents' opinions through face to face surveys. The results revealed that collaborative networks and supply chain resilience are positively associated. Collaborative networks help predict the supply chain performance while the companies are resilient.

From the studies, it is clear that collaboration is a significant supply chain activity. The activities are not individually related to the supply chain. Some of the mechanisms (information sharing, communication and more) support the collaboration in supply chain activities. These mechanisms can pave the way to enhance visibility, flexibility and velocity of supply chain activities. Therefore, collaboration considers as an important aspect of the study.

1.3. Agility

It refers to how quickly the organization respond to unpredictable changes. The market is filled with competitiveness, uncertainty and turbulence (Scholten *et al.* 2014). Hence the organization must have agility in the supply chain in ensuring the delivery of uninterrupted products and services (Bui *et al.* 2020; Nandi *et al.* 2021). Moreover, it is significant in managing logistics processes, structure and organization systems (Rafique *et al.* 2018; Gligor

et al. 2013; Power *et al.* 2001). It is considered the top determinant of supply chain resilience due to delivering a product on time (Remko 2020; Xu *et al.* 2020). Also, it overcomes the sudden changes made in an internal or external environment (Goldman 1995; Tseng, Lin 2011). Thus, it is considered an effective competitive tool to meet the sudden changes, line up with diverse capabilities, and meet the customers healthy (Christopher 2000; Lin *et al.* 2006; Gligor *et al.* 2013). Supply chain agility has five dimensions alertness, decisiveness, accessibility, swiftness and flexibility. Out of five determinants, the study emphasizes three aspects: alertness, accessibility, and swiftness (Gligor 2016; Rafique *et al.* 2018; Nazempour *et al.* 2019). A detailed description of individual studies is presented subsequently.

Nazempour et *al.* (2019) analyzed the core factors of supply chain agility. The study focused on measuring the connections between supply chain agility and the performance of the firm. Also, it extended to measure the effect of supply chain agility on supply chain performance. The study had fixed quantitative research methods in which surveys were utilized to know the effect. Data were collected from the managers in Iran. The findings of the study showed that the factors were alertness and swiftness. Also, factors had a positive association with supply chain performance. The study shows the researcher that supply chain agility formative elements were alertness and swiftness. Both variables can be used to represent supply chain agility. Thus, the study shows that quantitative research methods can measure supply chain agility.

Rafique *et al.* (2018) discuss that the agile supply chain spurred up in the present scenario. The main intention was to meet the customer demand superiorly. Agility is considered the primary driver, and it may lead to gain from competitiveness. Also, the knowledge directs the author to measure supply chain agility empirically. The study measured the aspects through qualitative research methods that the interviews had adopted. The findings of the study showed that supply chain agility had a positive connection with the subdimensions. Subdimensions of agility were alertness, decisiveness, flexibility, swiftness and accessibility. The research can grasp the most important formative element of agility from the study. It will be useful for the researcher to incorporate the elements in the themes of the present study.

Gligor (2016) shows how the firms quickly adjust to react to changes made in the external environment. Supply chain agility is considered a source for the firm to operate in an uncertain environment. Hence, the author had framed the objective as the role of supply chain agility

and how it influence supply chain fit. The studied nature was quantitative research methods in which non-experimental survey methodology was applied to collect the data. Also, different elements of supply chain agility (alertness, swiftness, flexibility and decisiveness) were considered. Analysis showed that all the elements negatively correlated with supply chain fit.

Table 2: Agility

Author	Objective	Methods	Results	Contribution
Nazem pour *et al.* 2019	To measure the core factors of supply chain agility	Quantitative research methods	Factors were alertness and swiftness	Supply chain agility formative elements were alertness and swiftness. Both variables can be used to represent supply chain agility.
Rafique *et al.* 2018	To measure supply chain agility empirically.	Qualitative research methods	Supply chain agility had a positive connection with the subdimensions. Subdimensions of agility were alertness, decisiveness, flexibility, swiftness and accessibility	The research can grasp the most important formative element of agility.
Gligor 2016	Role of different elements of supply chain agility	Quantitative research methods	Different elements of supply chain agility (alertness, swiftness, flexibility and decisiveness	All the elements are taken into account

Source: Own illustration

Alertness refers to "the ability to detect changes, prospects and threats" (Gligor 2013). It is the first dimension of supply chain agility to meet all the above aspects quickly. The role of alertness is to scan the external environment, anticipate routines, and understand alternatives and sense prospects and threats (Tseng, Lin 2011; Tallon, Pinsonneault 2011; Lu, Ramamurthy 2011). Alertness can read and respond to real demand, otherwise termed market sensitivity (Gligor 2013). Also, it is considered an essential element for a firm to support SCM and make effective use of operational efficiency (Alam *et al.* 2019).

Accessibility: It defines as "acquiring the appropriate data in a quick and a better manner" (Tseng, Lin 2011; Gligor, Autry 2012). IT is the second dimension of supply chain agility. Textile companies are sharing information through ICT. Hence, most networks are virtual (Lin

et al. 2006; Christopher 2000). If changes are detected through alertness, the firm can easily access data and decide based on agile response (Lu, Ramamurthy 2011; Tseng, Lin 2011). The agile response is possible in textile companies only if there is an effective collection and dissemination of information Sheffer 2006. With the help of real-time information, supply chain individuals can meet sudden changes that exist in an external environment (Lu, Ramamurthy 2011). Some previous studies pinpoint that accessibility is the key enabler of Supply chain agility (*ibid*). Therefore, accessibility is a necessary condition for agility that has been considered.

Swiftness is defined as "how the firm reacts to the changes and quickly implements the determination towards SCM" (Gligor *et al.* 2013; Yusuf *et al.* 2014). It is the third dimension of supply chain agility. It is a core element of supply chain agility because it brings in the organization's potential as per swiftness in the movement of products (Farrow, Young, & Bruce 2005; Yusuf *et al*. 2014). Swiftness is competent in the supply chain process to cope with uncertainties in the external environment and deliver the product quickly (Rafique *et al.* 2018; Christopher 2000). It supports task-related and operational activities in the shortest possible time (Lin *et al.* 2006; Zhang, Sharifi 2000). One of the recent studies pinpointed that swiftness is one of the key enablers of supply chain agility (Jindal *et al.* 2021)

1.4. Visibility

It defines as "traceability and transparency of supply chain process" (Tse, Tan 2012). The other definition stated that visibility refers to how the supply chain actors access or share information they think useful for their operations contemplate mutual benefit (Barratt, Oke 2007). Studies have pinpointed that visibility is the important antecedent of supply chain resilience (Johnson *et al.* 2013; Kamalahmadi, Parast 2016; Jüttner, Maklan 2011; Ponis, Koronis 2012; Christopher, Peck 2004; Dubey *et al.* 2017). It enhances responsiveness among supply chain actors, improves decision making operational and supply chain performance (Christopher, Lee 2004; Maghsoudi, Pazirandeh 2016; Williams *et al.* 2013; Choi, Sethi 2010). One study gives more importance to supply chain visibility to avoid and mitigate disruptions (Blackhurst *et al.* 2011). Also, it improves resilience and robustness in supply chain activities (Brandon-Jones *et al.* 2014).

Ivanov (2020) discusses that visibility is one of the significant aspects of the supply chain in helping the organization redefine itself from ongoing changes in the external environment. Visibility of supply chain integrates with agility, resilience and sustainability. All the aspects were measured through a viable supply chain approach. It provided the outcome that visibility and resilience are associated directly. As a result, the organization can redefine, rebuild supply chain activities, sustain the organization for a long period.

