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Antecedents of Risk Information Sharing & Processing Mechanism in Supply Chain: A social and technical Perspective

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Abstract

This paper emphasizes Supply Chain Risk Management (SCRM), whose execution can boost an organization's resilience and operating performance. Drawing on quantitative data from 231 supply chain professionals in various industries, the results highlight that subcomponents of SCRM—specifically strategy alignment and technology usage—significantly influence risk information sharing, analysis, and evaluation. Abstract Surprisingly, an SCRM-oriented culture does not significantly affect the exchange of risk information or the amount of risk partnership. At the same time, team support has insignificant effects on risk analysis and assessment. From these insights, it is evident that although having a culture of SCRM in place and some team involvement is beneficial, they could not, altogether, pave the way toward the organizational capability of evaluating and disseminating risk-related information. In its place, the emphasis on aligned SCRM strategy and technological advancement in the supply chain sector becomes a critical factor for risk mitigation. This suggests an absolute imperative for managers: to facilitate a technological-enabled SCRM approach that is collaborative, in line with the strategy, and allows integrated information processing. Fortifying these domains can help minimize weaknesses, increase response, and streamline the supply chain performance; continuous monitoring and improvement of information dissemination processes are essential, as they facilitate better risk management across the supply chain network.

Keywords: *Supply chain risk management, Information, processing mechanism, operational performance.*

Introduction

The importance of managing risks within supply chains is growing as the global economy becomes more volatile, alongside business trends like outsourcing and advancements in information technology. (Revilla & Sáenz, 2014; Son & Orchard, 2013; Tang, 2006a; Zsidisin & Wagner, 2;10). This shift has led to intricate global supply chains and heightened international competition. By leveraging distributed resources within supply networks, companies can strengthen their capabilities and boost their competitive edge. Firms must understand the interconnections within their supply chains and assess potential risk factors, including their likelihood, impact, and complexity. (Priem & Swink, 2012).

The authors conducted a systematic literature review in this section, providing researchers with an understanding of the primary domains of supply chain risk management and highlighting several subprocesses such as risk identification, risk assessment, risk mitigation, and further risk handling activities. Specific theories are proposed to improve comprehension: value-focused process engineering to define risks, graph theory for risk assessment, the information processing perspective, and resource dependence theory for response tactics. (Zsidisin et al., 2004; Bode & Wagner, 2010).

Information processing theory views corporations as systems designed to handle information. To remain responsive to their environment, they must effectively gather, interpret, and act upon relevant data. In the context of supply chain risks, this information may encompass hazards related to inventory, logistics, market conditions, political factors, technological shifts, or weather events. (Daft et al., 1987; Daft & Weick, 1984). The mechanism involves three critical subprocesses: the exchange of risk information, risk analysis, and a risk-sharing system.

The success of TQM, Six Sigma, and ERP practices in the integrated supply chain is attributed to factors such as culture, people, and strategy. Nevertheless, the influence of such features seems to have yet to be investigated. A corporate culture and philosophy of risk management could facilitate or be detrimental to risk management. Organizations that take risks foster creativity and innovation, leading to increased operational efficiency (Das and Joshi, 2007). Investing in risky activities encourages daring actions and product and service development innovation.

The socio-technical system view suggests that a firm's effectiveness relies on integrating social and technical systems. It suggests that relationships and technologies are crucial in addressing supply chain challenges. This perspective emphasizes the importance of combining social and technical aspects for improved productivity (Autry et al., 2010).

Based on the above, five organizational antecedents are proposed, namely (1) SCRM culture,(2) SCRM team support, (3) SCRM strategy alignment, and (4) Technology internalization to a supply chain risk information processing system.

Statement of the Problem

In the literature, there are also minimal studies in terms of information that have not investigated risk moving averages and the effectiveness of risk management processes and their performance (Richey et al., 2010; Fan, 2016; Qingxing et al., 2016) together with social and technical components of supply chain management in the same study (Fan, 2016). Distributing the benefits of implementing supply chain risk management systems and analyzing the impact of organizational characteristics on using SCRM is a necessary step. The risk evaluation model for comprehensive risk mitigation in supply chains—Untapped measures supply chain partners' participation and their proactive mechanisms to avoid uncertainty (Baofeng et al., 2016).

Significance of the study:

This paper investigates the impact of organizational features, inner mechanisms, and effects on organizational performance. Organizational features have been analyzed, including how they affect supply chain risk management and ultimately affect organizational performance by lowering supply chain risks. The impacts of social behaviors within the firm have been analyzed. The importance of information processing mechanisms within organizations has been investigated. Technical factors have also been focused on, specifically information technology.

