

# A MULTI-THEORETICAL FRAMEWORK FOR SUPPLY CHAIN RISK MANAGEMENT IN MALAYSIA'S CONSTRUCTION INDUSTRY: HIGHLIGHTS THE THEORETICAL INTEGRATION AND SECTOR-SPECIFIC FOCUS

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## Abstract

### Keywords:

Supply Chain Risk Management, Construction Industry, Risk Mitigation Framework, Multi-Theoretical Approach

The construction industry is inherently vulnerable to supply chain risks due to its complex, project-based nature and reliance on diverse stakeholders, materials, and external conditions. In Malaysia, these challenges are intensified by issues such as material shortages, labour constraints, regulatory changes, and unforeseen disruptions like the COVID-19 pandemic. Despite growing awareness of these risks, many firms continue to adopt conventional supply chain management approaches that are linear, reactive, and insufficiently equipped to manage the dynamic and interconnected nature of modern construction risks. This study aims to examine supply chain risks in the Malaysian construction industry through a robust theoretical lens and to propose a comprehensive, context-specific risk management framework. Three main objectives guide the research: to identify key supply chain risks, to assess the relevance and applicability of established theories in understanding these risks, and to develop a theoretical model for effective risk mitigation. The study is underpinned by a multi-theoretical foundation, incorporating Resource Dependence Theory (RDT), Transaction Cost Economics (TCE), Chaos Theory, Supply Chain Risk Management (SCRM) frameworks, Lean and Agile Supply Chain Theory, Network Theory, and Institutional Theory. These theories provide a comprehensive understanding of the causes, propagation, and mitigation of supply chain risks within construction projects. By bridging theoretical insights with industry practices, this research aims to contribute a tailored risk management framework that enhances resilience, adaptability, and performance in Malaysia's construction sector. The outcomes are expected to support industry stakeholders in making informed, proactive decisions that safeguard project success and long-term sustainability.



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## Introduction

The construction industry is widely acknowledged as one of the most risk-prone sectors due to its inherent complexity, heavy reliance on multiple stakeholders, fluctuating material prices, and rigid regulatory requirements (Zhao et al., 2013). Supply chain disruptions, such as delays in procurement, labour shortages, and political or environmental uncertainties, can significantly impact project timelines, budgets, and output quality (Ling & Hoang, 2010). In Malaysia, the construction industry plays a pivotal role in national development, facilitating urbanisation, infrastructure growth, and job creation. However, persistent supply chain vulnerabilities threaten its overall efficiency and sustainability.

One major challenge lies in the fragmented nature of the construction supply chain, where coordination among contractors, suppliers, subcontractors, consultants, and government entities is often inconsistent (Rahman & Kumaraswamy, 2005). The COVID-19 pandemic further magnified these vulnerabilities, exposing the limitations of traditional supply chain approaches, which tend to be linear, reactive, and cost-driven (Ng, 2021). Consequently, many construction projects in Malaysia continue to suffer from delays, cost overruns, and compromised quality due to the lack of robust risk management systems.

This study aims to address these challenges by identifying critical supply chain risks, evaluating theoretical frameworks that can explain the dynamics of these risks, and developing a customised risk management model tailored to the Malaysian context. The research will incorporate several theoretical lenses. Resource Dependence Theory (RDT) (Pfeffer & Salancik, 2006) highlights how firms manage uncertainty through inter-organizational relationships. Transaction Cost Economics (TCE) (Williamson, 1985) provides insight into governance mechanisms that reduce coordination and opportunism risks. Chaos Theory (Kiel & Elliott, 1996) explains the unpredictable nature of complex supply chains and the potential for minor disruptions to create significant consequences.

