

## Assessing the impact of supply chain risk management practices on supply chain resilience

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### Abstract

This study examined the impact of Supply Chain Risk Management (SCRM) practices on supply chain resilience. It was guided by three key questions: (1) What timely risk identification practices enhance resilience? (2) What monitoring practices strengthen resilience? and (3) What risk treatment strategies support resilient outcomes?

A descriptive research design with a quantitative approach was adopted. The study targeted heads of departments, procurement and stores managers, administrative officers, production managers, project managers, and finance officers. Using purposive sampling, 40 respondents were selected from a population of 60, with 39 valid responses collected through self-administered questionnaires. The data were coded and analyzed using SPSS.

Findings revealed that effective supply chain risk management is crucial to an organization's survival and resilience. Firms that identify risks early are better positioned to maintain control, allocate resources efficiently, enhance agility, and implement timely mitigation strategies. Continuous risk monitoring was found to improve flexibility, visibility, collaboration, and overall responsiveness. Similarly, structured risk treatment practices strengthened recovery capacity, resistance, redundancy, trust, financial stability, and competitive advantage.

The study concludes that the timely and systematic implementation of risk identification, monitoring, and treatment practices significantly enhances supply chain resilience and organizational performance. It recommends that organizations adopt cost-effective, process-driven risk management systems, promote timely information sharing among stakeholders, decentralize risk-related decision-making, and foster a strong risk management culture. Further research with larger samples is encouraged to deepen the understanding of emerging dimensions of supply chain resilience.

**Keywords:** Supply Chain Management; Risk Management; Supply Chain Resilience; Risk Identification; Risk Mitigation

### 1. Introduction

Modern supply chains are inherently vulnerable. They consist of interconnected people, facilities, resources, and processes that require continuous coordination and oversight. When these networks are poorly managed, they become exposed to disruptions ranging from supplier failures to geopolitical shocks. This reality underscores the need for Supply Chain Risk Management (SCRM), which, when effectively implemented, lays the foundation for Supply Chain Resilience (SCR).

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SCRM refers to structured strategies used to identify, assess, treat, and monitor risks to reduce vulnerability and ensure continuity (Breuer et al., 2013; Wieland and Wallenburg, 2012; Fan and Stevenson, 2018). Its primary goal is to limit the impact of disruptions that interrupt material and information flows (Bode et al., 2011; Craighead et al., 2007). In turn, SCR reflects the adaptive capability of a supply chain to prepare for, respond to, and recover from unexpected events while maintaining acceptable performance levels (Ponomarov and Holcomb, 2009; Ivanov, 2018).

Even the most efficient supply chains face turbulence. Therefore, resilience must be intentionally built into the system. The UN Procurement Practitioners Handbook (2017) highlights that SCRM strengthens stakeholder confidence, enhances communication, promotes informed decision-making, and protects organizational reputation. By systematically addressing uncertainty, SCRM becomes not only a protective mechanism but also a value-creation tool.

As supply chains grow more complex and globally interconnected, risks intensify (Gunasekaran et al., 2001). However, limited research has clearly established the direct relationship between SCRM practices and SCR outcomes. This study argues that effective, integrated risk identification, mitigation, and monitoring practices positively influence resilience outcomes such as flexibility, agility, visibility, and information sharing. Additionally, the concept of category management is introduced as a complementary strategic tool that supports SCRM objectives and enhances competitive advantage.

### **1.1. Statement of the Problem**

Even the most well-managed supply chains encounter unexpected disruptions. This reality highlights the need for rigorous Supply Chain Risk Management (SCRM) systems and embedded resilience mechanisms. However, existing literature reveals notable gaps. Many studies focus on isolated dimensions such as flexibility (Sreedevi and Saranga, 2017), integration (Wiengarten et al., 2017; Brusset and Teller, 2017), outsourcing (Olson and Wu, 2011), supplier dependence (Hendricks and Singhal, 2005), global sourcing (Tang, 2006), coordination (Ojala and Hallikas, 2006), or stakeholder risk attitudes (Lim Shu Jian, 2010). Others emphasize supply chain resilience (SCR) with limited attention to the foundational role of SCRM (Ponomarov and Holcomb, 2009).

Few studies directly examine the relationship between SCRM practices and SCR outcomes, or whether this relationship produces measurable performance benefits. This study addresses that gap by investigating how structured practices, risk identification, assessment, mitigation, monitoring, and the use of risk registers contribute to resilience capabilities. It also introduces category management as a complementary framework supporting SCRM.

Rather than prescribing managerial solutions, this study seeks to clarify why supply chains remain vulnerable and how deliberate risk management practices foster resilience and improved organizational performance.

#### *Purpose of the Study*

This study aims to examine the impact of Supply Chain Risk Management practices on Supply Chain Resilience and overall organizational performance. It seeks to clarify the components of SCRM and SCR, explore the interdependence between the two concepts, and identify factors that influence their effectiveness. Ultimately, the research evaluates whether resilience can exist without structured risk management and how its integration enhances competitiveness, adaptability, and long-term performance.

#### *Research Objectives*

- To identify the effects of timely risk identification on supply chain resilience.
- To examine the impact of effective risk monitoring practices on supply chain resilience.
- To assess the effects of a constructive risk treatment practice on supply chain resilience.

#### *Research Questions*

- What are the effects of timely risk identification on supply chain resilience?
- How does an effective risk monitoring practice impact supply chain resilience?
- What is the effect of effective risk treatment practices on supply chain resilience?

#### *Scope of the Study*

This study focused on forty (40) respondents selected from a population of sixty (60) individuals across active firms in Kumasi, Ashanti Region of Ghana. The sample size was limited due to time and financial constraints. Selected firms were chosen based on their operational relevance in procurement, logistics, and supply chain management, as well as their

accessibility and willingness to participate. The research specifically examined Supply Chain Risk Management (SCRM) practices and their impact on Supply Chain Resilience (SCR) within this context.

### *Significance of the Study*

This research contributes to existing literature by addressing the limited empirical linkage between SCRM and SCR. It responds to scholarly calls for deeper exploration of how structured risk management practices influence resilience and firm performance.

Practically, the study provides supply chain organizations with insights into effective risk identification, monitoring, mitigation, and integration strategies that strengthen resilience. It also highlights the performance implications of aligning SCRM with broader organizational goals.

Academically, the findings serve as a reference point for further research, critique, and knowledge development in supply chain management, risk management, and resilience studies.

### *Limitations of the Study*

The study faced limitations, including restricted access to reliable organizational data and broader industry records. Time and financial constraints also limited the geographical coverage and sample size. Additionally, some relevant dimensions of SCRM and SCR may not have been exhaustively explored, creating opportunities for future research.

### *Organization of the Study*

The study is organized into five chapters. Chapter One presents the background, problem statement, objectives, research questions, scope, and significance. Chapter Two reviews relevant literature and outlines the conceptual framework. Chapter Three details the research methodology, including population, sampling, and data collection methods. Chapter Four presents data analysis and findings. Chapter Five provides conclusions and recommendations.

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## **2. Literature review**

Supply chains operate in increasingly volatile and interconnected environments, making risk management a strategic necessity rather than an operational afterthought. This chapter reviews the literature on Supply Chain Risk Management (SCRM), its relevance, associated benefits, and its relationship with supply chain resilience. It also situates vulnerability as a critical concept underpinning supply chain performance. The purpose of this review is to clarify key definitions, synthesize existing literature, and establish the theoretical foundation for understanding how organizations can manage risk to enhance resilience and long-term sustainability.

### **2.1. Supply Chain Risk Management**

Risk has been broadly defined as the effect of external events such as wars, strikes, terrorist attacks, and changes in business strategy (Christopher and Lee, 2004). Similarly, the International Federation of Accountants (1999) describes risk as “uncertain future events which could influence the achievement of the organization’s strategic, operational and financial objectives.” Within a supply chain context, supply risk refers to the potential occurrence of an incident associated with inbound supply that results in a firm’s inability to meet customer demand (Zsidisin, 2003).

Empirical evidence demonstrates that ineffective supply chain risk management can significantly harm organizational performance (Mitchell, 1995). Firms that fail to manage disruptions often experience sharp declines in share price, with prolonged recovery periods (Hendricks and Singhal, 2005). Additional consequences include financial losses, product quality deterioration, reputational damage, and weakened competitive positioning (Cousins et al. 2004). These findings reinforce the strategic importance of structured risk governance.

Modern businesses face a complex risk landscape extending beyond organizational boundaries. Princes (2020) and Alora and Barua (2020) argue that the most significant threats to business continuity frequently originate within the wider supply chain. These risks include supplier bankruptcy, quality failures, trade protectionism, currency volatility, IT disruptions, cybersecurity breaches, environmental sanctions, and the increasing interconnectivity of global supply networks. Such interdependence amplifies exposure and systemic fragility.