Dubey *et al.* (2017) describe that supply chain resilience is one of the emerging concepts in the supply chain sector. The study focused on measuring the primary antecedents of a resilient supply chain through quantitative research methods. This measurement was made with the help of resource-based view and relational view theory. Analysis of the antecedents revealed that visibility was the primary aspect of determining the supply chain resilience in the manufacturing industry.

Later describing the importance of visibility in supply chain resilience, the study recognizes the importance of the visible dimension in supply chain activities. The dimensions of visibility are information exchange and information technology, business gathering and knowledge of asset status (Pettit 2008). Out of all the dimensions, the textile organization is more prone to information exchange and technology. Therefore, a detailed description of dimensions is presented below

Information technology: Utilizing technology to coordinate supply chain operations and allow visibility of internal operations and processes of the organization. It enhances the operations of the business, utilizes information in such a way to enhance flexibility in the organization. Electronic data interchange, RFID, web presence are the tools used to increase visibility. Also, it improves the response time in the supply chain (Vaagen *et al.* 2011). Lastly, electronic dissemination, filtering and monitoring of the information can be made rapid and, at the same time, cost-effective (Ahimbisibwe *et al.* 2016).

Information exchange refers to how the information communicates among the supply chain partners (Vilko 2012). Exchange of information is enough in creating the coordination of operation within the supply chain activities. One of the studies stated that sharing greater information can accelerate organization ability. In turn, the organization can respond to the

changes present in the business environment (Williams *et al.* 2013). Sharing information acts as a stick to hold all the supply chain activities and resources together (Holcomb *et al.* 2011). It diminishes risk and reduces the amount of buffer inventory that is required. If an organization can have a high level of visibility, then there should be a quality of information that link supply chain members that makes visibility distinctive (Barratt, Oke 2007).

1.5. Supply chain recovery

Supply chain recovery is the fundamental one to resilience. Supply chain experience many constraints (Son, Orchard 2013; DuHadway *et al.* 2019); it may vary based on the severity of the events. Generally, organizations may experience epidemics or pandemic outbreaks (Gurbuz, Ozkan 2020; Queiroz *et al.* 2021). All the outbreaks could potentially impact business and operations long-term (Koonin 2020; Huber *et al.* 2018). To mitigate the outbreak, it is essential to formulate recovery strategies. The recovery strategies are backup sourcing, backup supplier and information disruption recovery. Studies have shown that backup sourcing widely used strategy (Namdar *et al.* 2018; Zhang, Wang 2019). It is clear from the extensive evidence in the literature that the effective strategy to mitigate outbreaks risk backup suppliers is used (Chen *et al.* 2015; Saghafian, Van Oyen 2015). As per studies (Yang, Fan 2016; Blackhurst *et al.* 2021; Black, Glaser-Segura 2020), digitally sharing information can help mitigate the risks. Later determining the concept, the detailed description of individual studies is presented below

Blackhurst *et al.* (2021) discuss how digital technologies support managing supply chain resilience. Hence, the author focused on framing how SCR and digital technologies affect each other. The study approached the problem through qualitative research methods. Also, journals, articles, books were used to collect and investigate the data. The results indicated that changes in traditional designs, visibility and supply chain relationship were the three elements of the interplay between supply chain resilience and digital technologies. All three elements played a key role to meet the uncertain situation. The researcher learned from the study that technologies are one aspect of meeting supply chain disruption in an uncertain environment. It is useful for the researcher to consider technological aspects as one of the strategies to mitigate disruptions.

Black and Glaser-Segura (2020) mention that the supply chain has experienced disruption due to severe outbreaks. There is an emergent need to control risk in supply chain activities. Hence,

the author developed a mitigation model to meet supply chain disruption. To approach the concern, the study had utilized qualitative research methods. Electronic databases like Scopus, web of science, IEEE and google scholar were utilized in analyzing the data. The outcome of the study showed that the dimensions of the mitigation model were leadership, digitalization, preparedness, pivoting and resilience. All the dimensions were essential in directing the organization to meet outbreaks in future. The researcher observes that information sharing is considered essential in meeting outbreaks and diminishing disruption from the study. Moreover, digital systems direct the organization to make a strategic plan for meeting pandemic risk. The researcher finds digitalization, information sharing, digital system tools are the resilient network that rides out the increasing disruption in the world.

Namdar *et al.* (2018) show how to achieve supply chain resilience under disruption by utilizing sourcing strategies. The author addressed the research aim through quantitative research methods. With the help of existing studies, the study considered the strategies as backup sourcing, backup supplier contracts, visibility, collaboration and spot purchasing. Out of all the variables, collaboration and visibility influenced the supply recovery capabilities. However, recovery and warning capabilities determined the backup sourcing strategies. Buyers' warning capabilities were key in enhancing supply chain resilience. The researcher observes that backup sourcing depends on buyer warning capabilities from the study. The researcher learnt that backup sourcing is important to eliminate supply chain disruptions and enhance resilience.

Zhang and Wang (2019) show that the firms faced severe losses due to supply chain risks. Every firm has an interest to incorporate risk management into its operations. The author focused on a dual sourcing strategy to mitigate supply chain risks. Hence, the study aimed to measure how backup sourcing was an important component for supply chain stability. The author addressed the problem through quantitative research methods. The results revealed that the firms used backup sourcing as an operational strategy to overcome supply chain risks. Thus the study shows that backup sourcing is one of the aspects of mitigating supply chain risks. Therefore, the aspects find to be useful and incorporate the aspects in analysis and cover up the opinion in the interviews.

Chen *et al.* (2015) show how backup suppliers acted as an effective strategy to mitigate supply risks. The study compared backup suppliers with primary suppliers for horizontal fairness

concerns. To measure the objective, the author measured it through quantitative research methods. The analysis showed that the dominating strategy was the self-interested backup supplier. Also, the primary supplier was used when the backup supplier was not strong. From the study, the researcher learns that backup suppliers act as key evidence to benefit conditionally. The researcher finds it useful that a backup supplier considers one of the supply chain mitigating strategies.

Saghafian and Van Oyen (2012) discuss how flexible backup suppliers and disruption risk information helped mitigate risks. Also, how the variables helped to accelerate supply chain resilience. To measure the objective, the study adopted quantitative research methods. The study results showed that backup supplier contract was based on firm perception towards supplier risk. Firms contracting with backup suppliers have low perception errors concerning the reliability of the respective supplier. Firms consider the true supplier a better risk disruptor than a flexible supplier. However, disruption risk information is attractive to the low-profit margin firms. Thus, the study shows that backup suppliers and disruption risk information are important components to mitigate supply chain risks.

Yang and Fan (2016) point out that information management strategies acted as a technique to mitigate supply chain disruption risks. To do so, qualitative research methods were adopted with the help of existing literature studies. The analysis showed that there were no stable supply chain information strategies. Also, CPFR is considered the best way to provide complete supply chain information. Thus, the researcher observed that information sharing is the best way to overcome supply chain risks. The study offers insights that information sharing helps mitigate operational and disruption risks.

