

EUNICE ONIOVOSA ALEX-EYITENE

INVESTIGATION OF PROCUREMENT RISK MANAGEMENT STRATEGIES IN THE POST-CONTRACT AWARD PHASE.

CRANFIELD SCHOOL OF MANAGEMENT
PhD in Leadership and Management

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July 2025



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Abstract

This research empirically investigated how procurement risk management (PRM) strategies are used to manage risks in the post-contract award phase. Through three sequential papers, this study adopted multiple methods to gain insights into the procurement risks, risk management strategies, and risk management tools and techniques used in the post-contract award phase in manufacturing sector.

Paper 1 is a literature review of the risk management strategies used in the three procurement phases: pre-contract, selection and contracting, and post-contract award. The author conducted an SLR of 100 peer-reviewed articles published between 2000 and 2025. The key findings of this study are twofold. First, it synthesized four main themes: procurement risks, procurement risk management tools and techniques, procurement risk mitigation strategies, and factors that influence the selection of risk mitigation strategies across the three procurement phases. Second, the findings highlighted that procurement risk management tools and techniques in the post-contract award phase have been neglected in the literature compared to the pre-contract, and selection and contracting phases.

Paper 2, an empirical study, adopted a qualitative approach to gain insights into procurement risk management in the post-contract award phase. The author interviewed Procurement professionals (23) from 7 manufacturing industries in the United Kingdom (UK) and highlighted three key findings based on the interview insights. First, the results identified five risk categories: supplier performance, contract design, supplier relationship, ethical, and disruption risks. Second, procurement professionals combined technological tools, such as data analytics and machine learning, with human engagement techniques, including site visits and review meetings, to identify and assess risks and plan mitigation strategies. Third, a combination of preventive and reactive PRM strategies were implemented in the post-contract award phase.

Paper 3, an empirical study, examined how sociological mechanisms affect procurement risks and procurement risk management performance during the post-contract award phase. A quantitative survey was conducted among 313

procurement professionals from the US automotive manufacturing industry. This study has four key findings. First, combining trust with information sharing, commitment, and flexibility mitigates the negative effects of switching costs on procurement risk management performance than using trust alone. Second, combining trust with information sharing, commitment, and flexibility mitigates the negative effects of switching costs and negotiation costs on procurement risk management performance than using trust alone. Third, sociological constructs are insufficient as PRM mechanisms to mitigate the negative impact of environmental uncertainties on procurement risk management performance. Fourth, sociological constructs are insufficient as PRM mechanisms to mitigate the negative influence of supplier opportunistic behaviours on procurement risk management performance.

Overall, this thesis makes several key contributions and extends the literature in the following ways. This SLR study contributes to the existing literature by aligning the fragmented strands of risk management literature and systematically synthesizing the procurement risks, the tools and techniques for identifying, assessing, and mitigating risks, and the risk mitigation strategies in each procurement phase. Second, it provides a new, empirically based procurement risk management model that integrates procurement risk identification, assessment, and mitigation strategies into the post-contract award phase. Third, it provides new empirical evidence that combining trust with information sharing, commitment, and flexibility mitigates the negative effects of switching costs and negotiation costs on procurement risk management performance more effectively than using trust alone. Fourth, it provides new empirical evidence that combining trust with information sharing, commitment, and flexibility mitigates the negative effects of switching costs and negotiation costs on procurement risk management performance than using trust alone.

Keywords: Procurement Risk Identification, Risk Assessment, Risk Mitigation, Transaction Cost Economics Theory and Social Exchange Theory.

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List of Abbreviations

AI	Artificial Intelligence
ERM	Enterprise Risk Management
PLS-SEM	Partial Least Square- Structural Equation Modelling
PRM	Procurement Risk Management
PRMP	Procurement Risk Management Performance
SCM	Supply Chain Management
SET	Social Exchange Theory
SLR	Systematic Literature Review
TCE	Transaction Cost Economics
ML	Machine Learning
DA	Data Analytics

Key Definitions

keywords	Definitions
Opportunistic behaviour	Opportunistic behaviour is defined as self-interest seeking with guile, detrimental to exchange relationships, as suppliers seek to benefit at the expense of the buying organisation. (Wacker et al., 2016; Wang et al., 2015)
Environmental uncertainty	Environmental uncertainty is defined as unanticipated changes in circumstances surrounding an exchange that cannot be specified beforehand (Grover and Malhotra, 2003).
Asset specificity	Asset specificity refers to investments made by a firm that are of considerably less value outside of the focal relationship (Heide & John, 1980, p. 27)
Bounded rationality	Bounded rationality refers to the cognitive limitations of decision-makers in processing information, communicating, and making optimal choices (Tate et al., 2022; Hoffmann et al., 2013).
Switching cost	Switching cost is defined as the costs incurred by a firm when switching products or providers (Thompson and Cats-Baril, 2002)
Negotiation cost	Negotiation costs refer to the time, effort, and resources spent to reach an agreement on the terms and conditions of a transaction between a buying organisation and a supplier (Heunis et al., 2025; Shazad et al., 2018; Kuo et al., 2013)
Trust	Inter-organizational trust is defined as the expectation that an actor can be relied upon to fulfill obligations, will behave in a predictable manner, and will act and negotiate fairly when the possibility of opportunism is present. (Zaheer et al., 1998, p.143)
Information sharing	Information sharing is defined as “the extent to which critical, often proprietary, information is communicated to one's partner in a timely manner.” (Mohr & Spekman, 1994, p. 139).
Commitment	Commitment refers to the desire and willingness to maintain or improve a business relationship (Saglam et al., 2022).
Flexibility	Flexibility refers to partners common beliefs about the appropriate behavior in the case of changes in contractual agreements. Particularly, willingness to adapt and change original contract terms, in the face of specific requests of the other party (Caniëls & Gelderman, 2010; Yilmaz, Sezen, & Ozdemir, 2005).
Procurement risks	Procurement risks refer to any problem that leads to a breakdown of the procurement process and impedes the flow of materials and information between the supplier and the buying organisation (Author)
Procurement risk management	Procurement risk management refers to the process of identifying and assessing risks arising from the procurement process and developing appropriate risk mitigation strategies (Author)
Procurement risk management performance	Procurement risk management performance refers to the effectiveness of a buying organisation to confront opportunities and threats in its environment, address supplier reliability issues, and develop mutually agreed strategies to minimise operational disruptions, reduce cost, enhance supplier compliance, and improve organisational performance (Liu et al., 2018; Hoffman et al., 2013

1 INTRODUCTION.

Chapter overview

In the introductory chapter, the author outlines the fundamentals of the PhD thesis by discussing the research background, procurement phases and activities, and definitions of procurement risk and risk management. The research aims, objectives, and research questions are outlined in this section. The research design and structure are presented at the end of the chapter.

1.1 Research Background

Procurement involves coordinated processes through which materials, skills, facilities, and capabilities are obtained from external sources at the most favourable conditions (Hong et al., 2018; Van Wele, 2018). Procurement has evolved significantly from a mere transactional function that supports day-to-day operations into a strategic function that directly contributes to the long-term financial success of organisations (Moshtari et al., 2021; Aghajanian, 2018). However, risk events, including trade tensions such as the US-China trade war, tariffs, the Russia-Ukraine war, and the COVID-19 pandemic, have exposed the weaknesses existing within the procurement strategies of organisations (Ma et al., 2024; Çıkmak & Ungan, 2022). For instance, the COVID-19 pandemic led to major procurement and supply disruptions in 94% of Fortune 1000 companies (Accenture, 2020; Fortune, 2020). Manufacturing organisations faced procurement challenges that leading to shortage of parts and raw materials, closure of production facilities, unfulfilled demand, and a loss of revenue (el Baz & Ruel, 2021; Paul & Chowdhury, 2021).

The primary objective of procurement is to achieve an uninterrupted flow of materials and services from the supply base to an organisation through efficient supplier selection and supplier relationship management (Ellis et al., 2010; Hong & Kwon, 2012). In the last decade, the outsourcing of business activities to a network of suppliers spread across different continents and countries has made the procurement process more complex, thereby increasing the risk within the procurement phases (Nyamah et al., 2023; Merzifonluoglu, 2015; Van Weel &

Van Raaij, 2014; Wu et al., 2009). Moreover, a recent publication by McKinsey (2024) reported that due to globalisation, procurement leaders continue to face significant geopolitical and economic challenges that require them to reassess their supplier relationships and risk management practices end-to-end, and to develop appropriate risk mitigation strategies.

1.1.1 Procurement phases and activities

The procurement function manages business purchase requirements through procurement activities, categorized into three distinct phases: pre-contract, selection and contracting, and post-contract (Heinis et al., 2021) as shown in Figure 1-1.

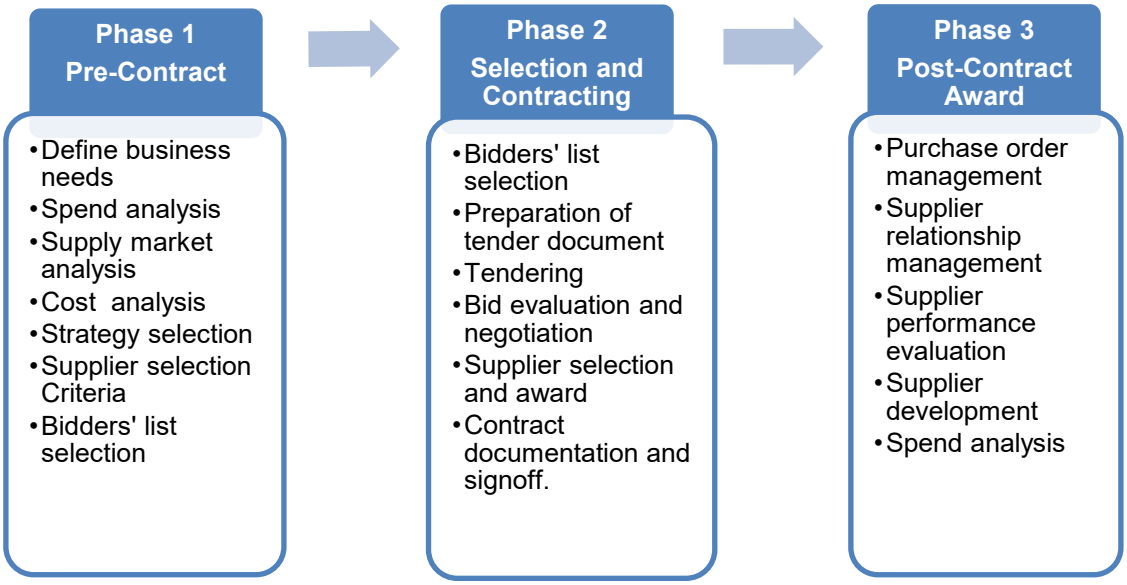


Figure 1-1 Procurement phases and activities

Source: (Backstrand et al., 2019; Monczka et al., 2020; Heinis et al., 2021)

The pre-contract phase involves planning strategic activities, such as identifying business needs, conducting spend analysis, analysing the supply market, and selecting appropriate sourcing strategies (Dixit, 2020; Ates et al., 2018; Cano-Olivos et al., 2019). This is followed by the selection and contracting phase,

during which tactical activities such as selecting the bidders' list, preparing tender documents, tendering, supplier selection, and contract award are carried out (Handayani et al., 2022; Van Weele, 2018; Van Raaij et al., 2016). The post-contract award phase is focused on contract execution and performance management. The overall purpose of this phase is to ensure that suppliers deliver goods and services as agreed and the organisation gets expected value from the contracts (Aghajanian, 2018; Backstrand et al., 2019; Huma et al., 2020). Through these three phases, procurement teams ensure the efficient coordination and flow of required information and materials between the business and external suppliers (Monczka et al., 2020).

The procurement process in each phase is critical to achieving objectives and organisational goals (Heinis et al., 2021; Backstand et al., 2019). Moreover, the success or failure of an organisation is majorly dependent on the effectiveness of procurement processes because procurement decisions directly affect costs, quality, and delivery of good and services and these impact profitability, reputation and competitiveness. (Nyama et al., 2022). Although the procurement phases are hierarchically interconnected, each has unique characteristics that differentiate them (Cagno et al., 2011). All three phases have a similar need for effective stakeholder engagement to achieve their goals successfully. For example, research has highlighted that procurement teams need to engage with budget owners, users, and suppliers to effectively define business requirements, evaluate suppliers and implement contracts in the pre-contract, selection and contracting, and post-contract phases, respectively (Nyamah et al., 2023; Saputro et al., 2022; Cagno et al., 2011).

The need for accurate documentation exists across all three phases. For instance, product specifications, tender packages, supplier evaluations, contract terms, and contract management plans must be accurately documented in the three phases to ensure effective procurement (Cagno et al., 2011; Micheli,2008). Furthermore, all three phases have inherent risks that must be appropriately managed, to prevent negative impact on the overall quality of the procurement process (Nyamah et al., 2023; Aghajanian, 2018). However, the effectiveness of risk management in each procurement phase depends on the skills and

competencies of the procurement teams (Moshtari et al., 2021; Kersten et al., 2011).

1.1.2 Procurement risks and Procurement risk management definitions

There is no universally agreed definition of procurement risks. Procurement risks have been described as anything that can go wrong in the procurement process that leads to a breakdown in the procurement process, making it difficult to achieve the procurement outcome (CIPS, 2021). Christopher & Peck, (2004) and Tavana et al. (2021) defined procurement risks as widespread problems that impede the flow of materials and information from an organisation's supply base (Christopher & Peck, 2004; Tavana et al., 2021), while Ellis et al. (2010) defined supply chain risk as "an individual's perception of the total potential loss associated with the disruption of supply of a particular purchased item from a particular supplier." Each of these definitions emphasize different risk aspects: procurement process, exchange parties, and flow of materials and information. By combining the critical aspects, the author defined procurement risks as '*any problem that leads to a breakdown of the procurement process and impedes the flow of materials and information between the supplier and the buying organisation*.' This definition is more appropriate for this study since it captures the multidimensional nature of procurement risks.

