A Dynamic Capabilities Framework for Managing Supply Chain Risk and Building Resilience in Malaysia's Priority Manufacturing Sectors

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ABSTRACT

Global supply chains have become increasingly complex and interconnected, making them highly susceptible to disruptions caused by pandemics, geopolitical instability, and climate-related events. These vulnerabilities are especially pronounced in emerging economies, where manufacturing sectors are heavily reliant on international networks. Despite increasing academic and managerial focus on supply chain resilience, existing models often examine risk management, resilience, performance, and sustainability in isolation, lacking an integrated perspective. This paper develops a conceptual framework grounded in Dynamic Capabilities Theory (DCT) to explain how firms can enhance supply chain performance by leveraging structured risk management practices and sustainability initiatives. The framework integrates four key constructs, which are Supply Chain Risk Management (SCRM), Supply Chain Resilience (SCR), Supply Chain Performance (SCP), and Sustainability Efforts (SE), with SE acting as a moderating factor that amplifies the relationship between SCRM and SCR. By aligning these constructs with DCT's core functions of sensing, seizing, and transforming, the model provides a holistic explanation of how firms can build adaptive and responsive supply chains. The paper offers four theoretical propositions and outlines practical and policy-oriented implications, contributing to the development of more resilient and sustainable supply chain strategies, particularly in developing manufacturing contexts.

KEYWORDS: Supply chain risk management, Supply chain resilience, Supply chain performance, Sustainability, Dynamic capabilities

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1. INTRODUCTION

The COVID-19 pandemic served as a critical stress test for global supply chain networks. It revealed deep-seated weaknesses in firms' ability to anticipate risks, maintain supply continuity, and respond swiftly to disruption. As governments imposed lockdowns, border closures, and mobility restrictions, supply chains simultaneously faced surging demand and constrained supply. Disruptions impacted essential functions such as raw material sourcing, international logistics, warehouse operations, and downstream production, leading to widespread bottlenecks. Industries like automotive, electronics, pharmaceuticals, and food manufacturing endured prolonged delivery delays, capacity reductions, and cost escalations (Nayak et al., 2022; Maheshwari & Jaggi, 2024; Dzreke & Dzreke, 2025).

The consequences were particularly severe for firms lacking structured Supply Chain Risk Management (SCRM) mechanisms or end-to-end visibility. Organizations dependent on single-source suppliers or centralized networks experienced higher exposure to cascading failures. As highlighted by Shahsavari et al. (2025), the absence of proactive risk mapping, supplier audits, and scenario planning severely limited firms' capacity to absorb shocks. Scott and Gong (2021) similarly noted that siloed risk functions and inadequate

coordination mechanisms amplified response delays. These challenges collectively signaled a strategic inflection point in supply chain management, where resilience, adaptability, and sustainability are no longer peripheral but fundamental imperatives for sustaining competitive advantage in global production ecosystems.

This imperative is particularly salient in Malaysia, where the manufacturing sector has long been a cornerstone of economic growth and export competitiveness. According to the United Nations Industrial Development Organization (2021) assessment, the country's manufacturing industries faced a broad spectrum of challenges including labor shortages, raw material scarcities, production shutdowns, and market volatility. Priority sectors such as aerospace, electrical and electronics (E&E), pharmaceuticals, medical devices, and chemicals experienced direct shocks and indirect ripple effects due to their integration into global value chains. The study further revealed that firms in Malaysia encountered difficulties managing logistics delays, factory closures, and disruptions in supplier relationships, particularly during Movement Control Orders. Small and medium-sized enterprises (SMEs), which make up a large portion of Malaysia's manufacturing base, were disproportionately affected due to limited risk management capabilities, lack of digitalization, and constrained cash flow buffers (United Nations Industrial Development Organization, 2021).

Although some firms responded by diversifying supplier bases, digitizing procurement systems, or adopting cloud-based inventory controls, many remained reactive, lacking structured frameworks to navigate uncertainty (Ivanov & Dolgui, 2021; Belhadi et al., 2024). The New Industrial Master Plan (NIMP) 2030 further emphasizes that Malaysian firms are transitioning toward value-driven, sustainable, and technologically integrated supply chain ecosystems, yet institutional gaps and fragmented implementation still hinder these efforts (Ministry of Investment, Trade and Industry, 2023). Simultaneously, manufacturers are facing mounting pressure from global buyers to meet environmental, social, and governance (ESG) standards, including traceability, ethical sourcing, and lifecycle impact reporting (Morris, 2023).