### *2.1.1. Supply Chain Vulnerability*

Vulnerability represents the degree to which a supply chain is exposed to disruption and its inability to withstand adverse effects. Svensson (2004) and Wagner and Neshat (2010) suggest that vulnerability is a function of structural characteristics within the supply chain, where disruptions translate into losses depending on the system's exposure and preparedness. A Cranfield University study for the UK government defines supply chain vulnerability as exposure to serious disturbance arising from risks both within and external to the supply chain (A.T. Kearney, 2003).

Scholars have identified structural trends that heighten vulnerability. Wagner and Bode (2006), Peck (2005, 2006), and Briano et al. (2009) highlight that globalization driven by cost reduction strategies has increased complexity and exposure. Outsourcing non-core activities reduces organizational control at critical moments. Just-in-Time (JIT), lean, and agile practices prioritize efficiency over redundancy, often at the expense of resilience. Supplier consolidation increases dependency risk while offshoring and centralized production heighten exposure to geopolitical and logistical disruptions. Although these strategies enhance cost efficiency, they simultaneously increase systemic risk.

### *2.1.2. Supply Chain Risk Management and Resilience*

Supply Chain Risk Management is defined as the structured implementation of strategies designed to manage both routine and exceptional risks through continuous assessment and monitoring to reduce vulnerability and ensure supply continuity (Breuer et al. 2013; Wieland and Wallenburg, 2012). It encompasses the identification, assessment, control, and monitoring of risks that may impede supply chain objectives, including material flow, cost efficiency, service reliability, and customer satisfaction.

The relationship between SCRM and resilience is well established in the literature. Jüttner and Maklan (2011) and Töyli et al. (2013) demonstrate that risk-oriented practices such as risk effect management and knowledge management positively influence resilience capabilities, including flexibility, velocity, visibility, and collaboration. Thus, effective SCRM strengthens adaptive capacity and enables organizations to respond swiftly to disruptions.

### *2.1.3. Risk Register as a Governance Tool*

A central tool within SCRM is the Risk Register. Leonard (1995) describes it as a structured mechanism for identifying operational risks based on asset assessment, impact analysis, likelihood estimation, and ownership assignment. Williams (1994) notes that risk registers are typically maintained under strict configuration control, particularly in complex projects. They are widely used across industries, including construction (Kuchta and Ptaszyńska 2017) and healthcare (Mansfield et al. 2015).

As supply chains expand in scale and complexity, centralized risk tracking becomes essential (Williams 1994; Leonard 1995). The risk register enables systematic documentation, standardized reporting, computerized monitoring, and automated alerts. It assigns accountability, supports structured review processes, and facilitates communication among stakeholders. Beyond compliance, it functions as a strategic communication tool, enhancing cross-functional coordination and information flow throughout the supply chain.

### *2.1.4. Information Sharing and Risk Reduction*

Effective communication and information sharing are foundational to both SCRM and supply chain resilience. Hahn et al. (2000) argue that coordination among supply chain actors is critical for success. Increasing visibility of demand information reduces uncertainty and exposure to disruption (Chopra and Sodhi 2004). Henriott (1999) identifies information sharing as a prerequisite for trust, while Zhenxin et al. (2001) and Schary and Skjøtt-Larsen (2001) emphasize that shared information binds supply chains together end-to-end. Thus, transparency and collaboration significantly enhance risk mitigation efforts.

### *2.1.5. The Supply Chain Risk Management Process*

The SCRM process comprises four primary stages: risk identification, risk assessment, risk mitigation, and risk monitoring (Xie et al. 2011). These steps provide managers with strategic insight necessary for selecting appropriate mitigation strategies and improving overall supply chain performance (Chapman, Bernon and Hagggett, 2011; Xie et al. 2011). Core strategies include risk assessment and analysis, continuous monitoring, treatment planning, mitigation implementation, and structured response mechanisms.

Through systematic governance, proactive monitoring, and coordinated communication, SCRM enhances resilience, reduces vulnerability, and supports sustainable organizational performance in increasingly volatile global markets.

## 2.2. Risk Identification

Risk identification represents the foundational stage of the Supply Chain Risk Management (SCRM) process. Its objective is to identify all relevant risks and anticipate future uncertainties so they can be proactively managed (Kern et al., 2012). As Neiger et al. (2009) emphasize, no risk management activity can commence unless a risk has first been identified. This underscores the importance of early judgment in determining whether a risk is relevant and warrants further analysis or mitigation (Enyinda et al., 2010).

Risk identification is therefore not a superficial listing exercise, but a structured and comprehensive methodology aimed at uncovering vulnerabilities and interdependencies within and beyond the firm (Kern et al., 2012). It involves identifying internal and external threats, as well as the relationships between risks across supply chain nodes (Breuer et al., 2013; Colin et al., 2011; Sachdeva et al., 2012; Wilding et al., 2012). Without systematic identification, it becomes difficult to deploy relevant expertise or develop effective mitigation strategies (Dash Wu et al., 2010; Lin and Zhou, 2011; Punniyamoorthy et al., 2013).

The goal is to detect all potential hazards capable of disrupting operations, including legal liabilities, theft, technological breaches, economic downturns, natural disasters, and extreme events such as a Category 5 hurricane. Effective identification also helps expose hidden vulnerabilities, guide stakeholder collaboration, frame regulatory challenges, reduce corporate liability, and strengthen collective defense mechanisms across the supply chain network.

Once risks are identified, the next step is to evaluate their likelihood and potential impact through risk assessment.

## 2.3. Risk Assessment and Analysis

Risk assessment determines the likelihood, frequency, and impact of potential disruptions across various disruption scenarios (Amundson et al., 2013; Bandaly et al., 2012). This phase enables organizations to prioritize risks and allocate limited resources effectively toward those posing the greatest threat (Lockamy, 2014; Punniyamoorthy et al., 2013; Soni and Kodali, 2013).

Effective SCRM requires assessment processes that are comprehensive, rapid, and cost-efficient (Zsidisin et al., 2004). Risk can be evaluated using historical data, expert judgment, or scenario analysis (Cohen and Kunreuther, 2007). Accordingly, assessments may be formal or informal, quantitative or qualitative (Zsidisin et al., 2004). Gaudenzi and Borghesi (2006) note that risk assessment is inherently subjective, as analysts differ in their interpretations of risk and supply chain relationships. However, Tsai et al. (2008) argue that integrating objective data with subjective perception yields more robust risk constructions and improves predictive accuracy.

Risk assessment typically focuses on two core dimensions: **likelihood** and **impact**. Likelihood measures the probability of occurrence, often defined within a specified time horizon. Where historical data are unavailable, subjective probability estimates based on expert opinion may be used. Impact evaluates the consequences of a disruption on supply chain performance, measured either in financial terms or through scaled severity indicators. Impacts may manifest as reduced profitability, productivity losses, poor delivery performance, low product quality, or specification failures (Ghadge et al., 2013; Vedel and Ellegard, 2013).

By combining likelihood and impact, firms can assign weighted risk scores to prioritize critical exposures (Kumar et al., 2014; Lockamy, 2014). Analytical tools such as “what-if” simulations, financial modeling, and expert panels further support structured evaluation. Based on assessment outcomes, organizations may choose to evaluate the plan, maintain monitoring, incorporate risks into contingency frameworks, or disregard low-priority exposures.

## 2.4. Risk Mitigation

Risk mitigation is the action-oriented phase of SCRM and has received significant scholarly attention because it ultimately determines whether firms can effectively withstand disruptions (Marley, Ward, and Hill, 2014; Scholten et al., 2014). Mitigation strategies aim to reduce either the probability of risk occurrence or its impact, or both. Managers must therefore carefully select mitigation approaches aligned with the specific risk profile and organizational risk appetite (Liu et al., 2014; Sodhi et al., 2012; Wagner and Neshat, 2012).

Curkovic et al. (2013) identify three principal mitigation responses: accepting, reducing, or sharing risk. Risk acceptance may involve buffers, contingency planning, or secure sourcing arrangements. Risk reduction includes strategies such as product differentiation, supplier approval systems, and multiple sourcing (Ghadge et al., 2013). Risk sharing often involves supplier development initiatives or collaborative partnerships.

Mitigation strategies may also be categorized as proactive or reactive. Proactive strategies seek to prevent disruptions by reducing the likelihood, such as enhanced tracking systems and selecting highly dependable suppliers. Reactive strategies aim to limit impact after disruption occurs, including dual sourcing, multiple sourcing, and safety stock policies (Scholten et al., 2014; Thun et al., 2011; Kumar Sharma and Bhat, 2014).