Table 3: Supply chain recovery

Author	Objective	Methods	Results	Contribution
Blackhurst *et al.* 2021.	How SCR and digital technologies affect each other.	Qualitative research method	Changes in traditional designs, visibility, and supply chain relationships were the three interplay elements between supply chain resilience and digital technologies.	Technological aspects as one of the strategies to mitigate disruptions
Black and Glaser-Segura, 2020.	Developed mitigation model to meet supply chain disruption.	Qualitative research method	Leadership, digitalization, preparedness, pivoting and resilience helped to overcome the outbreak	Digital systems direct the organization to make a strategic plan for meeting pandemic risk.
Namdar *et al.* 2018	How to achieve supply chain resilience under disruption through the utilization of sourcing strategies	Quantitative research method	Collaboration and visibility influenced the supply recovery capabilities. However, recovery and warning capabilities determined the backup sourcing strategies	Backup sourcing is important not only to eliminate supply chain disruptions but also to enhance supply chain resilience.
Zhang and Wang, 2019	To measure how backup sourcing acted as an important component for supply chain stability	Quantitative research method	Firms used backup sourcing as an operational strategy to overcome supply chain risks.	Backup sourcing is one of the aspects in mitigating supply chain risks
Chen *et al.* 2015	To compare backup suppliers with primary suppliers for horizontal fairness concerns.	Quantitative research method	Dominating strategies were the self-interested backup supplier. Also, the primary supplier was used when the backup supplier was not strong.	Backup supplier acting as a piece of key evidence to get conditionally benefit.
Saghafian And Van Oyen, 2012	How flexible backup suppliers and disruption risk information helped to mitigate risks.	Quantitative research method	The backup supplier contract was based on firm perception towards supplier risk. Firms contracting with backup suppliers have low perception errors concerning the reliability	Both backup suppliers and disruption risk information is an important component to mitigate supply chain risks

			of the respective supplier. Disruption risk information is attractive to the low-profit margin firms.	
Yang And Fan 2016.	Information management strategies acted as a technique to mitigate supply chain disruption risks	Qualitative research method	No stable information management strategies are available. Presently, CPFR is considered the best way to provide complete supply chain information.	Information sharing is the best way to overcome supply chain risks.

Source: Own illustration

1.6. Research gap

The studies examining the elements of supply chain resilience are inconsistent. Most of the studies have the basic four elements of supply chain resilience. But the studies either conceptualize or measure the dimensions through quantitative or mixed research methods. The studies suggested their elements quantitatively (Chowdhury, Quaddus 2016; Jüttner, Maklan 2011; Johnson *et al.* 2013; Zsidisin, Wagner 2010; Lee, Rha 2016). Pettit *et al.* 2013 measured the elements through mixed research methods. Some recent studies direct the researcher to measure the elements through qualitative research methods (Scholten and Schilder, 2015; Yang. And Fan 2016; Rafique *et al.* 2018; Blackhurst *et al.* 2021). Other methods are needed to provide a stronger basis for elements of supply chain resilience.

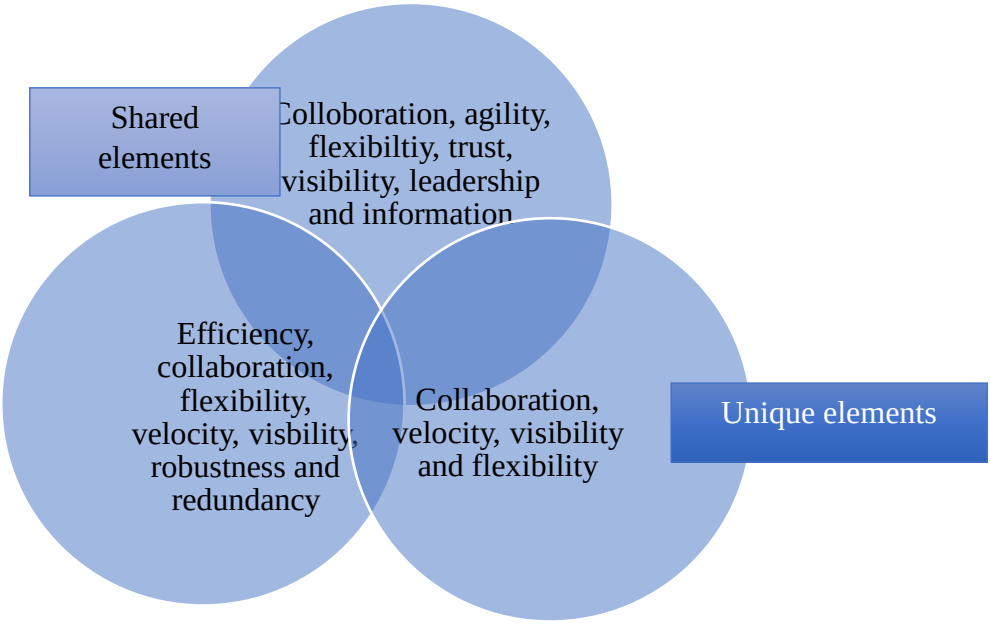

Figure 2. Basis for elements of supply chain resilience
Source: Own illustration

Moreover, studies indicated that the supply chain recovery strategies could direct the firm to mitigate the risks. Recent studies indicate that supply chain recovery strategies can enhance supply chain resilience (Namdar *et al.* 2018; Zhang, Wang 2019). Further studies are needed to describe whether strategies can resolve disruptions and increase supply chain resilience.

Later observing the present requirement of supply chain resilience, the researcher raised a question on enablers of supply chain resilience and how the elements of SCR suppress disruption in the textile industry in Pakistan.

2. RESEARCH METHODOLOGY

The section shows the sequential steps of measuring research problems through systematic and critical evaluation of research objectives. The study researches with the consistent support from research onion. Research onion uses to recognize the entire research process adopted by the researcher. The layers of research onion are research philosophy, strategy, choices and methodology. The detailed description of all the layers describes in detail.

2.1. Research philosophy, strategy and methodology

Research philosophy is a belief or idea of collecting, interpreting, and analyzing data. Some philosophies are positivism, realism, objectivism, pragmatism and more. The most suited philosophy is realism. There are two types of realism: direct realism and critical realism. Critical realism holds change as constant.

Research approach and its justification: Research refers to the systematic investigation of sources of materials and derives out the facts to reach a new conclusion. Generally, research is conducted either qualitative or quantitative or both. Quantitative research identifies the area of interest, generate hypothesis and validate the results. It is highly objective and works with numerical data (Plonsky 2017). However, qualitative research helps gain insights about particular phenomena through participants' subjective experiences.

Justification: The study uses qualitative research methods to measure supply chain resilience elements and its supply chain recovery strategies. Similar approaches have been used previously by (Scholten and Schilder, 2015; Yang. And Fan 2016; Rafique *et al.* 2018; Blackhurst *et al.* 2021).

Research Strategy: Research strategies are an experiment, action research, case study, survey, grounded, archival and ethnography. A case study is a suitable comprehensive study for the work. The real situation of textile organizations is analyzed and studied.

Justification: The study employs the case study method is fully described in past studies Pettit *et al.* (2013); Jüttner and Maklan (2011); and Scholten and Schilder (2015).

Research choice: The choice describes the methods adopted in investigating the study. There are three methods: the Mono method, mixed-method and multi-Method. Monomethod adopts one method, mixed method adopts two methods, but multi-method adopts several research methods brought together for the same study.

Justification: The mono method (interviews) is widely used in three methods. This method has been previously described by (Scholten and Schilder, 2015; Yang. And Fan 2016; Rafique *et al.* 2018; Blackhurst *et al.* 2021).

Time horizon: It expresses the time limit fixed to execute the study. There are two-time horizons: longitudinal and cross-sectional study. The former has no time limit, whereas the latter have predefined time. As a result of the time horizon, a cross-sectional study is the best time horizon for the study.

