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Abstract

All nations, communities, organisations, and people are affected by a complex and dynamic business environment. Threats from this unpredictable environment might emerge from within or outside an organisation and vary in frequency and degree. Creating a resilient system overall can fix that. This research seeks to understand how human capital and the supply chain share crisis resilience. A descriptive qualitative study using the phenomenological technique explores managers' views on supply chain and human capital resilience. Results reveal that supply chain resiliency—the essence of resilience—is substantially correlated with human capital. Supply chain resilience requires human capital resilience. Strong personnel can handle crises, adapt, collaborate, contribute, innovate, and build a strong supply chain. This study identifies supply chain-human capital resiliency nexus factors to help firms improve supply chain performance. Outperforming competitors in volatile markets enhances corporate performance. Data from internal and external sources can improve a company's supply chain and human capital resilience.

Keywords: Disruptions, Resilience, Human Capital, Supply Chain Resilience, Phenomenological Study

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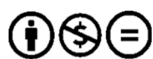
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Abstract

All nations, communities, organisations, and people are affected by a complex and dynamic business environment. Threats from this unpredictable environment might emerge from within or outside an organisation and vary in frequency and degree. Creating a resilient system overall can fix that. This research seeks to understand how human capital and the supply chain share crisis resilience. A descriptive qualitative study using the phenomenological technique explores managers' views on supply chain and human capital resilience. Results reveal that supply chain resiliency—the essence of resilience—is substantially correlated with human capital. Supply chain resilience requires human capital resilience. Strong personnel can handle crises, adapt, collaborate, contribute, innovate, and build a strong supply chain. This study identifies supply chain-human capital resiliency nexus factors to help firms improve supply chain performance. Outperforming competitors in volatile markets enhances corporate performance. Data from internal and external sources can improve a company's supply chain and human capital resilience.

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Introduction

The duties of supply chain management have become increasingly intricate because of innovation, evolving technology, the global pandemic, and various customer preferences. (Ivanov & Dolgui, 2021; Sabahi & Parast, 2019). Thus, manufacturers in the business sector encounter unforeseen interruptions, and they rely on global supply chain strategies to effectively manage these challenges. (Qader et al.,

2022). The use of supply chain methods such as just-in-time (JIT), lean manufacturing, zero inventory, and supply source reduction can enhance productivity and reduce costs. By adopting these improvised contentions, issues may be effectively managed. (Essuman et al., 2020). Failure to address the disturbance might result in substantial financial losses. Competitive advantage cannot be achieved without adapting and implementing these techniques.



(Ambulkar et al., 2014); Nguyen et al., 2020). Organizations that have robust supply chain operations can effectively handle significant interruptions in a controlled and manageable manner, resulting in many advantages. According to (Li et al. (2017), supply chain resilience refers to the capacity of a supply chain network to endure interruptions and promptly recover to its regular state. However, it's not easy for businesses to reorganize their supply chain operations and commit more resources, such as human and financial capital, to make their supply chain strong and resilient. Prior studies on supply chain resilience almost entirely neglected human capital in favor of relational and technological viewpoints, despite its critical role in handling disturbances to the supply chain. Obstacles to the restoration of disrupted supply chain operations arise from employees' lack of knowledge, resiliency, and flexibility. These issues include changes to work routines, anxiety among employees, and the need to adapt job skills in remote work settings (Butterick & Charlwood, 2021). Despite the many factors that influence supply chain resilience, human capital stands out as a key component that can help organizations become more resilient (Shela et al., 2021). According to (Agostini & Nosella, 2022) human capital is one of the integral parts of intellectual capital, defined as "a combination of individual capabilities and skills, such as knowledge, competence, and leadership.". (Serenko & Bontis, 2016) define human capital as "the multi-tasking capability, engagement, commitment, experience, attitude, creativity and intelligence level of employees."

At this point of our discussion, we understand what supply chain resiliency and human capital are, but this leads to the question of what specific set of skills of employees make them resilient enough to perform better in an uncertain environment. That improved and resilient performance of the workforce may increase supply chain performance in the context of making it more resilient and robust to external and internal disruptions. The purpose of this

study is to better understand the nexus between supply chain resilience and human capital resilience, as the role of resilient human capital is missing in the current literature in the context of a resilient supply chain.

This article provides insights into the characteristics and connection points of resiliency between the human capital and supply chain, in addition to outlining various practitioners' and experts' perspectives. Expert interviews are done in Pakistan. The results of the current study add to the body of knowledge in connection with supply chain and human capital resilience. Practitioners and experts in supply chain operations find insights into the nexus for resilience.