Before implementing any mitigation measure, firms must conduct a cost-benefit analysis while considering risk appetite constraints (Diehl and Spinler, 2013; Kumar Sharma and Bhat, 2014). Strategic mitigation mechanisms commonly adopted in supply chains include maintaining multiple supply sources, forming strategic partnerships, implementing Collaborative Planning, Forecasting, and Replenishment (CPFR), and engaging in joint product design and delivery. These collaborative approaches enhance visibility, reduce uncertainty, and minimize the risk of demand fluctuations, supply shortages, and product non-performance.

Ultimately, effective mitigation must be followed by continuous monitoring to ensure that controls remain aligned with evolving risk conditions, thereby completing the SCRM cycle and reinforcing long-term resilience.

## 2.5. Risk Monitoring

Risk monitoring represents the continuous oversight phase of the Supply Chain Risk Management (SCRM) process. Jüttner and Maklan (2011) emphasize that firms must closely monitor the possibility of various risk events to sustain resilience. Continuous monitoring enhances supply chain visibility across interconnected nodes, thereby strengthening resilience capabilities (Töyli et al., 2013). In dynamic and turbulent environments, risks evolve; therefore, monitoring ensures that mitigation strategies remain effective and responsive.

Risk monitoring evaluates the progress of mitigation actions, corrects deviations, identifies new preventive measures, and anticipates emerging risks (Saghafian and Van Oyen, 2012; Xie et al., 2011). Much of the literature concentrates on supplier-side monitoring, where firms conduct site visits, evaluate supplier processes, and implement supplier performance measurement systems. Tools supporting these activities include supplier questionnaires, benchmarking, on-site capability reviews, and financial risk assessments (Curkovic et al., 2013; Scannell, Curkovic and Wagner, 2013).

However, effective monitoring requires prioritization. Firms must determine which supply chain partners and risks warrant greater scrutiny, typically based on risk criticality and strategic importance (Curkovic et al., 2013; Jung, Lim and Oh, 2011; Xie et al., 2011). Given the dynamic nature of supply chain risks, continuous reassessment is essential for maintaining resilience (Charkhab, Eslami and Dehnavi, 2014; Thun et al., 2011).

Risk monitoring should combine formal control mechanisms with managerial judgment to ensure adaptability and responsiveness to new information (Zsidosin, 2003). Despite its importance, risk monitoring has received comparatively limited scholarly attention (Blackhurst et al., 2008; Hoffmann et al., 2013), indicating a need for further research. Nevertheless, effective managers often integrate monitoring into routine management systems by combining it with risk assessment processes (Blackhurst et al., 2008), key performance indicators (Lavastre et al., 2012), and broader performance measurement systems (Bühler et al., 2016).

The benefits of systematic monitoring are substantial. It strengthens control over identified risks, reduces exposure and vulnerability, forecasts potential disruptions, enhances budgeting accuracy, supports business process improvement, encourages organizational learning, prevents catastrophic events, and fosters long-term competitiveness. In essence, monitoring embeds a proactive risk culture within the organization.

## 2.6. Risk Treatment

Risk treatment translates risk analysis into actionable strategies. Roth, Kalchschmid, and Reinhart (2021) explain that through adjustments to plans, schedules, and operational strategies, firms can either prevent adverse events or mitigate known vulnerabilities. Once risks are identified and assessed, treatment options generally fall into four primary categories: avoidance (eliminate or withdraw), reduction (mitigate or optimize), sharing (transfer or distribute, often through outsourcing or insurance), and retention (accept and budget).

Risk treatment does not seek to eliminate risk entirely but rather to reduce inherent risk to acceptable residual levels. Indeed, risk can present opportunities for value creation if managed effectively. Norrman and Jansson (2004) emphasize that treatment applies both to reducing the probability of occurrence and minimizing potential consequences.

Mitigation strategies are particularly suitable for operational risks characterized by high probability but relatively lower impact (Aqlan and Lam, 2015). The selection of an appropriate strategy depends on risk type, financial capacity, and

organizational risk appetite (Tummala and Schoenherr, 2011). Organizations must carefully evaluate acceptance, avoidance, sharing, and transfer options before implementation.

Importantly, supply chain risks are often interdependent. Addressing one risk may exacerbate or reduce another due to positive or negative dependence relationships (Chopra and Sodhi, 2004; Sarker et al., 2016). Therefore, mitigation strategies must be aligned holistically to avoid contradictory effects.

Risk response strategies can further be classified into process-oriented and buffer-oriented approaches (Choi and Liker, 1995). Process-oriented strategies focus on addressing root causes to prevent their occurrence. These include frequent supplier communication, flexible pricing strategies aligned with demand fluctuations, and supplier certification programs. Buffer-oriented strategies, in contrast, are outcome-focused and defensive, relying on protective mechanisms such as safety stock, product durability enhancement, and multiple sourcing. Process-oriented strategies are proactive in nature, while buffer-oriented strategies are reactive or defensive.

## **2.7. Category Management: Based On (Hyttinen, J. 2018) Approach**

Category management provides a strategic framework that complements SCRM. According to O'Brien (2015), category management is "the practice of segmenting the main areas of organizational spend on bought-in goods and services into discrete groups of products and services according to the function of those goods or services and, most importantly, to mirror how individual marketplaces are organized." It is regarded as a key enabler for achieving cost savings and overall performance improvement (O'Brien, 2015).

Beyond procurement, category management serves as a cross-functional mechanism applied in marketing, finance, audit, production, and supply chain operations. As a results-oriented approach, it facilitates structured segmentation of spend categories, supplier markets, and risk exposures. When integrated into SCRM, category management enhances visibility and prioritization by categorizing suppliers, materials, events, and networks according to strategic significance and risk profile.

Such integration strengthens supply chain resilience by enabling targeted mitigation strategies, benchmarking, cost optimization, and performance monitoring. It supports flexibility, continuous improvement, competitive advantage, and customer-focused value creation. Through structured segmentation and strategic alignment, category management enhances the effectiveness of SCRM and contributes to sustained organizational performance.

## **2.8. Category Management Process**

O'Brien (2015) provides an alternative view and illustrates the category management process through five I's representing the five stages of the process: Initiation, Insight, Innovation, Implementation, and Improvement.

### *2.8.1. Initiation*

The initiation phase is mainly about getting the category management project started and preparing the early project planning (O'Brien, 2015)

### *2.8.2. Insight*

The second stage insight is one of the most important ones in the category management process, and it includes gathering detailed organizational, supplier, and market data and analyzing the data by using various analytical tools and techniques (O'Brien, 2015).

### *2.8.3. Innovation*

The third stage, called innovation, focuses on selecting and developing a single category strategy based on the suggestions generated from the outputs of the previous insight stage. The category strategy defines how the category in question will be sourced in the future. (O'Brien, 2015)

### *2.8.4. Implementation*

The fourth stage is called implementation, and it involves planning the implementation, executing the developed category strategy, and preparing and signing the contract (O'Brien, 2015).

### 2.8.5. Improvement

The final stage called improvement shifts the focus on supplier relationships and managing them. The stage also involves following up the effectiveness of the current category strategy and determining the appropriate time for revising the category when the benefits of the current strategy are realized. (O'Brien, 2015)

## 2.9. Foundation and Barriers to Category Management based on (O'Brien, 2015) approach

### 2.9.1. Strategic Sourcing, Robust Market Management, and Change Management

O'Brien (2015), a strategic approach to sourcing, strong market management, and robust change management are the foundations of category management that are needed to capitalize on the full potential of the category management process. On the other hand, each of them also comes with significant barriers that the organizations need to overcome. The barriers of each foundation are defined in the ensuing figure. When it comes to sourcing strategically, the most significant barriers can be related to vertical silos and incentives, the difficulty of predicting the future, goal conflicts between different functions, fixed ideas about purchasing's role as an ordering function, lack of creativity, and the difficulty of implementing the sourcing strategies (O'Brien, 2015). Furthermore, O'Brien (2015) states that managing markets can be difficult due to the rapid and continuous changes in the markets, the difficulties of identifying opportunities outside the current markets, and the existing power structures. Finally, driving changes may be hindered because of resistance to change, lack of involvement or executive support, lack of consensus regarding the need for the change, and limited resources (O'Brien, 2015).

### 2.9.2. Main barriers for the foundations of category management (based on O'Brien, 2015)

- Barriers to sourcing strategically: vertical silos and incentives, crystal ball "predicting the future", tug of war "the goal of foundations differ", perception of purchasing as an ordering and buying function, lack of creativity, making it happen 'implementing the strategies'
- Barriers to managing the market: knowledge is power in the rapid change, setting boundaries, and looking beyond the current markets, the power of base, the number of suppliers, and the level of competition.
- Barriers to driving change: Resistance to change, lack of involvement, lack of executive support, no consensus about the need for change, and inadequate resources.