Procurement risk management has been described form several perspectives including financial and corporate governance, business continuity and crises management, and reputational and process control (Tummala & Schoenherr, 2011; Hallikas et al., 2004; Zsidisin & Ritchie, 2009; Zsidisin, 2003). A single definition of procurement risk management is rare in the literature, therefore for this research the author defined procurement risk management as *the process of identifying and assessing risks arising from the procurement process and developing appropriate risk mitigation strategies.* Procurement risk management has moved to the forefront of business strategies because of its direct impact on profitability (Nyamah et al., 2023). It has become necessary for

procurement managers to re-evaluate and develop procurement strategies that will enable their organisations to manage and withstand future procurement risks (Accenture, 2020; Capgemini, 2020).

The research on procurement risk management evokes interest because procurement activities involve significant financial investments with third parties, directly impacting organisations' bottom line (Nyamah et al., 2023; Aghajanian, 2018). Organisations focus on risk management in the pre-contract and selection and contracting, assuming that once a contract is signed, risk exposure declines. However, significant risks including delays, failure to meet specifications, cost overruns, quality issues and relationship breakdowns mostly occur in the post-contract award phase. These risks can have a profound impact on value-for-money, operational continuity, and organisational reputation (Hong et al., 2018; Hallikas et al., 2016). Therefore, this study recognises procurement risk management in the post-contract award phase as a critical yet under-researched area that requires a structured approach.

The manufacturing Sector is a highly relevant context for investigating procurement risk management because it plays a pivotal role in the economy. For instance, in the UK, the manufacturing sector contributes about 10% of the total UK GDP (Bank of England, 2024), and export from UK manufacturing was at a total of £359.1 billion in 2024 (MTA, 2024). The UK manufacturing sector has been highly exposed to procurement risks as it is heavily dependent on inputs from foreign suppliers in the US, China and Europe (Bank of England, 2024). This sector continues to face shortages, elevated costs of raw materials and components and manufacturers have struggled to find alternative suppliers for raw materials and parts, therefore affecting their profitability (Business Insider, 2023). A holistic study that explains how procurement risk management strategies are used in the post-contract award phase in the manufacturing sector is still needed.

1.1.3 Transaction Cost Economics and Social Exchange Theory

This PhD thesis is guided by two theoretical lenses: transaction cost economics (TCE) and the social exchange theory (SET). TCE provides a framework for understanding contractual transactions' economic and structural aspects, while SET provides social and relational dimensions of procurement exchanges. Both theories were selected because the combination of the economic focus of TCE with the relational insights of SET provides a more comprehensive explanation of the risks most likely to occur in contractual exchanges with the market in the post-award phase (Wacker et al., 2016). This combination enables the development of contractual and relational governance structures to manage procurement risks holistically (Habib et al., 2022; Wacker et al., 2016). Moreover, both TCE and SET have been extensively used as theoretical lenses to investigate transaction risks and buyer-supplier issues (Habib et al., 2022; Tran et al., 2022; Hoffmann et al., 2011; Kwon et al., 2005).

On the one hand, transaction cost economics (TCE) theory examines the exchange risks and transaction costs in inter-organizational economic relationships to define the best governance structure (Williamson, 1993). According to TCE, transaction costs are driven by key determinants such as the degree of asset specificity, uncertainty, and transaction frequency, coupled with human behaviour assumptions of bounded rationality and opportunism (Patil et al., 2023; Tate et al., 2022). On the other hand, social exchange theory (SET) examines the social interaction between two entities involved in such an interaction to achieve a positive economic outcome (Saglam et al., 2022; Ali & Khalid, 2017). The main idea of SET is that positive interactions over time will produce relational exchange norms such as trust, commitment, information sharing, and flexibility that govern an exchange relationship (Tate et al., 2022; Habib et al., 2020). Therefore, combining both TCE and SET provides a more holistic understanding of procurement risk management in the post-contract award phase.

1.2 Research Aim and Objectives

This PhD thesis aims to investigate how procurement risk management strategies are used to manage procurement risks in the post-contract award phase in manufacturing organisations. To achieve the research aim, the following research objectives are developed:

1) To investigate how procurement risk management strategies are used to manage risks in the three procurement phases: Pre-contract, selection & contracting, post-contract award.
2) To develop an evidence-based procurement risk management model for managing procurement risks in the post-contract award phase.
3) To evaluate how sociological mechanisms influence procurement risks including, exchange risks and transaction costs, and procurement risk management performance in the post-contract award phase.

1.3 Research Question

To achieve the research aim, this study seeks to address the following overall research question: ***How are procurement risk management strategies used to manage procurement risks in the post-contract award phase in manufacturing organisations?***

1.4 Philosophical Paradigm

Philosophical paradigm shapes how a researcher understands the nature of reality, how knowledge is generated, and what methods are appropriate (Onwuegbuzie et al., 2009).

Paper 1, a literature review, was guided by constructivist paradigm to systematically review risk management in the three procurement phases. Constructivism was selected because it views reality as socially constructed and shaped by human interpretation (Lincoln & Guba, 2000). It emphasises the subjective nature of knowledge, acknowledging that meaning is co-created by researchers and participants through interaction. Similarly, Paper 2, qualitative research, was also guided by constructivist paradigm to investigate procurement

risk management strategies used to mitigate risks in the post-contract award phase. The constructivist paradigm is particularly well-suited for qualitative research that seeks to understand complex, context-dependent human experiences rather than to discover objective truths (Onwuegbuzie et al., 2009; Lincoln & Guba, 2000). Paper 1 and paper 2 are theory building papers offering new perspective to understanding the procurement risk management as well as providing new models for procurement risk management.

Paper 3, a quantitative study, was guided by the post-positivist paradigm to investigate the influence of sociological mechanisms on procurement risks and procurement risk management performance in the post-contract award phase. The post-positivism paradigm was selected because it typically relies on structured methods, hypothesis testing, and measurement to reduce bias and error in understanding reality (Onwuegbuzie et al., 2009). The paradigm is particularly suited for Paper 3 since it is a theory testing paper, providing empirical evidenced insights about how sociological mechanisms influence procurement risks and PRM performance. A comparison of post-positivism and constructivism paradigms is presented in Table 1-1.

Table 1-1 Research paradigms' characteristics (Onwuegbuzie et al., 2009)

Paradigmatic Element	**Post-positivism**	**Constructivism**
Ontology	Social science inquiry should be objective.	Multiple contradictory, but equally valid accounts of the same phenomenon representing multiple realities.
Epistemology	Researchers should eliminate their biases, remain emotionally detached and uninvolved with the objects of study and test or empirically justify their stated hypotheses.	Subjective knower and known are not separable; Transactional/ subjectivist; cocreated findings /meaning.
Methodology	Time- and context free generalizations are desirable and possible and real causes of social scientific outcomes can be determined reliably and validly via quantitative (and sometimes qualitative) methods.	Hermeneutical/ dialectical; impossible to differentiate fully causes and effects; inductive reasoning; time and context-free generalizations are neither desirable or possible.
Nature of Knowledge	Nonfalsified hypotheses that are probably facts or laws.	Individual and collective reconstruction that may unite around consensus.

Research paradigms' characteristics (Onwuegbuzie et al., 2009)

1.5 Research Dissemination

A summary of the research dissemination is presented in Table 1-2

Table 1-2 Research dissemination (source; Author)

Papers	Journal Paper	Conference Paper
Paper 1 (Chapter 2)	**In preparation:** Alex-Eyitene, E., Habib, F., and Yates, N. (2024) "Risk management in the three procurement phases: a systematic literature review (SLR)" *Journal of Purchasing and Supply Management*	
Paper 2 (Chapter 3)	**In preparation:** Alex-Eyitene, E., Habib, F., and Yates, N. (2024) "Managing procurement risks in the post-contract award phase: empirical evidence from the manufacturing industry." *Journal of Purchasing and Supply Management*	Alex-Eyitene, E., Habib, F., and Yates, N. (2024), "Managing procurement risks in the post-award contract phase: empirical evidence from the manufacturing industry". In: 31st EurOMA Conference, 2024, Barcelona, 29 June, 2024
Paper 3 (Chapter 4)	**In preparation:** Alex-Eyitene, E., Habib, F., and Yates, N. (2024) "Managing procurement risks in the post-award contract phase: the interplay between transaction cost economics theory and social exchange theory", *International Journal of Operations & Production Management /International Journal of Production Economics*	

I am the lead author of all three papers in this thesis, responsible for reporting the research and writing the original manuscript. I conceived each paper's original ideas, research topic, scope, and objectives. My primary supervisor, Dr. Farooq Habib, and secondary supervisor, Dr. Nicky Yates, also the co-authors of the papers, supported me in planning, developing, and refining the papers. They provided critical feedback, which helped to shape my research and improve the quality.

1.6 Research Design and Structure

This thesis followed a PhD by papers format, comprising three studies: a systematic literature review (Paper 1), an abductive qualitative study (Paper 2), and a quantitative investigation using structural equation modelling (Paper 3). This format allowed the author to use different methods to explore procurement risk management from different angles. This PhD thesis employs a multiple method approach, including interviews and survey questionnaires carried out sequentially to investigate the phenomenon of procurement risk management in the post-contract award phase. Ultimately, the goal is to improve procurement risk management in the post-contract award phase by increasing the rigour involved in the risk management process. The potential contribution of this research is in twofold. Firstly, it addresses the gap identified in the literature and provide theoretical contributions that extend the procurement risk management body of knowledge. Secondly, it provides procurement professionals with practical insights into a holistic procurement risk management process in the post-contract award phase.

1.6.1 Overview of the studies in this thesis

This research adopts the PhD-by-paper route, which delivers the research contributions through three separate chapters: 2, 3, and 4, each formatted like an academic journal article and forms the main body of the thesis. Chapters 2, 3, and 4 correspond to and deliver each of the three research objectives (as shown in Figure 1-2). Overall, they form a logical piece of work that contributes to achieving the aim of the thesis.

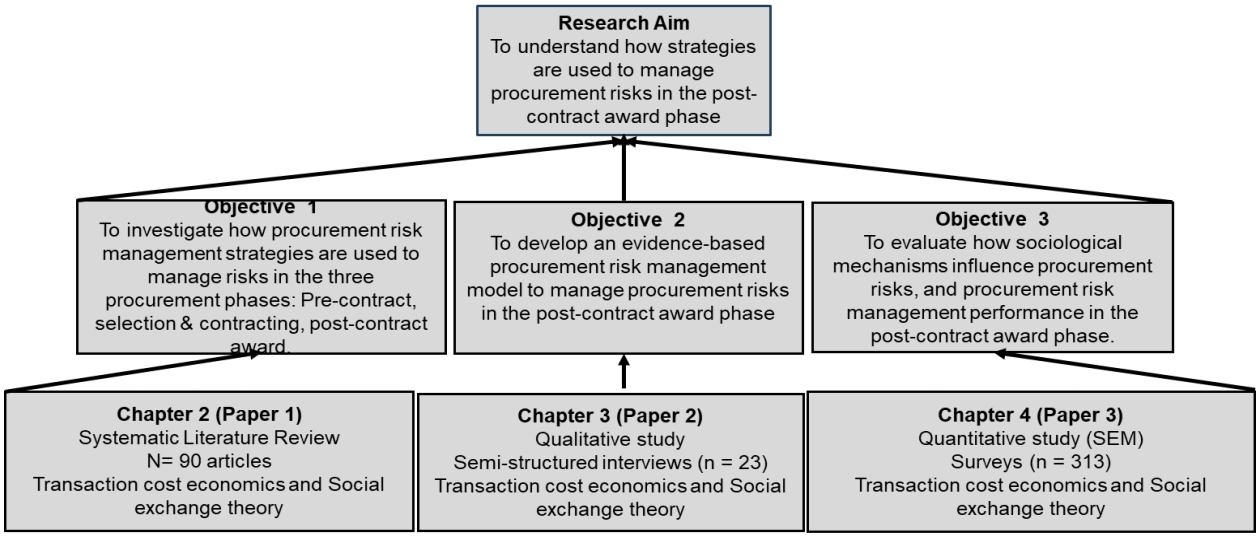


Figure 1-2 Summary of papers in the thesis (Source: Author)

Chapter 2 presents the literature review study aimed at examining the extant literature specifically to identify what is known about procurement risk, the tools/techniques used to manage procurement risks, the procurement strategies used to mitigate procurement risks and the factors that influence the selection of procurement risk management strategies in the three procurement phases: pre-contract, selection and contracting and post-contract award. The systematic literature review (SLR) method was used to accomplish the aim of this study, as it enabled the selection of 90 peer reviewed journals articles and the synthesis of essential findings from them. Social exchange theory (SET) and transactional economics theory (TCE) were used as theoretical lenses to understand and develop a conceptual framework for procurement risk management in the three procurement phases. This SLR study answers Objective 1, which is to investigate how procurement risk management strategies are used to manage risks in the three procurement phases: Pre-contract, selection & contracting, post-contract award. The finding provides insights of how procurement risk management strategies are used in pre-contract, and the selection and contracting phase but exposed the gaps in the literature, showing that procurement risk management in the post-contract award phase had been neglected. The insights from the SLR laid the foundation for the subsequent study (Paper2) in Chapter 3 which focused

on how procurement risk management strategies are used in the post-contract award phase and developed a procurement risk management model for managing procurement risks in the post-contract award phase.