Literature Review

The IPT and IPS theory helps us understand the risk process in the supply chain. IPT emphasizes subjective judgment and assessment of behavior intention or attitude toward performing a required task, whereas IPS focuses on the role of an organization in producing work units to collect, process, and transmit information effectively (Daft et al., 1987; Galbraith, 1973; Tushman & Nadler, 1978). Globalized production and natural disasters fail to track technological

disruptions and shifts in exchange rates and markets, and IPT accentuates the need for supply chain risk information (IPT 2013). The theory has been employed to examine several contexts of operations and supply chain management (including outsourcing (Handley & Benton, 2013), supply chain integration (Schoenherr & Swink, 2012), information systems (Williams et al., 2013), technology transfer (Handley & Benton, 2013), new product development (Williams et al.).

Dong and Cooper (2016) emphasize the importance of managing supply chain risks for business success. They propose an Orders-of-Magnitude AHP (OM-AHP)--based ex-ante supply chain risk assessment model for comparing tangible and intangible elements influencing risks. The process involves risk identification, assessment, ranking, and analysis, organized in a 2-way risk matrix. Risk assessment is challenging for managers (Hallikas et al.,2004).

Min et al. Performing qualitative meta-analysis, Ritchie (2016) investigated whether implementing supply chain security can reduce the likelihood of disruption. Firms take disaster disruption management less seriously than it deserves because they see it as a low probability. While resource configuration and risk management infrastructure contribute to a firm's resilience, the study found that how they interact with a supply chain disruption is also an essential factor that can exacerbate or mitigate an overall negative impact on that resilience. Our findings suggest that corporate responses to disruption vary based on their crisis navigation orientation toward managing risk. More stringent monitoring regarding security compliance led to less frequent disruptions, while safety stock adversely affected the number of supply chain disruptions experienced by the firm.

The research conducted by Kurniawan, Zailani, Iranmanesh, and Rajagopal (2016) investigated the effect of vulnerability mitigation strategies on supply chain effectiveness. Utilizing 218 questionnaires from medium- to large-scale manufacturing firms in Indonesia, the research found that supply chain visibility, effectiveness, and supplier development positively impact supply chain effectiveness. These effects were also moderated by risk management culture, which implies that growing participation by senior management and employees accompanies the establishment of these strategies. The study says risk management culture is critical to improving supply chain vulnerabilities and increasing supply chain effectiveness.

Jin and Ryan (2015) analyzed the effect of joint supply chain risk management (SCRM) on financial performance. This resulted in two joint practices (risk information sharing and risk sharing mechanisms). A total of 510 Chinese manufacturers were included in the study, and confirmatory factor analysis (CFA) and measurement models were used. The outcomes indicated that risk information-sharing and risk-sharing mechanisms were related to financial performance. The results also proved that a shared SCRM understanding between partners improves the efficiency of the risk-sharing mechanism. This study highlights the need for cooperative practices among supply chain partners for successful SCRM.

Hypothesis Development

A great deal of information regarding risk analysis and risk assessment needs to be shared among the supply chain members for effective information sharing; therefore, operating under a common framework is required, which is Supply Chain Risk Management (SCRM) (Pfohl et al., 2010). Managers can assess a consistent risk evaluation standard, making risk information sharing more accurate and reliable. An organizational culture built around supply chain risk is imperative for business success and continuity of operations. A risk management culture is necessary for strengthening a firm's internal and contextual status (Chen et al., 2013), a perspective that supports inter-organizational standards and perceptions among supply chain partners and thus helps enhance organizational performance.

H1a: SCRM culture diffusion positively and significantly influences risk information sharing.

H1b: The culture of SCRM diffusion substantially impacts the analysis and assessment of risk.

The supply chain risk management (SCRM) team is integral to firms' ability to share and assess supply chain risk information. Cross-functional, multi-disciplinary teams help share information between partners, and an innovative and collaborative team is well qualified to address challenges presented by international supply chains. Traditional and risk analysis technique-conscious teams can develop reasonable risk analysis and evaluation (Zsidisin & Ritchie, 2008).

H2a: Impact of SCRM team support on risk information sharing.

H2b: SCRM team support is highly significant in risk analysis and evaluation.

Strategy alignment connects SCRM strategies with supply chain and firm strategies and is categorized as part of strategic supply chain management (SCRM) [25]. Such relates plans and the consensus of various management members and provides a clearer understanding of supply chain risks. It will increase information availability, decrease transaction costs, and provide a more effective risk assessment process (Christopher & Peck, 2004), thus making decision-making easier.

