BUSINESS AND ECONOMICS RESEARCH JOURNAL

ISSN: 1309-2448

HOSPITAL SUPPLY CHAIN PERFORMANCE: UNDERSTANDING THE MODERATING ROLE OF RISK CULTURE

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ABSTRACT

This research investigates the impact of supply chain capabilities and performance by studying the significance of supply chain risk culture. This includes the attitudes, beliefs, and practices that determine how a business tackles risk management inside its supply chain, influencing how it perceives and reacts to uncertainty. The study collected 294 samples from hospital workers at chosen hospitals to investigate characteristics that influence Supply Chain performance, with a particular emphasis on agility, collaboration, and adaptability. In the healthcare sector, it has been observed that a hospital's supply chain capabilities have a substantial impact on its performance. Furthermore, risk culture had a significant negative moderating impact on the relationship between SC capability and SC performance. Simply put, a strong risk-aversion In other words risk culture weakens the relationship between supply chain capabilities and SC performance when it takes a high value and visa versa.

Keywords: risk culture, supply chain, healthcare, moderator

Introduction

The process of transforming raw resources into finished goods and delivering those goods to clients is known as a supply chain. Supply networks have been around since the first products and services were created and distributed in history. For instance, Henry Ford revolutionised the auto industry by standardising car parts, which allowed for mass production to meet the demands of a growing customer base. The intricate connectivity patterns that supply chains have developed over time mean that both related and unrelated activities have a significant impact on them (Ivanov, 2019). Supply chains (SCs) of today are vast, intricate networks with the goal of delivering goods in the correct amount, at the correct location and time, in volatile markets. Global market instability puts SCs at risk of disruptions (Pettit et al., 2010). Such disruptions pose risks that can be characterised in the context of a supply chain as an occurrence whose future direction cannot be predicted and may jeopardise the objectives of the organisation (Abdel-Basset et al., 2019). According to a different study, risk is an uncertain development that could result in a supply chain organisation operating at a loss by becoming less efficient and effective (Heckmann et al., 2015). Supply chains must work on building up their resilience in order to reduce potential risks and guarantee that operations continue normally in case there are any interruptions. Ponomarov and Holcomb (2009) defined Supply Chain Resilience (SCRes) as "the chain's ability to prepare for unexpected events and respond to disruptions by recovering business continuity at the desired level to ensure business continuity."

Enter the concept of supply chain risk culture: a dynamic concoction of attitudes, behaviours, and practices that together control an organisation's approach to recognising, analysing, and

mitigating risks inside the complicated web of its supply chain. It extends beyond risk management standards to infiltrate an organisation's DNA, changing how it sees and reacts to uncertainty (Heckmann et al., 2015).

In recent years, a number of high-profile incidents and long-standing issues, such as severe earthquakes and political upheaval, fuel shortages, diseases, and terrorism, have significantly impeded businesses' ability to produce and ship their goods (Mandal, 2017; Chen et al., 2013; Sawik, 2013; Sodhi et al., 2012; Singhal et al., 2011). Such interruptions point to a lack of supply chain planning across numerous industries, including the healthcare supply chain (Heckmann et al., 2015). Because of the critical nature of the services they provide and the potentially serious consequences of unanticipated disruptions, resilience is a key component of the supply chain in the healthcare sector (Alemsan et al., 2022).

Resilience is intrinsically connected to supply chain risk culture. It serves as the foundation for an organisation's capacity to recover from Supply Chain interruptions, assuring continuity and Supply Chain Performance(SCP). In an age of rising complexity and unpredictability in global supply chains, cultivating a strong supply chain risk culture is not simply a good practice; it is a strategic requirement(Heckmann et al., 2015).

According to research, a company must create logistical procedures and skills to enhance SCRES (Fiksel et al., 2015), and through the integration of SC capabilities, a SC develops resilience (Tang & Tomlin, 2008). Terms like SC capabilities (Blackhurst et al., 2011), resilience capabilities (Jüttner & Maklan, 2011), resilience strategies, logistics capabilities (Ponomarov & Holcomb, 2009), capability factors, SC characteristics are used interchangeably (Kochan & Nowicki, 2018), therefore, in this study, the term SC capability has been used.

In the typological framework of SCRes developed through CIMO (Context-interventions-mechanisms-outcomes) logic, Kochan & Nowicki (2018) emphasised integrating SC Capabilities in order to achieve resilience, thereby Supply Chain Performance (SCP). Three supply chain capability aspects (interventions) were identified by them, namely readiness, responsiveness and recovery. According to literature (e.g. Scholten & Schilder (2015), collaboration is the key indicator of readinessThe planning and execution of supply chain activities by two or more companies for mutual benefit is simply referred to as collaboration (Simatupang & Sridharan, 2008).