Despite these developments, the academic literature often treats risk management, resilience, and sustainability as distinct domains of inquiry, neglecting their potential synergies. For example, Fiksel and Bakshi (2023) and Mihrete and Mihretu (2025) highlight resilience and sustainability as important constructs but do not explore their integration with SCRM in a cohesive framework. Moreover, relatively few conceptual models are tailored to emerging-market contexts such as Malaysia, where supply chain upgrading is challenged by institutional variability, infrastructure gaps, and skill mismatches (Baloch & Rashid, 2022). This leaves a critical research gap: there is limited understanding of how firms in emerging economies can simultaneously integrate SCRM, resilience, and sustainability to enhance supply chain performance (SCP).

This paper seeks to address that gap by proposing a conceptual framework rooted in Dynamic Capabilities Theory (DCT), which explains how firms' sense, seize, and transform internal and external competencies in response to environmental volatility (Teece et al., 1997). The framework integrates four interrelated constructs: SCRM, SCR, SCP, and SE as a contextual moderator. In this structure, SCRM functions as a sensing mechanism to detect and assess disruptions, SCR enables adaptive continuity (seizing), and SCP represents the performance outcomes of transformed capabilities. SE supports and amplifies these dynamic capabilities by embedding long-term adaptability, stakeholder engagement, and ESG alignment.

Accordingly, this paper addresses the identified gap by developing a theory-driven conceptual model that explains how firms in Malaysia's priority manufacturing sectors can strengthen their supply chains through integrated risk, resilience, and sustainability strategies. The remainder of the paper is organized as follows: Section 2 presents the theoretical background and defines the key constructs. Section 3 outlines the methodological approach adopted for framework development. Section 4 introduces the conceptual model and accompanying propositions. Section 5 discusses the theoretical, practical, and policy implications. Section 6 concludes with key contributions and directions for future research.

2. THEORETICAL BACKGROUND

This study is grounded in DCT, a strategic management framework that explains how firms can achieve and sustain competitive advantage in volatile and uncertain environments. Originally introduced by Teece et al. (1997), DCT highlights the importance of an organization's ability to sense opportunities and threats, seize them through timely resource reallocation, and transform or reconfigure capabilities to adapt to changing environments. Unlike the traditional Resource-Based View, which emphasizes the possession of valuable, rare, inimitable, and non-substitutable resources, DCT shifts attention to how these resources are mobilized and renewed dynamically to respond to uncertainty.

In the context of global supply chains, which are frequently disrupted by pandemics, geopolitical shifts, technological disruptions, and climate-related events, DCT offers a powerful lens to examine how

firms respond to and recover from such shocks. Supply chain environments today are marked by heightened complexity, regulatory scrutiny, and stakeholder pressure for ethical and sustainable practices (Singh, 2025). Under such conditions, static capabilities are insufficient. Firms must develop routines and strategic processes that allow for continuous sensing of risk, rapid mobilization of resources, and ongoing transformation of supply chain configurations (Herburger et al., 2024; Zheng et al., 2025).

DCT is especially relevant in examining SCRM and SCR, as these constructs represent dynamic competencies rather than fixed capabilities. SCRM aligns with the "sensing" dimension of DCT, whereby firms identify vulnerabilities, monitor signals of disruption, and gather intelligence from across the supply network (Kähkönen et al., 2023; Lu et al., 2025;). SCR reflects the "seizing" function, in which firms leverage agility, flexibility, and redundancy to adapt to disruptions and maintain continuity (Kähkönen et al., 2023; Stadtfeld & Gruchmann, 2024). SCP, the outcome of these capabilities, represents the "transforming" dimension, where continuous learning and system reconfiguration improve responsiveness, customer satisfaction, and long-term value creation.

Several empirical and conceptual studies have adopted DCT to examine SCR and SCP. For instance, Pu et al. (2023) used DCT to conceptualize resilience as a dynamic capability that emerges from proactive and reactive supply chain practices. Irfan et al. (2022) and Manzoor et al. (2022) applied DCT to illustrate how firms dynamically reconfigure their resources and processes to enhance supply chain agility and resilience. Similarly, Singh et al. (2022) emphasized that DCT is instrumental in explaining how firms in emerging markets build resilience through innovation and stakeholder collaboration under institutional constraints. More recently, Tegethoff et al. (2025) applied DCT to demonstrate how sustainability-oriented supply chains can be both resilient and performance-driven through continuous adaptation.