Literature Review

Resilience is defined in this study as the capacity to bounce back from challenging circumstances (Ambulkar et al., 2014); Bhamra et al., 2011). In line with (Essuman et al., 2020), we define organizational supply chain resilience as the capacity of a provider to react to significant disruptions and resume regular business operations. The ability of the systems to adapt and withstand brief disruptive events is more precisely characterized by supply chain resilience (Ribeiro & Barbosa-Povoa, 2018). To assess their level of sensitivity to prevent these disruptions, firms should identify the potential vulnerabilities and risks that can endanger their operations in advance (Ivanov, 2021; Sabahi & Parast, 2019). Accordingly, we define resilience as a process that begins when a firm confronts disruptions (resulting from worldwide disruption calamities) and ends when things return to usual situations. That is most in line with our main study objective and allows more room to find differences in how organizations react to interruptions and their ability to execute as they did before the crisis in the context of human capital resiliency. (Gunasekaran et al., 2015) claim that there are four essential parts to supply chain resilience capability: risk-management culture, agility, re-engineering, and collaboration. Supply Chain

Resilience (SCRs) is becoming more and more crucial in today's scenario (Birkie et al., 2017). Researchers have highlighted several strategies leading corporations may use to strengthen SCRs, including re-shoring, agility, and multi-sourcing (Paul & Chowdhury, 2020; Qader et al., 2022; Zouari et al., 2020). To address the conflict between efficiency and resilience, numerous well-known academics have projected that post-disruption SCRs will become more fragmented (Namdar et al., 2017). For businesses in some regions, this would present opportunities, while for others, it would present obstacles.

The most challenging aspect of change is culture, and it is also challenging to offer an exclusive description. According to Abeysekara et al., (2019), leadership and innovation are the two key components of a risk management culture. Establishing a resilient organization requires both leadership and innovation (Ivanov et al., 2013). To achieve efficient and resilient supply chain activities, leaders should be completely involved in building human capital to make firm operations resilient enough to compete in turbulent environments. Risk management culture enables the reduction of risks, both proactively and retroactively (Mandal, 2017). This method helps you keep an eye on supply chain plans and changes that happen because of new technologies, competitors, and what customers want Proactively, it helps in seeing potential pitfalls and strives to mitigate the impacts before they occur to make supply chain operations resilient and robust (Hosseini & Ivanov, 2019; Ivanov & Dolgui, 2021). Everyone in an organization knows that new ideas are the only way to bring about progress. The amount of creativity is closely linked to the process of building human capital and the culture of learning in the workplace (Baryannis et al., 2019). It could affect an organization's ability to stay alive, grow, and even keep its strength over time.

According to Jin et al. (2021), Human capital plays a crucial role in facilitating the acquisition of knowledge and the development of innovative technologies. It contributes to the efficient

operation of manufacturing processes by conserving energy and generating novel technological advancements. To maintain technological advancement and make firm business operations more resilient, (Butterick & Charlwood (2021) found that more educated employees can utilize these resources and technologies, resulting in more effective and resilient supply chain operations. In times of crisis, the demand for specialized individuals with highly relevant industry-specific training will surge as these workers look for employment in business firms that provide higher returns and lower employment-loss risk (Pereira et al., 2019).

To put it another way, the global financial crisis might have prompted highly skilled workers to be resilient against non-resilient firms, thereby enhancing supply chain resilience and ultimately boosting overall firm performance. According to (Choksy et al., 2022), in unstable, unpredictable, and many other challenging situations, resilient firms and their people survive to cope with these challenges in a more effective way than non-resilient organizations. Employees who can apply their knowledge and experience to help the company maintain strong ties with supply chain partners will be found in organizations with relatively high levels of human capital (Serenko & Bontis, 2016). Therefore. HC is a crucial prerequisite for learning to take place. In line with Mubarak et al., (2022) human skills, capabilities, and expertise enable the firm to engage in structural innovation and cooperation with other businesses, organizations, and institutions, as well as adapting to the business environment.

