INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN ECONOMICS & MANAGEMENT SCIENCES

OPEN ACCESS JOURNAL

Vol 15, Issue 1, (2026) E-ISSN: 2226-3624

Strengthening Supply Chain Risk Management in SMEs: A Contemporary Conceptual Framework

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DOI Link: http://dx.doi.org/10.6007/IJAREMS/v15-i1/27379

Published Online: 13 January 2026

Abstract

Small and medium-sized enterprises (SMEs) are particularly vulnerable to supply chain risks due to limited resources and operational constraints. Existing supply chain risk management (SCRM) frameworks, largely developed for large enterprises, provide limited guidance for SMEs. This study develops a capability-based conceptual framework that links key SME supply chain risks to three resilience-building capabilities: operational flexibility, demand management, and disruption preparedness. Grounded in the Resource-Based View (RBV), Dynamic Capabilities Theory (DCT), and Contingency Theory (CT), the framework explains how SMEs can embed resilience into everyday managerial practices through low-cost and feasible routines. The study offers SMEs specific conceptual insights and a foundation for future empirical research on supply chain resilience.

Keywords: Supply Chain Risk Management (SCRM), Small and Medium-Sized Enterprises (SMEs), Supply Chain Resilience, Operational flexibility, Demand Management, Disruption Preparedness Capability, Resource-Based View (RBV), Dynamic Capabilities Theory (DCT), Contingency Theory (CT)

Introduction

Supply chains are currently exposed to rising levels of uncertainty, reflected in fluctuating transportation conditions, unstable market demand and increasing cost pressures. These changes have intensified the operational risks that enterprises encounter across procurement, logistics and distribution activities. Small and medium-sized enterprises (SMEs) are more vulnerable to these uncertainties because they have limited resources, constrained operational capacity and a narrow supplier base.

Supply chain risk management (SCRM) has therefore become an essential component of supply chain resilience. Existing studies provide extensive classifications of supply chain risks and identify a range of mitigation approaches. However, much of this literature focuses on large enterprises with diversified supplier networks and sophisticated analytical tools. As a result, the applicability of these recommendations to SMEs is limited. Consequently, there remains limited understanding of how SCRM can be effectively applied within resource-constrained SME environments.

Current research has identified multiple categories of supply chain risks, including supply, demand, operational, logistics, financial, and information-system risks (Babu et al., 2021; Gurtu & Johny, 2021). These risks reflect vulnerabilities in both the physical movement of materials and the accuracy and timeliness of information that supports operational decisions. Their combined effects may quickly escalate into performance instability when SMEs lack adequate mitigation capabilities.

This study addresses this SME-focused applicability gap by proposing a conceptual framework for SME SCRM. The framework is based on three key capabilities: operational flexibility, demand management and disruption preparedness capability. These capabilities align with the main risk categories affecting SMEs and provide a structured basis for strengthening supply chain resilience within resource-constrained environments.

Literature Review

Supply Chain Risk

Supply chain risk is generally understood as the potential for uncertain events or conditions to disrupt material, information or financial flows and thereby adversely affect supply chain performance. Prior research suggests that supply chain risks arise from multiple sources, including firm-level operational uncertainties, inter-firm dependencies embedded in supply chain networks, and exogenous disruptive events (Chaudhuri et al., 2020; Emrouznejad et al., 2023). Accordingly, supply chain risk needs to be assessed at the network level rather than at the level of individual firms. Supply chain risk management (SCRM) is therefore defined as a systematic, phased process of identifying, assessing, prioritizing, mitigating and continuously monitoring risks across the network with the aim of stabilizing performance and protecting value creation (Chaudhuri et al., 2020; Gurtu & Johny, 2021; Sultana et al., 2024).

Supply chain resilience is discussed as a capability for coping with disruptions, whereas supply chain vulnerability is treated as an indicator reflecting exposure to disruption risks (Ma et al., 2020; Shishodia et al., 2023; Sultana et al., 2024). Recent studies conceptualize supply chain vulnerability as the susceptibility of supply networks to disruptions and the predisposition of risk factors to overwhelm mitigation efforts (Azadegan et al., 2020; Zavala-Alcívar et al., 2020). Resilience, by contrast, refers to the capacity of a supply chain to withstand, adapt to, and recover from disruptions while maintaining acceptable levels of operational performance (Golan et al., 2020).