DCT is particularly suitable for the Malaysian context due to the evolving and institutionally diverse nature of its manufacturing sector. Malaysia's industrial ecosystem, while globally integrated, faces challenges such as limited digitization, compliance gaps, and skill shortages. These structural constraints necessitate the development of dynamic capabilities that are contextually embedded and strategically aligned. Through the DCT lens, Malaysian firms can be viewed not just as recipients of shocks but as active agents capable of evolving through sensing market shifts, seizing operational opportunities, and transforming their supply chain structures to meet both local and global expectations.

Within this framework, SCRM is conceptualized as a sensing capability that enables firms to identify, assess, and mitigate potential risks across the supply chain. These risks may stem from operational inefficiencies, geopolitical tensions, pandemics, or natural disasters. SCRM involves both proactive and reactive mechanisms, such as risk mapping, scenario planning, supplier diversification, and investment in predictive analytics (Can Saglam et al., 2021). In Malaysia's context, while some manufacturing firms have adopted structured SCRM systems, others rely on fragmented and ad hoc approaches, particularly in sectors with less regulatory oversight.

SCR is positioned as the seizing capability that reflects a firm's ability to absorb, adapt to, and recover from supply chain shocks while maintaining functional integrity (Stadtfeld & Gruchmann, 2024; Kähkönen et al., 2023). Resilient supply chains exhibit agility, visibility, and redundancy (Ivanov, 2022) that allow firms to reroute logistics, adjust production schedules, and collaborate effectively with partners during crises. Sectoral studies suggest that resilience is manifested differently across industries; for instance, aerospace (Morandini et al., 2024) and medical device manufacturers (Gereffi et al., 2022) often emphasize regulatory compliance and traceability, while E&E firms focus on lead time compression and dual sourcing (Vinodh, 2020).

SCP, representing the transforming capability, is the ultimate outcome of dynamic supply chain strategies. It encompasses metrics such as delivery reliability, operational efficiency, customer satisfaction, and financial returns (Ning & Yao, 2023). The literature suggests that resilient and well-governed supply chains outperform reactive ones in times of disruption. In Malaysia's highly competitive manufacturing landscape, maintaining high SCP is essential for retaining export competitiveness and meeting increasingly complex customer demands.

A critical addition to this framework is SE, which is positioned as a moderating factor that enhances the effectiveness of SCRM in fostering SCR. SE includes practices such as green procurement, supplier ESG audits, lifecycle analysis, and eco-certifications (Fonseca & Dias, 2025). These practices embed long-term thinking into supply chain operations, improve transparency, and facilitate alignment with global sustainability standards. Importantly, SE enables firms to develop adaptive capacity, the ability to not just recover from disruption but to evolve supply chain practices in environmentally and socially responsible ways (Negri et al. 2021).

Taken together, these four constructs, SCRM, SCR, SCP, and SE, provide a theoretically coherent and practically relevant framework for understanding SCR in emerging

market contexts. This paper proposes that SCRM (sensing) enhances SCR (seizing), which in turn drives SCP (transforming). The relationship between SCRM and SCR is further strengthened by the presence of strong SE, which reinforces the firm's ability to build adaptive and sustainable supply chains. The next section outlines the conceptual methodology used to develop this framework.

3. METHODOLOGY

This study adopts a conceptual research design, which is appropriate for theory development in domains where empirical generalizations remain limited and constructs are under-integrated, such as the nexus of supply chain risk, resilience, sustainability, and performance in emerging economies. Conceptual research allows for the synthesis of prior knowledge to develop frameworks that clarify relationships, extend theoretical boundaries, and offer direction for future empirical investigation (Meredith, 1993; Whetten, 1989; MacInnis, 2011). As such, this paper does not collect primary data but instead draws on existing scholarship to develop a theory-informed model grounded in Dynamic Capabilities Theory (DCT).

The conceptual framework was developed using a structured four-stage methodology in **Figure 1**, consistent with best practices in theory-building research in operations and supply chain management (Ketokivi & Choi, 2014; Carter et al., 2015). This approach ensures both analytical rigor and contextual relevance, as emphasized by Whetten (1989) and Jabareen (2009), who advocate for conceptual models to be logically consistent, clearly bounded, and embedded within the complexity of real-world settings.