Methodology

This qualitative study (Aspers & Corte, 2021) was conducted by applying the phenomenological approach to gain insight into managers' concepts and lived experiences regarding resiliency phenomena regarding the supply chain and human capital. Phenomenological research describes the shared significance that multiple people's unique lived experiences of a phenomenon have for them (Manen & Manen,

2021). When studying phenomena, such as resiliency in our study, as researchers, our emphasis is on describing what all participants have in common and similar to them by asking respondents what they experienced (textual description) and how they experienced (structural description) about a particular phenomenon (Moustakas, 1994). We used the purposive sampling technique (Bowen, 2009) for interviews: we selected the individuals who were most suitable to properly respond to the research question and who were most relevant to the topic. These were the people who could tell us a lot about their lived experiences, the difficulties and challenges they had to deal with during the disruption and crisis, and how they overcame

them with resilient phenomena. Individual interviews were taken from 20 supply chain managers working in the textile industry of Pakistan.

Results

The findings of the qualitative analysis are presented in this portion of the study and are categorized according to the relationship between supply chain resilience and the resilience of human capital. Following are the important indicators (themes) of human capital resiliency that respondents discussed during interviews after converting their codes into themes.

Table 1

Human Capital Resiliency Indicators

(Themes)	Consolidated Statements
Emotional Intelligence	<p>Ten participants responded that “employees’ ability to recognize, understand, and manage one’s own emotions, as well as to recognize and understand the emotions of others, is the capacity to use emotions to guide thought and behavior, and to effectively manage one’s own emotions in different situations.”</p> <p>Some participants highlighted, “Workforces with high emotional intelligence are often able to navigate social situations more effectively, build strong relationships, and handle stress and challenges with greater resilience.”</p>
Multi-tasking	<p>The majority of the interviewees informed me that “multitasking refers to the ability to perform multiple tasks or activities simultaneously.”</p> <p>Three participants addressed that “it is a common phenomenon in today’s fast-paced world, where people are often juggling various responsibilities and demands.”</p>
Creativity	<p>Almost all participants said, “Creativity refers to the ability to generate novel and valuable ideas or solutions.”</p> <p>Ninety percent of respondents said that “it involves combining existing knowledge, experiences, and skills in new and innovative ways to come up with original and useful concepts or products.”</p>
Innovation	<p>Seven participants highlighted “the process of creating something new or improving upon an existing product, service, or idea.”</p> <p>All participants responded, “It involves the development of new ideas, products, or processes that add value to society and have the potential to transform the way we live and work.”</p>
Adaptability	<p>Seventy percent of respondents disclosed that “We think a resilient workforce is more likely to adapt to changes in the supply chain. They can quickly adjust to new processes, technologies, and working conditions.”</p> <p>The majority of interviewees added, “This adaptability can help the supply chain respond</p>

(Themes)	Consolidated Statements
Controllability	<p>more effectively to disruptions such as natural disasters, supplier bankruptcies, or labor shortages.”</p> <p>Most of them reported that “The ability to control or manipulate a system or process to achieve a desired outcome.”</p> <p>Some respondents delineated that “In engineering and control theory, controllability refers to the ability of an external control input to steer a system from any initial state to any desired final state within a finite amount of time.”</p>
Continuity	<p>Three interviewees emphasized that “in our point of view, resilient employees are more likely to stay with the company over the long term.”</p> <p>All participants added “This continuity can help to maintain institutional knowledge and expertise in the supply chain. It can also help to reduce turnover and the associated costs of training new employees.”</p>
Collaboration / Communication	<p>The majority of the interviewees revealed that “Yes, a resilient workforce is more likely to collaborate effectively with other teams in the supply chain. They can work together to solve problems, share information, and coordinate efforts.”</p> <p>All participants expressed that “This collaboration can help to reduce communication breakdowns, improve efficiency, and minimize disruptions.”</p>
Commitment	<p>Some respondents delineated that “The act of making a promise or pledge to do something or follow through on a certain course of action”</p> <p>All participants revealed that “it involves dedicating oneself to a particular goal, activity, or relationship, and taking responsibility for one’s actions and decisions to achieve that goal or maintain that relationship.”</p>

Following are the supply chain resilience indicators that respondents discussed during interviews, converted into themes.