Data collection: The study gathers data through interviews (DiCicco-Bloom, Crabtree 2006). It is the most common method of qualitative research (Gill *et al.* 2008). There are three types of interviews: structured, unstructured and semi-structured interviews (Stuckey 2013). Out of three types, the researcher predetermined the questions, and hence the interview method adopted is structured interviews. The researcher conducted structured interviews among the participants. The method used to collect the data is through asynchronous interviews. The primary advantage of using interviews is that it allows interviewees to answer their opinions conveniently. There are no time and location constraints, but it is a less expensive and convenient way of gathering opinions from the respective samples. The major constraint of such interviews is the absence of visual cues of communication between interviewer and interviewee

Justification: It is noted that qualitative interviews are the best way to know the elements of supply chain resilience and its disruption. Similar methods presented previously described by Rafique *et al.* (2018); Scholten and Schilder (2015); Chowdhury and Quaddus (2016); Jüttner and Maklan (2011); Johnson *et al.* (2013); Pettit *et al.* (2013)

Data analysis: Thematic analysis is one method to identify and analyze the patterns of themes in qualitative data (Clarke, Braun 2014). Similarly, the study applies thematic analysis to determine the supply chain resilience of the textile industry in Pakistan.

2.2. Research questions and method

Detailed evaluation of past studies shows that fewer studies emphasize the elements of supply chain resilience through qualitative research methods. Namdar *et al.* 2018; Zhang, Wang 2019 argued in their study that recovery strategies could enhance supply chain resilience. As a result, studies increase the need to evaluate supply chain resilience elements and their recovery strategies in textile industries. The researcher plans to measure the aspects in three subheadings: supply chain resilience, supply chain risk management and supply chain recovery. These three headings help to derive out five themes. All the five themes and their respective research questions are mentioned below.

Table 4. Research question

Questions	Themes
What are the recent developments in risk management practices	Supply chain recovery
What is the status of supply chain visibility in the textile organization	Visibility
How do coordination and collaboration support the resilience of the textile organization	Coordination &collaboration
How do textile organization evaluate their agility?	Agility
How do the textile organization reduce uncertainties, suppress disruption, and manage supply chain risks?	Reduction of supply chain uncertainties

Source: Own illustration

2.3. Intended sampling and actual participants

The study intends to sample from the topmost companies in Pakistan. Cross Stitch, Sapphire Retail Limited, Style Textile, Interloop Denim Limited, and Nishat Mills Limited are higher rated companies. As per the VIS rating, the top-rated organizations are A and A+ and have a stable position in the respective organization. So, the organizations take into account, and the detailed description presented below

Style textile: It is a well-established organization with its headquarters in Lahore. Style textile is ranked as number one, in top exporters of Pakistan for year 2020-2021.This company is single largest garment producing facility in the country who serves all the top brands across the world. Appx annual sales of their company is appx 430 million us dollars. The organization produced end-to-end apparel to renowned customers (Adidas, Nike, Reebok and more).

Being the giant of garment division, they have highly established procedures to get maximum yield and rest of garment industry take them as leaders and follow their footsteps. The organization objective is to be an industry leader committed to offering continuous support for people, products, technology and processes. The current workforce in the organization is 30,000. The major international customers are Nike, Adidas, Oliver, whereas the domestic customer is Rupali. (Top 50 exporters of Pakistan in 2021, n.d.)

Nishat mills limited: The organization started its inception in 1951. The organization is one of the most modern textile companies in Pakistan. Nishat mills is the trend setter of Pakistan's textile industry. It is the only company in Pakistan who is dealing in almost every field of textile manufacturing business whether its yarn, weaving, printing/dyeing, yarn dyeing, home textiles, bottom wear fabrics, garments sewing setup, terry towels, sewing thread productions, embroidery etc. That's why it holds a strong and central position in industry, which shapes the overall trends of textile business.

For example, Nishat mills is number one buyer of cotton crop, as being financially strong company, they always buy cotton crop stocks covering full year projections/production plans which no other company does. Since they buy massive portion of cotton crop so company plays an important role in controlling the cotton price and can influence the market demand and supply in later part of the year when crop is finished from market. The total workforce of the organization is 8000. The average exports of the organization are 353.03 million USD.

For example, when digital printing, trend came to market, Nishat was the very first company from entire Pakistan to buy and setup the Digital Printing machines and got their employees trained from Italy to successfully run the machines. (Nishat Mills Ltd, n.d.)

Then later on, rest of companies followed their footsteps and installed Digital Printing machines too, hence a lot of Digital Print business was shifted to Pakistan.

Interloop denim limited: Similarly, Interloop is a big name of knitting and hosiery sector of textiles. They are pioneer of this field and categorized as number 1 in knitting sector. It has its headquarters in Pakistan, expanding its unit to more than two continents. Annually, the organization produces 700 million pairs of socks and tights. The mission of the organization is to be an agent for the stakeholders & community and to do business ethically. The vision will be a full family clothing company. The organization is giving importance to integrity, care, accountability, respect, and excellence. The workforce of the Style textile limited is more than 25000 employees. The annual revenue of the organization is 300 million USD. The customers of the organization are Guess, mustang and Diesel. (Interloop, n.d.)

Sapphire retail limited: It is one of Pakistan's public limited clothing companies. The company offers superior quality and design products to the customers at an affordable price. The quality of the products produced by the company is one of the prominent brands in Pakistan. The organization mission is to recognize the premier suppliers in the market and serve quality products to the customers. At present, it has branches in 21 locations in Pakistan. The total number of employees in the organization is more than 7500. The overall revenue of the organization is 1,61,48,568.00 USD. (Top 50 exporters of Pakistan in 2021, n.d.)

Cross stitch: The organization specializes in fabrics and pret, and its identity is applying cross stitch techniques, creating designs deep-rooted in ancient art forms. The offering products of the organization are modern digital silk print and digitally lawn collection. These collections offer a unique product to women. The objective of cross stitch is to produce the best brand of high quality and low cost. At present, the workforce of Cross stitch is more than 1000 in Lahore, Pakistan. As of 2020, the average sales of Cross stitch is 5.4 million USD.

Population: In this study, the population are professional employees of the top-rated textile organization in Lahore.

Actual participant: The study has the participants as professionals of textile organizations in Lahore. The study approaches the professionals having the below-stated qualifications.

Table 5. Participants.

Particulars	Description
Job title	Senior manager
Company experience	More than ten years
Education background	Bachelor's in engineering or master's in engineering

Source: Own illustration

All the participants were approached by phone, gathered respective mail IDs of professionals from the respective companies. E-mail notices of studies had been sent to fifteen professionals. Out of 15 professionals, ten professionals provide their time for active participation in the interviews. Therefore, ten professionals are the actual participants for the study.

2.4. Sampling strategies

In this research, purposive sampling is the typical approach to determine samples. The primary objective of using this sampling strategy is to pick out the limited number of primary data sources which can contribute more to exhibit the real information on supply chain resilience. It considers being one of the cost & time-effective methods. So, this study uses purposive sampling to measure the elements of supply chain resilience. The study fixes inclusive criteria and exclusion criteria.

Inclusive criteria

1) Participants should be professional employees of the selected Textile organization in Lahore, Pakistan.
2) The professionals should have either bachelors or master's education.
3) The professionals should have experience of more than ten years.
4) The professional should be designated either as a manager or senior manager.
5) The size of employees should be more than 750.

Exclusive criteria

1) Professionals are working in other branches of the textile organization. They should not be within the geographical limit of Lahore.
2) The size of employees is less than 750.

Justification: Purposive sampling technique has been widely used in the previous literature (Scholten and Schilder, 2015; Yang. And Fan 2016; Rafique *et al.* 2018; Blackhurst *et al.* 2021).

Sample size: The researcher approaches 15 professionals from the textile organization, but ten professionals have actively participated in the interviews. Hence, the sample size for the study is 10.