The interrelationship among risk, vulnerability, and resilience provides a conceptual foundation for understanding how supply chains respond to disruptions. In particular, SMEs are more exposed to adverse effects when high vulnerability is combined with limited mitigation capacity (Koporcic et al., 2025). This makes resilience-building strategies critical, as they help stabilize performance and enable recovery in resource-constrained environments.

Supply Chain Risk Types Relevant to SMEs

Prior research shows that SMEs typically face supply, demand, operational, logistics, financial, and information-system risks (Babu et al., 2021; Gurtu & Johny, 2021). These risk categories capture disruptions originating inside the SME's own operations. They also reflect risks transmitted through upstream and downstream partners in the wider supply network.

Supply risk emerges when SMEs face supplier unreliability, quality inconsistencies, delivery delays or shortages of critical materials (Babu et al., 2021). Because SMEs often rely on a narrow supplier base and possess limited bargaining power, they have limited buffering capacity, making supplier-level disruptions more likely to result in production delays and stockouts. Demand risk involves volatile order volumes, unpredictable customer behaviour and sudden market shifts. SMEs typically lack advanced forecasting tools and have limited capacity to adjust production or inventory, making them particularly vulnerable to demand-side uncertainty (Barrera-Sánchez & García-Cáceres, 2025; Annamalah et al., 2025). Operational risk refers to breakdowns in internal production and administrative processes, such as procedural errors, equipment failures, or labour skill gaps. Because SMEs often lack efficient processes and quality-control routines, they are highly vulnerable to internal operational disruptions that reduce productivity and increase the risk of delivery and quality failures (Naudé & Chiweshe, 2017).

Logistics risk arises from transportation delays, freight cost fluctuations and cross-border uncertainties that disrupt the movement of goods. SMEs often outsource logistics to third-party providers, increasing their dependence on external partners and raising their vulnerability to delivery disruptions (König & Spinler, 2016). Financial risk is linked to currency fluctuations, credit risk, and liquidity risk (Witantri et al., 2025). In the context of SMEs, weaker financial buffers mean that cost shocks in logistics or sourcing can quickly translate into operational instability. Information-system risk arises when SMEs rely on incomplete, outdated or manually processed data. The absence of integrated digital systems reduces visibility across supply and demand, weakens decision-making and heightens vulnerability to disruptions (Wu et al., 2025; Delgado et al., 2025).

Collectively, these six categories of risks illustrate the multi-layered vulnerabilities that SMEs face across their supply chains. Unlike larger firms, SMEs often experience simultaneous exposure to several of these risks because their limited resources, narrow supplier bases and constrained digital capabilities reduce their ability to buffer disruptions. Understanding how these risks interact to destabilize operations provides a foundation for developing a structured set of capabilities to strengthen SCRM in SMEs, which is the focus of the following section.

Research Gap

Despite increasing scholarly attention to supply chain risk management, most existing SCRM frameworks and practices have been developed with large enterprises in mind (Tang, 2006; Norrman & Wieland, 2020). These approaches typically assume diversified supplier portfolios, advanced digital infrastructures, and dedicated planning functions, conditions that are rarely present in SMEs. As a result, their direct applicability to SMEs is limited, leaving smaller firms more exposed to operational failures, information disruptions, and cascading performance instability.

In response to these limitations, a growing body of research has begun to examine supply chain risks specifically in SME contexts. However, while a limited number of studies have explored interdependencies among supply chain risks, many studies continue to adopt fragmented perspectives that focus on isolated risk categories or individual mitigation practices (Murray & Barajas, 2014; Ferreira de Araújo Lima et al., 2020). As a result, the

interaction and propagation of multiple risk sources across supply chain processes remain insufficiently explored. Consequently, the mechanisms through which concurrent supply, demand, operational, logistics, financial, and information-system risks jointly destabilize SME operations remain insufficiently understood.

Addressing this gap, the present study develops a holistic, capability-based conceptual framework that explains how SMEs can manage interacting and compounding risks under resource constraints. The framework explicitly links multi-dimensional risk exposure to a focused set of resilience-building capabilities. These capabilities reflect the operational and organizational constraints that characterize SME supply chains.