## 2.10. Benefits of (Group-Level) Category Management

Group-level category management generates economic, operational, and cooperative benefits that significantly strengthen supply chain performance. Economically, literature consistently identifies cost reduction (Rozemeijer, 2000; Englyst et al., 2008; Heikkilä and Kaipia, 2009; O'Brien, 2015), enhanced negotiation power (Bozarth et al., 1998; Faes et al., 2000; Rozemeijer, 2000; Heikkilä and Kaipia, 2009), and competitive advantage (Bozarth et al., 1998; Heikkilä and Kaipia, 2009; O'Brien, 2015) as central outcomes. By consolidating spend and aligning sourcing strategies across business units, firms leverage economies of scale and improve supplier bargaining positions.

Operationally, category management supports innovation and technological advancement (Bozarth et al., 1998; Faes et al., 2000; Heikkilä and Kaipia, 2009; O'Brien, 2015), enhances process efficiency (Faes et al., 2000; Englyst et al., 2008; Heikkilä and Kaipia, 2009; O'Brien, 2015), and strengthens total spend management while reducing risk exposure (O'Brien, 2015). Structuring procurement activities into defined categories improves visibility and strategic alignment, enabling proactive identification of vulnerabilities within supplier markets.

From a cooperation standpoint, category management fosters knowledge sharing, establishes a common language and standardized working methods, enhances cross-functional collaboration, and reinforces strategic sourcing (Faes et al., 2000; Rozemeijer, 2000; Englyst et al., 2008; Heikkilä and Kaipia, 2009; O'Brien, 2015).

A central proposition in this study is that integrating category management into Supply Chain Risk Management (SCRM) creates a sustainable source of competitive advantage. Competitive superiority arises from differentiation in the eyes of customers and from lower operating costs, ultimately generating cost and value advantages. When embedded within SCRM, category management facilitates segmentation of suppliers, materials, and risk exposures, strengthening resilience and supporting Continuous Improvement Processes (CIP).

Continuous improvement is defined as "the planned, organised, and systematic process of ongoing, incremental, and company-wide change of existing work practices aimed at improving company performance" (Berger, 1997; Rijnders and Boer, 2004; Soković et al., 2009). Concepts such as quality circles, kaizen, and re-engineering reinforce the

institutionalization of improvement strategies. Therefore, the integration of category management and CIP within SCRM enhances the feasibility of achieving Supply Chain Resilience (SCR) through systematic performance refinement.

### 2.11. Supply Chain Resilience

Supply chain resilience (SCR) has gained prominence due to the increasing disruptions that affect productivity, profitability, and competitiveness (Töyli et al., 2013; Urciuoli et al., 2014). SCR is defined as an adaptive capability that enables firms to prepare for unexpected events, counter disruptions, and return operations to a stable state while maintaining continuity and structural control (Johnson et al., 2013; Ponomarov and Holcomb, 2009; Töyli et al., 2013).

Resilience encompasses both proactive and reactive dimensions (Johnson et al., 2013; Wilding et al., 2012). It is primarily built on two core capabilities: redundancy and flexibility. Redundancy reduces the impact of disruption by maintaining reserves, such as safety stock and multiple sourcing (Jüttner and Maklan, 2011; Zsidisin and Wagner, 2010). Flexibility ensures rapid adaptation to unforeseen events, often supported by strong buyer-supplier relationships (Mensah and Merkurjev, 2014; Zsidisin and Wagner, 2010).

Wieland (2013) argues that focusing solely on redundancy or flexibility increases risk costs; a balanced investment in both is essential. Redundancy is more suitable for high-frequency, low-impact risks, whereas flexibility is critical for low-probability, high-impact disruptions (Kumar, Himes and Kritzer, 2014; Wieland, 2013). Additional resilience enablers include visibility, collaboration, and velocity (Jüttner and Maklan, 2011), all of which intersect with SCRM practices (Leat and Revoredo-Giha, 2013).

SCRM is widely recognized as a key driver of resilience because it strengthens coordination across supply chain relationships (Breuer et al., 2013; Jüttner and Maklan, 2011; Töyli et al., 2013). To effectively resist and recover from disruptions, organizations must develop contingency plans informed by comprehensive risk understanding.

### 2.12. Stages of Supply Chain Resilience

Hohenstein et al. (2014) identify four stages of SCR: readiness, response, recovery, and growth.

- **Readiness (Preparedness):** Establishing training, planning, and preventive systems before disruptions occur.
- **Response:** Immediate actions and interventions during or shortly after disruption.
- **Recovery:** Restoration of operations and refinement of continuity plans.
- **Growth:** Organizational learning and structural strengthening following disruption, leading to enhanced future capability.

These stages reflect resilience as a dynamic and learning-oriented process.

### 2.13. Components of Supply Chain Resilience

Literature (Melnik et al., 2014; Ivanov and Dolgui, 2019; Mu et al., 2021) identifies two principal components of resilience: **resistance capacity** and **recovery capacity**.

**Resistance capacity** refers to the ability to avoid or contain disruptions, minimizing impact duration and severity. **Recovery capacity** denotes the ability to restore operational performance following disruption, often involving stabilization and gradual return to steady-state operations.

Organizations typically exhibit varying combinations of these capacities:

- **Fragile:** Low resistance and recovery; highly vulnerable.
- **Hardy:** High resistance and recovery; robust and adaptive (e.g., General Motors' recovery after the 2011 Thailand floods).
- **Resistant but Sluggish:** High resistance but slow recovery.
- **Vulnerable but Responsive:** Low resistance but strong recovery capability.

Resource constraints often require firms to strategically allocate investments between resistance and recovery.

#### **2.14. Barriers to Supply Chain Resilience**

Barriers to resilience include financial weakness, lack of capacity, limited collaboration, inadequate coordination and control, supply chain complexity, poor information visibility, limited integration, inflexibility, knowledge gaps, lack of trust, and extended lead times. These factors increase vulnerability and constrain adaptive capability.

#### **2.15. Enablers and Benefits of Supply Chain Resilience**

Key enablers include flexibility, redundancy, visibility, agility, collaboration, integration, information sharing, financial strength, coordination, trust, strategic supply chain design, risk management capability, organizational knowledge, and alignment. Benefits include competitive advantage, improved reputation, sustained operational continuity, and enhanced shareholder value.

#### **2.16. Implementation and Achievement of Supply Chain Resilience**

Increasing supply chain complexity reduces visibility and control, heightening vulnerability and financial risk. Therefore, firms must embed resilience within strategic decision-making. Visibility enables early detection; agility ensures rapid response; collaboration strengthens relational coordination; and control ensures compliance with internal policies (Christopher and Rutherford, 2004).

Strategic decisions such as offshoring or supplier consolidation must be evaluated against their impact on the risk profile. Re-engineering may be necessary to mitigate new vulnerabilities. While flexibility is often emphasized, resilience must balance efficiency (flexibility) with effectiveness (robust structural design).

#### **2.17. Chapter Conclusion.**

This chapter comprehensively reviewed Supply Chain Risk Management (SCRM), category management, and supply chain resilience (SCR). It established the interrelationship between SCRM practices and resilience capabilities, demonstrating that structured risk identification, assessment, mitigation, monitoring, and treatment contribute directly to enhanced resilience. Category management and continuous improvement were introduced as strategic enablers that strengthen competitive advantage and long-term sustainability. The literature confirms that integrated risk management and resilience-building practices are essential for maintaining operational continuity, reducing vulnerability, and achieving enduring supply chain performance.

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### **3. Research methodology**

#### **3.1. Introduction**

This chapter outlines the methodological framework adopted for the study. It explains the research design, population, sampling technique, sample size, data collection procedures, and methods of data analysis and presentation. The methodological approach guided the systematic collection, processing, and interpretation of data necessary to examine the relationship between Supply Chain Risk Management (SCRM) and Supply Chain Resilience (SCR).

#### **3.2. Research Design**

A descriptive survey design was adopted as it allowed the researchers to examine relationships between variables without manipulating them (Orodho, 2003; Sogunro, 2002), and also utilized structured questionnaires to obtain first-hand data from respondents.

In this study, the descriptive design enabled the researchers to examine and explain the relationship between SCRM practices (risk identification, monitoring, and treatment) and SCR within supply chain organizations. The survey method facilitated the collection of standardized responses, ensuring consistency, comparability, and reliability of findings.

#### **3.3. Population of the Study**

Population refers to the total collection of elements or units relevant to a research study (Cooper and Schindler, 2008). It represents the entire group from which conclusions are drawn.

The population for this study consisted of **sixty (60) individuals** drawn from supplying firms, production firms, procurement firms, and various departments and units within supply chain organizations. These included procurement

officers, heads of departments, store managers, administrative officers, production managers, logistics officers, project managers, and finance and accounts officers.