In Stage 1: Literature Mapping and Construct Clarification, a comprehensive review of peer-reviewed journal articles, policy documents (e.g., Ministry of Investment, Trade and Industry, 2023), and institutional reports (e.g., United Nations Industrial Development Organization, 2021; Malaysian Investment Development Authority, 2024) was conducted. This review aimed to define and distinguish the four core constructs, which are SCRM, SCR, SCP, and SE, drawing on multidisciplinary sources from operations management, organizational theory, and sustainability literature. Following MacInnis' (2011) recommendations, this stage emphasized conceptual clarity, definitional consistency, and construct validity.

In Stage 2: Theoretical Framing, DCT was selected as the underpinning framework due to its suitability for explaining how organizations adapt to environmental turbulence. Within this framework, SCRM represents a sensing capability (detecting risks), SCR represents a seizing capability (adaptive response), and SCP reflects transforming capability (performance outcomes). SE was modelled as a contextual moderator that enhances a firm's dynamic responses to disruption. This mapping aligns with Whetten's (1989) call for theory to explain "what" constructs are included, "how" they interact, and "why" the relationships matter.

Stage 3: Contextualization to Malaysia's Priority Manufacturing Sectors involved tailoring the framework to five strategic industries identified under the New Industrial Master Plan 2030: aerospace, electrical and electronics (E&E), pharmaceuticals, medical devices, and chemicals. These sectors were selected based on their exposure to global disruptions and their role in Malaysia's economic development. Contextual grounding enhances the external validity and practical relevance of the framework, in line with the guidance of Ketokivi and Choi (2014), who emphasize that conceptual models must reflect the complexity of the operational environment they seek to address.

In Stage 4: Proposition Development, relationships among the constructs were translated into conceptual propositions rather than hypotheses, as is customary in exploratory theory-building (MacInnis, 2011). These propositions express theoretical linkages derived from literature synthesis and logical reasoning. They are intended to guide future empirical studies, whether through case studies, surveys, or mixed-method designs and stimulate scholarly inquiry into how dynamic capabilities operate within supply chains in emerging economies.

By employing this four-stage approach, the framework achieves a balance between conceptual depth, contextual sensitivity, and theoretical coherence. The method aligns with Jabareen's (2009) framework development process and reflects Meredith's (1993) emphasis on systematic conceptualization as a valid form of scientific contribution in operations research. The result is a diagnostic and explanatory model that offers new insights into how supply chains can be structured to manage risks, enhance resilience, and meet sustainability goals in volatile and resource-constrained environments.

4. CONCEPTUAL MODEL AND PROPOSITIONS

The fragility of global supply chains made evident by the COVID-19 pandemic has driven significant interest in developing more resilient and adaptable supply chain systems, especially in emerging economies such as Malaysia. The country's priority manufacturing sectors, including aerospace, electrical and E&E, pharmaceuticals, medical devices, and chemicals, were highly impacted by pandemic-related disruptions. These sectors, deeply embedded in global value chains, faced cascading effects due to constrained sourcing, logistical breakdowns, and sudden regulatory changes.

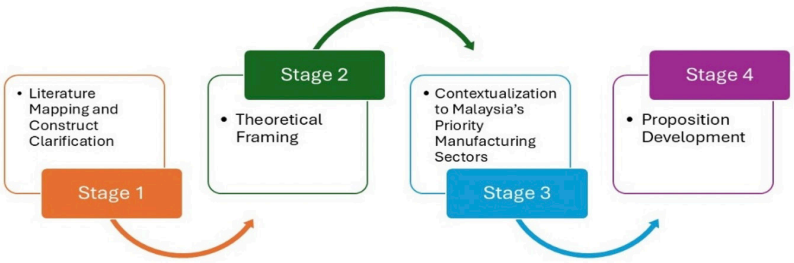

Figure 1: *Four-stage methodology*

The crisis revealed structural weaknesses in supply continuity, flexibility, and responsiveness, especially among firms lacking structured and proactive SCRM (United Nations Industrial Development Organization, 2021). These challenges highlighted the inadequacy of siloed or reactive approaches to supply chain governance and emphasized the need for integrated frameworks that capture how firms develop the capabilities to sense risks, seize adaptive responses, and transform toward performance outcomes.

Grounded in DCT, this study proposes a conceptual framework linking four key constructs: SCRM, SCP, and SE. Within the DCT lens, SCRM is conceptualized as the firm's sensing capability, involving proactive activities such as dual sourcing, contingency planning, supplier diversification, and the use of real-time data analytics to anticipate and mitigate potential disruptions. SCR represents the seizing capability, encompassing the firm's ability to adapt through agility, flexibility, collaboration, and visibility in operations. SCP reflects the transforming capability, wherein these efforts translate into delivery reliability, operational efficiency, and customer satisfaction. SE serves as a moderating factor that strengthens the link between SCRM and SCR. This includes practices such as green procurement, eco-certifications, and supplier sustainability training, which collectively foster long-term adaptability, stakeholder alignment, and regulatory compliance.