Conceptual Framework for Building Supply Chain Resilience in SMEs

Theoretical Foundation

The proposed framework is grounded in three complementary theoretical perspectives that explain how SMEs can strengthen supply chain resilience under multi-risk exposure. Firm performance is shaped by valuable and difficult-to-imitate internal capabilities (Barney, 1991). In uncertain environments, such capabilities can contribute to greater operational stability. This reasoning is consistent with the Resource-Based View (RBV) of the firm, which emphasizes analysing firm performance from the resource side rather than the product side (Wernerfelt, 1984).

According to the dynamic capabilities perspective, commonly referred to as Dynamic Capabilities Theory (DCT), resilience depends not only on the possession of resources but also on the ability to reconfigure operational routines and adapt to rapid environmental change (Teece, 2007). It is particularly relevant for SMEs given their exposure to frequent fluctuations in supply, demand, and logistics conditions. Through sensing emerging disruptions, seizing appropriate responses, and reconfiguring operational processes, dynamic capabilities enable SMEs to respond proactively to compounding risks rather than reactively absorbing shocks.

Third, Contingency Theory (CT) argues that organizational effectiveness depends on achieving a fit between internal capabilities and environmental contingencies (Donaldson, 2001). In the context of SMEs, such contingencies may include resource scarcity, digital gaps and dependence on external partners, which heighten exposure to disruptions and necessitate tailored SCRM capabilities. This implies that SMEs require tailored SCRM capabilities rather than replicating large-enterprise models. Together, these theories justify a capability-based approach that aligns risk exposure with internal capability needs, enabling SMEs to anticipate, absorb and recover from disruptions more effectively.

Taken together, these three theoretical perspectives provide an integrated foundation for the proposed framework. RBV explains why internal capabilities constitute a critical source of stability and resilience under uncertainty. DCT clarifies how these capabilities are continuously reconfigured in response to disruption, while CT explains why SME-specific constraints necessitate context-sensitive capability design rather than the direct adoption of large-enterprise models.

Resilience Capabilities for SME SCRM

Operational Flexibility

Operational flexibility enables firms to rapidly adjust sourcing, production and inventory decisions to cope with uncertainties and respond to changes in supply or demand conditions (Stevenson & Spring, 2007). It enables firms to swiftly revise sourcing and production arrangements in the event of disruptions, including reallocating orders to alternative suppliers to maintain continuity and minimize the effects of shortages (Kamalahmadi et al., 2021). These adaptations are particularly critical in SMEs, where resource constraints and limited buffers make disruptions more likely to propagate into service failures.

According to the RBV, firm resources that are valuable, rare, and difficult to imitate can serve as sources of sustained competitive advantage (Barney, 1991), which may contribute to more stable performance when firms face environmental uncertainty. In supply chain contexts, operational flexibility constitutes such a capability because it is embedded in firm-specific routines, coordination mechanisms, and experiential knowledge that are difficult for competitors to replicate. It therefore enables firms to respond more effectively to disruptions.

DCT further argues that resilience depends not only on access to resources but also on the ability to reconfigure operational routines and maintain continuity during volatile conditions (Teece, 2007). As SMEs typically operate with resource constraints and limited buffers, flexible adaptation is critical for sustaining operational flow and avoiding cascading disruptions. Therefore, operational flexibility strengthens supply chain resilience by allowing SMEs to maintain continuity of operations, even when confronted with fluctuations in supply availability or internal process disturbances. This capability thus forms a foundational element of the proposed framework for enhancing SCRM effectiveness in SMEs.

Demand Management

Demand management capability can be understood as a firm's ability to anticipate changing customer requirements, integrate demand information across supply chain functions, and align order fulfillment and inventory decisions to respond effectively to market variability (Croxton et al., 2002; Esper et al., 2010). For SMEs, this capability mitigates demand and financial risks by enabling accurate forecasting, timely response to market shifts and reduced exposure to sales volatility. The ability to match production and inventory levels with real market needs reduces the likelihood of stockouts, obsolete inventory and excessive working capital pressure.