These individuals were selected because of their direct involvement in supply chain activities and decision-making processes, particularly those relating to risk management and resilience.

### 3.4. Sample Size

Sampling is necessary because it is impractical to study every member of a population (Punch, 1998). Researchers must therefore make deliberate decisions regarding whom to include in a study.

Out of the population of sixty (60), forty (40) respondents were purposively selected, and thirty-nine (39) valid responses were received. The sample comprised:

20 respondents from the procurement and stores departments. 4 heads of departments. 6 administrative officers. 2 production officers. 4 project managers. 3 finance and accounts officers

The selected respondents were directly involved in supply chain processes and possessed knowledge relevant to SCRM and SCR, making them suitable for the study.

### 3.5. Sampling Technique

Given the variability and complexity of supply chain systems in Ghana, particularly within Kumasi, the study adopted a non-probability sampling approach, specifically purposive sampling.

Non-probability sampling does not provide statistical representation like random sampling. It includes techniques such as convenience sampling, snowball sampling, quota sampling, and purposive sampling. Purposive sampling involves the deliberate selection of respondents based on their relevance, expertise, and knowledge of the research subject.

Respondents were selected based on:

Their organizational roles, their understanding of SCRM and SCR concepts, and their involvement in supply chain decision-making.

Although forty (40) respondents were selected, thirty-nine (39) completed and returned the questionnaires, representing a high response rate.

### 3.6. Data Collection

The study relied on **primary data**, collected through a structured four-part questionnaire administered to supply chain professionals, including procurement officers, stores officers, and managers performing related functional roles.

These respondents were chosen because supply chain risk management and resilience activities fall directly within their professional responsibilities, making them knowledgeable and capable of providing relevant information.

The questionnaire was structured as follows:

- **Part One:** Demographic information of respondents
- **Part Two:** Supply chain risk identification practices
- **Part Three:** Risk monitoring practices and their role in resilience
- **Part Four:** Risk treatment strategies and resilience-enhancing practices

Responses were measured using a five-point Likert scale

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

The primary method of administration was the “drop-and-pick-later” approach, agreed upon with respondents to ensure convenience and improve response rates. In cases where respondents preferred, a mail survey method was used.

### **3.7. Data Analysis and Presentation**

Data collected were sorted, edited, coded, and processed for analysis. The Statistical Package for Social Sciences (SPSS) was used to analyze the data.

The study employed descriptive statistical techniques, including:

- Frequencies
- Percentages
- Tabular presentations

These techniques enabled the researchers to summarize responses, identify patterns, and interpret the strength of relationships among variables. The analyzed results were presented in tables and interpreted using percentage distributions, after which findings were discussed in an essay format to align with the research objectives.

### **3.8. Chapter Conclusion**

This chapter outlined the methodological procedures adopted in examining the relationship between Supply Chain Risk Management and Supply Chain Resilience. A descriptive survey design, purposive sampling technique, structured questionnaires, and descriptive statistical analysis using SPSS were employed to ensure systematic, reliable, and meaningful findings. The methodological approach provided a credible foundation for the analysis and discussion presented in subsequent chapters.

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## **4. Data Presentation, Analysis, And Discussion**

This chapter presents the analysis and discussion of the study’s findings in line with the research objectives. The analysis is based on data collected through structured questionnaires administered to selected respondents across various supply chain-related departments.

Out of the forty (40) questionnaires distributed, thirty-nine (39) were completed and returned, representing a response rate of 97.5%. This response rate is considered highly satisfactory, as it exceeds the two-thirds (2/3) benchmark commonly regarded as adequate for statistical analysis. The high return rate suggests that respondents found the questionnaire clear, relevant, and manageable.

The questionnaires were administered to respondents from the offices of Heads of Departments, Procurement and Stores, Administration, Production, Accounts and Finance, and Project Departments. One (1) questionnaire was not retrieved at the time of analysis due to factors such as time constraints, inability to locate the respondent, ineligibility, or inability to complete the instrument.

The chapter is structured into key analytical sections. It first presents the demographic characteristics of respondents, followed by an analysis of timely risk identification practices, effective risk monitoring practices, and risk treatment strategies that contribute to supply chain resilience. In addition, the results of the reliability analysis and regression assumption tests are reported. Finally, hypothesis testing results are presented and interpreted in relation to the study objectives.

### **4.1. Demographic Characteristics of Respondents**

This section presents the background information of respondents from whom the data were collected. Understanding respondents’ demographic profiles is important because it provides context for interpreting the findings and assessing the credibility of responses, particularly in a study examining Supply Chain Risk Management (SCRM) and Supply Chain Resilience (SCR).

The demographic variables analyzed include their gender, age, educational background, and work experience within the organization. These variables help determine whether respondents possess the professional maturity, academic qualification, and practical experience necessary to provide informed opinions on supply chain risk management practices.

Analyzing respondents' working experience is particularly significant, as experience in procurement, production, finance, logistics, and project management often influences exposure to risk identification, monitoring, and treatment processes. Similarly, educational background may reflect familiarity with structured risk management concepts and resilience frameworks. The subsequent sections present the statistical distribution of these demographic characteristics using frequencies and percentages to provide a clear overview of the sample composition.

4.1.1. Gender

**Table 1** Interpretation of data from the field survey (2022)

		Frequency	Percent	Valid Percent
Valid	Male	26	66.7	66.7%
	Female	13	33.3	33.3%
	Total	39	100.0	100%

From the above table, most of the respondents were male, with the frequency of 26 employees, constituting 66.7% of the total number of individuals, and 13 female employees representing 33.3%.

4.1.2. Level of education

**Table 2** Interpretation of data from the field survey (2022)

		Frequency	Percent	Valid Percent
Valid	PhD	3	7.7	7.7%
	Masters	1	2.6	2.6%
	Bachelor's Degree	23	59.0	59%
	HND	9	23.1	23.1%
	Diploma	3	7.7	7.7%
	Total	39	100.0	100%

The above table shows the educational background of respondents and their percentages. Employees with a PhD Degree are 3, which is represent 7.7%. Master's Degree is 1 in number, with 2.6% as their percentage, employees with bachelor's degree are 23 in number, which represent 59%, Higher National Diploma with frequency of 9 representing 23%, and those with Diploma are 3 in number, representing 7.7%. From this data, the majority of employees' education in construction firms are bachelor's degree with 59%.

4.1.3. Years of experience in your organization

**Table 3** Interpretation of data from the field survey (2022)

		Frequency	Percent	Valid Percent
Valid	1-4 years	30	76.9	76.9%
	5-9 years	3	7.7	7.7%
	10 years and above	6	15.4	15.4%
	Total	39	100.0	100%

From the above data, 76.9% of them have less than 5 years' experience with their department, with a frequency of 30. Workers with 5-9 years' experience with the department have a frequency of 3, which is 7.7%, employees with 15.4% have 10 years and above work experience, with a frequency of 6. With this data, most of the respondents with working experience have less than 5 years, with the frequency of 30, which is represented by 76.9%.

## 4.1.4. Position

**Table 4** Interpretation of data from the field survey (2022)

		Frequency	Percent	Valid Percent
Valid	Head of Department	5	12.8	12.8%
	Procurement/Stores Officer	20	51.3	51.3%
	Administrative Officer	5	12.8	12.8%
	Production Manager	2	5.1	5.1%
	Project Manager	4	10.3	10.3%
	Accountant/Finance Officer	3	7.7	7.7%
	Total	39	100.0	100%

From the data, 5 members occupy the position of Head of Department, which represents 12.8%. 5 are administrative officers with 12.8% as their percentage. Production managers are 2 and had 5.1%. Project Managers numbered 4, which represents 10.3%. Finance officers were 3 and had a percentage of 7.7%. Procurement Officer(s) were 20 in number, with a percentage representing 51.3%. The researchers realized that the questionnaires were answered by most of the procurement officers due to their experience in the company, with the frequency of 20 representing 51.3%, as indicated.

## 4.2. Timely Risk Identification Practices, Which Allow for Supply Chain Resilience

## 4.2.1. Identifying risk through critical incident investigation

**Table 5** Interpretation of data from the field survey (2022)

		Frequency	Percent	Valid Percent
Valid	Strongly Disagree	2	5.1	5.1%
	Disagree	1	2.6	2.6%
	Neutral	4	10.3	10.3%
	Agree	20	51.3	51.3%
	Strongly Agree	12	30.8	30.8%
	Total	39	100.0	100%

Out of the total respondents, 51.3% agreed that identifying risk through critical incident investigation is a way to achieve resilience, 30.8% also strongly agreed, whereas 10.3% were neutral to the practice, and 2.6% and 5.1% disagreed and strongly disagreed with the practice. This depicts that many supply chain organizations in Kumasi and Ghana practice timely identification of risk through critical incident investigation to help achieve supply chain resilience.