H3a: The positive quality, which is SCRM strategy alignment, has a significant influence on risk information sharing.

H3b: Alignment of SCRM strategy significantly influences risk analysis and assessment.

In transaction cost economics (TCE), risk information sharing lowers the magnitude of SCRs between departments and supply chain partners, lowering opportunistic behaviors and facilitating innovative monitoring and cautionary systems. With this, the firms can properly assess and analyze possible SCRs and impacts (Sodhi & Tang, 2012).

H4: Risk information sharing influences risk analysis and assessment

Communication of risk information is one of the leading strategies supply partner firms can adopt to avoid opportunism and guarantee the safety of the entire supply chain system. Frequent exchange of supply chain risk information (SCR) orients firms on imminent threats. It allows them to manage contingencies efficiently, increasing the efficiency of the risk-sharing mechanism (Kleindorfer & Saad, 2005).

H5: Sharing risk information influences risk-sharing arrangements.

Partners can create a transparent and robust risk-sharing system by sharing who has what responsibility for SCR. Recurrent risk monitoring and evaluation gives access to the latest knowledge and interventions to better understand events and re-describe crisis management roles. The solution gives the companies an agreed view of risks and emerges in dependence on plans and resources. (Bogataj et al, 2015; Hallikas et al, 2002; Sodhi & Tang, 2012).

H6: Risk assessment and estimation significantly affect risk-sharing arrangements.

Risk-sharing gadgets could support business performance by mitigating goal constraints and reconciling goals and the effort to reduce risk with risk response. This then translates to higher performance over time and design accuracy. It facilitates order processing at lower latency and

offers immediate information to partners, thus enabling them to anticipate delivery performance better and adapt to new market demands and needs. It also permits proper cost and benefit allocation to risk events to achieve a unified supply chain for enhanced performance (Faisal et al., 2006; Li et al., 2015; He, 2017).

H7: The risk-sharing model impacts the performance of the operation

New Supply Chain Agenda: SCT is critical for Supply Chain effectiveness. The IT competence helps inter-organizational and system cooperation. SCT internalization: Solutions with technologies addressing supply chain problems, enhancement of external information integration, and technologies used across all business functions for internal information integration (Kim & Lee, 2010; Stank et al., 2011).

H8a. SCT internalization has a significant impact on risk information sharing.

H8b. SCT internalization has a significant impact on risk analysis and assessment

Research Methodology

Our study uses a quantitative approach, and statistical tools cater to the results. After applying the empirical statistical tools, results depict the relationship between variables by hypothesis testing.

Research Purpose

The research aims to evaluate the effect of organizational antecedents (SCRM Culture, SCRM Team support, SCRM Strategy, Supply Chain technology internalization) on the firm's operational performance.

Target Population

The target population for this study is manufacturing concerns in Pakistan. Moreover, the observations gathered from the most active staff that is involved in the day-to-day operations of the supply chain of a manufacturing concern

Sample Size and Data Collection Method

This study's sample size is 231 respondents, which complies with Tabachnick and Fidell (2007). The selected population should have 1 to 15 years of experience.

Measurement instrument

A questionnaire based on literature was used to capture SCRM culture, SCRM team support, SCRM strategy, internalization of supply chain technology, risk analysis, and risk sharing. In turn, they were used to measure operational performance in the firm.

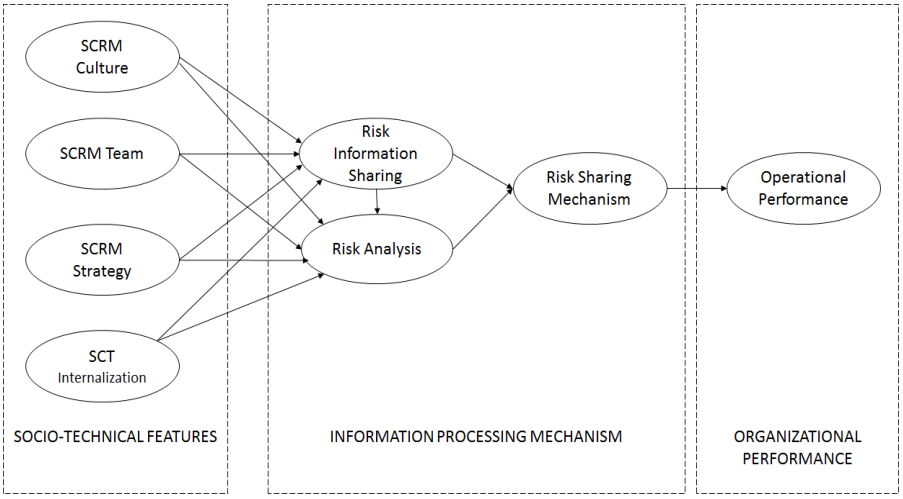
Statistical technique

A pragmatic approach was undertaken to investigate academically relevant variables across different manufacturing firms across Karachi through logical analysis, subjective experience, and observation, thereby increasing the transferability of theory (Morgan, 2007) and background about causal linkages from a quantitative point of view.