According to DCT (Teece, 2007), resilience arises from the ability to reconfigure operational routines under volatility. In this sense, demand-driven planning and replenishment strengthen supply chain resilience by supporting responsiveness to market variability and maintaining continuity of operations (Croxton et al., 2002; Ivanov, 2021). CT posits that organizations should adapt their structures and planning practices to fit contextual conditions such as environmental and task uncertainty, as misfit can reduce performance (Donaldson, 2001). In the case of SMEs, such contingencies often manifest in resource scarcity and limited information capabilities, which constrain formal forecasting and increase reliance on manual coordination processes. By improving demand visibility and communication across supply-chain actors, SMEs can detect early signals of disruption and take pre-emptive actions to stabilize performance. Therefore, demand management capability supports supply chain

resilience by reducing the exposure to demand-related variability and promoting more predictable revenue and operational continuity.

Disruption Preparedness Capability

Disruption preparedness capability can be viewed as the pre-disruption dimension of supply chain resilience, which emphasizes anticipatory planning and continuity measures to mitigate the effects of potential disruptions (Ponomarov & Holcomb, 2009; Chowdhury et al., 2021). It includes commonly recognized preparedness practices such as scenario analysis, contingency planning, inventory buffers, multi-sourcing arrangements, and crisis communication systems that help reduce disruption severity and accelerate recovery. These mechanisms are crucial for SMEs because their limited redundancy and high dependence on external logistics partners heighten vulnerability to supply disruptions and operational breakdowns.

Dynamic capabilities support firms' ability to adapt and reconfigure their operations when faced with disruptions (Teece, 2007), while preparedness focuses on creating such adaptive capacity prior to disruption events to maintain continuity (Ivanov, 2021). CT argues that organizational responses to uncertainty should be aligned with contextual constraints to maintain performance (Donaldson, 2001). For SMEs, this implies that disruption preparedness should be tailored to their resource constraints and reliance on external partners, rather than relying on costly, redundancy-intensive risk mitigation strategies. As a result, SMEs can enhance resilience by developing low-cost preparedness practices such as establishing backup logistics options, maintaining safety stock for critical items, and improving disruption monitoring capabilities. Therefore, disruption preparedness capability contributes to supply chain resilience by ensuring faster recovery and minimizing performance degradation when disruptions occur.

Conceptual Framework

The developed framework is visually presented in Figure 1. It illustrates the logical flow from multi-dimensional risk exposure in SMEs to the development of organizational capabilities, the implementation of operational practices, and the eventual strengthening of supply chain resilience. The leftmost side of the framework reflects the simultaneous and interconnected nature of supply, operational, demand, financial, logistics, and information-system risks that SMEs frequently encounter. These risks act as the initiating drivers that pressure SMEs to strengthen their internal systems and competencies in order to reduce performance instability.

Moving toward the center, the framework positions operational flexibility, demand management, and disruption preparedness as the three core resilience-building capabilities. Each of these capabilities responds to specific risk categories. Operational flexibility is linked to risks arising from upstream uncertainties and operational failures, whereas demand management directly addresses revenue-related exposure stemming from fluctuating market conditions and financial instability. Disruption preparedness corresponds to risks in logistics and information systems where SMEs face heightened vulnerability due to their reliance on external partners and limited technological maturity. Through this structure, the framework emphasizes capability–risk alignment rather than a one-size-fits-all approach to risk mitigation.