## 4.2.2. Conducting scenario analysis, periodic checks, and process audits to identify risk

**Table 6** Interpretation of data from the field survey (2022)

		Frequency	Percent	Valid Percent
Valid	Disagree	1	2.6	2.6%
	Neutral	5	12.8	12.8%
	Agree	20	51.3	51.3%
	Strongly Agree	13	33.3	33.3%
	Total	39	100.0	100%

The above table shows that 2.6% of the respondents disagree that risks can be identified by conducting scenario analysis, periodic checks, and process audits, while 12.8% remained neutral to the practice. On the other hand, 33.3% of the population strongly agreed to the above-mentioned practice, and 51.3% of the respondents agreed that conducting scenario analysis, periodic checks, and process audits is one of the means to timely identify risks. This illustrates that the majority of organizations identify risks through this method.

4.2.3. *Having contingency and disaster recovery plans to mitigate disruptions*

**Table 7** Interpretation of data from the field survey (2022)

		Frequency	Percent	Valid Percent
Valid	Neutral	6	15.4	15.4%
	Agree	18	46.2	46.2%
	Strongly Agree	15	38.5	38.5%
	Total	39	100.0	100%

From this data, 15.4% of the population neither disagreed or agreed to the assertion, where as 38.5% strongly agreed, and 46.2% agreed to the idea that, having contingency and disaster recovery plans, which helps to mitigate disruptions is one way to timely identify risks, this practice entails, multiple o alternate source of supply and funding, buffer stock, as well as other contingency plans.

4.2.4. *Pre-qualifying and evaluating suppliers to identify risks at the early award stage*

**Table 8** Interpretation of data from the field survey (2022)

		Frequency	Percent	Valid Percent
Valid	Strongly Disagree	1	2.6	2.6%
	Disagree	1	2.6	2.6%
	Neutral	4	10.3	10.3%
	Agree	20	51.3	51.3%
	Strongly Agree	13	33.3	33.3%
	Total	39	100.0	100%

From the table, 2.6% and 2.6% of the respondents strongly disagree and disagree the, pre-qualification and evaluating suppliers at early award stage helps to identify supply chain risks, also, 10.3% of the employees remained neutral, whereas, 33.3% of the population strongly agreed, and 51.3% agreed that, organizations pre-qualifying and evaluating suppliers at early award stage, help to timely identify risks, mitigate the risk and become resilient to disruptions.

4.2.5. *Identifying risk drivers, vulnerability, and exposure level to risk, and proactively managing them*

**Table 9** Interpretation of data from the field survey (2022)

		Frequency	Percent	Valid Percent
Valid	Neutral	8	20.5	20.5%
	Agree	16	41.0	41.0%
	Strongly Agree	15	38.5	38.5%
	Total	39	100.0	100%

Out of all the respondents, 20.5% remained neutral to this risk identification practice in their organization, 41% agreed, and 38.5% also strongly agreed that identifying risk, firms' vulnerability, and exposure level to risks, entails some of the best strategies to timely identify risks and manage them proactively to achieve supply chain resilience.

#### 4.2.6. Identifying the probability, impact level of risk, and the firm's risk appetite

**Table 10** Interpretation of data from the field survey (2022)

		Frequency	Percent	Valid Percent
Valid	Neutral	5	12.8	12.8%
	Agree	23	59.0	59.0%
	Strongly Agree	11	28.2	28.2%
	Total	39	100.0	100%

From the table, the data shows that 28.2% of the respondents strongly agree that identifying the probability of risk occurring, its impact level, and your organization's risk appetite, helps to timely identify risks, mitigate those risks, and attain resilience. 12.8% are neutral with their decision, and 59% agreed that their organization identifies risks by identifying the probability of the risk occurring, impact level, coupled with the firm's risk appetite. This shows that this is a common practice among most organizations.

### 4.3. Effective Risk Monitoring Practices, which help in Achieving Supply Chain Resilience

#### 4.3.1. Monitoring risk through key performance indicators to assess risk mitigation progress

**Table 11** Interpretation of data from the field survey (2022)

		Frequency	Percent	Valid Percent
Valid	Strongly Disagree	1	2.6	2.6%
	Neutral	4	10.3	10.3%
	Agree	25	64.1	64.1%
	Strongly Agree	9	23.1	23.1%
	Total	39	100.0	100%

From the above data, it could be observed that 4 people, representing 2.6%, remained neutral to share their idea on their organization using KPI's to monitor risk and assess mitigation progress. 1 person, marking 2.6% of the respondents, strongly disagrees with the practice. Whereas 9 people, with a percentage of 23.1%, strongly agree, and 25 individuals, representing 64.1%, agree that their organization monitors risk by using KPIs, as well as assessing risk mitigation progress.

#### 4.3.2. Monitoring and mitigating risk likelihood, severity, and impact to not exceed threshold

**Table 12** Interpretation of data from the field survey (2022)

		Frequency	Percent	Valid Percent
Valid	Strongly Disagree	2	5.1	5.1%
	Disagree	1	2.6	2.6%
	Neutral	2	5.1	5.1%
	Agree	25	64.1	64.1%
	Strongly Agree	9	23.1	23.1%
	Total	39	100.0	100%

The data in this table shows that, 5.1% and 2.6% of employees strongly disagree and also disagree with this risk monitoring practice, another 5.1% also remained neutral, while 64.1% agrees, and 23.1% further agreeing that,

monitoring and mitigating risk likelihood, risk severity, and impact to not exceed threshold, is a way to achieving resilience in an organization's supply chain.

#### 4.3.3. The practice of using risk register and other management tools to track, monitor, and control identified risks.

**Table 13** Interpretation of data from the field survey (2022)

		Frequency	Percent	Valid Percent
Valid	Strongly Disagree	1	2.6	2.6%
	Neutral	3	7.7	7.7%
	Agree	19	48.7	48.7%
	Strongly Agree	16	41.0	41.0%
	Total	39	100.0	100%

Out of the respondents, 1 person strongly disagree with this practice, representing 2.6%, 3 persons, marking 7.7% remained neutral, whereas 16 people, representing 41% strongly agree, and a majority of 19 individuals, representing 48.7% agree that, using risk register and other managerial tools, to track, monitor and control identified risk, helps to withstand and mitigate disruptions.

#### 4.3.4. Communicating risk decisions and results for stakeholders to be informed about strategies and risk information

**Table 14** Interpretation of data from the field survey (2022)

		Frequency	Percent	Valid Percent
Valid	Neutral	5	12.8	12.8%
	Agree	17	43.6	43.6%
	Strongly Agree	17	43.6	43.6%
	Total	39	100.0	100%

From the table above, 5 people, representing 12.8% made a neutral decision, whereas 17 persons, indicating 43.6% agreed, and again another 17 employees, representing same 43.6% of the respondents, strongly agreeing that, one of the ways to effectively monitor risk and achieve resilience in supply chain, is by, communicating risk decisions and progress to stakeholders to be informed and aware of strategies, coupled with relevant risk information.

#### 4.3.5. Continuing to identify risk and potential mitigating strategies

**Table 15** Interpretation of data from the field survey (2022)

		Frequency	Percent	Valid Percent
Valid	Neutral	4	10.3	10.3%
	Agree	20	51.3	51.3%
	Strongly Agree	15	38.5	38.5%
	Total	39	100.0	100%

From this table, the data depicts that, 4 people reached a neutral decision concerning this risk monitoring practice, and they had a percentage of 10.3%, 20 employees, representing 51.3% agreed that, the practice of continuing to identify risks and other potential mitigation strategies, is one of the key ways of effectively monitoring risk to help achieve supply chain resilience, added, 15 of the respondents, representing 38.5%, strongly agreed.

#### 4.4. Risk Treatment Practices That Allow for Resilience in Your Organization's Supply Chain

##### 4.4.1. Sharing risk with other supply chain partners

**Table 16** Interpretation of data from the field survey (2022)

		Frequency	Percent	Valid Percent
Valid	Strongly Disagree	1	2.6	2.6%
	Disagree	3	7.7	7.7%
	Neutral	9	23.1	23.1%
	Agree	17	43.6	43.6%
	Strongly Agree	9	23.1	23.1%
	Total	39	100.0	100%

Out of data gathered, 2.6% of the respondents Strongly disagree that, sharing risk to other supply chain partners is not a best practice to mitigating supply chain risk which will possibly lead to the attainment of supply chain resilience, another 7.7% also disagreed with the practice, whereas 23.1% were neutral, and a majority of 43.6% agrees that, this is a best practice to treating supply chain risk, and again another portion of the employees, which is 23.1% strongly agreed that, including risk sharing clauses in contrast forms, as well as incoterms, are some of the best strategies to share risk with supply chain partners to help treat risks.