Interview questions: In this study, the interview questions are raised in five sections. The first section asks the general information of the interviewee, and it includes information's like gender, level of education, a year spent in position & organization and the nature of the job. The second section asks for company information (company name, age, size, number of employees, nature of the operation, and more) and supply chain management in the textile organization. The third section covers the questions related to supply chain resilience (mapping current supply network, level of visibility, sourcing & manufacturing strategy, strategies to tackle the situation). The fourth and fifth sections include supply chain risk management and recovery questions.

2.5. Limitations

The researcher finds it quite difficult to contact professionals of the respective organization. Due to the external environment changes, they stuck with their work. Some of the professionals give a small amount of time for the interviews. The researcher could not get detailed answers to their interview questions in such a case.

The study conducts interviews for middle and big companies. The study did not take small companies. As a result, it fails to represent the whole textile industry in Pakistan. In this case, generalization may occur.

Criteria have reduced the number of companies to five. Increasing the geographical limit can help to get more professionals. The outcome may be more precise.

3. ANALYSIS

3.1. Profile of participants

The participants working in Cross stitch, Saphire, Style, Nishat, and Interloop denim limited textile organization have been interviewed to assess the textile industry's supply chain resilience in Pakistan. Ten participants actively participated in the interviews. Four participants from "Style textile private limited," one from "Cross stitch," one from "Sapphire retail limited," two from "Interloop Denim Limited," and one from "Nishat Mills limited."

Among ten responses, nine participants were male, whereas one female participant was involved in the interviews.

About the education qualification of participants, they possessed a bachelor's degree, a master's degree. Most of the participants were master's degree holders than others.

3.2. Textile company information

Participants from the selected textile organization like Cross stitch, Saphire, Style, Nishat, and Interloop denim limited have participated in the interviews. Information regarding the nature of the firm operation, firm age, nature of textile products, suppliers, customers, and organizational objectives is discussed.

Nature of firm operation

Nature of firm operations may be either MNC or domestic, or direct. "NML" nature is direct operation, whereas "STL" involves domestic operations. The rest of the other organizations like "CS," "STL," "IDL" are MNC in the textile sector.

Firm age

A textile organization taken into account has 15 years, 20 years, 29years, 30 years, and 67 years. The age of "CS" is 15 years, "STL" is 20 years, "IDL" is 29 years, "SRL" is 30 years, and "NML" is 60 years.

Nature of textile products

The textile organization has products in standardized, variety, and customized products. Three companies produce standardized products, three in customized products, and four in producing various products.

Suppliers

Textile organizations reveal the supplier names of their own companies. The suppliers of "CS" are Nishat, sapphire, and weaving mills. "IDL" suppliers are local, and some are from China. Suppliers of "NML" are fabric, and there is no specification of suppliers name by participants of "SRL." Consequently, suppliers of "STL" are Adidas, Reebok, Nike, and Rupali.

Major customers

The textile organization's customers are retail companies, Adidas, Guess, Mustang, Diesel, Gap, Ikea, levis, Next, William Sonoma, bedding House, Nike, Levi's, S Oliver. "CS" has customers only in retail companies, whereas "IDL" customers are Guess, Mustang, and Diesel. Customers of "NML" are Gap, Ikea, levis. Next, William Sonoma, bedding House, whereas retail and individual customers are "SRL." "STL" customers are Nike, Adidas, Levi's, and S Oliver.

Objectives of the organization

"STL" focuses on business, quality, and innovation. "CS" objective is to produce the best high quality and low-cost brand. The critical goal of "IDL" is to follow the procedures to produce green environment products meant. "NML" aims to serve textiles' requirements to all retailers worldwide, whereas "SRL" objective is to grow profitability.

To sum up, the section, participated textile organization is performing either belong to MNC or doing the domestic operation. Companies producing various products are showing more interest in participating in our interviews. Major customers for the textile organization are Adidas, Guess, Mustang, Diesel, Gap, Ikea, levis, Next, William Sonoma, bedding House, Nike, Levi's, S Oliver. However, the suppliers are Nishat, sapphire, Adidas, Reebok, Nike, and Rupali. Finally, the

objective of textile organizations in Pakistan is to increase quality, innovation, and green practices, increasing profitability in the market.

After exhibiting the basic information of the profile of respondents and their company information, the study explores more into the thematic analysis of supply chain resilience of textile organizations in Pakistan. A detailed description of the analysis is presented below.

3.3. Theme 1: Visibility

Visibility of textile organization measures through product types. It includes customized, variety, and standardized products. Therefore, the study describes in detail that how visibility varies among the above-stated product types presented in the subsequent themes

Technology

Textile organizations producing a variety of products rely on software than others. Software like ERP, SAP and retail pro is used in the textile organization. One organization uses ERP alone, whereas the other uses SAP alone. The third one is using ERP, SAP, and retail pro. Thus, it observes that three of four uses live technology to upsurge the visibility in the textile organization.

Intermediaries

Customized products producing companies rely on intermediaries to exhibit visibility. One of three responses states that organizations rely on intermediaries for supply chain visibility.

No visibility

Three in ten responses stated that textile organization has no supply chain visibility. Three companies producing customized products followed by a huge variety of producing companies have low visibility.

Thus, it observes from the study that some are using technology to exhibit visibility, whereas the rest have low visibility in supply chain activities.

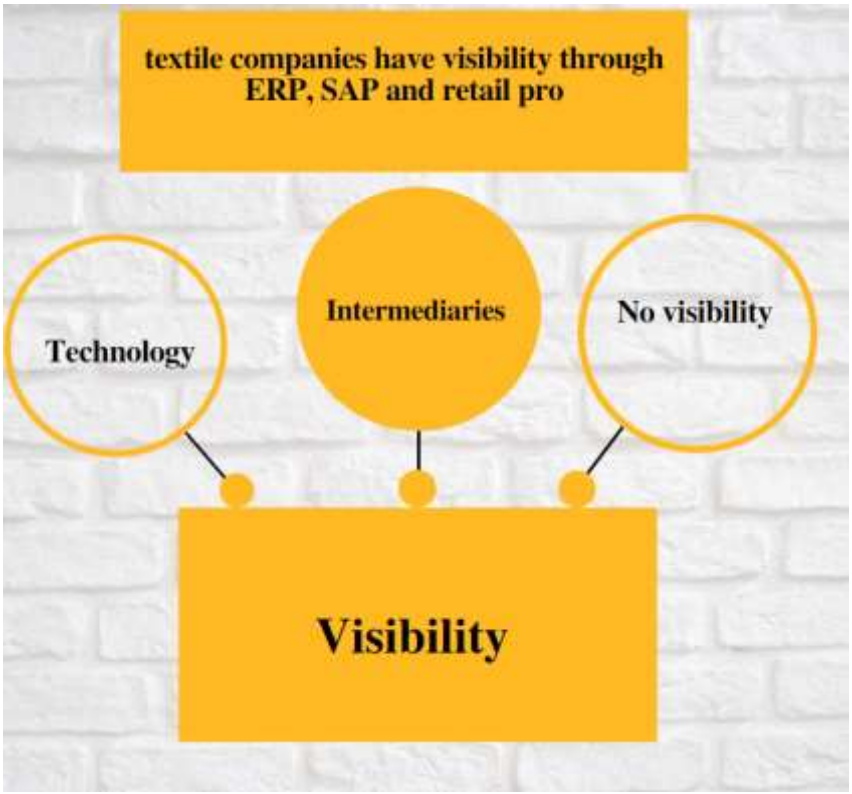

Figure 3. Visibility
Source: Own Illustration

3.4. Theme 2: Coordination and collaboration

Coordination indicates how the textile organization integrates the individual supply chain members to achieve the organization's goals. However, collaboration represents the integration of supply chain members, with the help of two attributes, how textile organizations manage supply chain resilience. The subsequent section presents a detailed description of the concept through interview opinion.