The conceptual model (see **Figure 2**) depicts the dynamic and interactive nature of these constructs. It posits that effective SCRM activities create the foundation for SCR development, which in turn enhances SCP. Furthermore, firms that incorporate SE as part of their strategic orientation are better positioned to operationalize risk insights into resilient capabilities due to improved collaboration, environmental transparency, and strategic foresight. This alignment not only ensures operational continuity but also enhances long-term competitiveness and social responsibility, dimensions increasingly demanded by global stakeholders.

To operationalize this framework, the following propositions are put forward:

Proposition 1: Firms that implement structured SCRM practices, such as dual sourcing, contingency planning, supplier diversification, and real-time data analytics, are more likely to develop SCR capabilities that enhance their ability to respond effectively to disruptions.
Proposition 2: Higher levels of SCR are positively associated with improved SCP, as resilient firms can maintain consistent performance in delivery reliability, operational efficiency, and customer satisfaction during times of uncertainty.
Proposition 3: SCRM may also exert a direct positive effect on SCP, especially in firms that use proactive planning and early-warning systems to avoid or minimize disruption impacts.
Proposition 4: SE positively moderates the relationship between SCRM and SCR. Firms with strong SE, such as eco-certifications, circular sourcing, and supplier training, enhance their adaptive capacity, making their risk management efforts more effective in generating resilience.

This conceptual model provides a dynamic and forward-looking framework for understanding how sensing, seizing, and transforming capabilities interact in the supply chain context, particularly when shaped by sustainability. It is especially relevant to Malaysia's key industrial sectors, where global compliance demands and vulnerability to external shocks necessitate more integrated, future-ready supply chain strategies.

5. IMPLICATIONS

5.1 Theoretical

From a theoretical perspective, this paper advances the application of DCT within the domain of supply chain management by integrating four critical constructs: SCRM, SCR, SCP, and SE into a cohesive model. While DCT has traditionally been used to explore firm-level innovation and competitive advantage, this study extends its relevance to SCR and sustainability in emerging market contexts. By mapping SCRM to sensing, SCR to seizing, and SCP to transforming capabilities, and incorporating SE as a moderator, the framework provides a more granular understanding of how firms navigate uncertainty and evolve through