Chapter 3 is a qualitative study that employed semi-structured interviews to explore and draw insights into how procurement risk management strategies are used in the post-contract award phase in the manufacturing sector. The selection of a qualitative research design was driven by the exploratory nature of this study since it provides in-depth insights into topics that are not yet fully understood and documented in prior literature. The semi-structured interviews enabled the author to elicit detailed information on how procurement risk management strategies are used in the post-contract award phase, from procurement professionals directly involved in procurement activities. In this study, TCE and SET theories were used as theoretical lenses to understand the PRM phenomenon, develop an evidence-based procurement risk management model, and guide procurement risk management decisions in the post-contract award phase for manufacturing businesses. Overall, this qualitative study contributes to objective 2: to develop an evidence-based procurement risk management model for the post-contract award phase. Insights from respondents in paper 2 highlighted the importance of human-engagement techniques based on SET constructs such as communication leading to information sharing, flexibility and commitment in procurement risk management. Interview insights highlighted that such sociological constructs reduce procurement risks and significantly impact procurement risk management outcomes. These insights informed the research direction of paper 3 (Chapter 4).

Chapter 4 presents a quantitative study that examines how sociological mechanisms influence procurement risks and procurement risk management performance during the post-contract award phase. The research employed both transaction cost economics (TCE) and social exchange theory (SET) as theoretical lenses for this study. TCE variables were used to explain procurement risks, including exchange risk and transaction costs. SET variables formed the sociological mechanisms that influence procurement risks and procurement risk management performance in the post-contract award phase. The author used

Survey questionnaires to collect data from procurement professionals, and data analysis was conducted using Partial Least Squares Structural Equation Modelling (PLS-SEM). This study contributes to Objective 3, which is to evaluate how sociological mechanisms influence procurement risks, including exchange risks and transaction costs, and procurement risk management performance in the post-contract award phase.

The findings from Chapters 2, 3, and 4 (Papers 1, 2, and 3) are synthesized and integrated in Chapter 5 to generate the overall contribution to knowledge, contribution to practice, research limitations, and future research directions.

1.7 References to Chapter 1

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2 PAPER 1: RISK MANAGEMENT IN THE THREE PROCUREMENT PHASES: A SYSTEMATIC LITERATURE REVIEW

Abstract

This research adopts the systematic literature review (SLR) methodology to investigate risk management strategies in the three procurement phases. The SLR identified 115 peer-reviewed articles published between 2000 and 2025. These articles were analysed to capture the risks that impact activities in each procurement phase, the tools/techniques used to identify, assess, and mitigate risks and the strategies used to manage these risks. The findings showed the following risks in each phase. 1) Pre-contract phase: wrong sourcing and award strategies, inaccurate spend analysis and forecasts, and inadequate stakeholder engagement. 2) Selection and contracting phase: lack of stakeholder collaboration, poor supplier selection, poor specification, inappropriate pricing schedules. 3) Post-Contract phase: supplier dependency, poor relationship management, natural risk events, supply issues, price risks, quality issues. Second, the findings showed there is limited use of tools/techniques to manage risks in the post-contract phase compared the pre-contract phase, and the selection and contracting phase.

This SLR study contributes to the existing literature by aligning the fragmented strands of risk management literature, and systematically synthesizing the procurement risks, the tools and techniques to identify, assess, and mitigate risks, and the risk mitigation strategies in each procurement phase. This study also contributes a novel conceptual framework that integrates the risk identification, assessment, and mitigation strategies into the three procurement phases. The novel PRM model provided will guide procurement managers' risk management decisions in the three procurement phases.

Keywords – Procurement risks; Identification; Assessment; Mitigation; Procurement phases.

2.1 Introduction

2.1.1 Problem Statement

Risk events, including the COVID-19 pandemic, the US-China trade wars, UK Brexit, the Japan-South Korea trade dispute, and the Russia-Ukraine war, have increased procurement failures in organisations (Han et al., 2024; Roscoe et al., 2020; Handfield et al., 2020; Singh et al., 2021; el et al., 2021). In March 2022, the coronavirus lockdown in Shanghai led to severe disruptions in the supply of car parts, which had a ripple effect on production in other countries. For instance, Mazda was forced to shut down two of its plants in Japan due to delays in sourcing essential parts from suppliers in Shanghai. This shutdown not only led to significant production delays but also resulted in financial losses (Forbes, 2022). This event highlighted a critical challenge for procurement leaders: the need to develop more robust, holistic risk management strategies to mitigate disruptions like these (Ganesh & Kalpana, 2022; Ernst & Young, 2021; Accenture, 2020; Remko, 2020). Despite ongoing efforts, many organizations still face significant gaps in their risk management approaches (McKinsey, 2021; CIPS, 2021; Capgemini, 2020).

With the increasing frequency of procurement risks and failures in recent years, there has been a growing interest among researchers in exploring various aspects of procurement risk management, such as risk identification, assessment, and mitigation (Enyinda et al., 2017; Ma et al., 2018; Aghajanian, 2018Cano-Olivos, et al., 2019; Ganesh et al., 2022; Saputro et al., 2022; Handayani et al., 2022; Schoenherr et al., 2023; Wang et al., 2025). However, it is recommended that to manage these risks effectively, organisations need a comprehensive and integrated approach throughout all phases of procurement (Han et al., 2024; Nyama et al., 2023, Van Hoek 2021). While existing studies have proposed specific risk mitigation strategies such as safety stock, contingent

sourcing, postponement, and collaboration (Schoenherr et al., 2023; Saputro et al., 2022; Fischer-Preßler et al., 2020; Manhart et al., 2020; Chang et al., 2015; Grötsch et al., 2013; Chen et al., 2012), there remains a gap in the literature when it comes to a holistic framework that encompasses risk identification, assessment, and mitigation across the three procurement phases. This paper aims to fill that gap by offering a comprehensive review of risk management strategies that address these key areas in the context of the entire procurement process.

2.2 Research Background

Over the years, procurement strategies have been developed to reduce costs and increase profitability without considering risks (Viera & Caetano, 2022; Fischer-Preßler et al., 2020; Purvis et al., 2016). This has resulted in the selection of global sourcing strategies that have increased procurement risks such as supply shortages, quality issues, supply tier visibility issues, and supplier dependency issues (Mouloudi et al., 2022; Taghizadeh et al., 2021; Hong et al., 2018; Hallikas et al., 2016).

2.2.1 Procurement risk management process

Procurement risk management is a 3-step process including 1) the identification of risk events, 2) assessment of the likelihood and impact of risk occurrence, 3) the development of risk mitigation plans to reduce risk occurrence, and reduce risk impact (Ganesh & Kalpana, 2022; Aghajanian, 2018; Hong & Lee, 2013; Cagno et al., 2011). The process is shown in Figure 2-1.

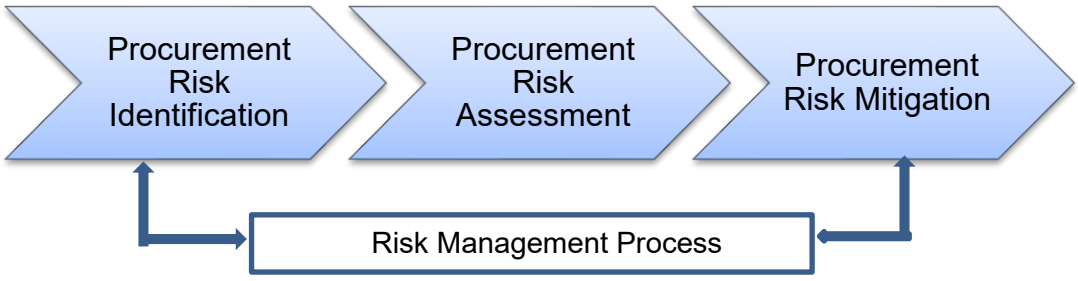


Figure 2-1 Procurement Risk Management Process. (Source: Aghajanian, 2018)

Procurement risk identification enables procurement managers to identify potential risk exposures that cause procurement uncertainties (Ma et al., 2018;). Unknown risks pose a significant threat to achieving procurement objectives because procurement managers cannot plan mitigation strategies when risks are unknown (Aghajanian, 2018). To develop appropriate procurement risk management strategies, it is crucial to understand the variety of procurement risks, such as supply market visibility risk, spend analysis risk, supplier selection risk, and supply risk, and their interrelationships (Tummala & Schoenherr, 2011; Vieira et al., 2022). For instance, General Motors uses a customised supply chain visibility tool that integrates their tier 1 and tier 2 suppliers to identify potential supplier risks across locations and to develop mitigation strategies (General Motors, 2021).

Procurement risk assessment involves the measurement of the probability and impact of risk occurrence (Cagno et al., 2011; Zsidisin et al., 2004). Risk assessment is a vital responsibility of the procurement function because of the potential negative impact of risk events associated with supplier selection and supply of materials and spares (Çıkmak & Ungan, 2022). Several studies (Ganesh & Kalpana, 2022; Dixit, 2022; Ma et al., 2018) have emphasised the importance of assessing the risk of poor quality, late deliveries, uncertain capacity, dispersed geographical location of suppliers, reputational issues, supplier's financial issues and supplier failures, to develop appropriate mitigation strategies. For example, Ford Motors conducts self-assessment questionnaires (SAQ) with their global Tier 1 suppliers and conducts a regular risk assessment of their supply base to prioritise and target risk issues that can impact their business most (Ford, 2019).

Procurement risk mitigation involves selecting and implementing activities and actions to eliminate or reduce the impact of procurement risks (Essaber et al., 2021; Chang et al., 2015). Without effective procurement risk mitigation, organisations' operations, productivity, and performance could suffer immensely when these risks occur (Chen et al., 2013). Organisations deploy several coordinated approaches at different phases to reduce vulnerabilities. (Manhart Baylor et al., 2020; Sodhi et al., 2012). For example, Toyota developed a RESCUE system to increase their suppliers' visibility at various tiers to mitigate potential risks (Taghizadehet al., 2021). While some organisations select proactive risk management strategies to manage their risk exposures before they occur (Grötsch et al., 2013), others implement reactive risk management strategies to reduce the severity of risk impact after the risks have occurred (Wieland & Marcus Wallenburg, 2012). On the other hand, some studies argue that a combination of proactive and reactive strategies can co-exist to reduce subsequent risks (Roscoe et al., 2020; Wieland & Marcus Wallenburg, 2012).

Procurement risk management tools/techniques are specific methods used to identify procurement risks, assess the probabilities and impact of procurement risks, and develop mitigation strategies to manage the identified risks (Ganesh et al., 2022; Cano-Olivos et al., 2019; Hong & Lee, 2013).

2.2.2 Review Questions

This review investigates the strategies that can effectively manage risks in the three procurement phases (Nyamah et al., 2023; Remko, 2020). It aims to answer the following review question.

RQ1: How are strategies used to manage procurement risks in the three procurement phases**?** This question is expected to provide an overall understanding of the procurement strategies used in managing procurement risks as outlined by academia. The main review question was deconstructed into four sub-questions to enable the identification, assessment, and mitigation of procurement risks in the three procurement phases. This approach would provide

a further in-depth understanding of the procurement risk management process (Ma et al., 2018; Aghajanian, 2018).

RQ1a: What are the procurement risks in the three procurement phases?

RQ1b: What are the tools/techniques used to manage procurement risks in the three procurement phases?

RQ1c: How are procurement strategies used to mitigate procurement risks in the three procurement phases?

RQ1d: What factors influence the selection of procurement risk management strategies in the three procurement phases?

One of the main contributions of the SLR is to identify gaps in knowledge that the author addressed in Paper 2 and paper 3.

2.3 SLR Methodology

The SLR methodology is adopted in this paper to examine the existing literature on procurement risk management, answer the review questions and identify future research direction (Tranfield et al., 2003). The SLR method is selected because it follows a transparent research process which is replicable, reduces researcher bias and provides a more reliable basis for drawing conclusions (Reim et al., 2015). The method also provides a good understanding of the different constructs, theories, and frameworks that would enable reasonable conclusions about the current body of knowledge of the procurement risk management field (Denyer & Tranfield, 2009). This study followed Denyer and Tranfield (2009) 5-stage SLR process: 1) planning, 2) searching, 3) screening, 4) extraction and synthesis, and 5) reporting.

2.3.1 Planning

An extensive scoping study was done to understand the concept of procurement risk management, define the research scope and develop the review questions. The research scope in Figure 2-2 is centred around procurement risk and procurement risk management strategies and activities.

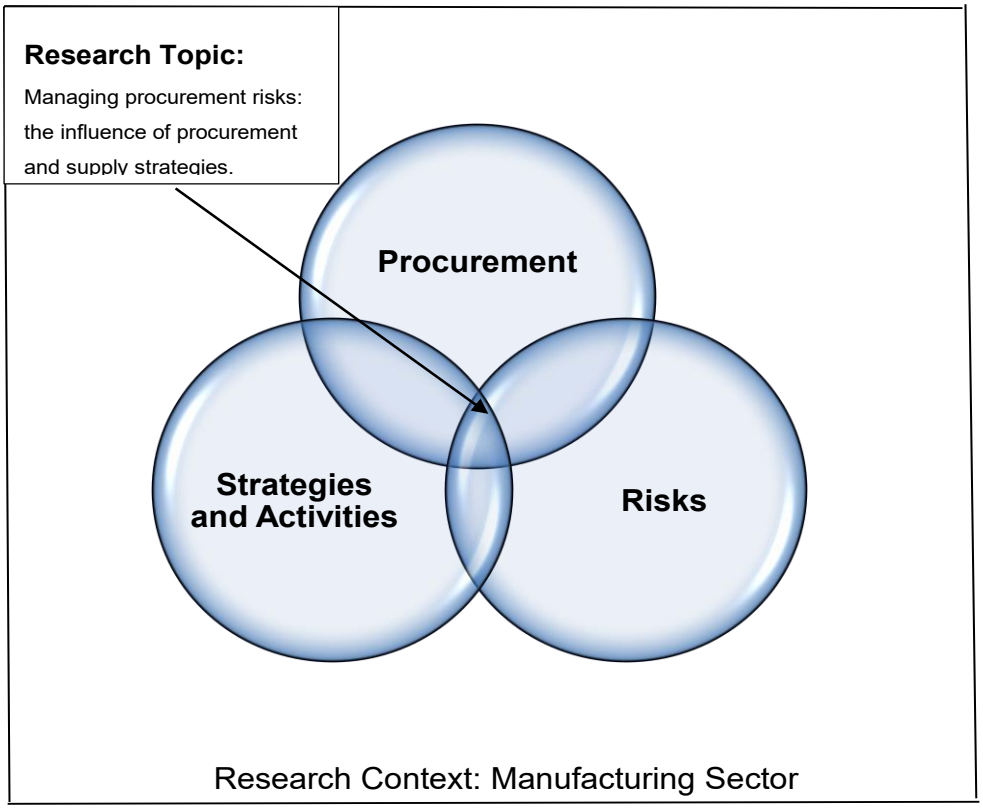


Figure 2-2 Research Scope (Source: Author)

2.3.2 Searching

Three keywords related to the research scope and title were selected based on frequently used words in the existing procurement risk management literature. The keywords were identified as procurement, risks, strategies, and activities (see table 2-1). In addition, alternative words consistently used as synonyms in

different streams of procurement risk management literature were also selected. The selected keywords and synonyms were used to formulate search strings using Boolean connectors: OR and AND, as shown in Table 2-1.