Information sharing

The textile organization producing various products plans to share supply chain information among members. All four participants had already planned to increase their level of data sharing among supply chain members. One of the participants stated that *" Yes, we are already doing this to have a keen overview of the situation through mutual feedback."*

Customized products producing organizations also increase information sharing, but they need time to execute. All three participants are taking steps to accelerate the information sharing among SC members. One of the participants opined that "It became the need of time."

All the standardized products produce textile organizations planning their information sharing among SC members. Information sharing is visible in various products companies than standardized and customized products.

Supply chain integration

Textile organization harmonies the relationship through supply, internal, and customer integration. The main objective of integration is to keep up a good cordial relationship with supply chain members, increasing flexibility. In the present section, the study evaluates all three integrations in detail

Supply integration

Textile organizations producing various products integrate with the supply chain ecosystem to mitigate the risks. The four opinions highlighted that the company has a long-term agreement with suppliers. Textile organizations and suppliers are sharing information in analytical form. Having such data sharing is to mitigate the supply chain risks. Below is the opinion of the textile organization

Participant1 stated that "Our Company integrates by the data sharing and vendor development to mitigate the risk."

Participant 4 believed that "Through sharing more data and analytical numbers."

Internal integration

Textile organizations are producing standardized products having more internal integration. Two participants stated that they had a structured way of carrying out the tasks effectively. They are not only fulfilling customer requirements but also acting as a backbone for the supplier and customer integration.

Customer integration

Customized products producing organizations integrate the relationship with customers. All three opinions are related to customer integration. The interviewees' answer shows that customer integration enhances the fair and better relationship. Also, a textile organization can recognize the requirements and meet the expectations

Three of one stated that "through fair and better relationship." second opined that "recognize the requirements and produce the requirements on expectations." Third also stated that "customer opinion in decision about the production of goods."

Thus, it observes that various products focused on supplier integration than others. However, customized keen on customer integration than internal and supplier integration. Finally, standardized requirements give more importance to internal integration than others.

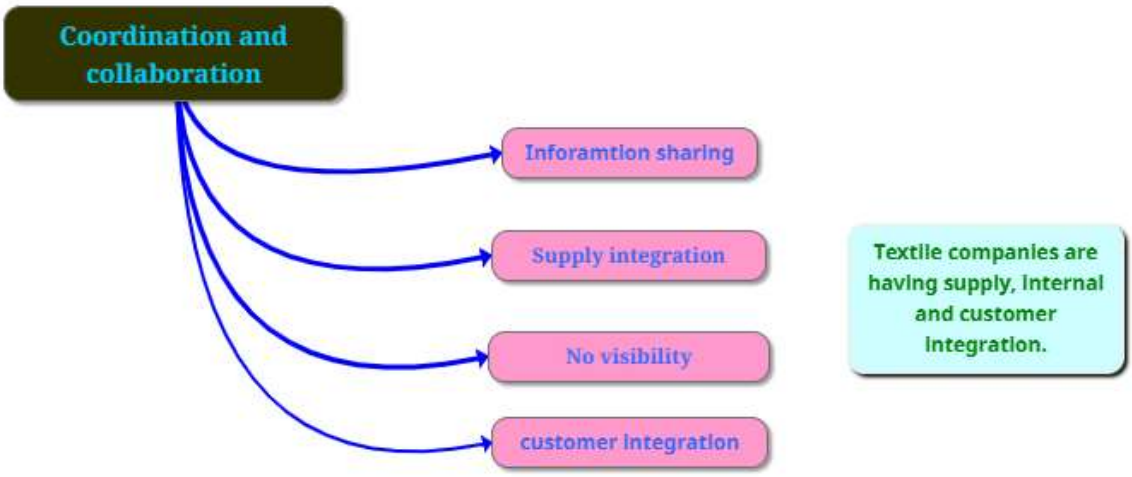

Figure 4. Coordination and collaboration
Source: Own Illustration

3.5. Theme 3: Agility

In the analysis, the theme agility focuses on how the textile organization reacts to unexpected external environment changes. The subsequent subsection provides an in-depth explanation of agility.

Textile organizations produce various products sensing, perceiving, and anticipating the business environment changes through experts. Experts efficiently give prior intimation to the concerned departments to overcome the supply chain risk. Also, they are directed to do proper planning to allocate and utilize resources effectively.

Four participants opined that "We have experts in strategic management who find solutions according to the current circumstances." The second participant stated that "they always communicate such circumstances efficiently to the concerned departments."

However, customized products producing companies have analytical supply chain capabilities from top-level management to bottom-level management. Collective wisdom knowledge of employees helps to make a timely awareness of requirements internally. Three of one stated that agility could be enhanced through potential employees from the observation. The study found no alertness made for companies involved in producing standardized products from the observation of opinions.

Thus, it observes that experts and employees play a vital role in alerting the organization about the changes made in the external environment.

Accessibility

Variety products producing companies rely on software SAP, retail pro to access relevant data. With the help of the data, they are making informed decisions on tackling the external environment changes. Interview opinion exhibits that four of two rely on software, whereas one relies on the internal report to access data.

Customized products producing companies collect information from employees, disseminate it, and decide. Three of one opinion stated that accessibility of information made through employees.

Participant 1 stated that "analytical capabilities and collective wisdom of employees."

However, it is surprising to recognize that standardized products have either internal records or software to access information. Thus, it observes that textile organizations rely on software, internal reports, and potential employees who have analytical skills to exhibit the information to the organization.

Swiftness

Swiftness focuses on how quickly the textile organization responds to the changes in the environment.

Customized products produce textile organizations reacting to the changes very calmly. Three of one response stated that handling the situation calmly.

Participant 7 pinpointed that "We try to handle every situation calmly."

Variety products produce textile organizations carrying out the tasks in the shortest period. They are reacting to the situation as quickly as possible. Four of the two opinions address the changes instantly.

One participant reported that "Try to react as quickly as possible."

Standard products producing companies react to the changes through forwarding forecasting. *One opinion stated that "Keep a keen eye on market situations, and if something is showing an expected shortage, we secure that material enough through forwarding forecasting."*

Thus, it shows that textile organizations react to the market changes by taking quick action, forward forecasting, and handling the situation calmly.

Figure 5. Agility

Source: Own Illustration

3.6. Theme 4: Reduction of supply chain uncertainties

With the help of the theme, the researcher addresses how the textile organization are taking steps to reduce supply chain uncertainty. Supply chain uncertainty is an issue that arises due to the complex nature of the SC ecosystem. To overcome the uncertainties, present in SC, how do the companies reduce uncertainties through their strategies? Subsequent sections present a detailed description of the theme.

Risk mitigation

Risk mitigation focuses on managing supply chain risks that lead to vulnerability. Textile organizations are following some of the strategies to overcome supply chain uncertainties. A detailed description of strategies is presented in detail.

Contingency plan

Customized product-producing companies have a contingency plan to overcome the supply chain vulnerability. Three of one informant reported that reduces the uncertainty through a contingency plan. As one interviewee said, "Contingency plan is the best option."

Variety products producing companies pinpointed a free material flow and decreased losses due to the shortage. *One informant stated that "free flow of material under the circumstances that the supply chain is interrupted," whereas another commented that "reduce the loss by the shortage."* Thus, three of the two informants said that a contingency plan is the best option to have a free flow of material and reduce the loss by the shortage.

Standardized products do not have any strategies to meet unpredictable changes by the external environment. On the whole, textile organizations are using contingency plans as a defensive tool in protecting the companies against unpredictable changes.