As far as responsive capabilities are concerned, in SCRes, responsive capabilities are developed through agility (Kochan & Nowicki, 2018). Agility in the supply chain means moving faster to reduce response times and moving quickly to adapt to unforeseen changes in demand or supply (Pettit et al., 2010). Finally, recovery in SCRes is the aspect majorly formed by the adaptability factor (Pettit et al., 2010; Blackhurst et al., 2011). Tukamuhabwa et al. (2015) defined adaptability as “The adaptive capability of a supply chain to prepare for and/or respond to disruptions, to make a timely and cost-effective recovery, and therefore progress to a post-disruption state of operations-ideally, a better state than prior to disruption”.

It has been seen in the recent COVID pandemic how the three stages, Readiness, Responsiveness and recovery, played a very crucial role in healthcare resilience.

Past literature has talked about the link between Risk Culture and SCRes to achieve SCP. The antecedents of Supply Chain Performance among others include SCRes (Belhadi et al., 2021). Studies have emphasised on the adoption of SC resilient strategies to face disruption and maintain Supply chain performance at the pre-disruption level (Carvalho et al., 2012; Chowdhury et al., 2019).

In the wake of the current pandemic, the study provides important insights for the healthcare organisations in India to develop a robust supply chain in order to overcome disruptions and uncertainty posed by the external environment. The present research studies the factors affecting supply chain performance in the healthcare sector. In particular, SC capabilities would be studied as a combination of three dimensions (agility, collaboration and adaptability). We also investigate the boundary conditions that increase the supply chain performance of health sector supply chains.

Theoretical background and hypothesis development

SCM was not prepared for a global disruption caused by the COVID-19 pandemic, both as a discipline and as a practice. SCs are the invisible backbone of any country's economy and have endured a lot of damage due to a lack of preparedness during these testing times (Sombultawee et al., 2022). In the healthcare sector, SCM has gained interest as a method for increasing output and elevating standards (Jarrett, 1997); Doerner and Reiman, 2007Since SCM in the healthcare industry is closely tied to patient care, it is more complex (Mustaffa & Potter, 2009). highlighted the significance of the supply chain for healthcare items since they are exchanged and disseminated in the healthcare system in numerous ways (Bhamra et al., 2011; Zheng et al., 2006). Healthcare resilience has previously been viewed from several angles, including ecological, social, and organisational, but more recently, it has begun to permeate the healthcare industry (Bhamra et al., 2011). There is no way for supply networks to cease operations in healthcare when faced with disruption because human lives are on the line (Rehman & Ali, 2021). Healthcare supply networks are of sporadic interest; an interdisciplinary approach to healthcare SCM is required whereby the lessons in terms of models and concepts from the Industrial sector can be extended to the healthcare sector (Vries et al., 2011). About the level of partner or client involvement, the degree of personalisation of services provided, and the degree of uncertainty surrounding the basic process, the healthcare industry's supply chain is distinct from that of the manufacturing sector. These have a substantial influence on the functioning of healthcare organisations and increase the dynamism and complexity of the healthcare value chain (Pitta & Laric, 2004). Hospital supply networks differ from typical industrial supply chains in a number of ways. It's a convoluted system that needs a flow of products and services to satisfy the needs of those who deliver patient care (Schneller & Smeltzer, 2006).

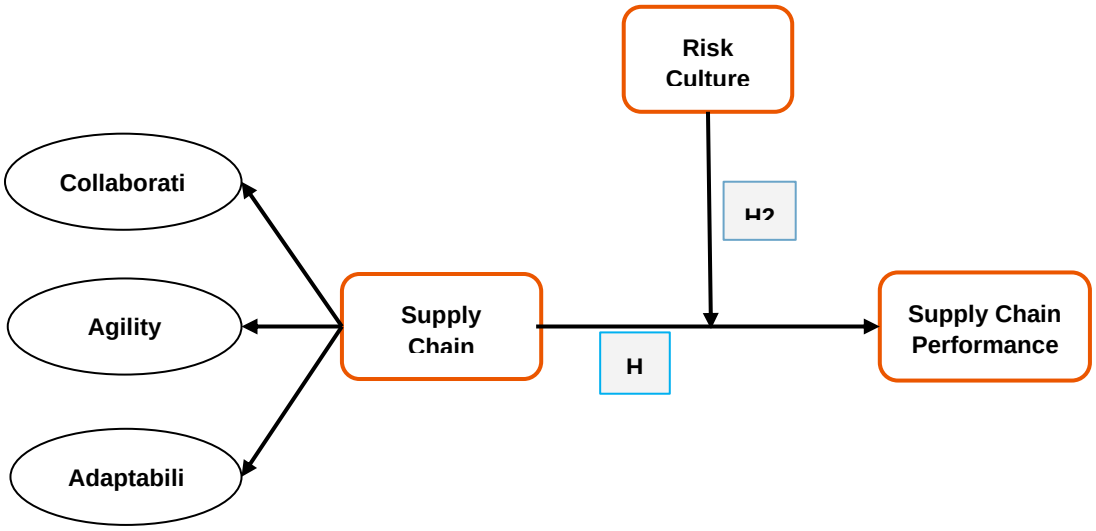
It is clear that the modern supply chain is more vulnerable to interruptions caused by both natural and man-made factors (Wagner & Bode, 2006). Manufacturing supply chains have been influenced by a number of new sorts of disruptions during the past ten years. Short-term impacts