Table 2-1 Keywords and search terms (Source: Author)

Risk		Procurement		Strategies and Activities
Risk OR	AND	Procure* OR	AND	Strateg* OR
Threat OR		Purchas* OR		"Supplier selection" OR
Disrupt* OR		Sourc* OR		"Supplier Evaluation" OR
Uncertainty OR		Buy* OR		"E- Auction" OR
Hazard		"Procurement Phases"		Tendering OR
				"Contract Management" OR
				"Contract Design" OR
				"Supplier Appraisal" OR
				"Supplier Development" OR
				Identification OR
				Assessment OR
				Mitigation OR

The Proximity operators N3, N/3, and W3 were included in the search strings (see Table 2-2), and used to query EBSCO, ProQuest, and Scopus databases, respectively, to retrieve articles with titles and abstracts closely related to the research keywords and research scope. These databases were selected because they provide access to high-quality peer-reviewed articles that will be useful in gaining insight into how strategies are used to manage risks in the three procurement phases. EBSCO includes over 2,800 scholarly business publications, such as peer-reviewed journals, market reports, and company

profiles. It is widely used by business school faculty, students, and researchers (Zhang & Su, 2018). ABI/Inform (ProQuest) provides access to approximately a large repository of international periodicals is considered one of the most extensive business databases, providing both current and historical documents (ProQuest, 2018). Scopus is the world's largest repository of peer-reviewed literature, spanning sciences, social sciences, and medical fields. It features content from over 5,000 international publishers and offers advanced tools for research tracking and analysis (Elsevier B.V., 2017). The search for literature across the three databases with the search strings returned 25,476 documents and 67% of these were from Scopus (16,939), 25% from ProQuest (6,482), and 8% were from EBSCO (2055).

Table 2-2 Search strings / academic databases. (Source: Author)

Business Source Complete (EBSCO)	(Procure* OR Purchas* OR Sourc* OR Buy OR “Procurement Phases”) N3 (Risk OR Threat OR Disrupt* OR Uncertainty OR Hazard) AND (Strategy OR “Supplier Selection” OR “Supplier Evaluation” OR “E-Auction” OR Tendering OR “Contract Management” OR “Contract Design” OR “Supplier Appraisal” OR “Supplier Development” OR Identification OR Assessment OR Mitigation)
ABI/inform complete (ProQuest)	(Procure* OR Purchas* OR Sourc* OR Buy* OR “Procurement Phases”) N/3 (Risk OR Threat OR Disrupt* OR Uncertainty OR Hazard) AND (Strategy OR “Supplier Selection” OR “Supplier Evaluation” OR “E-Auction” OR Tendering OR “Contract Management” OR “Contract Design” OR “Supplier Appraisal” OR “Supplier Development” OR Identification OR Assessment OR Mitigation)
SCOPUS	(Procure* OR Purchas* OR Sourc* OR Buy* OR “Procurement Phases”) W/3 (Risk OR Threat OR Disrupt* OR Uncertainty OR Hazard) AND (Strategy OR “Supplier Selection” OR “Supplier Evaluation” OR “E-Auction” OR Tendering OR “Contract Management” OR “Contract Design” OR “Supplier Appraisal” OR “Supplier Development” OR Identification OR Assessment OR Mitigation)

2.3.3 Screening

In the first screening stage, inclusion criteria such as publication type, source type, subject area language, and keywords were strictly applied to select relevant articles (See Table 2-3). This ensures that the literature review is based on approved and verified literature with methodological rigor and comprehensiveness. Only articles written in English from academic journals within business, management, and accounting subject areas that matched the research keywords were selected.

Table 2-3 Inclusion criteria (Source: Author)

Criteria	Inclusion Criteria	Rationale
Publication type	Peer-reviewed Articles	To ensure the literature review is based on approved and verified literature.
Source type	Academic Journals	To ensure methodological rigour and comprehensiveness.
Subject area	Business, Management and Accounting	To narrow down on articles focused on the research topic
Language	English	To avoid translation errors.

Non-English articles, conference papers, book chapters, reviews, trade journals, newspapers, and articles outside the research keywords were excluded (Table 2-4). This first stage of screening reduced the Scopus articles to 170, ProQuest to 167, and EBSCO to 85. A total of 422 articles were selected at this first screening stage.

Table 2-4 Exclusion Criteria (Source: Author)

Criteria	Exclusion Criteria	Rationale

Publication type	Feature, News, Commentary, Front Page/ Cover Story, Conference Paper, Review, Book chapter, and Conference Review,	To ensure the literature review is based on approved and verified literature.
Source type	Conference Proceedings, Books, Trade Journal, Newspapers, Magazines, Dissertation &Theses, and Conference Papers and Reports.	To ensure methodological rigour and comprehensiveness.
Subject Area	Natural Sciences, Computer Sciences, Engineering, and all other unrelated subject areas.	To narrow down on articles in the discipline of study: Business and Management
Keyword	All other words not related to the research scope	To narrow down articles focused on the research scope
Language	Non-English language journals	To avoid translation errors.

The selected 422 articles were exported to an Excel sheet in the second screening stage, 106 duplicates were removed, and the remaining 316 articles were further screened based on title and abstract criteria (Table 2-5). The abstracts were read and a total of 186 articles (Toth et al., 2020; Verweij et al., 2020; Sen & Ongsakul, 2017; Hong et al., 2016; Eweje et al., 2012) were rejected because their titles and abstracts were not related to the research scope.

Table 2-5 Title and Abstract Screening Criteria. (Source: Author)

Database	**Inclusion Criteria**	**Exclusion Criteria**
Scopus, ProQuest and Ebsco	Titles and abstract related to the research keywords and scope: Procurement, Risks, Procurement Strategies and Activities	All titles and abstracts not focused on the research keywords and scope.

Full-text review was conducted for the remaining 130 articles in the third screening stage, and 30 additional articles were rejected (Zhao et al., 2019; Hughes et al., 2018; Gardon et al., 2014) because they were not focused on procurement risks and/or procurement risk management and did not help answer the review questions. One hundred articles were accepted after the entire reading, and quality criteria (see Table 2-6) were used to assess the research

methodology, data analysis methods, contribution to theory, and practice of the selected 100 articles.

Table 2-6 Quality Criteria (Source: Pittaway et al., 2004)

No	Quality Criteria	Level			
		0	1	2	3
1	Methodology	Lack of adequate information to assess this criterion	Flawed research design with inappropriate quantitative methods	Justified research design; poor execution of idea	Research design adequately examines the research argument
2	Contribution to theory	Lack of adequate information to assess this criterion	Weak theoretical base	Incomplete theoretical base	Robust theoretical grounding; contribution to theory of practice
3	Data analysis: sample design and composition	Lack of adequate information to assess this criterion	Inadequate data sample; inconclusive research results	Appropriate data sample; adequate results but inadequate explanation	Appropriate data sample; properly explained research results support theoretical arguments
4	Implications for practice	Lack of adequate information to assess this criterion	Study fails to inform practice of implications	Study provides limited implications for practice	Study provides critical implications for practice

The minimum quality score required for an article to be included in the SLR was eight marks. All 100 articles met this minimum threshold as the articles had transparent methodologies with a good contribution to theory and practice. Overall, the author selected a total of 100 articles for the SLR. Figure 2-3 shows the summary of the systematic search process.

2.3.4 Extraction and Synthesis

The data synthesis is based on Denyer and Tranfield (2009) descriptive and thematic analysis method. The descriptive analysis presents a clear explanation of the overall state of the research literature. On the other hand, the thematic analysis captures in-depth information about the themes and varied contexts identified in the literature.

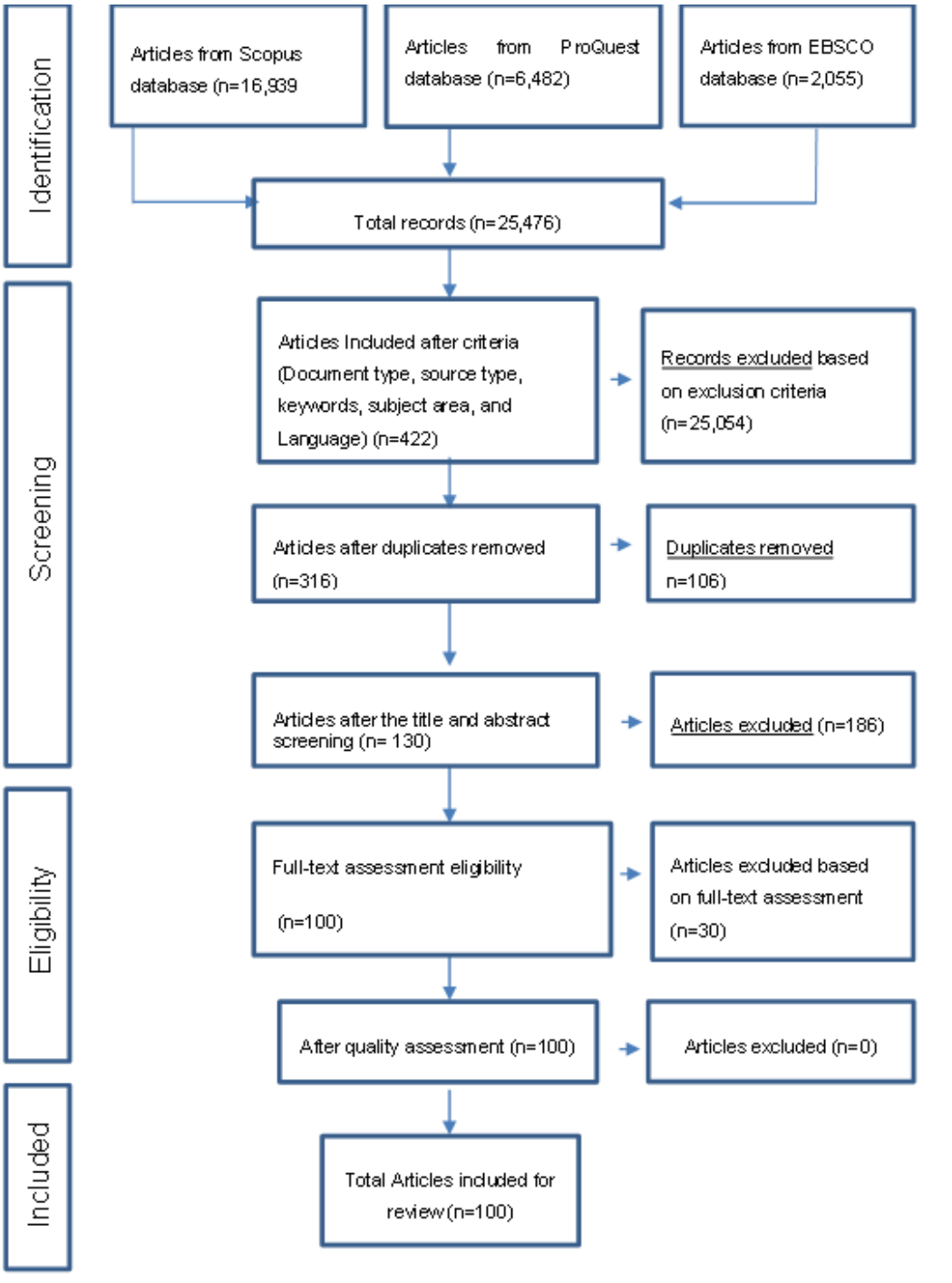


Figure 2-3 PRISMA Flow of Article Selection Process (Source: Ghadge et al., 2020)

2.4 Descriptive Findings

This section presents the analysis of the characteristics of all the 100 articles selected for this review. It begins with a review of the chronological distribution of papers by date, distribution of papers by location, field of study, methodology, theoretical lens, and journals. A breakdown of the distribution of papers to different descriptive categories is presented at the end.