## Research Objectives

The objective of this study is to contribute a tailored risk management framework that enhances resilience, adaptability, and performance in Malaysia's construction sector. The primary objective of this study is to develop a comprehensive, context-sensitive risk management framework for the Malaysian construction industry by integrating multiple organizational and systems theories. Specifically, the study aims to:

- i. Identify and categorize the critical supply chain risks prevalent in Malaysia's construction industry.
- ii. Evaluate the applicability and explanatory power of multiple theoretical perspectives, including RDT, TCE, Chaos Theory, Lean and Agile Supply Chain Theory, Network Theory, and Institutional Theory in understanding and mitigating supply chain risks.
- iii. Construct a multi-theoretical, empirically grounded framework that enhances the resilience, adaptability, and performance of construction supply chains under dynamic and uncertain conditions.

## Literature Review

Additionally, Lean and Agile Supply Chain Theory emphasizes responsiveness and waste minimization (Christopher & Towill, 2001). In contrast, Network Theory highlights the importance of relational ties and collaboration among stakeholders (Provan & Kenis, 2007). Institutional Theory (Scott, 2001) offers further insight into how regulatory pressures, norms, and institutional constraints shape organizational responses to supply chain risk.

The integration of these theories aims to provide a more holistic and context-sensitive understanding of risk propagation and mitigation within the Malaysian construction sector. The proposed framework will contribute both to academic literature and industry practice by offering actionable strategies for enhancing supply chain resilience, agility, and performance.

**Supply Chain Risk in Construction:** The construction industry is uniquely exposed to supply chain risks due to its project-based structure, complexity, and reliance on multiple stakeholders across fragmented processes. Risks such as material delays, price volatility, subcontractor defaults, and labour shortages are prevalent and often lead to time and cost overruns (Sweis et al., 2008). Construction supply chains are further complicated by geographical dispersion, long lead times, and site-specific customization (Xie & Liu, 2022). These risks are magnified in developing countries like Malaysia, where regulatory uncertainty and infrastructural constraints exacerbate existing vulnerabilities (Abidin et al., 2019).

**Challenges in the Malaysian Construction Supply Chain:** Malaysia's construction industry is characterized by high reliance on foreign labour, dependency on imported materials, and weak enforcement of project coordination mechanisms (Construction Industry Development Board (CIDB), 2021). Studies have shown that many construction firms lack structured risk assessment tools and often resort to reactive measures rather than proactive planning (Ali & Rahmat, 2010). These limitations contribute to recurring issues such as cost escalation and quality compromise, which undermine project sustainability and stakeholder confidence. Moreover, the COVID-19 pandemic highlighted the fragility of supply chains, resulting in widespread project delays and resource bottlenecks (Kamaruddin et al., 2022).

**Theoretical Perspectives on Supply Chain Risk Management (SCRM):** A variety of theories have been used to explain supply chain behaviour and risks in construction. RDT suggests that organizations seek to manage interdependencies and external uncertainties by forming strategic alliances or vertically integrating their operations (Pfeffer & Salancik, 2006). TCE, on the other hand, emphasizes the role of governance structures in minimizing opportunism and inefficiencies, particularly in contracting and subcontracting relationships (Williamson, 1985). These theories provide valuable perspectives for understanding how firms structure their relationships to mitigate supply chain risks.

**Chaos Theory and Uncertainty Management:** Chaos Theory has increasingly been applied to construction management to account for non-linearity and unpredictability in project environments (Kiel & Elliott, 1996). It posits that minor disturbances in the system such as a late material delivery can trigger disproportionately large disruptions. This concept is particularly relevant in megaprojects where cascading effects are common. In the Malaysian context, where projects often span years and involve numerous regulatory approvals, Chaos Theory helps explain why risk mitigation strategies must account for systemic sensitivity and adaptability (Kiel & Elliott, 1996).

**Agile and Lean Approaches to Risk Mitigation:** Lean and Agile Supply Chain Theories emphasize responsiveness, flexibility, and the elimination of non-value-adding activities (Christopher & Towill, 2001). Lean construction aims to streamline processes, minimize waste, and enhance reliability. At the same time, agile principles facilitate rapid adaptation to changes and disruptions (Shammas-Toma et al., 1998). Malaysian construction firms have begun exploring these principles, especially in response to the recent pandemic. However, implementation remains limited due to a lack of training, stakeholder resistance, and inadequate technology integration (Ismail et al., 2020).