on daily SC operations are caused by micro interruptions such as manufacturing failures, lead time increases, and man-made disturbances (Rahman et al., 2022). At its essence, supply chain risk culture revolves around the concept of resilience. Understanding resilience itself can be distilled into the capacity to be resilient. This capacity encompasses proficiency in foreseeing potential disruptions and effectively reacting to them – attributes commonly referred to as resilience skills (Brusset & Teller, 2017).

The healthcare industry may be impacted by pandemics, Natural calamities, as well as social, economic, and political discord; resilience is essential to addressing these effects (Marmolejo-Sauedo & Hartmann-Gonzalez, 2020; Mandal, 2017). Recent events have brought to light a variety of dangers that must be taken into account while analysing healthcare resilience and creating effective response plans. Haiti's 2010 Port au Prince earthquake, the Indian Ocean Tsunami in 2004, the UK's 2007 summer floods, Israel's 2008–2009 Gaza War, and the 2009 pandemic Swine Flu have all served as examples of the various risks that exist as well as how important it is to consider their impact on health and healthcare, whose services are frequently unavailable when they are most needed (Achour & Price, 2010). Due to the importance of their services and the serious effects that interruptions might have, the healthcare supply chain must be resilient (VanVactor, 2011).

To increase their resilience, healthcare organisations, their partners, suppliers, and stakeholders must create safeguards for their activities in the case of an interruption (Mandal, 2017; Mathur et al., 2018). Mathur et al. (2018) found that there is a direct association between SCM techniques and SC performance that may have a greater impact on OP development in the case of Indian healthcare sectors, effective SC performance may be essential to overall OP improvement. The conceptual model is presented in Figure 1.

Figure 1: Conceptual Model



In the framework of supply chain resilience (SCres), it is postulated that a robust supply chain capability influences supply chain performance. Supply chain capabilities comprising

collaboration (a key indicator of readiness), agility (associated with responsive capabilities), and adaptability(integral to recovery) is expected to enhance readiness, responsiveness and recovery in the supply chain, as emphasised by Kochan & Nowicki (2018). Therefore, it is anticipated that companies with well-developed supply chain capabilities will exhibit higher levels of supply chain performance. So, from the above discussion, it is hypothesised that

H1: Supply Chain Capability (Collaboration, Agility, Adaptability) has a positive impact on Supply Chain Performance.

In the context of global supply chains, supply chain capability, encompassing readiness, responsiveness and recovery interventions, is expected to positively impact supply chain performance. Moreover, the strength of this relationship is contingent upon the level of cultivation of a strong supply chain risk culture within the organisation. Risk culture is the concoction of attitudes, behaviour and practices and is anticipated to enhance the positive influence of supply chain capability on an organisation's skill to recover from supply chain interruptions, ensuring continuity and optimising supply chain performance. This hypothesis posits that risk culture plays a crucial moderating role in shaping the outcomes of the relationship between supply chain capability and supply chain performance, particularly in the face of increasing complexity and unpredictability in global supply chains. From the above discussion, it is hypothesized that

H2: Risk Culture moderates the relationship between Supply Chain Capability and Supply Chain Performance.

Research Methodology

Data Collection

The study used a cross-sectional research approach, and a survey questionnaire was used to gather primary data (online and offline). The questionnaire was reviewed by academic experts. The components in the questionnaire were measured using a five-point Likert scale. The scales were adopted from prior studies. The target population were Private and semi-government hospitals in Andhra Pradesh, and a stratified random selection technique was used since it allows population harmonisation from sub-populations. (Hair et al., 2010). The survey link was shared with approximately 550 potential respondents, of which 286 responded (a response rate of 52 per cent). Additionally, an offline survey was administered to around 80 participants, resulting in receipt of 59 completely filled surveys (a response rate of 74 per cent). After accounting for 51 cases of missing data, the final sample consisted of 294 responses.