2.4.1 Chronological Distribution

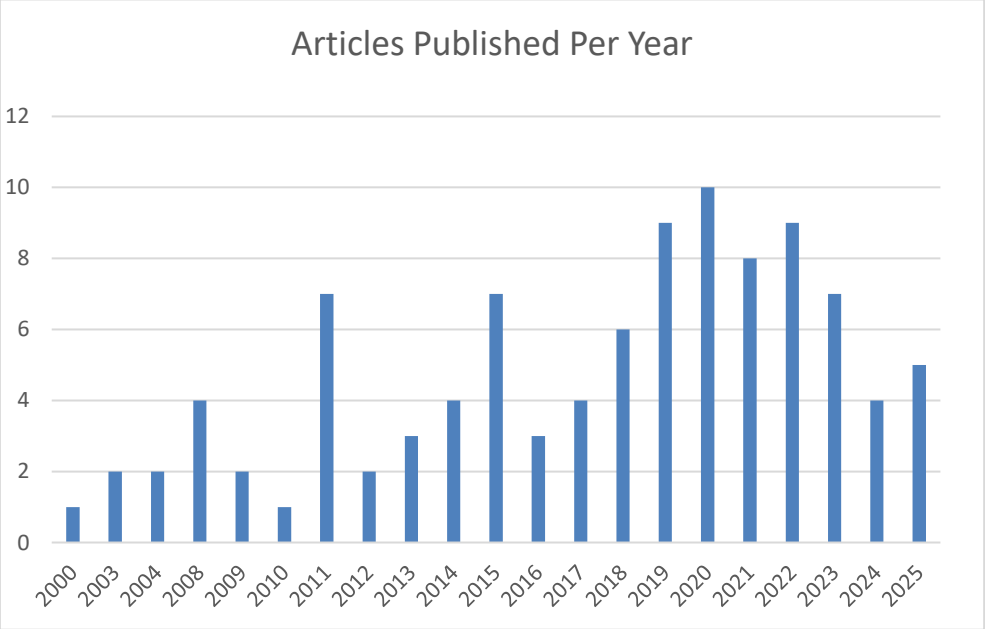


Figure 2-4 Chronological Distribution (Source: Author)

The selection criteria did not restrict the articles to any specific publication period. Instead, the emphasis was on selecting articles that contained relevant information that could be useful in analysing the current state of procurement risk management literature. Nonetheless, the analysis of the chronological distribution by year helps to show the development pattern of procurement risk management over time. The chronological distribution in Figure 2-4 shows that

the selected articles were published between 2000 and 2025. 71% of these articles were published in the last ten years between 2015 and 2025. This trend indicates a growing interest in procurement risk management within this period.

2.4.2 Distribution by geographical location

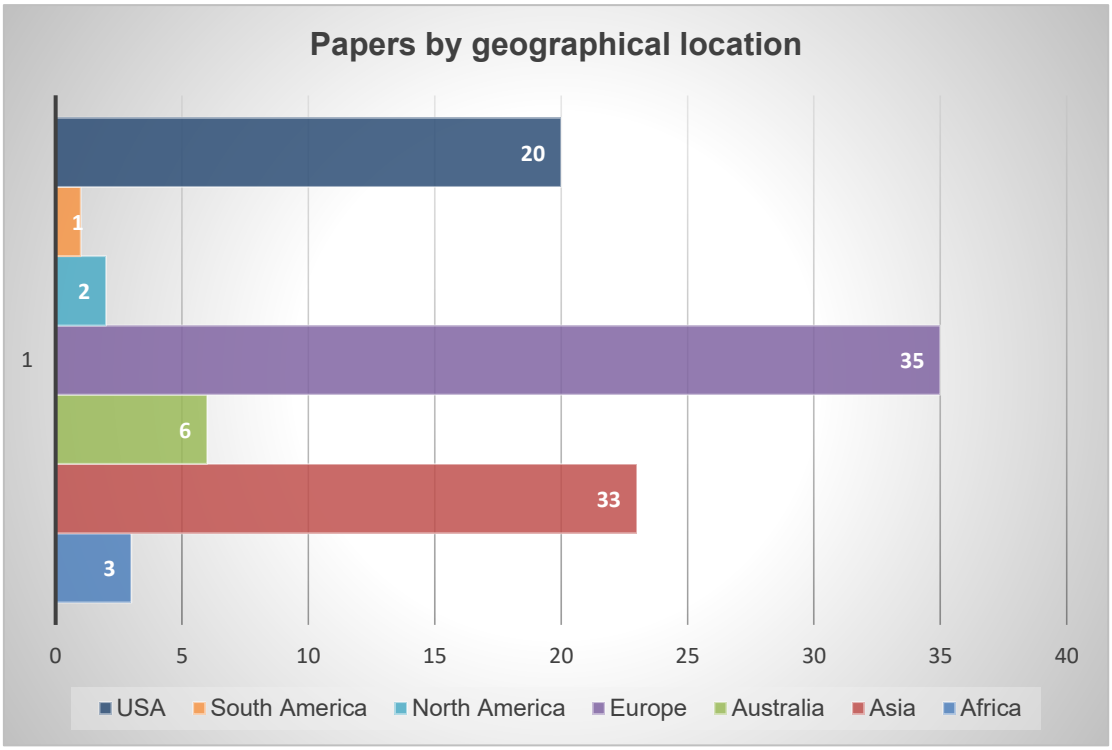


Figure 2-5 Distribution of papers by geographical location. (Source: Author)

The classification of the selected 100 articles by location found that the studies were carried out in 26 countries across six continents. The analysis of these articles revealed that authors in Europe, Asia, and the USA as shown in Figure 2-5 dominated the research related to procurement risks and procurement risk management strategies. The research from these three regions accounted for 88% of the selected articles: 35, 33, and 20, respectively. This research trend indicates increased interests in procurement risks in regions with increased global sourcing activities, such as Europe, the USA, and Asia. It supports this research argument that global sourcing has increased procurement risks. Based on the evidence gathered from this analysis, the investigation of procurement risk management in Africa, South America, and Australia are potential areas for future research.

2.4.3 Research Scope

The analysis of the field of the study revealed that 'procurement strategies and activities' was the predominant research focus of the selected articles (75), compared to 59 studies on Procurement risks, 37 studies on procurement risk assessment tools/techniques, and 22 studies on procurement risk identification tools/techniques. Only 16 articles examined procurement risk mitigation tools. Between 2012 and 2016, there was a sharp decline in procurement risk identification and assessment research as studies focused more on procurement strategies and activities. The breakdown of the field of study is shown in Figure 2-6 below. The review showed another increase in the research on procurement mitigation strategies and activities in 2020 during the coronavirus pandemic (Hallikas et al., 2020; Huma et al., 2020; Van Hoek, 2020) and on procurement risk identification, assessment, and procurement strategies and activities in the year 2022 (Schoenherr et al., 2023; Vieira et al., 2022; Ganesh & Kalpana, 2022; Tavana et al., 2022). The sharp decline in studies on procurement risk identification and assessment tools indicates future research direction.

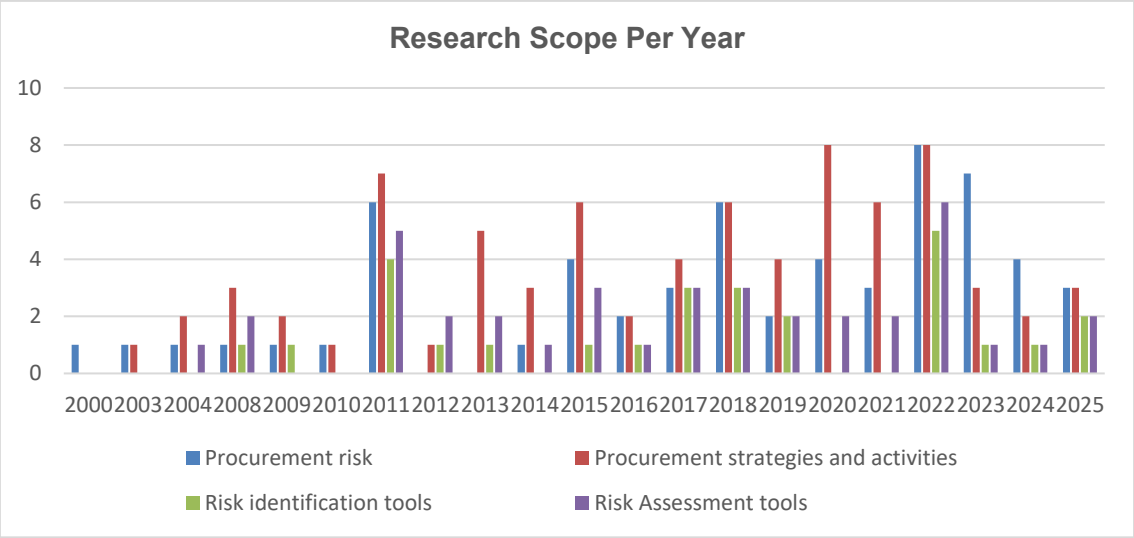


Figure 2-6 Research Scope per Year (Source: Author)

The selected articles were a combination of both analytical and empirical articles. The categorisation of the methodologies was based on the structure presented by Habib et al. (2015). Of the 100 articles selected, 65 were empirical studies, while the remaining 35 were analytical studies. The analytical articles were divided into conceptual (12), literature review (16), mathematical (5), and statistical (2). Furthermore, 52% of the empirical papers adopted quantitative research methods predominantly based on Surveys and case studies (Dixit et al., 2022; Nyamah et al., 2023; Essaber et al., 2021; Gao et al., 2019; Kara et al., 2018). It was found that more studies used quantitative methods in procurement risk management studies, and this presents opportunities to use qualitative or mixed methods to investigate procurement risk management in future research.

2.4.4 Distribution by Publication

The 100 articles used for this review were from 48 academic journals. Sixty of the articles were from 18 journals that published more than one paper (Table 2-7). The contributions to the literature on procurement risk management were from journals such as *the Journal of Purchasing and Supply Management,*

International Journal of Production Research, International Journal of Operations and Production Management and International Journal of Production Economics.

Table 2-7 Distribution of articles by publication. Source: Author

Publication Journals	Number of Articles
Annals of Operations Research	1
Benchmarking: An International Journal	2
Computers and Industrial Engineering	3
Decision Support Systems	2
European Journal of Operational Research	1
IEEE Transactions on Engineering Management	2
Industrial Engineeringand Management Systems	1
Industrial Management and Data Systems	3
International Journal of Construction Management	2
International Journal of Logistics Management	4
International Journal of Operations and Production Management	10
International Journal of Physical Distribution and Logistics Management	4
International Journal of Production Economics	5
International Journal of Production Research	9
International Journal of Productivity and Performance Management	2
International Journal of Risk Assessment and Management	1
International Journal of Supply Chain Management	1
International Journal of Systems Science: Operations and Logistics	1
Journal of Business Logistics	1
Journal of Business Research	2
Journal of Cleaner Production	2
Journal of Purchasing and Supply Management	12
Journal of Supply Chain Management	6
Management Decision	3
Supply Chain Forum: An International Journal	3
Supply Chain Management: An International Journal	2
Sustainability	2
Transportation Research Part E	2
Omega	3
Operations Research	1
The International Journal ofLogistics Management	1
The Journal of Business and Industrial Marketing	1
Thunderbird International Business Review	1
Uncertain Supply Chain Management	1
International Journal of Physical Distribution & Logistics Management	3

2.4.5 Application of Theory

Overall, only 17 of the articles (Table 2-8) stated the theoretical foundations of their studies. Six articles applied the contingency theory lens, which dates back to the 1960s and 1970s (Burns & Stalker, 1961; Fiedler, 1964; Luthans, 1976) to analyse the selection of appropriate procurement strategies and activities. In comparison, two articles used the agency theory lens, applied in various supply chain contexts for decades (Eisenhardt 1989, p.59, Celly and Frasier, 1996; Camuffo et al., 2007) to argue that procurement organisations are exposed to risks when interacting with suppliers as principals and agents (Huma et al., 2020; Zsidisin et al., 2004). Based on these findings, future researchers could apply other theoretical lenses such as Transaction cost economies (TCE), social exchange theory (SET), and relational view (RV) to investigate procurement risk management strategies.

Table 2-8 Theory application. (Source: Author)

Theory	Theory application	References
Contingency theory	Examined the interaction between the contingency variables of firm size and strategic context.	Roscoe et al., 2020
	Considered the fit between supply chain strategies and supplier management practices.	Prajogo et al., 2018
	Discussed the relationship between purchasing strategy and purchasing structure, and the mediating role of purchasing proficieny.	Ateş et al., 2018
	Developed a rubic to match mitigation strategies with risk contexts.	Chang et al., 2015
	Supplier insolvenciy as an indicator of vulnerability and impacts proactive risk management strategies.	Grötsch et al., 2013
	Selection of risk mitigation strategies by examining risk categories, risk sources, and supply chain configurations.	Talluri et al., 2013
Agency theory	Discussed the main reasons for agency problem as the conflicting goals between the buyer(principal) and supplier (agent).	Huma et al., 2020
	Discussed supply risk assessment as part of strategy to obtain information on supplier activities, promote goal congruence between suppliers and buyers to reduce uncertainty.	Zsidisin et al., 2004.
Resource dependence theory	To explain all aspects of both buffering strategies and bridging strategies used to reduce procurement related risks.	Manhart et al., 2020
Attention-based view (ABV)	How procurement manager's attention to supply risk management contributes to resilience.	Lorentz et al., 2021
Theory of swift, even flow	To examine the flows between supplier, manufacturer and customer within supply chain.	Chen et al., 2012
Theory of constraints	Procurement risk related factors that constrain effective procurement processes.	Nyamah et al., 2022
Grounded theory	To identify strategic goals set for procurement of multi-items.	Schoenherr et al., 2011
Principal-Agent theory	Procurement process risks related to buyer-supplier relationship.	Micheli et al., 2008
Resource-Based View	The use of I4T resources to develop unique capabilities which enables procurement related risk mitigation.	Ali et al., 2021
Systems theory	Enhancing supply risk management.	Guertler et al., 2015
The dynamic capabilities view(DCV	The influence of stakeholder interest on Procurement functions risk management processes.	Foerstl et al., 2010

2.5 THEMATIC ANALYSIS

The thematic analysis answers the review questions by identifying procurement risks in the three phases of procurement, analysing the tools/techniques for

managing procurement risks in the three phases of procurement, discussing factors that influence the selection of procurement risk management strategies in the three phases of procurement and presenting a conceptual model for procurement risk management.