Table 2

Supply Chain Resiliency Indicators

Themes	Consolidated Statements
Recoverability	<p>All participants revealed that “The capability of a supply chain system to bounce back and regain normal operations after a disruption. It involves the ability to identify potential risks, prepare for them, and respond to them in a timely and effective manner.” Ten participants responded, “Recoverability also involves resilience, which is the ability of a supply chain to absorb a shock and adapt to changes without experiencing long-term negative effects.”</p>
Response	<p>All interviewees disclosed that “Firms react quickly and effectively to changes in the supply chain, such as disruptions, fluctuations in demand, or shifts in customer preferences.”</p> <p>The majority of the interviewees added that “A well-designed supply chain response system enables a company to proactively mitigate risks and minimize the impact of disruptions on business operations while maintaining quality and customer satisfaction.”</p>
Robustness	<p>Some respondents delineated that “If the supply chain system resists or recovers from disruptions, or other unexpected events and continues functioning effectively.”</p> <p>The majority of respondents added that “a robust system can adapt and cope with changing conditions, unforeseen circumstances, and errors without failing.”</p>
Multi-sourcing	<p>Eighty percent of respondents disclosed that “it’s the practice of obtaining goods or services from multiple sources, rather than relying on a single supplier. This approach is often used</p>

by businesses to mitigate risks and increase their flexibility and responsiveness to changes in the marketplace”

Agility Some respondents added that “Company’s ability to respond quickly and effectively to changes in customer demand, supplier availability, or market conditions”

The majority of interviewees added, “It involves the use of strategies, processes, and technologies that allow companies to quickly adapt to changing circumstances and meet customer needs.”

Reengineering The majority of the interviewees responded, “The process of redesigning or restructuring a system, process, or organization to make it more efficient, effective, and profitable.”

All participants added, “ It involves examining the current processes and systems to identify areas that can be improved and implementing changes that will result in significant improvements in performance, productivity, and profitability.”

Visibility Some respondents added that “The ability of a company or organization to track and monitor their products as they move through the supply chain, from raw materials to the finished product.”

All participants informed that “It involves the use of technology and data to provide real-time information and insights into the status of products, inventory levels, and logistics operations.”

Continuous Improvement All participants disclosed that “An ongoing process of making incremental changes and enhancements to products, services, processes, or systems to achieve better outcomes and greater efficiency over time.”

The majority of the interviewees said, “The concept of continuous improvement is based on the belief that small, incremental changes can lead to significant improvements over time.”

Some indicators of human capital making employees more resilient, like emotional intelligence, multi-tasking capability, creativity and intelligence level, collaboration, and communication rooted in employees, can be important sources of a resilient supply chain. Emotional intelligence can be a vital skill for an employee’s resiliency to manage their stress level and make the supply chain more resilient when

disruption occurs. For employees working in the supply chain department or other employees indirectly involved in supply chain activities, mental consciousness is very important.

Following is a description of the nexus of human capital resiliency with supply chain resiliency, which we conclude from interviews with respondents.

Table 3

Nexus of Human Capital Resiliency Indicators with Supply Chain Resiliency Indicators

Nexus of	Description
Emotional-Intelligence with Supply Chain Recoverability	When disruptions occur in the supply chain, such as natural disasters or economic downturns, a resilient workforce is better equipped by using emotional intelligence skills to manage the crisis and mitigate its impact. They can adapt to new circumstances, problem-solve, and make decisions that help the supply chain recover more quickly.

Nexus of	Description
Flexibility with Supply Chain Agility	<p>Workers who are flexible and have learning attitudes are better equipped to deal with an interrupted supply chain. They have to be well aware of the production processes and understand the distribution and logistics channels. The adaptability in the workforce can make them resilient to deal with changing circumstances and difficulties. They can respond quickly to change scenarios to find solutions</p>
Innovation and Creativity with Supply-Chain Re-engineering	<p>A workforce with the capacity for adaptability can swiftly adjust to changing conditions and consequently become innovative. They can handle problems efficiently and effectively. The reflection of attitudes comes from the production as well. New ways are generated, and new products come into existence. The supply chain mechanism has also become innovative. The overall system becomes robust, cost-effective, and efficient.</p>
Sustainable-behavior with Supply-Chain Vulnerability	<p>Resilient individuals possess characteristics such as perseverance and dedication to the long-term viability of the supply chain. The concept of sustainability, which may need priority, includes actions that are favorable to the environment and the decrease of waste. When a supply chain is sustainable, there is less vulnerability and more long-term resilience than when it is threatened.</p>
Collaboration-and Communication with Supply-Chain Visibility	<p>Collaboration and communication play a significant role in the supply chain management system. This can enhance collaboration among manufacturers, retailers, customers, and other stakeholders. By implementing this approach, it is conceivable to enhance the level of visibility in the supply chain, therefore fostering collaboration among all stakeholders to overcome challenges and ensure smooth operations.</p>
Continuous-Improvement with Process-optimization and waste reduction in Supply Chain	<p>Resilient human capital is defined by a persistent commitment to continuous growth and improvement. Over time, the staff members who consistently explore ways to improve operations, increase productivity, and minimize waste can achieve a stronger and more efficient supply chain. By identifying and rectifying the vulnerabilities and inefficiencies in the supply chain, workers can enhance their resilience and reduce the likelihood of disruptions.</p>
Adaptability with Supply-Chain Response	<p>An adaptable workforce is more inclined to adjust to alterations in the supply chain. They can quickly adjust to new processes, technologies, and working conditions. This adaptability can help the supply chain respond more effectively to disruptions such as natural disasters, supplier bankruptcies, or labor shortages.</p>