Measures

Every one of the constructs was measured on a 5-point Likert scale, one being “strongly disagree” to five being “strongly agree”.

Risk culture was measured with a five-item scale which was taken from (Rofyanto Kurniawan et al.,2016). Some examples of items are: “Our firm makes sure that all employees are vigilant toward supply chain risk”. Cronbach’s alpha for risk culture is 0.935.

Healthcare SC Capability was a composite measure of agility, collaboration and adaptive capabilities. Healthcare Agility was measured with a five-item scale (Mandal, 2018) - Gligor et al.(2016), Gligor and Holcomb (2012), Baltacioglu et al.(2007). Some examples of items are: "Our hospital supply chain can respond in a fast manner to customers' (i.e. patient's) medical needs". Supply Chain Collaboration (SCC) was measured with a Three-item scale - (Belhadi et al., 2021) - Dubey et al. (2020), Srinivasan and Swink (2018). Some examples of items are: "We continuously share our resources (i.e., data, information, knowledge, and infrastructure) with our suppliers, partners ...etc.". Adaptive Capabilities (AC) was measured with a Three-item scale (Belhadi et al., 2021) - Tarafdar and Qrunfleh (2017), Srinivasan and Swink (2018). Some examples of items are: "We can rapidly adjust capacity to accelerate or decelerate production in response to external changes". The Cronbach's alpha for SC capabilities was 0.913.
Healthcare SC performance was measured with a five-item scale (Mandal, 2018) - Chen et al.(2013). Some examples of items are: "The flow of patients in our hospital supply chain is considerably improving over time". Cronbach's alpha for the Healthcare SC performance scale is 0.731.

Data Analysis

Because the study used a cross-sectional research design, the risk of common method variance producing biased estimates exists. The statistical package for social sciences (SPSS v.22) and Jamovi 2.3.28 were used for the analysis. To test the moderation hypothesis, we used the PROCESS macro developed for SPSS by Hayes (2022).

Results

Table 1 provides descriptive statistics and intercorrelations among the study variables.

Table 1: Descriptive statistics, coefficients of correlations and Cronbach's alpha values

Variables	Mean	S.D.	1	2	3
1. Supply Chain Performance	3.88	0.640	0.731		
2. Risk Culture	3.56	0.911	0.403***	0.935	
3. Supply Chain Capabilities	4.03	0.633	0.750***	0.481***	0.913

Note: N = 294, *** = p < .001, Cronbach Alpha values are reported in diagonal with bold font, S.D. = Standard Deviation

Common Method Bias (CMB)

Since the present study relies on cross-sectional self-reports, there is a potential for common method bias or variation. To assess this bias retrospectively, we employed Harman's one-factor test, as recommended by Podsakoff, Mackenzie, Lee and Podsakoff (2003). An Exploratory factor analysis without rotation was performed to determine the amount of the common method bias or variation. According to the findings of Harman's one-factor test, The Harman's single factor test showed that 41.8% of the total variance was explained by a single factor, which was less than 50%, indicating that CMB was not problematic for our data. Furthermore, as previously

indicated, the three-factor model suited the data better than the single-factor model, providing additional proof that common method bias was not a problem (Gopalan & Pattusamy, 2020). While the findings of these analyses do not exclude the potential of common method variance, they do show that it is unlikely to considerably affect the interpretations of the results.

Hypotheses Testing

The PROCESS Macro created by Hayes (2022) for SPSS v4.2 was used to test the moderated mediation hypotheses. Model 1 was used to test the hypotheses (Hayes, 2022). We used the bootstrap strategy to handle the non-normal distribution of data (Byrne, 2010). The 95% bias-corrected confidence interval was generated using percentile estimation with 5000 bootstrap samples. The findings are detailed in the next section, which includes tables.