Lean principle

Textile organizations producing a variety of products give importance to the lean principle. It has a close alignment from raw material to the customer through cooperation. Four of one responses said that the lean principle is one of the strategies in diminishing supply chain vulnerability.

So, customized and standardized textile product companies do not have a lean risk mitigation strategy.

Advanced analytical techniques

Four participants stated that advanced analytical techniques were used to overcome the supply chain uncertainties. Thus, it observes that the textile organization mitigate the risks through a contingency plan (lean principle and advanced analytical techniques).

Reactive strategies

Textile organizations are handling the actions after the risk occurs. Some actions like safety stock, supplier backup to reduce supply chain uncertainty.

Safety stock

Customized product companies are keen on safety stock for the most frequently used items. Three of one response opined that safety stock is the best option for reducing uncertainties.

However, various products-producing companies stated that safety stock is a reactive strategy. Four of one informant stated that safety stock is used to reduce uncertainties.

Thus, it observes that textile organizations have safety stock as reactive strategies to reduce uncertainties and inventory shortages.

Supplier backups

Variety products are producing companies having alternative suppliers to reduce the supply chain uncertainty. *Four of one responses stated that "alternative suppliers are always available."*

All three textile organizations of customized products have alternative suppliers in the market.

One of three responses opined that alternative suppliers are there for standardized products.

Thus, alternative suppliers are one of the reactive strategies of the textile organization.

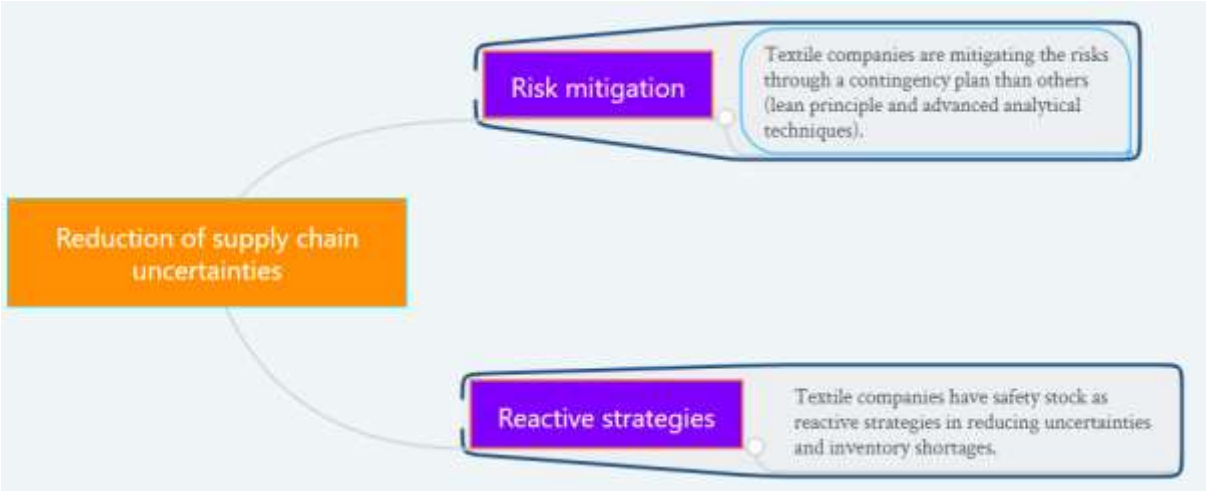

Figure 6. Reduction of supply chain uncertainties
Source: Own Illustration

3.7. Theme 5: Supply chain recovery

Backup inventory

Standardized product companies have a separate stock report to monitor inventory regularly. The main intention is to have backup inventory in the organization.

As one interviewee said, "Stock reports are created and updated regularly to maintain inventory levels keenly."

A variety of products companies have backup inventory for their organization. Four of one responses opined that "by having backup inventory."

Thus, it is clear from the analysis that Textile organizations have backup inventory for the significant products. Backup inventory maintains for standardized and various products. However, customized products don't have backup inventory.

Backup supplier

The textile organization have reliable alternative suppliers to handle supply chain disruption. Customized products are producing companies stating that alternative suppliers help to handle unplanned situations. However, standardized and varied products producing companies are giving

no importance to a backup supplier. Thus, it concludes that backup suppliers are available for customized products than others.

Information disruption recovery

Textile organization recover their information disruption through information sharing effectively. Variety products are producing textile organization use software like ERP, SAP, retail pro to communicate live. Having open communication can diminish information disruption. Out of ten, one respondent stated that "SAP and Retail Pro" diminishes information disruption.

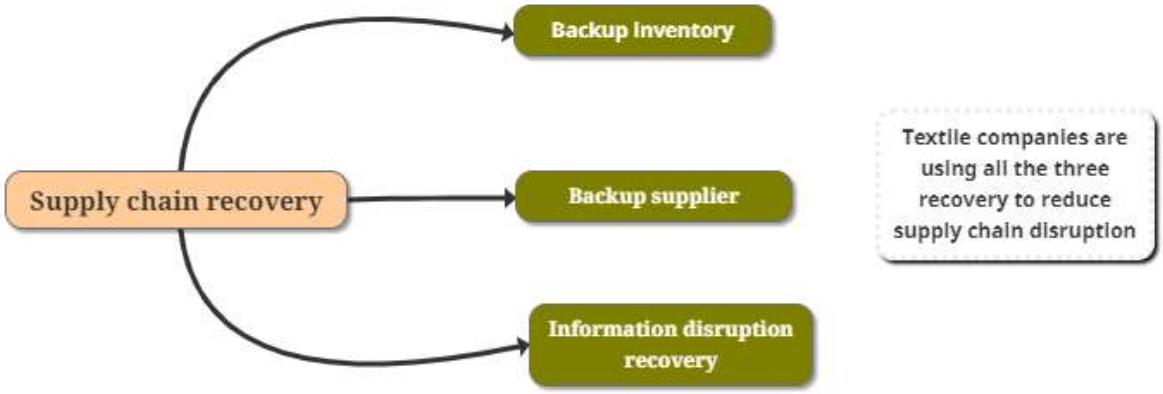

Figure 7. Supply chain recovery
Source: Own Illustration

3.8. Discussion

In this study, qualitative research methods to measure supply chain resilience elements and its supply chain recovery strategies. Similar approaches have been used previously by (Scholten and Schilder, 2015; Yang. And Fan 2016; Rafique *et al.* 2018; Blackhurst *et al.* 2021). The mono method (interviews) is widely used in three methods. This method has been previously described by (Scholten and Schilder, 2015; Yang. And Fan 2016; Rafique *et al.* 2018; Blackhurst *et al.* 2021). qualitative interviews are the best way to know the elements of supply chain resilience and its disruption. Similar methods presented previously described by Rafique *et al.* (2018); Scholten and Schilder (2015); Chowdhury and Quaddus (2016); Jüttner and Maklan (2011); Johnson *et al.* (2013); Pettit *et al.* (2013)

Profile of participants: The participants working in Cross stitch, Sapphire, Style, Nishat, and Interloop denim limited textile organization have been interviewed to assess the supply chain resilience of the textile industry. Most participants were male and were master's degree holders in the interviews.

Nature of textile organization: The textile organization were either MNC or domestic. All the selected textile organization ages were between 15-67 years. These companies were producing standardized and customized products. The suppliers of the textile organization were Nishat, sapphire, and weaving mills, Adidas, Reebok, Nike, and Rupali. Such companies customers were Adidas, Guess, Mustang, Diesel, Gap, Ikea, levis, Next, William Sonoma, bedding House, Nike, Levi's, S Oliver. To sum up the companies information, it has been focusing on increasing quality, innovation, and green practices, increasing profitability in the market.