2.5.1 Mapping procurement risks across the procurement phases

2.5.1.1 Procurement risks in the pre-contract award phase

Pre-contract risks occur during procurement planning activities (Harju et al., 2024; Nyamah et al., 2023). Cagno et al., 2011 found that the achievement of procurement objectives in this phase is impacted by internal risks directly linked to the management and technical activities and external risks that occur outside the organisation (Table 2-9). This review showed that internal risks, such as wrong forecasts, inaccurate spend analysis, and wrong sourcing strategies, and external risks, such as supply market issues and political and regulatory issues, affect the quality of procurement outcomes (Aghajanian, 2018; Chen et al., 2013; Cagno et al., 2011). For example, internal risks such as the lack of visibility of supply tiers affect the supplier selection strategy (Taghizadehet al., 2021), and this has a long-term impact on the procurement outcome because activities and inefficiencies of lower-tier suppliers can impact the quality, cost, and delivery of the products and materials (Shabani-Naeeni et al., 2020; Ates et al., 2018).

Secondly, the risk of inaccurate spend analysis lead to haphazard spending decisions, which could affect the achievement of commercial procurement goals. This is because some procurement teams do not know the aggregate items procured within their organisation, so they cannot leverage the negotiation and cost-reduction opportunities associated with aggregating category spend (Sharma et al., 2022; Ateş et al., 2018). For instance, Moshtari et al. (2021) found that practical spend analysis can help humanitarian organisations such as UNICEF and the Danish Refugee Council (DRC) achieve cost savings in their procurement budgets and formulate better sourcing strategies.

Table 2-9 Procurement risks in the pre-contract phase (Source: Author)

	Long term	Short term
Internal	Wrong sourcing and award strategies (Saputro et al., 2022; Tarigan & Siagian, 2021; Tavana et al., 2021; Luzzini et al., 2014).	Inadequate stakeholder engagement (Vieira et al., 2022; Cagno et al., 2011; Foerstl et al., 2010)
	Lack of visibility of supply tiers (Taghizadehet al., 2021; Shabani-Naeeni et al., 2020; Ates et al., 2018).	Inadequate skills and competencies (Moshtari et al., 2021; Kersten et al., 2011).
	Inaccurate forecasts of requirements (Ganesh & Kalpana, 2022; Chowdhury et al., 2019; Ma et al., 2018; Lavastre et al., 2012)	
	Inaccurate spend analysis (Sharma et al., 2022; Moshtari et al., 2021; Ates et al., 2018; Moshtari et al., 2021)	
External	Geo-political issues (Aghajanian, 2018)	
	Regulatory risks (Aghajanian, 2018; Chen et al., 2013; Cagno et al., 2011).	

Thirdly, the risk of inaccurate forecasts of business requirements exposes procurement to enormous financial costs when it occurs (Ganesh & Kalpana, 2022; Ma et al., 2018; Aghajanian, 2018; Chen et al., 2013; Lavastre et al., 2012). Even with the use of sophisticated forecasting tools, forecasting errors still occur (Cano-Olivos et al., 2019). The risk of inaccurate forecasts could be linked to inaccurate spend analysis and a lack of understanding of business needs (Ali et al., 2021; Chen et al., 2013). Procurement teams experience shortages or procure excess inventory when wrong forecasts are used (Ali et al., 2021). For example, Chowdhury et al. (2019) and Hong et al. (2018) found that inaccurate forecasts have a cascading effect on inventory holding and capacity utilization costs, significantly increasing the total procurement cost and reducing the organisation's profits.

Fourthly, the risk of selecting the wrong sourcing and award strategies can adversely affect the entire procurement process when it occurs (Luzzini et al., 2014). The selection of the appropriate sourcing strategy is critical for the long-

term success of building a suitable supply base and supplier relationship (Tarigan & Siagian, 2021). This is because selecting an appropriate sourcing strategy can enhance supplier relationships, improve quality and enable cost savings. On the other hand, an inappropriate procurement strategy leads to increased costs, poor quality, supplier dependency, and shortages (Tavana et al., 2021; Saputro et al., 2022). Nyamah et al. (2023) found that procurement organisations with inappropriate procurement strategies have to deal with an increased financial burden that could threaten their overall performance and competitiveness. Furthermore, external risks involving political and supply market issues can significantly impact procurement strategies (Aghajanian, 2018; Schoenherr et al., 2008). For example, the Ukraine-Russia war has led automotive manufacturers Mercedes-Benz and Renault to re-evaluate their sourcing strategies for car components. In contrast, the US-China trade war has led Mazda, Ford, and General Motors, to explore sourcing car components from other countries, including Japan (FT, 2022).

In conclusion, procurement risks such as supply market visibility, inaccurate spend analysis, forecasts, and wrong sourcing strategy risks significantly impact procurement costs and performance in the pre-contract phase. Failure to mitigate these risks have a long-term effect on the quality of an organisation's supply base, increase costs and reduce profits (Nyamah et al., 2023; Moshtari et al., 2021). It is, therefore, critical to assess these pre-contract risks to develop appropriate risk management strategies to help mitigate the impact on procurement performance.

2.5.1.2 Procurement Risks in the Selection and Contracting Phase

The central procurement goal in this phase is to select the best supplier or suppliers to deliver the business needs (Saputro et al., 2022). The achievement of this goal is impacted by internal risks that involve operational activities, such as the preparation of request for price (RFP) documentation, or risks linked to strategic decisions, such as supplier selection criteria (Cagno et al., 2011) and external risks in the supply market. The lack of alignment between the business

strategy and supplier selection strategy is a significant internal risk in this selection phase, making it challenging to achieve procurement and the organisation's strategy (Table 2-10). For instance, Foerstl et al. (2010) indicated that organisations with a sustainability strategy must include sustainability criteria in their supplier selection to reduce risk exposure by preventing non-compliant suppliers from becoming part of their supply base. In addition, Saputro et al. (2022) suggest that to achieve procurement goals successfully, the supplier selection criteria, which is a strategic decision, must align with the procurement strategy.

Supplier selection risk is the most common operational risk (Shabani-Naeeni et al., 2021; Zsidisin et al., 2015; Bilsel & Ravindran, 2011). This is because selecting incompetent suppliers exposes the organisation to significant post-contract issues such as long delivery lead-time, supply shortages, and high defect rates (Saputro et al., 2022; Nyamah et al., 2023). For example, Volkswagen recalled 4.8 million vehicles sold in China because of faulty airbags from their automotive parts supplier, Takata causing serious reputational damage (FT, 2017; Zsidisin et al., 2016). The risk of selecting inefficient suppliers in this procurement phase can increase overall procurement costs, reduce profits and negatively impact the organisation’s reputation when it occurs (Saputro et al., 2022; Song et al., 2017; Foerstl et al., 2010; Schoenherr et al., 2008).

The internal operational risks, including poor presentation of product specifications, inappropriate pricing schedules, and inaccurate assessment of suppliers’ technical skills, can adversely affect the quality of the procurement outcome, increase costs, and reduce the overall procurement performance (Nyamah et al., 2023; Micheli, 2008). For instance, research has indicated that operational errors in the request for price (RFP) documents and omissions of terms and conditions in the contract documents can severely impact procurement outcomes and expose the organisation to legal issues (Ma et al., 2017; Neiger et al., 2009).

Table 2-10 Procurement risks in the selection and contracting phase (Source: Author)

	Strategic	Operational
Internal	Lack of alignment between business strategy and supplier selection criteria (Saputro et al., 2022; Foerstl et al., 2010)	Supplier selection risk (Vieira et al., 2022; Nyamah et al., 2023; Shabani-Naeeni et al., 2021; Songet al., 2015; Zsidisin et al., 2015; Bilsel & Ravindran, 2011; Micheli, 2008).
	Lack of collaboration between stakeholders (Moshtari et al., 2021; Manhart et al., 2021; Reichenbach et al., 2017; Guertler et al., 2015; Lavastre et al., 2012; Neiger et al., 2009).	Poor presentation of product specification (Nyamah et al., 2023; Handayani et al., 2022; Micheli, 2008). Inappropriate pricing schedules (Ma et al., 2017; Neiger et al., 2009). Inaccurate assessment of suppliers' technical skills (Saputro et al., 2022; Song et al., 2017; Foerstl et al., 2010; Schoenherr et al., 2008). Lack of adequate procurement and IT skills (Moshtari et al., 2021; Kersten et al., 2011). Poor contract terms and conditions (Ma et al., 2017; Neiger et al., 2009).

Furthermore, the effective management of the supplier selection process requires procurement teams to have good procurement knowledge and skills. Moshtari et al. (2021) and Kersten et al. (2011) attributed the occurrence of operational risks to the lack of competencies and skills in the execution of procurement strategies. Similarly, Ali et al. (2021) and Ganesh et al. (2022) indicated that the supplier selection process requires complex procurement and IT skills that are yet to be fully developed within the procurement function.

2.5.1.3 Procurement Risks in Post-Contract Award Phase

The procurement risks that occur in the post-contract phase after contracts have been awarded to the selected supplier(s) inhibit the realisation of the overall procurement objectives (Nyamah et al., 2023; Lorentz et al., 2021; Enyinda et al.,

2017; Hallikas et al., 2016). These risks are presented in Table 2-11. On the one hand, procurement risks arise from inefficiencies within the organisation, such as poor supplier relationship management, supplier dependency, non-compliance with contract terms and conditions, and lack of post-contract management skills (Ganesh and Kalpana, 2022; Hong et al., 2018; Guertler et al., 2015;). On the other hand, external factors such as machine breakdowns, quality risks, and capacity constraints, affect the operations of upstream suppliers, leading to delays, shortages, and increased costs (Junaid et al., 2020; Song et al., 2017; Lockamy et al., 2015; Hong & Lee, 2013).

Procurement risks also arise from disruptive events such as natural risk events or geo-political issues (Saputro et al., 2022; Mouloudi et al., 2022). Aghajanian, 2018). For example, due to the Russia-Ukraine war, BMW halted car production in Germany and Austria in March 2022 because their suppliers in Ukraine could not supply the wire harnesses required for production (BMWblog, 2022). The Covid-19 pandemic, the 2019-2020 Australian bushfire, the 2014 Southeast Asia typhoon Halong and the 2011 tsunami in Japan are examples of natural risk events that have caused significant supply disruptions in the post-contract phase (Vieira et al., 2022; Gao et al., 2019).

Supplier dependency risk has increased over time due to outsourcing business requirements to global suppliers that offer competitive prices and better technologies (Raj et al., 2022; Halikas & Lintukangas, 2016). Nassar et al. (2019) indicated an increasing outsourcing trend in the automotive industry as automakers sole source parts and components from suppliers across the globe. This sourcing trend makes it difficult for procurement teams to switch to alternative sources quickly when suppliers face disruptions (Ghadge et al., 2021).

Table 2-11 Procurement risks in the Post contract-phase (Source: Author)

Risk Type	Procurement risks	Risk attribute	Literature reference
Internal	Supplier dependency risk	Product-related	Raj et al., 2022; Junaid et al., 2020; Remko et al., 2020, kara et al., 2018; Hallikas et al., 2016; Talluri et al., 2013 Kersten et al., 2011.
	Non-compliance with contract terms.	Process-related	Ganesh and Kalpana, 2022; Handayani, et al., 2022; Hong et al., 2018.
	Inadequate information technology systems.	Process-related	Ganesh and Kalpana, 2022; Ali et al., 2021.
	Poor supplier relationship management.	Process-related	Dixit et al., 2022; Taghizadeh et al., 2021; Kara et al., 2018; Reichenbachs et al., 2017; Hallikas et al., 2016; Grötsch et al., 2013;
External	Political risks.	Environmental/ Macro	Saputro et al., 2022; Mouloudi et al., 2022; Taghizadeh et al., 2021; Roscoe et al., 2019; Gao et al., 2019; Aghajanian, 2018.
	Natural risk events.	Environmental	Raj et al., 2022; Bag et al., 2021; Lorentz, et al., 2021; Taghizadeh et al., 2021; Remko et al., 2020; Gao et al., 2019; DuHadway et al., 2019.
	Supply risk	Product-related	Lorentz et al., 2021; Essaber et al., 2021; Chowdhury et al., 2019; Guertler et al., 2015; Hong and Lee, 2013; Grötsch et al., 2013; Micheli, 2008; Zsidisin et al., 2004.
	Price risk	Product-related	kara et al., 2018; Hallikas et al., 2016; Fischl et al., 2014.
	Capacity constraints	Process-related	Lavastre et al., 2012; Zsidisin et al., 2004.
	Machine breakdown	Process-related	Saputro et al., 2022; Nyamah et al., 2023; Chen et al., 2013.
	Quality Control	Process-related	Hong and Lee, 2013.

For example, Junaid et al. (2020) found that the negative financial and operational performances of automotive organisations can be linked to the lack of backup suppliers and the high level of supplier dependency that has resulted in production failures from shortages of components, quality issues, and delivery delays. This lack of backup suppliers is driven by the procurement teams' belief in single-sourcing and the need to build close relationships with single-source suppliers to maintain low costs (Junaid et al., 2020). For instance, in 2017, BMW could not build thousands of luxury cars in Germany because their leading steering gears supplier, Bosch, experienced a machine breakdown that caused significant steering gear shortages, negatively impacting their profitability (FT, 2017). Furthermore, price risks expose procurement teams to unplanned increases in procurement costs after contracts have been awarded (Halikas & Lintukangas, 2016). The price of products, raw materials, and parts are volatile in the supply market and are driven by fluctuating demand and supply (Hong et al., 2018). For instance, in 2022, the price of Nickel increased by 90% because of the Russia-Ukraine War (Bloomberg, 2022) and the increased demand for electric vehicle production. Such price changes threaten the viability of procurement financial plans and budgets (Fischl et al., 2014) and reflect the interrelationships and ripple effects of procurement risks (Ivanov et al., 2019).