Ethical consideration

Emphasizing ethics, the researcher guarantees that the respondents' anonymity, confidentiality, and privacy are protected and will not be disclosed to anyone outside the research report. The questionnaire respects the principles of Fouka and Mantzorou (2011), and the participants have the right to abandon the study at any time.

Figure 1
Conceptual Framework



Discussion and Analysis

Reliability Analysis

The SMART PLS analysis evaluates construct reliability and validity using factor loadings, Cronbach's alpha, composite reliability, and average variance. (Campbell and Fiske, 1959).

Table 1
Convergent Validity / Reliability Testing (Campbell & Fiske, 1959)

Construct	Items	CR	AVE
Risk Info. Sharing	5	0.846	0.580
Risk Analysis	5	0.834	0.503
Risk Sharing Mech.	3	0.845	0.647
SCRM Culture	4	0.831	0.553
Operational Performance	3	0.776	0.537
SCRM Strategy	3	0.828	0.616
SCRM Team	6	0.870	0.529
SC Technology	4	0.800	0.501

Path Analysis

Path analysis and blindfolding reveal a significant impact of independent variables on dependent variables, except psychological empowerment on employees' innovative behavior at a 5% significance level (Kock, 2016).

Table 2
Hypothesis Testing (Kock, 2016)

Variables	Coefficient	T Statistics	P Values	Status
SCRM Culture -> Risk Inf. Sharing	-0.124	1.670	0.095	insignificant
SCRM Culture -> Risk Analysis	0.153	2.187	0.029	Significant
Risk Inf. Sharing -> Risk Analysis	0.206	2.456	0.014	Significant
Risk Inf. Sharing -> Risk Sharing Mech.	0.316	4.443	0.000	Significant
Risk analysis -> Risk sharing Mech.	0.219	2.770	0.006	Significant
Risk sharing -> Operational performance	0.671	14.505	0.000	Significant
SCRM Strategy -> Risk Inf. Sharing	0.134	1.984	0.047	Significant
SCRM Strategy -> Risk Analysis	0.163	2.191	0.029	Significant
SCRM Team -> Risk Inf. Sharing	0.342	5.377	0.000	Significant
SCRM Team -> Risk Analysis	-0.017	0.213	0.832	insignificant
SC Tech -> Risk Inf. Sharing	0.454	6.115	0.000	Significant
SC Tech -> Risk Analysis	0.222	2.503	0.012	Significant

Here is the interpretation of the variables based on the coefficients, t-statistics, p-values, and their significance status:

1. **SCRM Culture**
   - **Risk Information Sharing:** The coefficient (-0.124) is not statistically significant (t-statistic = 1.670, P-value = 0.095), indicating culture does not significantly affect risk information sharing.
   - **Risk Analysis:** The coefficient (0.153) is statistically significant (t-statistic = 2.187, p-value = 0.029), suggesting that SCRM culture positively influences risk analysis.
2. **Risk Information Sharing:**
   - **Risk Analysis:** The coefficient (0.206) is statistically significant (t-statistic = 2.456, p-value = 0.014), indicating a positive relationship between risk information sharing and risk analysis.
   - **Risk Sharing Mechanism:** The coefficient (0.316) is statistically significant (t-statistic = 4.443, p-value = 0.000), suggesting that risk information sharing positively affects implementing risk-sharing mechanisms.
3. **Risk Analysis:**
   - **Risk Sharing Mechanism:** The coefficient (0.219) is statistically significant (t-statistic = 2.770, p-value = 0.006), indicating that risk analysis influences the implementation of risk-sharing mechanisms.
   - **Operational Performance:** The coefficient (0.671) is highly statistically significant (t-statistic = 14.505, p-value = 0.000), suggesting that risk analysis significantly impacts operational performance.
4. **SCRM Strategy:**
   - **Risk Information Sharing:** The coefficient (0.134) is statistically significant (t-statistic = 1.984, p-value = 0.047), indicating that SCRM strategy positively influences risk information sharing.
   - **Risk Analysis:** The coefficient (0.163) is statistically significant (t-statistic = 2.191, p-value = 0.029), suggesting a positive relationship between SCRM strategy and risk analysis.
5. **SCRM Team:**

- **Risk Information Sharing:** The coefficient (0.342) is highly statistically significant (t-statistic = 5.377, p-value = 0.000), indicating that the SCRM team significantly influences risk information sharing.
- **Risk Analysis:** The coefficient (-0.017) is not statistically significant (t-statistic = 0.213, p-value = 0.832), suggesting that the SCRM team does not significantly affect risk analysis.