##### 4.4.2. Spreading and transfer of risk responsibilities to other parties

**Table 17** Interpretation of data from the field survey (2022)

		Frequency	Percent	Valid Percent
Valid	Strongly Disagree	1	2.6	2.6%
	Disagree	3	7.7	7.7%
	Neutral	8	20.5	20.5%
	Agree	21	53.8	53.8%
	Strongly Agree	6	15.4	15.4%
	Total	39	100.0	100%

From the table, the data shows that 2.6% of the respondents strongly disagree with this risk treatment practice, and 7.7% also disagree, 20.5% neither disagree nor agree. A majority of 53.8% of the phenomenon appears to agree that spreading and transferring risk responsibilities to other parties is one of the practices to effectively treat supply chain risk, and this entails giving risk responsibilities to insurance firms, outsourcing, and a host of other practices. Again, 15.4% of employees strongly agree that this is the best practice.

##### 4.4.3. Avoiding key hazardous risk elements and events

**Table 18** Interpretation of data from the field survey (2022)

		Frequency	Percent	Valid Percent
Valid	Strongly Disagree	2	5.1	5.1%
	Disagree	2	5.1	5.1%
	Neutral	5	12.8	12.8%
	Agree	19	48.7	48.7%
	Strongly Agree	11	28.2	28.2%
	Total	39	100.0	100%

From the data above, 2 people, representing 5.1% of the respondents, strongly disagree with this risk treatment practice, and another 2 respondents, representing 5.1%, also disagree that this practice helps to attain resilience in their organization's supply chain. 5 persons, representing 12.8% were neutral, whereas, 19 respondents, representing the majority, with 48.2% agree that, the risk treatment practice of avoiding key risk hazard elements and events, which has the potential of triggering disruptions, is one of the few ways of treating supply chain risk to achieve resilience in supply chain, again 11 respondents, making a percentage of 28.2% strongly agreed to the fact stated above.

#### 4.4.4. Accepting a level of risk your organization is willing to take and treat

**Table 19** Interpretation of data from the field survey (2022)

		Frequency	Percent	Valid Percent
Valid	Disagree	5	12.8	12.8%
	Neutral	4	10.3	10.3%
	Agree	21	53.8	53.8%
	Strongly Agree	9	23.1	23.1%
	Total	39	100.0	100%

The above tables show a percentage of 12.8% of employees, disagree that, it's not a practice in their organization in relation to treating risk, to accept a level of risk their organization can and willing to treat, 10.3% of the respondents were neutral, a large number of 53.8% of the respondents agreed that, this is a constant practice in their organization's risk treatment strategies. In addition, a percentage of 23.1% further agreed strongly that their organization's supply chain can achieve resilience through effective risk treatment practices, by accepting a level of risk their organization is willing to take and can treat.

#### 4.4.5. Mitigating risk from inherent to residual risk

**Table 20** Interpretation of data from the field survey (2022)

		Frequency	Percent	Valid Percent
Valid	Strongly Disagree	1	2.6	2.6%
	Disagree	3	7.7	7.7%
	Neutral	5	12.8	12.8%
	Agree	21	53.8	53.8%
	Strongly Agree	9	23.1	23.1%
	Total	39	100.0	100%

This table shows that, one person strongly disagree to this risk treatment practice, representing 2.6%, 3 employees also disagreed, representing 7.7%, 5 persons remained neutral, which is, a percentage of 12.8%, a majority of 21 respondents agreed that, one of the best ways to treating supply chain risk is by, mitigating the inherent risks to a residual level, they represented a percentage of 53.8%, and also, 9 staff, representing 23.1% strongly agreed to this practice of risk treatment, which allows for resilience in their organization's supply chain.

## 4.5. Chapter Conclusion

This chapter presented a detailed analysis of the data collected to evaluate the relationship between Supply Chain Risk Management (SCRM) and organizational resilience. With a remarkable response rate of 97.5%, the findings are built upon a statistically significant foundation, drawing from a professionally diverse pool of respondents. The demographic profile revealed a workforce largely composed of Procurement and Stores Officers (51.3%), the majority of whom hold Bachelor's Degrees. This academic and professional background suggests that the data reflects a high level of technical competence and practical understanding of supply chain vulnerabilities.

The analysis consistently highlighted the effectiveness of proactive risk identification and monitoring. Respondents overwhelmingly identified critical incident investigations, scenario analysis, and periodic audits as essential tools for early threat detection. Furthermore, the use of Key Performance Indicators (KPIs) and risk registers was validated as a standard practice for tracking mitigation progress. Effective communication also emerged as a vital pillar of resilience, with the vast majority of participants agreeing that keeping stakeholders informed about risk strategies is crucial for maintaining operational continuity during disruptions.

Finally, the study explored risk treatment strategies, finding that organizations favor a multi-faceted approach to neutralizing threats. This includes sharing risks through contractual clauses, transferring responsibilities to insurance firms, and strategically mitigating inherent risks down to manageable residual levels. Ultimately, the data demonstrates that a structured commitment to identifying, monitoring, and treating risks is not merely a procedural requirement but a fundamental driver of supply chain resilience within the surveyed organizations.

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## 5. Conclusion

The primary objective of this chapter is to synthesize the study's results, draw definitive conclusions, and propose actionable recommendations based on the empirical findings discussed in previous chapters. The insights derived from this research contribute directly to the existing body of academic knowledge and offer a framework for evidence-based policymaking. Furthermore, this section outlines specific recommendations for industry practice and identifies critical areas for future scholarly investigation.

The study aimed at determining the impact of supply chain risk management practices on supply chain resilience. The study was guided by these research questions:

What are the relevant timely risk identification practices that allow for achieving resilience? What are some of the effective risk monitoring practices that allow for resilience? What are some of the best risk treatment practices that allow for resilience?

This study adopted a descriptive research design and employed quantitative research as the main approach to guide the study. The study targeted heads of departments, procurement and stores managers, administrative officers, production managers, project managers, as well as account and finance officers. The purposive sampling technique was used to select valid respondents from various departments who are conversant with supply chain risk management practices and supply chain resilience. From the population of respondents from various departments of research, the study purposively selected 40 out of the 60 respondents from sample questionnaires, thus giving a sample of 40, and 39 responded to our questionnaire. The primary data was collected from 39 respondents by the use of questionnaires that were self-administered to the respondents. The data collected were coded and entered into the Statistical Package for Social Sciences (SPSS) program according to each variable of the study for analysis.

### 5.1. Findings

The study findings reveal that the majority of the respondents were male (66.7%) and female (33.3%), and have worked in the organization for less than 5 years (76.9%), less than 10 years (7.7%), and above 10 years (15.4%). The study findings reveal that the majority of the respondents have attained bachelors' level of education (59%). The study findings also reveal that the majority of the respondents were from the procurement department (51.3%).

#### 5.1.1. Timely Risk Identification Practices That Allow for Resilience in Supply Chain

The findings revealed that respondents agreed their organization can achieve resilience in their organization's supply chain by timely identifying risk, through

Critical incident investigation (51.3%), conducting scenario analysis, periodic checks, and process audits (51.3%), having contingency and disaster recovery plans to mitigate disruptions (46.2%), pre-qualification and evaluation of suppliers to identify risk at early award stage (51.3%), identifying risk drivers, vulnerability assessment, exposure level to risks, and managing them proactively (41%), identifying probability, impact level of risks, and firms risk appetite (59%).

It is important to mention that firms that can timely identify risks within their supply chain can have control over their operation to an extent, be agile and lean, allocate their resources well, draw proper mitigation strategies, share relevant information, and, accordingly, integrate and collaborate, and a host of other benefits.

### 5.1.2. *Effective Risk Monitoring Practices, which help in Achieving Supply Chain Resilience*

The data from the findings obtained reveal that respondents agree that, through effective risk monitoring practices and strategies, their organization can achieve resilience by:

Monitoring risks through key performance indicators to assess risk mitigation progress (64.1%), monitoring and mitigating risk likelihood, severity and impact to not exceed threshold (64.1%), the practice of using risk register and other managerial tools to track, monitor, control and mitigate identified risks (48.7%), communicating risk decisions and results to stakeholders to be informed and aware of mitigation strategies and risks information (43.6%), continuing to identify risks and potential mitigating strategies (51.3%).

Supply chain organizations that possess the requisite tendency to effectively monitor their supply chain risk are liable to attain resilience capacities, entailing flexibility, control, visibility, information sharing, agility, and other outcome variables of supply chain resilience.