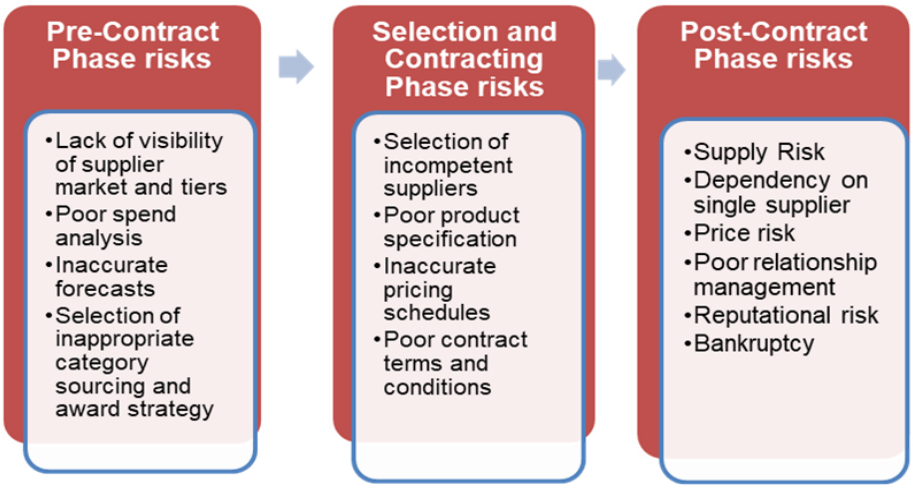


Figure 2-7 Procurement risks in the three procurement phases.

(Source: Nyamah et al, 2023; Hong et al., 2018; Aghajanian, 2018; Hallikas et al., 2016)

In conclusion, pre-contract, contracting and selection, and post-contract procurement risks (see Figure 2-7) can increase costs, reduce procurement performance and impact the organisation's profitability. Procurement teams must develop and implement appropriate risk management strategies to mitigate the risk impact in the three procurement phases.

2.5.2 Procurement risk management (PRM) tools/techniques in the three phases of procurement

Procurement risk management tools/techniques are used to identify potential procurement risks, assess the probabilities and impact of procurement risks, and develop mitigation strategies to manage the identified risks (Ganesh et al., 2022; Cano-Olivos et al., 2019; Hong & Lee, 2013). Following the review**,** the tools and techniques for managing procurement risks have been classified into three: procurement risk identification tools/techniques, procurement assessment tools/techniques, and procurement risk mitigation tools/techniques (Cagno et al., 2011). This section discusses the tools and techniques used in the different procurement phases.

2.5.2.1 PRM tools/techniques in the pre-contract phase

The tools/techniques used to proactively identify, assess, and mitigate procurement risks in the pre-contract are examined in this section. The analysis is vital to this research because it will guide the selection of an appropriate tool/technique to identify procurement risk in our conceptual procurement risk mitigation framework.

Pre-contract risk identification tools/techniques: Researchers (Schoenherr et al., 2008; Ganguly & Guin, 2011, Aghajanian, 2018) have suggested using models to enhance procurement risk identification as models provide a more structured way of risk identification. For instance, Cagno et al. (2007) proposed the procurement risk cube (PRC) model to breakdown procurement risk sources, while Neiger et al. (2009) used the value-focused process engineering (VFPE) model to identify procurement risks at the operational and strategic levels. Hong and Lee (2013) developed an integrated procurement risk management (PRM) framework to identify global and local supplier risks. Desai et al. (2015) adopted the fishbone diagram, known as the Ishikawa diagram, to identify the root causes of procurement-related risks, including poor-quality materials, counterfeits, and over-ordering.

With the development of industry 4.0 technologies, recent studies have argued that artificial intelligence, machine learning and data analytical tools provide more dynamic alternatives to the conventional methods for identifying procurement risks in today's data-driven environment. For example, by leveraging AI-driven predictive analytics and machine learning algorithms, procurement teams can proactively identify potential risks during the planning phase and adjust their sourcing strategies in response (Tian et al., 2024, Andersson et al., 2024; Ganesh and Kalpana, 2022). The learning and prediction capabilities of AI provide more accurate spend analysis and visibility of potential spend risks (Jackson et al., 2024). Moreover, AI's predictive capability enables procurement teams to model different potential sourcing scenarios based on historical patterns and data and identify potential risks during the planning phase. This is particularly invaluable for strategic procurement decisions (Jackson et al., 2024; Sharma et al., 2022). Although Artificial intelligence tools such as machine learning are still at a nascent stage, researchers have suggested that procurement managers embrace the advantages of technology to implement superior ways of identifying procurement risks (Ganesh & Kalpana, 2022;

Sharma et al., 2022; Toorajipour et al., 2021; Bag et al., 2021; Ivanov et al., 2020). The pre-contract risk identification tools/techniques are shown in Table 2-12.

Table 2-12 Pre-contract risk identification tools/techniques (Source: Author)

Tools/techniques	Nature of risks	References
Procurement risk cube (PRC)	Product-related risks, market-related risks, supplier-related risks,	Cagno et al., 2011
Value-focused process engineering (VFPE)	Risk of supplier selection, supplier's inability to conform to specification, poor supplier collaboration, financial instability, dependence instability	Neiger et al., 2009
Procurement risk management (PRM)	Supply risk, unpredictable demand, and volatile price	Hong and Lee, 2013
House of risk (HOR)	Risks in the procurement activities: Purchase requisition problems.	Handayani et al., 2022
Criticality assessment method	Country concentration risks, supply risks, and price risks.	Mouloudi and Samuel, 2022
Fishbone diagram	Defective parts and products, delivery delays, and counterfeit products.	Desai et al., 2015
Artificial intelligence (AI), Machine Learning (ML), and Data Analytics	Supply risk, end-to-end visibility	Kang et al., 2025; Tian et al., 2024; Jackson et al., 2024; Ganash and Kalpana, 2022, Sharma et al., 2022; Bag et al., 2021.

Pre-contract risk assessment tools/techniques: The analytical hierarchy process (AHP): The AHP method is the most used risk assessment technique in

the selected literature (Dixit et al., 2022; Essaber et al., 2021; Enyinda & Mbah, 2016; Schoenherr et al., 2008). While these studies applied AHP in its traditional form, others used improved versions of AHP to strengthen the quality of assessments. For example, Vieira et al. (2022) used a fuzzy AHP to assess and classify potential risks in the outsourcing process. Tavana et al. (2022) applied the fuzzy AHP to create a hierarchical structure to rank procurement-related risks.

Failure Mode and Effects Analysis (FMEA): The FMEA is the second most used risk assessment technique. FMEA's strength is its ability to assess procurement-related risks and develop contingency plans for risk mitigation. However, it is criticised for its difficulty and subjectivity, which could dilute the quality of the risk assessment outcome (Nepal et al., 2015). To overcome the FMEA limitations, several researchers have proposed the combination of FMEA with other risk assessment techniques. For instance, Nepal and Yadav (2015) combined the FMEA and the Bayesian belief network (BBN) techniques to proactively quantify the risk probabilities and cost factors associated with global supplier selection. Cano-Olivos et al. (2019) combined the FMEA with the AHP technique to analyse, evaluate and prioritise direct and indirect procurement risks. On the other hand, Ghadge et al. (2017) proposed using an improved version of FMEA known as the Fuzzy logic-based approach to reduce bias and increase the accuracy of risk assessments and prioritisation. Furthermore, Lavastre et al. (2012) adopted the Failure Mode Effects and Criticality Analysis (FMECA) to assess, classify and prioritise the severity and effects of risks.

Song et al. (2017) applied the decision-making and trial evaluation laboratory DEMATELL technique to simultaneously evaluate and prioritise the strengths and influences of emerging sustainability risk factors, including economic, environmental, and social risks. Ma et al. (2017) presented the fuzzy based house of risk (HOR) technique to objectively assess and prioritise procurement related risk events and agents. They suggest that fuzzy HOR assessment enhances the quality of risk mitigation decisions on material planning, forecasting, supplier assessment, and supplier relationship

management. Junaid et al. (2020) developed the Risk assessment index system technique to analyse procurement related risk factors within the automotive industry. This technique enabled the classification of procurement related risks, risk impact, and the development of countermeasures for risk mitigation.

Artificial Intelligence, Machine learning algorithms, and data analytics are being increasingly used for procurement risk assessment, in addition to risk identification (Andersson et al., 2025; Tian et al., 2024; Ganesh and Kalpana, 2022). Ganesh and Kalpana (2022) argue that a combination of artificial intelligence and data analytics techniques such as machine learning, data mining, decision tree, and Bayesian networks are more accurate in modelling and assessing several procurement-related risks. The pre-contract risk assessment tools/techniques are presented in Table 2-13.

Table 2-13 Pre-contract risk assessment (Source: Author)

Tools and techniques	References
The analytical hierarchy process (AHP)	Essaber et al., 2021; Dixit et al., 2022; Enyinda and Mbah, 2016; Schoenherr et al., 2008
Fuzzy AHP	Vieira et al. 2022; Tavana et al. 2022
Failure Mode and Effects Analysis (FMEA)	Nepal et al., 2015; Cano-Olivos et al., 2019.
Fuzzy logic-based approach	Ghadge et al., 2017
Failure mode effects and criticality analysis (FMECA)	Lavastre et al., 2012
Artificial intelligence (AI), Machine learning (ML), and Data analytics	Ganesh and Kalpana, 2022; Tian et al., 2024; Jackson et al., 2024;
Decision-making and trial evaluation laboratory (DEMATEL)	Song et al., 2017
Fuzzy-based house of risk (HOR):	Ma et al., 2017
Risk assessment index system	Junaid et al., 2020

Pre-contract risk mitigation tools/techniques: Machine Learning (ML) and data analytics (DA) integrated techniques: Ganesh and Kalpana (2022) proposed the combination of Artificial intelligence (AI), Machine Learning (ML), and predictive data analytics techniques to develop both proactive and reactive contingency and recovery plans to manage procurement risks proactively.

In summary, the review of PRM tools/techniques in the pre-contract phase indicates that procurement risk identification and assessment are the predominant proactive risk management activities (Dixit et al., 2022; Essaber et al., 2021). Risk mitigation has received less attention (as shown in Table 2.14), as only one proposed a tool for risk mitigation plans (Ganash & Kalpana, 2022). Using risk mitigation tools/techniques is essential to this research because it completes the risk management process by enabling a structured way of developing and implementing mitigation strategies. Investigating risk mitigation tools/techniques in the pre-contract phase could be a potential area for future research.

Table 2-14 Pre-Contract Risk Mitigation tools (Source: Author)

Tools and techniques	Reference
Artificial intelligence (AI), Machine Learning (ML), and Data analytics	Ganash and Kalpana, 2022

2.5.2.2 PRM tools/techniques in the selection and contracting phase.

This section examines the tools/techniques used to identify, assess and mitigate procurement risks in the selection and contracting phase.

Selection and contracting risk identification tools/techniques:

Zsidisin et al. (2016) adopted a classification technique to demonstrate that risks from supplier, market, and component sources must be considered when

selecting new suppliers. Saputro et al. (2022) acknowledged Kraljic Portfolio Matrix (KPM) as a critical procurement diagnostic tool and suggested it could be used as a first step to identify supplier selection criteria based on supply complexities. Despite the advantages of the kraljic categorisation technique, some studies (Dixit et al., 2022; Montgomery et al., 2018) have highlighted that this method does not incorporate buyer-supplier relationships; therefore, the potential risks associated with such relationships are not identified.

In summary, identifying risks in the selection and contracting phase is integral to this research because it is the starting point for ensuring a comprehensive risk management strategy (Dixit et al., 2022). Notwithstanding, only a handful of researchers have used tools/techniques (Table 2-15) to identify the risks that impact the procurement process in the selection and contracting phase (Saputro et al., 2022; Zsidisin et al., 2016). This indicates a potential opportunity for future research.

Table 2-15 Selection and Contracting Risk Identification Techniques

(Source: Author)

Tools and techniques	Nature of risks	References
Kraljic portfolio matrix	Capacity constraints, quality issues, and delivery delays.	Saputro et al., 2022
Classification technique	Quality, supply, supplier capability risks, sourcing from non-domestic countries, and multi-tier supplier risks.	Zsidisin et al., 2016

Selection and contracting risk assessment tools/techniques

Risk assessment tools (Table 2-16) are crucial in selecting and contracting phase. They help organisations enhance supplier selection by evaluating and prioritising supplier risks. Junaid et al. (2021) highlighted the importance of

assessment techniques in which different supplier risks are measured, assessed, and prioritized according to their probability of occurrence and severity level. Song et al. (2017) proposed a rough weighted decision-making and trial evaluation laboratory (DEMATEL) to assess and prioritise environmental and social sustainability risk factors. Pontre et al. (2011) used the enterprise risk management (ERM) tool to evaluate suppliers and enhance supplier selection decisions in public procurement. Cagno et al. (2011) proposed the procurement risk cube for an in-depth risk assessment to support procurement proposals and strategic supplier selection. Micheli (2008) developed the risk efficiency-based supplier selection; REBaSS as an efficient risk assessment technique to aid in selecting the most appropriate suppliers of critical materials. Ganguly and Guin (2011) applied the fuzzy risk assessment framework technique to analyse and compare the risk exposures of suppliers to enable prudent supplier selection decisions.