Discussion

In today's turbulent and uncertain business environment, firms need to have resilient structures in the context of structural,

technological, and, most importantly, employee-resilient behavior in the form of human capital. This study explores the important but missing past literature nexus between firm supply chain resiliency and human capital resiliency during

times of crisis in Pakistan's manufacturing industry. Disruptions that create a crisis for most organizations can affect firm supply chain performance and ultimately overall firm performance when the firm's structure is not resilient and a risk management culture is not adopted (Abeysekara et al., 2019; Croucher et al., 2019). So, it's very significant for firms to prepare for the worst conditions by promoting a risk management culture and making structure, technological, and human capital resilient. From this study, we can deduce that there is a very close nexus between supply and human capital resiliency, as most of the indicators of human capital resiliency are strongly linked with supply chain resiliency. The resilience of human capital has a substantial influence on the resilience of the supply chain. Only an adaptable workforce can handle issues in crises and critical situations, such as natural disasters or economic recessions (Essuman et al., 2020). The ability, and capacity of employees, agility, and problem-solving techniques can increase the overall efficiency of the supply chain system and contribute to informed decision-making (Agostini & Nosella, 2022). Workers with resilience can adapt themselves more quickly and be productive in the organization (Mubarik et al., 2021), and they become innovative and find solutions to every problem. Moreover, they become financially resilient too. (Gu et al., 2023). Learned and experienced employees become more productive by promoting new methods and processes and using techniques to minimize waste. (Butterick & Charlwood, 2021). After becoming adaptive, they (Serenko & Bontis, 2016). A resilient workforce comprises individuals who have expertise in risk management. Achieving success necessitates the ability to foresee potential issues and devise strategies to resolve them. Proficient personnel can mitigate the consequences of natural calamities and other interruptions in the supply chain (Jin et al., 2021). Effective supply chains are the outcome of efficient collaboration and ongoing communication. Proficient communicators and collaborative team members facilitate the

coordination of suppliers, manufacturers, distributors, and customers (Ciravegna et al., 2023). Ultimately, this may enhance collaboration among all stakeholders in the supply chain, thus enhancing their capacity to effectively address difficulties and maintain seamless operations. A resilient team is consistently motivated to enhance their performance. Employees who consistently strive to improve procedures, boost productivity, and reduce inefficiencies can progressively enhance the supply chain (Pereira et al., 2019). By identifying and rectifying vulnerabilities and inefficiencies, workers can enhance the resilience and adaptability of the supply chain to effectively manage disruptions.

Conclusion

According to the data and analysis presented above, there is a significant relationship between supply chain resilience and human capital resilience. Every supply chain must incorporate human resources with processes and technology. The overall supply chain experiences negative consequences when managers do not possess adequate resilience. For instance, if key stakeholders in the supply chain lacked resilience, they would struggle to effectively manage disruptions caused by events such as natural disasters, pandemics, or economic downturns. In the event of such occurrences, any problems with the distribution network might have a domino impact on other activities, clients, and the financial outcome.

Furthermore, the construction and maintenance of a strong supply chain require a culture that continually strives for enhancement and a willingness to adapt to changing circumstances. This necessitates a workforce that is resilient, capable of acquiring knowledge, displaying creativity, demonstrating emotional intelligence, fostering personal growth, and adjusting to novel difficulties. Supply chain resiliency and human capital resiliency are mutually dependent. Companies that allocate resources to develop resilient workforces will have

a stronger ability to withstand disruptions and sustain a reliable supply chain in the long run. The resilience of the supply chain relies heavily on the resilience of human capital. An adaptive,

imaginative, devoted, and collaborative staff is crucial for efficiently responding to disturbances and ensuring long-term stability in the supply chain.

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