**Network and Institutional Theories in Construction SCM:** Network Theory underscores the importance of collaborative networks and relational governance among project participants (Provan & Kenis, 2007).

Strong inter-organizational ties facilitate information sharing, risk pooling, and joint problem-solving. Simultaneously, Institutional Theory explains how organizations respond to regulatory, normative, and cognitive pressures in shaping their risk management practices (Scott, 2001). In Malaysia, compliance with government procurement regulations and CIDB guidelines has a significant influence on how firms manage risk. Nevertheless, institutional inertia often limits the adoption of innovative practices. A multi-theoretical approach combining these perspectives offers a more holistic understanding of construction supply chain risks and responses.

## Methodology

This study employs a mixed-methods approach, with a qualitative-dominant design, to comprehensively explore Supply Chain Risk Management (SCRM) within the Malaysian construction industry. The methodology is designed to facilitate both the exploration of industry-specific risks and the development of a theoretical framework grounded in empirical insights and established theories.

### Research Design

The research is structured in three sequential phases. First, an exploratory literature review and content analysis of industry reports will be conducted to identify prevalent supply chain risks and theoretical gaps. Second, semi-structured interviews with key stakeholders, contractors, suppliers, project managers, and government regulators. Hence, it will provide qualitative data on risk experiences, mitigation strategies, and theoretical relevance. Finally, the findings will inform the design of a framework development workshop, using a suitable method to refine and validate the theoretical model with expert input.

### Data Collection

A purposive sampling technique will be used to select 20–30 experienced professionals from across the construction supply chain, including representatives from public infrastructure projects, private developments, and regulatory bodies such as CIDB. Interview questions will cover themes including types of supply chain risks encountered, coping strategies, inter-organizational relationships, and institutional constraints. All interviews will be recorded, transcribed, and thematically coded using NVivo software.

### Data Analysis

Thematic analysis will be employed to identify patterns, relationships, and emerging themes in the qualitative data. This will be complemented by theory-driven coding, which aligns the data with constructs from RDT, TCE, Chaos Theory, Lean/Agile Theory, Network Theory, and Institutional Theory. Triangulation with secondary data, including industry reports and project case studies, will ensure reliability and robustness.

### Framework Development

The final theoretical framework will be constructed through constructivist grounded theory techniques, allowing themes to emerge organically while being informed by theory. A panel of experts will participate in a two-round process to validate the relevance and structure of the proposed framework. The resulting model will provide a context-sensitive guide to managing supply chain risks in Malaysia's construction industry.

### Theoretical Framework Development

The proposed theoretical framework integrates multiple organizational and systems theories to capture the complexity, uncertainty, and institutional dynamics of supply chain risks in Malaysia's construction

industry. This multi-theoretical model provides a more nuanced and holistic understanding of risk sources, propagation mechanisms, and mitigation strategies.

## Findings

### Resource Dependence Theory (RDT)

RDT emphasizes how firms manage uncertainties in their external environment by developing dependency-reducing strategies, such as forming long-term contracts, joint ventures, or vertical integration (Pfeffer & Salancik, 2006). In Malaysia, where materials and labour are often sourced externally or subcontracted, firms utilize strategic partnerships to secure key resources and mitigate volatility in their supply chains.

### Transaction Cost Economics (TCE)

TCE provides insight into how governance structures are used to minimize opportunistic behaviour and transaction inefficiencies (Williamson, 1985). In construction, relational contracts, performance bonds, and quality guarantees are standard tools to reduce risk in subcontracting. Malaysian construction firms frequently encounter high coordination costs and legal ambiguity, underscoring the importance of effective governance mechanisms.