6. **SC Tech:**

- **Risk Information Sharing:** The coefficient (0.454) is highly statistically significant (t-statistic = 6.115, p-value = 0.000), indicating that SC tech significantly influences risk information sharing.
- **Risk Analysis:** The coefficient (0.222) is statistically significant (t-statistic = 2.503, p-value = 0.012), suggesting a positive relationship between SC tech and risk analysis.

These interpretations provide insights into the relationships between different variables within the study framework, highlighting which factors significantly influence others and which do not.

Blind Folding

Blindfolding calculates Stone-Geisser's Q^2 value, indicating predictive relevance in a PLS path model. All independent variables have Q^2 values greater than 0, indicating relevance.

Table 3
R Square (Sarstedt et al.,2012)

	R Square	Q^2
Risk Information Sharing	0.508	0.274
Risk Analysis	0.346	0.130
Risk Sharing Mechanism	0.214	0.127
Operational Performance	0.450	0.225

R Square measures the data close to the regression line, also known as the coefficient of determination. The threshold value of R square is greater than 20% (Sarstedt et al.,2012). Blindfolding is a sample reuse technique. It allows for calculating Stone-Geisser's Q2 value (Stone, 1974; Geisser, 1974). A Q2 value more significant than Zero for the latent variable shows that the PLS Path model has predictive relevance for this variable (Hair et al., 2017).

Conclusion and Recommendation

SCRM culture diffusion involves sharing values and beliefs about risk management within an organization and among supply chain partners. It affects responsibility and risk perception. Studies show that SCRM culture positively impacts risk information sharing and risk analysis. However, geographical differences between partners can lead to cultural differences, complicating complex situations for managers. Bureaucratic and egalitarian cultures also impact risk management, with bureaucratic cultures trusting routine procedures (Robert et al. (2012).

SCRM team support is a cross-functional group that supports risk management activities within a firm and supply chain. It helps mitigate adverse risk effects through synergy and regular monitoring. However, it can also negatively impact risk management due to communication and handling issues, leading to delays and impeded decision-making (Couillard, 1995). Proper authority consignment is crucial for effective risk management.

SCRM strategy alignment is crucial for firms to respond to supply chain vulnerabilities like natural calamities, artificial disasters, and financial disasters. It improves response to disruptions and positively impacts risk information sharing, analysis, and assessment. Risk information sharing involves sharing critical and exclusive SCR information, while risk analysis and assessment help identify SCRs and mitigate risks. Aligning SCRM strategies with supply chain strategies enhances risk-sharing mechanisms and helps supply chains foresee risks before they occur.

SCT internalization integrates various technologies into daily operations to improve supply chain management (SCM). It enhances internal information systems, strengthens external information, and supports the Supply Chain Risk Management (SCRM) process. It positively impacts risk information sharing and risk analysis.

Risk-sharing mechanisms involve formal policies and agreements where supply chain partners share obligations and duties for mitigating supply chain risks (SCRs). Without these mechanisms, SCRM practices would not be possible. Knowledge about risk becomes vital as supply chains expand and new partners and markets introduce new risks. Proper information dissemination leads to better operational efficiency, with proper information processes resulting

in more efficient firm performance (Christopher & Lee, 2004; Norrman & Jansson, 2004; Sheffi & Rice, 2005).

Managerial Implications and Future Recommendations

Supply chain risk and technology are crucial for identifying opportunities and addressing challenges in the supply chain. Effective risk management is essential for operational performance (Manuj & Mentzer, 2008a). Managers should closely link risk analysis and identification, adopt mitigation strategies for vulnerabilities, and focus on daily supply chain activities. Strengthening information processing and developing internal collaboration is essential for managing supply chain risk. SCRM strategies should align with business strategies, and regular follow-up meetings between internal departments and suppliers can help address issues. Long-term relationships with suppliers are crucial for trust. Ensure SCRM team support and monitor team coordination. The study found insignificant impacts on risk information sharing and risk analysis and assessment, but more research is needed to validate these findings. This research is being conducted on manufacturing firms. However, industry-specific research, like automotive, pharmaceutical, apparel, cement, etc., could be done to obtain industry-specific results.

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