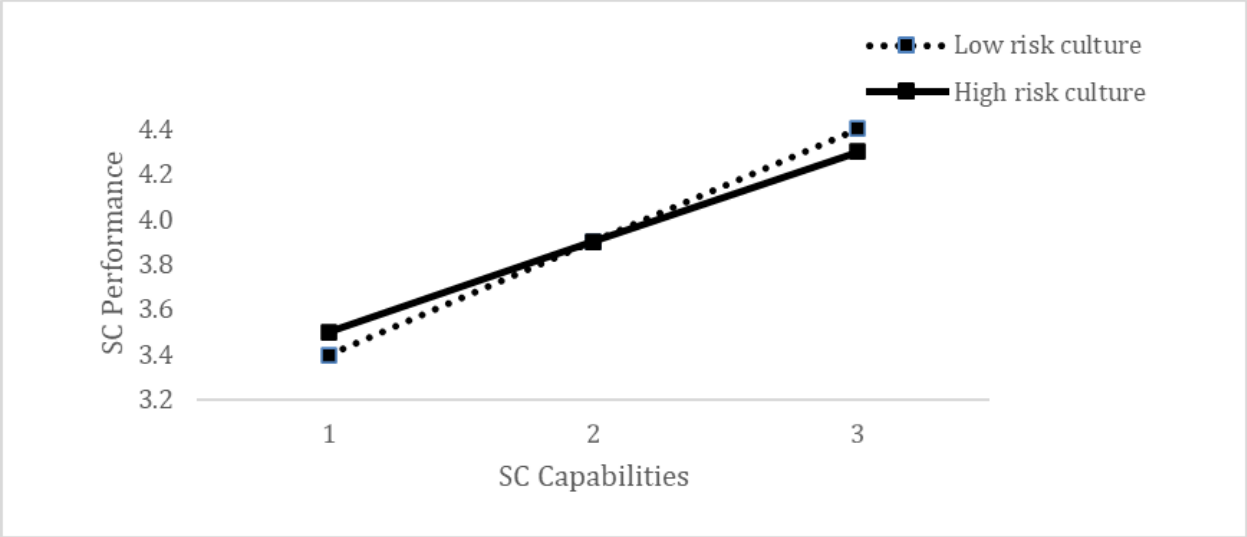
Supply Chain Capabilities is positively related to Supply Chain performance (unstandardised regression coefficient, β=1.15, $p < 0.01$). Hence, hypothesis 1 is supported. In hypothesis 2, the relationship between SC Capabilities and SC Performance was significantly moderated by risk culture (interaction effect=-0.12, CI= -.20, -.04) (refer Table 2). The simple slope effect for this relationship is significant at low level of the moderator (risk culture) (simple slope= .83, CI= -.38, -.15), mean level (simple slope=0.73, CI=.64, .81) and high level (simple slope= .62, CI=.49, .74). Thus, hypothesis 2 is supported. Table 2 shows the results of the regression analysis.

Table 2 Coefficient Estimate for the Moderation Model for Supply Chain Performance

Variables	Dependent Variable: Supply Chain Performance				
	β	SE	t-value	LLCI	ULCI
Constant	-0.87	0.54	-1.61	-1.94	0.20
Supply chain capabilities	1.15	0.14	8.16***	0.88	1.43
Risk culture	0.51	0.16	3.23***	0.20	0.83
Supply chain capabilities x Risk Culture	-0.12	0.04	-3.05***	-0.20	-0.04
R^2	0.58				
F value	132.81***				

Note: N=294, β - Unstandardized regression coefficients, SE- Standard Error, ***p<0.01, LLCI-lower level of confidence interval, ULCI-upper level of confidence interval

Figure 2 shows the interaction effect between SC Capabilities and SC Performance at low and high levels of risk culture.



Research Limitations and Prospects for the Future

First, the study was conducted in the state of Andhra Pradesh, India, and cannot be generalised to the rest of the world because of cultural variability. Second, we primarily focused on the healthcare sector, and there is a scope for future research in other industries with distinct operational dynamics. Third, because of the evolving nature of supply chains and risk environments, it is crucial to recognise that the dynamics of supply chains and associated risks are subject to change over time. Fourth, the research may rely predominantly on one research method or data source. A mixed method approach, combining qualitative and quantitative methods, could provide a more comprehensive understanding of the phenomena under investigation.

Conclusion

This research has provided insightful information on the relationship between supply chain performance, capabilities, and the significant impact of supply chain risk culture. Through a thorough analysis of the interactions between these variables, we have discovered important insights that provide a basis for improving supply chain tactics in the healthcare industry. The supply chain capabilities—adaptability, agility, and collaboration—have been shown to play a critical role in the study.

Additionally, the research has highlighted the importance of supply chain risk culture as a crucial moderator. The association between supply chain performance and capabilities is greatly impacted by the existence of risk culture. The positive relation between supply chain performance and capabilities is weakened when risk culture is more prominent, and the link is strengthened when the risk culture is less prominent.

This research is an important step toward better understanding the complex dynamics that drive supply chain performance. Recognising the critical role that supply chain risk culture and capabilities play, firms can strengthen their supply networks to not only withstand shocks but also emerge stronger and more flexible in an ever-changing global context.

Ethical Standard Adherence

Ethical Approval for conducting the study was provided by the institution's ethical committee as the study has human participation. Consent was obtained from the individuals before the participation.

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