### Chaos Theory

Chaos Theory explains how minor disruptions in one part of the supply chain can cause significant ripple effects in highly interconnected and time-sensitive construction projects (Kiel & Elliott, 1996). This is particularly relevant in Malaysia's infrastructure megaprojects, where delays in regulatory approvals or port clearances can cascade through the supply chain.

### Lean and Agile Supply Chain Theory

Lean principles reduce waste and improve reliability through standardization and continuous improvement, while agile strategies enhance responsiveness and adaptability (Christopher & Towill, 2001). Malaysian construction firms have begun adopting modular construction and Just-in-Time (JIT) delivery systems to manage disruptions. However, implementation remains uneven due to gaps in capability.

### Network Theory

Network Theory provides a relational view of supply chains, highlighting the importance of trust, information flow, and collaborative governance among firms (Provan & Kenis, 2007). In Malaysia, Public-Private Partnerships (PPPs) and project alliances can facilitate collaborative risk-sharing. However, weak linkages among smaller subcontractors often limit the effectiveness of coordination.

### Institutional Theory

Institutional pressures regulatory (e.g., CIDB standards), normative (e.g., industry best practices), and cognitive (e.g., managerial mindsets) shape how firms perceive and manage risk (Scott, 2001). In Malaysia, risk management behaviour is influenced by national policies, such as the Construction Industry Transformation Programme (CITP) and the Public Works Department's procurement guidelines.

## Discussion

By synthesizing these six theories, the proposed framework provides a comprehensive structure for assessing, interpreting, and managing supply chain risks across various phases of construction projects in Malaysia. It accounts for both internal firm behaviours and external institutional environments, enabling stakeholders to design risk mitigation strategies that are both operationally sound and contextually relevant. The study is expected to deliver the following key outcomes:

- i. **Empirical Insights into Construction Supply Chain Risks:** A detailed typology of risk sources (e.g., material shortages, regulatory bottlenecks, labour disruptions) affecting Malaysian construction projects. A deeper understanding of how these risks propagate and escalate within fragmented project environments.
- ii. **Theoretical Contribution:** A novel integration of six complementary theories to form a holistic analytical lens. The demonstration of how each theory uniquely contributes to understanding different dimensions of supply chain risk (e.g., RDT for dependency, Chaos Theory for unpredictability, Network Theory for collaboration).
- iii. **Practical Risk Management Framework:** A validated, actionable model that can guide construction firms and regulators in proactively identifying, assessing, and mitigating supply chain risks. A framework adaptable to firm size, project type, and regulatory context.
- iv. **Policy and Industry Recommendations:** Strategic recommendations for policymakers, such as enhancing institutional support, promoting collaborative networks, and incentivizing agile practices. Guidelines for construction practitioners on implementing lean/agile systems, strengthening inter-firm trust, and navigating institutional constraints.

## **Conclusion**

This study addresses the pressing need for a robust and adaptable SCRM approach in Malaysia's construction industry. Through the integration of multiple theoretical lenses and qualitative insights from key industry stakeholders, the research develops a context-specific, multi-theoretical framework that captures the complex, dynamic, and institutionally embedded nature of supply chain risks. The traditional, linear risk management approaches are insufficient in today's volatile construction environment. Instead, risk mitigation must be systemic, theory-informed, and sensitive to both firm-level and environmental factors. By offering a well-rounded framework grounded in empirical and theoretical rigor, this study makes significant contributions to both academic discourse and practical advancements in managing construction supply chain risk in emerging economies. Ultimately, the research empowers stakeholders' contractors, suppliers, regulators, and policymakers to adopt proactive, informed, and coordinated risk management strategies that safeguard project performance and long-term sector sustainability.

## **Co-Author Contribution**

Author 1 carried out the fieldwork, prepared the literature review and overlooked the whole article's write up. Author 2, wrote the research methodology and did the data entry. Author 3 carried out the statistical analysis and interpretation of the results.

## **Conflicts of Interest**

The authors declare no conflicts of interest regarding the publication of this paper.

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**Data Availability Statement:** All relevant data are within the manuscript and its [Supporting Information](#) files.