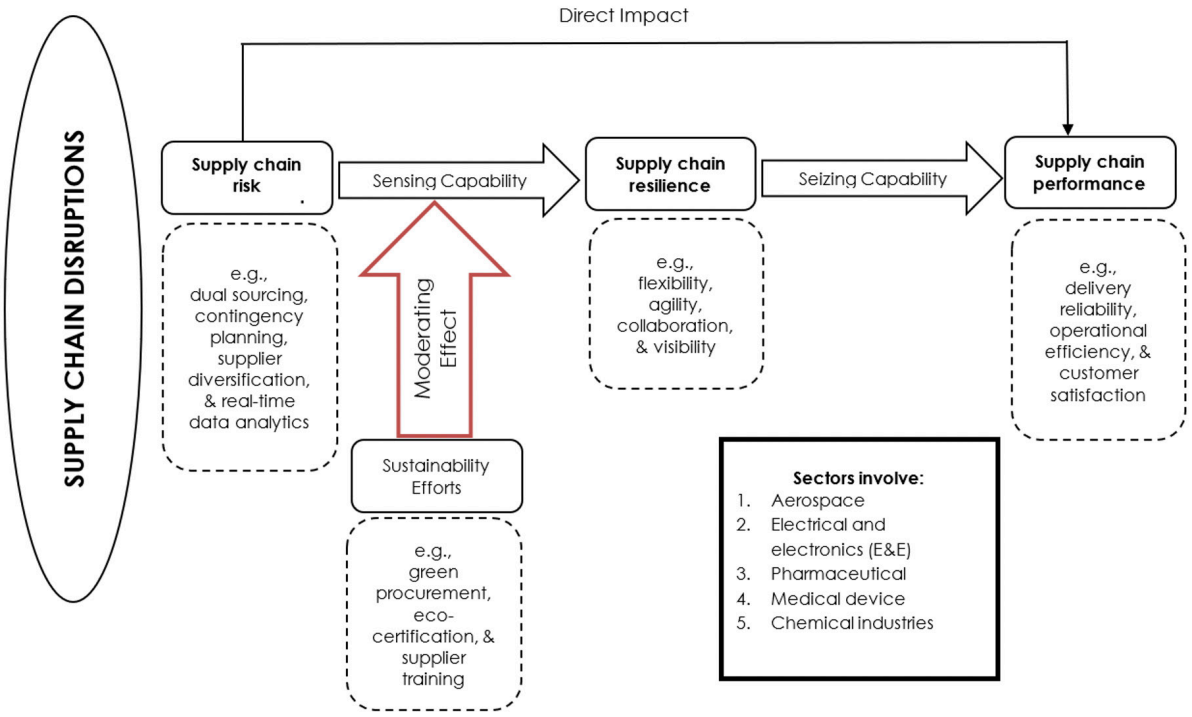

Figure 2: *A Dynamic capabilities framework for managing supply chain risk and building resilience*

adaptive learning and resource reconfiguration. It also responds to calls in the literature for more integrative models that bridge operational risk, performance outcomes, and sustainability

5.2 Managerial

From a managerial standpoint, the framework offers a diagnostic tool for firms aiming to enhance their preparedness and responsiveness in volatile environments. Managers can use the model to assess the maturity of their supply chain capabilities, identify gaps in risk mitigation strategies, and embed sustainability practices to strengthen supplier collaboration, compliance, and transparency. For example, manufacturing firms in Malaysia's E&E or pharmaceutical sectors can adopt dual sourcing, predictive analytics, and ESG-driven procurement simultaneously to build adaptive supply chains that meet both resilience and regulatory requirements. The model emphasizes that resilience is not just about crisis response but also about long-term capability building, particularly when supported by SE such as green innovation, resource efficiency, and life-cycle management.

5.3 Policy

From a policy perspective, the framework aligns with the goals outlined in Malaysia's NIMP 2030, which emphasizes resilience, sustainability, and digital transformation as national imperatives. The proposed model can inform policy tools and public-private partnerships that support supply chain upgrading in strategic sectors. Policymakers may leverage this framework to design industry-specific incentives, training programs, or ESG compliance frameworks that build resilience at the systemic level. For instance, SCR audits and sustainability-linked tax benefits could help SMEs and tier-2 suppliers adopt integrated SCRM and SE practices that complement larger firms' capabilities, thus reducing overall systemic risk.

5.4 Future Empirical Studies

Finally, this framework offers a rich research agenda for future empirical studies. Researchers are encouraged to operationalize the constructs and test the propositions through multi-sector surveys, longitudinal studies, or comparative case analyses. The model can also be adapted to test moderating effects of variables such as digital transformation, firm size, or supply chain complexity. Furthermore, exploring how the strength of SE varies across industries, regions, and institutional environments could provide deeper insights into the contextual boundaries of the model. In doing so, future research can validate, refine, and expand the framework's utility in enhancing resilient and sustainable supply chains, particularly in regions undergoing industrial transition and ESG-driven globalization.

6. CONCLUSION

This paper has developed a conceptual framework rooted in DCT to explain how firms in Malaysia's priority manufacturing sectors can enhance their SCR and SCP through integrated risk management

and sustainability strategies. The framework links four interrelated constructs: SCRM as a sensing capability, SCR as a seizing capability, SCP as the outcome of transformation, and SE as a moderating force that enhances adaptive capacity. Grounded in the context of Malaysia's industrial transformation and global supply chain challenges, the model responds to the growing need for holistic approaches that integrate resilience and sustainability, particularly in emerging economies with sector-specific vulnerabilities and institutional complexities.

The conceptual model addresses critical gaps in the existing literature by offering an integrated, theory-driven explanation of how firms develop dynamic capabilities to withstand and adapt to disruption. It also provides practical guidance for managers seeking to embed ESG principles into supply chain strategies and for policymakers aiming to align industrial policy with resilience and sustainability goals under NIMP 2030. By emphasizing propositions rather than hypotheses, the paper lays the groundwork for future empirical research, encouraging scholars to test, refine, and expand the model across different industries and contexts.

In conclusion, the framework contributes to a growing body of scholarship at the intersection of supply chain management, sustainability, and strategic capability development. It highlights the importance of moving beyond short-term risk mitigation toward long-term transformation anchored in sustainability and continuous learning. While conceptual in nature, the model offers significant potential for real-world application and empirical validation, ultimately supporting the design of more resilient, adaptive, and responsible supply chains in Malaysia and beyond.

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