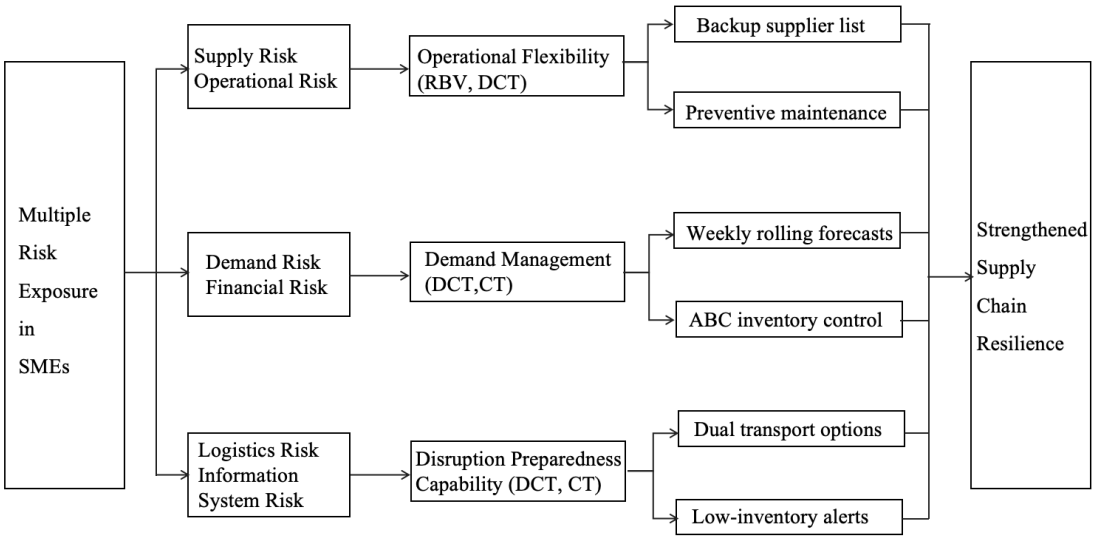

Figure 1: Conceptual Framework for Strengthening Supply Chain Risk Management in SMEs

As attention shifts to the right-hand side of the model, the framework specifies a set of simple operational routines that make the three capabilities actionable in SME settings. In practice, SMEs enhance operational flexibility by maintaining updated backup supplier lists and conducting regular basic maintenance on critical equipment, which allows orders and production to be reconfigured quickly in response to quality problems, delays, or equipment failures. Demand management is put into practice by preparing short-horizon rolling demand forecasts in a simple spreadsheet, updating them regularly with recent sales data, and applying inventory prioritization methods such as ABC classification, in which a small group of high-value or high-volume items is reviewed more frequently and held at tighter safety levels than less critical products. Disruption preparedness is reflected in concrete arrangements such as securing at least two transport options for important routes, for example combining a regular carrier with an express provider, and setting straightforward low inventory alert thresholds in basic software or manual monitoring sheets so that managers are informed as soon as stock of critical items falls below a predefined minimum. Through these low-cost and easy-to-implement routines, SMEs are able to use the three capabilities in a practical way and convert them into more stable operations and improved performance during and after disruptions.

The final element of the framework establishes strengthened supply chain resilience as the intended outcome of these capability-driven interventions. When SMEs successfully align risk exposure, capability development, and operational execution, they are better equipped to maintain continuity of operations, protect revenue flows, and recover more rapidly once disruptions materialize. This integrated model explains how resilience is developed in SMEs and offers practical guidance for managers operating under volatile and resource-constrained conditions. The framework adds to the literature by translating theory into actionable guidance that fits SMEs' constraints, offering a basis for future empirical testing and practice.

Discussion

Strategic Implications

The proposed capability-based framework carries several strategic implications for strengthening supply chain resilience in resource-constrained SMEs. First, it emphasizes that risks in SME supply chains are often interconnected rather than isolated. Disruptions in procurement, production, logistics or sales can quickly escalate across the network when SMEs lack buffers or response mechanisms. By clearly aligning different risk categories with targeted resilience capabilities, the framework enables SMEs to transition from reactive, crisis-driven responses toward more structured and preventative risk governance.

Second, the framework highlights that resilience in SMEs should be developed through adaptable rather than resource-heavy approaches. Operational flexibility, demand-driven decision-making and disruption preparedness all reinforce the ability to detect early warning signals, adjust operations quickly and restore continuity after disruptions. These capabilities provide a balanced pathway for resilience improvement that does not rely on costly systems or large-scale investments, which are often unaffordable for smaller firms.

Third, the framework stresses the importance of tailoring resilience efforts to the contextual realities of SMEs. These firms frequently operate with limited financial margins, manual information flows and high dependence on external logistics and supply partners. Rather than adopting standardized practices designed for large enterprises, SMEs should prioritize approaches that are aligned with their operational realities. They can focus on practical, low-complexity routines such as short-term forecasting, maintaining supplier alternatives, and implementing basic alert mechanisms. Through this lens, resilience becomes an achievable objective even under resource scarcity.

Finally, the framework positions supply chain resilience as a strategic asset that supports long-term business success. SMEs that maintain consistent delivery performance and respond swiftly to disruptions are better positioned to retain customer trust, sustain revenue flows and differentiate themselves competitively in volatile markets. By driving a shift toward proactive capability development, the framework elevates resilience from a passive defensive measure to an active contributor to sustainable growth.