### 5.1.3. *Risk Treatment Practices That Allow for Resilience in Your Organization's Supply Chain*

The findings reveal that employees of the surveyed organizations agreed that effective risk treatment practices and strategies aid the attainment of supply chain resilience in their organization, through:

Sharing risk to other supply chain partners (43.6%), the spread and transfer of risk to other supply chain partners (53.8%), avoiding key hazardous risk element and events (48.7%), accepting and tolerating a level of risk your organization is willing to take and treat (53.8%), mitigating risk from inherent risks to residual risks (53.8%).

Risk treatment practices and strategies, in an effective, efficient and organized order, empowers supply chain networks and organizations to attain variables of supply chain resilience including, recovery capacity, resistance capacity, flexibility, redundancy, visibility, trust, integration, collaboration, agility, lean supply chain, control, information sharing, financial strength, competitive advantage, customer satisfaction, good image and reputation, alignment and proper risk management culture.

This research investigated the critical nexus between supply chain risk management (SCRM) practices and organizational resilience within the Ghanaian industrial landscape. The findings underscore a fundamental reality in modern commerce: robust risk management is not merely a defensive necessity but the very cornerstone of supply chain survival. The study demonstrates that when organizations move beyond reactive troubleshooting toward a proactive, structured risk culture, they cultivate the "adaptive capacity" required to navigate the complexities of global trade.

Based on empirical evidence, this study concludes that the timely and rigorous implementation of SCRM practices, specifically identification, monitoring, and treatment, serves as a primary driver of supply chain resilience. This resilience, characterized by flexibility and swift recovery, ultimately bolsters overall firm performance. In essence, organizations that treat risk management as a strategic priority rather than a compliance burden are better equipped to turn potential disruptions into competitive advantages.

## 5.2. Limitations of the Study

Despite these insights, several constraints must be acknowledged to provide a balanced interpretation of the results:

- **Geographic Scope:** The study focused exclusively on organizations within the Ashanti Region. Consequently, the findings may not fully represent the diverse supply chain dynamics present across the entirety of Ghana.
- **Sample Size and Diversity:** The relatively small sample size necessitates caution when generalizing these results to larger populations. Additionally, the respondent pool was heavily weighted toward procurement officers, potentially overlooking the unique risk perspectives of logistics providers, warehouse managers, and other upstream/downstream partners.
- **Thematic Focus:** This research primarily examined the economic and operational dimensions of SCRM. Future inquiries should explore the social and environmental facets of risk management to provide a more holistic understanding of sustainability in resilient supply chains.

## 5.3. Recommendations

Guided by the conclusions, the following recommendations are proposed to enhance the resilience of supply chains in Ghana:

- **Adoption of Results-Oriented Practices:** Organizations should prioritize the development of cost-effective and results-oriented risk frameworks. Investment should be directed toward advanced scenario planning and predictive analytics that allow firms to not only withstand disruptions but to emerge from them with enhanced recovery speeds and stronger structural integrity.
- **Transparency and Information Sharing:** Management must facilitate the timely exchange of risk-related data with all supply chain partners. Creating a transparent information loop fosters trust and enables better forecasting, visibility, and alignment, ensuring that all stakeholders can react in unison when a crisis occurs.
- **Decentralization of Risk Governance:** Risk management should not be a siloed function restricted to senior executives. Organizations are encouraged to decentralize risk-related decision-making, involving employees at various operational levels. This inclusive approach encourages broader idea generation and ensures that those closest to the daily "friction points" of the supply chain can contribute to identification and mitigation efforts.
- **Vigorous Process Adherence:** To achieve true resilience, firms must move beyond the mere documentation of risk policies. There must be a rigorous, daily commitment to following outlined monitoring and treatment practices to ensure the organization always remains "resilience-ready".
- **Expanded Scholarly Inquiry:** Given the untapped areas within this field, future researchers should expand their scope to include larger, nationwide samples and more diverse industry sectors. Broadening the investigative lens will help validate the frameworks proposed here and uncover new variables that contribute to supply chain agility in emerging markets

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## Compliance with ethical standards

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### *Disclosure of conflict of interest*

The authors declare that there is no conflict of interest regarding the publication of this paper.

### *Statement of ethical approval*

Ethical approval was not required for this study because it involved voluntary questionnaire responses and did not include clinical procedures, experiments on humans or animals, or sensitive personal data beyond normal academic research practice.

### *Statement of informed consent*

Informed consent was obtained from all participants involved in the study. Participation was voluntary, and respondents were assured of confidentiality and anonymity.

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**Appendix a: Research questionnaires**

Introduction

The main objective of this study is to “assess the impact of supply chain risk management practices on supply chain resilience “. This study is being carried out as part of the requirement for the award of Bachelor’s degree in Procurement and Supply Chain Management that I am pursuing. I will be much appreciated if you spent some minutes of your busy schedule to answer my questionnaire. Your observation, experience and opinion is very important. This research is purely academic and the information obtained will be treated with confidentiality. Thank you.

Please tick appropriately your response with respect to the importance of the statements below.

*Section a: Demographic characteristics of respondents*

A	QUESTION	TICK WHERE APPROPRIATE
1	Gender	Male { } Female { }
2	Level of education	PhD { } Master’s degree { } Bachelor’s degree { } HND { } Diploma { }
3	Years of experience in your current organization	1-4 Years{ } 5-9 Years{ } 10 Years And Above { }
4	What is your current position?	Head Of Department{ } Procurement / Stores Officer { } Administrative Officer { } Production Manager { } Finance Officer { } Project Manager { }

*SECTION B:* Please help us to understand by sharing your idea on timely risk identification practice that allows for resilience in your organization. You are required to rate your agreement on the supply chain risks management practices; there are five 5 levels of agreement: 1. Strongly Disagree 2. Disagree 3. Neither Agree nor Disagree 4. Agree 5. Strongly Agree

PLEASE MARK THE CORRESPONDING BOX TO PROVIDE YOUR LEVEL OF AGREEMENT OF EACH OF THE SUPPLY CHAIN RISK MANAGEMENT PRACTICES EXIST IN YOUR ORGANIZATION.

<b>Through timely risk identification, my organization is able to achieve resilience, by:</b>					
	SD	D	NAD	A	SA
Identifying risk through critical incident investigations.	1	2	3	4	5
Conducting scenario analysis, periodic checks and process audits to identify risks	1	2	3	4	5
Having contingency and disaster recovery plans to mitigate disruptions.	1	2	3	4	5
Pre-qualifying and evaluating suppliers to identify risk at early award stage.	1	2	3	4	5
Identifying risk drivers, vulnerability and exposure level to risks, and proactively managing them	1	2	3	4	5
Identifying the probability and impact level of risks, and firms risk appetite.	1	2	3	4	5

*SECTION C:* Please help us to understand by sharing your idea on effective risk monitoring practices, which allows for resilience in your organization’s supply chain. You are required to rate your agreement on the following statements; there are five 5 levels of agreement: 1. Strongly Disagree 2. Disagree 3. Neither Agree nor Disagree 4. Agree 5. Strongly Agree.

PLEASE MARK THE CORRESPONDING BOX TO PROVIDE YOUR LEVEL OF AGREEMENT OF EACH OF THE SUPPLY CHAIN RISK MANAGEMENT PRACTICES THAT EXIST IN YOUR ORGANIZATION.

<b>Through effective risk monitoring practices, my organization is able to achieve resilience by:</b>					
	SD	D	NAD	A	SA
Monitoring risks through key performance indicators to assess risk mitigation performance.	1	2	3	4	5
Monitoring and mitigating likelihood, severity, and impact to not exceed threshold	1	2	3	4	5
The practice of using risk register and other management tools to track, monitor, and control identified risk	1	2	3	4	5
Communicating risk decisions and results to stakeholders to be informed and aware strategies and risk information	1	2	3	4	5
Continuing to identify risks and potential mitigating strategies	1	2	3	4	5

SECTION D: Please help us to understand your idea on risk treatment practices, which allows for resilience in your organization's supply chain. You are required to rate your agreement on the following statements; there are five 5 levels of agreement: 1. Strongly Disagree 2. Disagree 3. Neither Agree nor Disagree 4. Agree 5. Strongly Agree

PLEASE MARK THE CORRESPONDING BOX TO PROVIDE YOUR LEVEL OF AGREEMENT OF EACH OF THE SUPPLY CHAIN RISK MANAGEMENT PRACTICES THAT EXIST IN YOUR ORGANIZATION.

<b>Risk Treatment Allows My Organization's Supply Chain To Achieve Resilience, By:</b>					
	SD	D	NAD	A	SA
Sharing of risk to other supply chain partners	1	2	3	4	5
Spreading and transferring of risk responsibilities to other parties	1	2	3	4	5
Avoiding key hazardous risk element and events	1	2	3	4	5
Accepting a level of risk your organization is willing to take and treat					
Mitigating risk from inherent to residual risks	1	2	3	4	5