Supply chain resilience: The study evaluated the SCR using five major themes: Visibility, coordination & collaboration, agility, reduction of supply chain uncertainties and supply chain recovery. (Chowdhury, Quaddus 2016; Jüttner, Maklan 2011; Pettit *et al.* 2013; Johnson *et al.* 2013; Zsidisin, Wagner 2010; Lee, Rha 2016) reported similar elements in their studies. The detailed findings of each theme are present below

Visibility: Textile organizations used live technology to exhibit visibility (Johnson *et al.* 2013; Kamalahmadi, Parast 2016; Jüttner, Maklan 2011; Ponis, Koronis 2012; Christopher, Peck 2004; Dubey *et al.* 2017) reported that technology considers as the element of visibility in increasing the performance. A relatively small number of companies were using intermediaries for supply chain visibility. It is similar to the reported findings of Williams *et al.* 2013; Barratt, Oke 2007; Holcomb *et al.* 2011

Coordination & collaboration: Textile organization made a strategic plan for producing various products. Later the plan was shared among the members of the companies. Supply chain integration is used to manage the risk in supply chain activities. Such integration is enhanced through internal and customer integration. These integrations are evaluated based on the nature of products (customized, variety and standardised). Themes exhibited that variety of products

focused on supplier integration, customized products on customer integration but standardized products on internal integration.

Agility: Textile organizations have experts who can alert the organization regarding changes in the external environment. These companies depend on potential employees, software, and internal reports to collect information about the organization. The textile organization could react to the changes, forecast, and handle the situation easily with this information. The observations also agree with the studies reported by Gligor 2016; Rafique *et al.* 2018; Nazempour *et al.* 2019.

Reduction of supply chain uncertainties: textile organizations used contingency plans to protect the companies against unpredictable changes. Together, the lean principle was used to diminish the supply chain vulnerability. Safety stock and supplier backup were the alternatives available for the companies to tackle the supply chain uncertainty.

Supply chain recovery: The textile organization had backup inventory, suppliers, and information disruption recovery to handle supply chain disruption. It is clear from the extensive evidence in the literature that the effective strategy to mitigate outbreaks risk backup inventory, suppliers are used (Chen *et al.* 2015; Saghafian, Van Oyen 2015; Yang, Fan 2016; Blackhurst *et al.* 2021; Black, Glaser-Segura 2020)

CONCLUSION

Textile organizations are facing risks owing to late deliveries, long lead time, and stock out and overstock. All these risks make the supply chain activities susceptible to threats in the market. To sustain in the competitive market, organizations have to be resilient. There are elements of resilience that support overcoming the disruption in supply chain activities. Most of the elements measured either quantitative or mixed methods. Fewer studies give importance to qualitative research methods. So, similar methods are applied to fill the study gap. This study focuses on identifying the elements of SCR in the textile industry. Assessment of supply chain resilience and its outcome helps recognise elements' importance in eradicating the disruption in supply chain activities. Such recognition of elements evaluates through qualitative research methods. Samples are textile organizations professionals, and the samples' determination is based on purposive sampling. Next, an asynchronous interview conducts among the respective samples.

The opinion of samples is measured with the help of thematic analysis to determine the elements of supply chain resilience of the textile industry. Thematic analysis reveals that a few companies did not have visibility in their supply chain activities. Information sharing is not visible for the companies producing standardized and customized products. A relatively small number of the textile organization have data sharing with suppliers. This sharing can direct the textile organization to mitigate the risks easily. Most companies rely on internal records and potential employees to react to the external environment changes. Such companies overcome the changes through a contingency plan. A relatively small number of companies use the lean principle to diminish supply chain vulnerability. Despite recovery strategies, backup suppliers, inventory, and information disruption can help overcome supply chain disruption. From the outcome, the study observes that textile organizations are giving less importance to elements of supply chain resilience. So, disruption in supply chain activities affects the textile organization to meet the global standards. The companies should adopt the technology to increase transparency in supply chain activities. It can support the companies to mitigate the supply chain disruptions. Finally, the study concludes that the elements of SCR are a key aspect of mitigating the risks and making the companies competitive. Still, the companies can sustain themselves for a long time.

Implications: The manager should be proactive in developing the elements of the supply chain resilience of the textile organization. They should set up an appropriate network and infrastructure to create resilience capabilities in reducing vulnerabilities present in the supply chain.

Managers should have a continuous commitment to communicate and collaborate with members and supply chain partners. Proper training and education should extend to employees to create an awareness of risk management of the textile organization.

Managers should fix the elements of supply chain resilience in determining the aspects of the operations and improve the tactics in enhancing supply chain agility.

Managers have to identify the important elements of supply chain resilience, which should be addressed in increasing firm agility.

Managers have to identify the weakness of elements of supply chain resilience, take corrective actions in diminishing and eliminating the vulnerabilities and increase the supply chain agility.

Textile organizations should give importance to applying technology in the respective organization. Application of technology is in the form of implementation of SAP, ERP and more based on the needs of the organization.

Scope for further research: The results obtained in this case do not apply to Pakistan's entire textile industry. In this study, limited participants have been considered. It is essential to extend the applicability of the method to a wider class to get insights into the supply chain resilience of the textile organization. This study was limited to professionals but could be extended for considering the supply chain executives to explore the importance of elements in the textile organization.

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APPENDICES

Appendix 1. Interview

Interviewee information

1. Gender
2. Level of education
3. The year spent in the position
4. The year spent in the organization
5. Nature of job

Company information &role of supply chain management

6. Company name
7. Firm age
8. Firm size
9. Number of employees
10. Nature of operation (Domestic or MNC)
11. If MNC, describe the mode of entry (direct or franchise)
12. What is the nature of textile products? (e.g., standard, variety, or customized)
13. Major suppliers
14. Major customers
15. Objectives of the company
16. Where do you see SCM in the textile organization concerning importance and recognition?
17. Can you tell me how your position relates to daily supply chain activities?

Supply chain resilience

18. To what extent have you mapped your current supply network?
19. Please indicate the level of visibility your organization has into its supply chain?
20. How does resilience influence your organization sourcing and manufacturing strategy?

21. What are strategies do you take to tackle this situation?
22. What are the planning challenges your company faces?
23. Do you plan to increase the level of data sharing with your supply ecosystem?
24. How have you enhanced supply chain resilience amidst changes in the external environment?

Supply chain risk management

25. Do you agree that your companies are operating in an uncertain environment?
26. If yes, Why?
27. What is your attitude towards risk?
28. What types of risk in a supply chain does your textile company face daily operation?
29. Please rank the risks following the importance and severity
30. How does your textile company manage supply chain risk?
31. Do you have a particular system to manage supply chain risk?
32. How did your company integrate with partners in the supply chain to prevent or mitigate risk?
33. What strategies do you use to risk mitigation, and what should be done in the future for its prevention?
34. Do you know situations when the risk management system in your company has failed?
35. Why and what were the consequences?
36. What conclusion was made?

Supply chain recovery

37. How flexible is your facility to accommodate market uncertainties?
38. How do you manage risks during inventory level optimization?
39. What is the bottleneck present in the internal supply chain process?
40. How do you deal with the obsolete raw material in your stock?
41. Do you have your transportation system or depend on third-party logistics?
42. What are the ways you follow to reduce transportation costs?
43. What challenges do you face to keep transportation costs down?
44. How flexible is your logistics to accommodate market uncertainties?
45. How do you react during sudden demand fluctuation?
46. How reliable is your logistics to address market needs?
47. What are the challenges to achieving a delivery schedule?

48. How does your operation react to the fluctuation of uncertain demand?
49. How do you maximize your throughput?

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