Managerial Implications

The proposed framework offers concrete guidance for SME managers by clarifying how resilience can be embedded into everyday managerial decisions rather than treated as an abstract strategic objective. Its primary contribution lies in translating risk exposure into a small set of actionable managerial priorities that are feasible under conditions of limited resources. First, the framework highlights the importance of operational flexibility as a managerial decision logic, rather than as a structural investment. For SME managers, flexibility does not necessarily require maintaining large buffers or excess capacity. Instead, it involves routinely reviewing supplier dependence, identifying viable alternatives for critical inputs, and ensuring that internal processes allow for rapid switching when disruptions occur. Managerial attention to these issues enables faster response to supply and operational disturbances and reduces the likelihood that localized disruptions escalate into prolonged service failures.

Second, the framework emphasizes demand management as a coordination capability that links market signals with operational execution. Managers play a central role in ensuring that demand information, even when collected through simple tools, is consistently incorporated into inventory and production decisions. Regular short-term forecasting, frequent review of sales deviations, and prioritization of high-impact products allow SMEs to stabilize cash flow and reduce exposure to demand volatility. From a managerial perspective, demand management thus becomes a mechanism for balancing responsiveness and control rather than a purely analytical function. Third, the framework positions disruption preparedness as an anticipatory managerial practice embedded in routine planning activities. Rather than relying on formal risk departments or complex simulations, SME managers can enhance preparedness through low-cost arrangements. These include defining minimum stock thresholds for critical items, establishing backup logistics options, and maintaining clear communication protocols with key partners. These practices enable quicker recovery once disruptions materialize and reduce decision-making delays during crisis situations.

Importantly, the framework suggests that effective SCRM in SMEs depends on consistent managerial prioritization across these three capability areas, rather than sporadic reactions to individual disruptions. Managers who systematically align operational decisions with flexibility, demand visibility, and preparedness are better positioned to contain risk propagation and maintain performance stability. In this sense, resilience emerges not from isolated initiatives but from the cumulative effect of repeated, capability-oriented managerial choices. Overall, the managerial value of the framework lies in its ability to guide SMEs toward focused and feasible resilience-building actions. By clarifying where limited managerial attention and resources should be directed, the framework helps SME managers move from reactive problem-solving toward a more structured and sustainable approach to SCRM.

Practical Challenges

Despite its practical orientation, the implementation of the proposed framework may face several challenges in real-world SME settings. One key constraint relates to limited managerial time and resources. SME managers often perform multiple roles simultaneously, leaving little capacity for sustained planning and systematic risk monitoring. As a result, under heightened day-to-day operational pressure, managers may shift attention away from practices related to operational flexibility and disruption preparedness.

Furthermore, short-term performance pressures may hinder consistent capability development. The benefits of resilience-building practices often materialize over time, whereas SMEs frequently prioritize immediate cost control and service fulfillment. This short-term orientation can undermine sustained managerial commitment to flexibility, demand visibility, and preparedness, particularly when disruptions are infrequent. Recognizing these challenges is essential for realistic application of the framework. Instead of undermining the framework's value, these constraints point to the importance of gradual implementation and disciplined managerial effort to embed resilience practices into routine decisions.

Conclusion

This study proposes a capability-based conceptual framework to strengthen supply chain risk management in SMEs operating under conditions of uncertainty and resource constraints. By integrating insights from the RBV, DCT, and CT, the framework explains how SMEs can address

multi-dimensional supply chain risks through the development of operational flexibility, demand management, and disruption preparedness. The study contributes to the SCRM literature by shifting attention away from large-enterprise-oriented solutions toward a framework that reflects the operational realities of SMEs. Rather than emphasizing complex systems or resource-intensive practices, it demonstrates how resilience can be built through simple, low-cost managerial routines that align risk exposure with internal capability development.

From a managerial perspective, the framework highlights that effective SCRM in SMEs depends not on isolated initiatives, but on sustained managerial prioritization of key capabilities in everyday decision-making. By clarifying where limited attention and resources should be directed, the framework provides practical guidance for managers seeking to enhance operational stability and recovery capacity. Several limitations should be acknowledged. As a conceptual study, the framework has not been empirically tested, and its applicability may vary across industries and institutional contexts. Future research could validate the proposed relationships through qualitative case studies or quantitative analysis, and explore how factors such as digitalization, supply chain collaboration, and institutional support influence resilience-building efforts in SMEs.

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