On the other hand, some studies suggest that supplier selection risks are better estimated with Machine learning and data analytics techniques because they provide more accurate results. The integration of predictive analytics and artificial intelligence (AI) has revolutionized supplier risk identification in procurement by allowing early detection of potential disruptions, fraud, or performance issues. Predictive models leverage historical supplier performance, financial data, market trends, and geopolitical factors to estimate the likelihood of supplier risks. AI technologies such as machine learning (ML), natural language processing (NLP), and neural networks empower procurement professionals to analyze unstructured data from sources like news, social media, and supplier reports, uncovering early warning signs before problems arise (Chowdhury et al., 2025)

For instance, Hao et al. (2020) proposed the Language scale, fuzzy theory, and NSGA-II algorithm. They argued that supply risk factors such as price, quality, delivery, and technical capabilities must be correctly evaluated to balance cost reduction and supply efficiency. Lockamy and McCormack (2015) presented the

Bayesian networks (BN) technique to assess and quantify the risk probabilities and risk profiles of suppliers within the supply base of an automotive company. Kara et al. (2018) applied the clustering-based supplier risk assessment approach to assess and eliminate unreliable suppliers in supplier selection. Artificial intelligence, machine learning and data analytical tools provide more dynamic alternatives to the conventional methods for assessing procurement risks in today's data-driven environment (Jackson et al., 2014)

Table 2-16 Selection and Contracting Risk Assessment tools (Source: Author)

Tools and techniques	References
Language scale, fuzzy theory, and NSGA-II algorithm	Hao et al., 2020
Clustering-based supplier risk assessment approach	Kara et al., 2018
Bayesian networks (BN)	Lockamy and McCormack, 2015
Enterprise risk management (ERM)	Pontré et al., 2011
Decision-making and trial evaluation laboratory (DEMATEL)	Song et al., 2017
Risk efficiency-based supplier selection (REBaSS):	Micheli, 2008
Artificial Intelligence, Machine Learning and Data Analytics	Kang et al., 2025; Jackson et al., 2024

Selection and contracting risk mitigation tools/techniques: Studies have highlighted the significance of a comprehensive risk management approach across each procurement phase (Nyamah, 2023; Remko, 2020). Similar to the

pre-contract phase, using tools/techniques is equally important in the selection and contracting phase because it enables procurement teams to develop appropriate strategies to mitigate the risks in the supplier selection and contracting phase (Saputro et al., 2022). Despite this, risk mitigation tools/techniques have not been studied in the selection and contracting phase in the selected literature. This absence of risk mitigation tools/techniques presents further research opportunities.

2.5.2.3 Procurement Risk Management tools/techniques in the post-contract phase

This section examines the tools/techniques used to identify, assess and mitigate procurement risks in the procurement contract implementation stage after the selected supplier (s) and the contracts are awarded (see Table 2-17).

Post-contract risk identification tools/techniques

Pontre et al. (2011) adopted the Enterprise Risk Management ERM policy to identify risks involved in post-contract activities, enabling procurement managers to plan a structured risk mitigation strategy. Although the objective is reactive, risk identification is an ongoing process as some new risks occur during the implementation at the post-contract phase (Pontre et al., 2011).

Post-contract risk assessment tools/techniques

The fishbone diagram was used in the research conducted by Dessie et al. (2015) to assess and map the root causes and impact of post-contract procurement related risks. The aim was to develop appropriate risk corrective strategies. Although this technique is commonly used, it heavily relies on expert opinions and judgment, making it subjective and prone to bias (Dessie et al., 2015).

Post-contract risk mitigation tools/techniques

Hong and Lee (2013) applied the goal programming model to support supply risk mitigation decisions. The model aimed to determine the optimal order quantity

assigned to selected suppliers within the supply base (Hong & Lee, 2013). While this model can support mitigation decisions, it does not consider other risk events, such as geo-political risks and natural disasters, that impact procurement risk management strategies. Kırılmaz and Erol (2017) presented a proactive procurement plan to mitigate supply-side risks by considering supplier risk profiles in order allocations. Table 2-19 summarizes the post-contract tools/techniques applied in the literature.

Table 2-17 Post-contract award tools/techniques (Source: Author)

PRM stage	Tools and techniques	References
Risk Identification	Enterprise risk management (ERM)	Pontré et al., 2011
Risk Assessment	Fishbone diagram analysis	Desai et al., 2015
Risk Mitigation	Procurement plan	Kırılmaz and Erol (2017)
	Goal programming model	Hong and Lee (2013)

In conclusion, the literature review of the PRM tools and techniques in the three procurement phases indicates that the pre-contract phase focuses on identifying and assessing the risks that impact the procurement process. On the other hand, in the selection and contracting phase, the focus is mainly on assessing risks related to supplier selection. In the post-contract phase, risk identification and assessment have not been studied extensively. This gap presents an opportunity for further research.

2.5.3 Procurement risk mitigation strategies in the three procurement phases.

Procurement risk mitigation should be considered throughout the procurement decision-making phases (Remko, 2020). When risk management begins in the planning and preparation stage, potential threats and vulnerabilities can be identified, and mitigation plans can be included early in the procurement

decision (Van Weel, 2018). For example, Nyamah et al. (2023) suggest that procurement leaders should adopt strategies to identify risks at each phase to enable early detection and prevent the transfer of risks from one phase to another. To reduce these vulnerabilities, organisations deploy several coordinated approaches at different phases (Manhart Baylor et al., 2020; Sodhi et al., 2012).

2.5.3.1 Procurement strategies to mitigate risks in the pre-contracting phase.

Technology as a strategy: Artificial intelligence and Data Analytics

Artificial intelligence (AI) and data analytics (DA) play significant roles in driving procurement process improvements (see Figure 2-8) and mitigating the risks of incorrect spend analysis, supply market analysis, and forecasting (Guida et al., 2023). For instance, Orpheus, a McKinsey company, uses AI-based analytics for automated data extraction and spend categorization to increase the precision of spend analysis, and enable spend transparency and actionable insights (McKinsey, 2023). This is to help procurement managers identify spend optimization opportunities that result in cost savings. AI and DA can also enhance the visibility of the supply market and its tiers (Ganesh & Kalpana, 2022; Bag et al., 2021; Ivanov et al., 2019) by enabling the collation and analysis of large volumes of market information from varied internal and external sources (Bag et al., 2021). Recent studies (Guida et al., 2023; Sharma et al., 2022; Jahani et al., 2021) have suggested that these technologies can help procurement teams improve the quality of market analysis because they provide a better understanding of supply market patterns and behaviours of potential suppliers within the market.

AI and DA can also provide enormous value in mitigating the risk of inaccurate forecasts. Predictive analytics, enabled by DA, can help improve demand forecasts, leading to more efficient sourcing and inventory management decisions (Brintrup et al., 2020; Ivanov et al., 2019). For instance, Sharma et al. (2022) emphasized that AI accurate forecasting capabilities can lead to efficient

resource planning and overall operational efficiency. Furthermore, AI and DA can enable procurement teams to make informed decisions in the selection of sourcing strategies. As suggested by Deloitte (2023), these technologies are valuable in helping inform the appropriate sourcing strategies for different product categories using myriad data to identify shifts in global supply trends and to provide insights into future trends.

Stakeholder engagement: Stakeholder engagement is critical in managing risks while planning procurement activities. Dixit et al. (2022) emphasised that effective communication between procurement teams, budget owners, legal, and finance can break down functional silos and enable stakeholder support and buy-in while defining procurement needs and selecting sourcing strategies (Nyamah et al., 2023).

Training and capability development: The contributions of the procurement team to achieving procurement objectives strongly depend on their skills and competencies (Stek & Schiele, 2021). Technology has revolutionised the procurement planning process; as such, procurement professionals need to be trained to use technology to improve their analytical skills, reduce risks associated with inaccurate analysis and improve the quality of their procurement strategies and decisions (Ganesh et al., 2022; Ali et al., 2021). For instance, Guida et al. (2023) identified that analytical and technological skills required for strategic planning activities such as spend analysis are yet to be fully developed

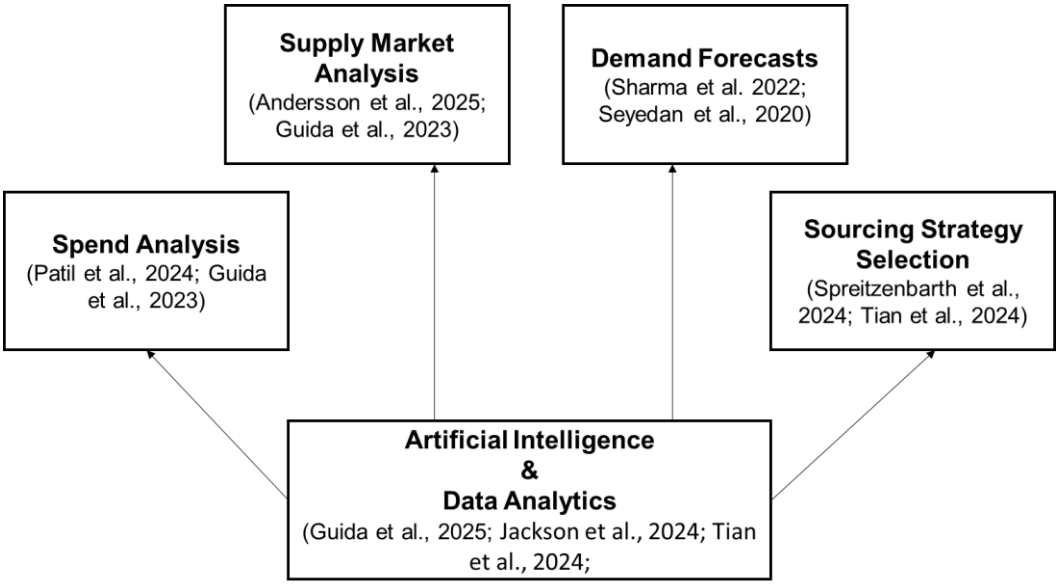


Figure 2-8 AI and DA in the Pre-contract Phase (Source: Guida et al., 2025; Spreitzenbarth et al., 2024)

within the procurement function. This is a significant barrier to harnessing technology's advantages.

Proactive sourcing strategy plan: The sourcing and award strategy selected at the pre-contract stage guides the procurement teams in engaging suppliers and managing supplier relationships (Prajogo et al., 2018). Procurement teams can proactively mitigate potential supply-related risks by selecting appropriate sourcing and award strategies at the pre-contract stage (Huma et al., 2020; Pereira et al., 2014). Mitigating potential procurement risks should be among the significant factors driving the strategy decisions while planning procurement (Thun & Hoenig, 2011).

Supplier diversification/ Dual sourcing: Supplier diversification is a proactive risk mitigation strategy that diversifies the supply base to spread risks (

Chowdhury et al., 2025; Hong et al., 2018). Instead of using a single supplier, procurement teams should plan to source products from multiple suppliers to mitigate supply risks (Wenting et al., 2022). For example, Van Hoek (2020) found that adopting multiple sourcing strategies with geographically diverse suppliers provides more flexibility and responsiveness and mitigates supplier dependency risk when adequately implemented.

Flexible / Option Contracts: Procurement teams should plan to negotiate flexible supply contracts that provide rights to purchase from a supplier as required to mitigate the risks of supply bottlenecks and demand fluctuations. Hong et al. (2018) highlighted that such contracts provide flexibility to shift order quantities across suppliers.

Contingent Sourcing Plans: Contingent sourcing plans are proactive risk management strategies because they enable procurement teams' speedy decision-making when supply disruptions occur (Fischer-Preßler et al., 2020; Cano-Olivos et al., 2019; Lavastre et al., 2012). For example, in a recent study by Schoenherr et al. (2023), procurement managers stated that it was prudent to have contingency plans with reactive risk management approaches in place as they guide how to respond to unforeseen crises quickly.

Localised Sourcing Plans: Sourcing products from local suppliers reduces the risks associated with long lead times of global sourcing (van Hoek, 2020; Mena et al., 2018). Procurement teams can balance global sourcing risk by developing a mix of near or local sourcing options in their supply base during the pre-contract phase. For instance, Bag et al. (2021) suggested that procurement teams should explore developing local suppliers closer to their manufacturing facilities to mitigate supply uncertainties instead of distant suppliers.

Pre-contract risk mitigation strategies are shown in Table 2-18.

Table 2-18 Pre-contract risk mitigation strategies (Source: Author)

Strategies	Applications	Reference
Technology: Artificial intelligence and data analytics.	Supply market analysis	Guida et al., 2023; Sharma et al., 2022; Ganesh & Kalpana, 2022; Bag et al., 2021; Jahani et al., 2021; Ivanov et al., 2019.
	Spend analysis	Guida et al., 2023.
	Demand forecasts	Sharma et al., 2022; Brintrup et al., 2020; Ivanov et al., 2019.
Stakeholder Engagement	Procurement teams, Budget owners, Legal, finance.	Dixit et al., 2022; Nyamah et al., 2023.
Training and Capacity Development	Technological and analytical skills	Guida et al., 2023; Belhadi et al., 2022; Stek & Schiele, 2021.
Proactive sourcing strategies.	Supplier diversification/ dual sourcing	Wenting et al., 2022; Golmohammadi & Hassini, 2020; Van Hoek, 2020; Manhart et al., 2020; Hong et al., 2018.
	Contingent Sourcing Plans	Schoenherr et al., 2023; Fischer-Preßler et al., 2020; Cano-Olivos et al., 2019; Lavastre et al., 2012.
	Flexible / Option contracts	Hong et al., 2018.
	Localised sourcing plans	Bag et al., 2021; van Hoek, 2020; Mena et al., 2018.

2.5.3.2 Procurement strategies to mitigate risks in the selection and contracting Phase.

Artificial Intelligence and Data Analytics: AI and DA are increasingly being implemented to enhance the identification, evaluation, negotiation, and selection of suppliers that can deliver the organisation's objectives. AI-driven procurement platforms help mitigate supplier selection risks because of their ability to assess supplier performance based on insights from analysis of large volumes of data

from multiple sources, including financial reports, supplier databases, industry reports, and news articles (Schoenherr et al., 2023; Ivanov, 2021). For example, GEP Smart, powered by AI, enables procurement teams to access information to identify, evaluate and select new suppliers across product categories and regions (GEP, 2023).

AI and DA can support procurement teams in preparation for negotiations. They can provide valuable insights for should-cost models and suggest appropriate actions in specific situations, thus reducing the time spent manually creating and reviewing negotiation options (Jahani et al., 2021). For instance, Suplari uses AI and machine learning to identify opportunities to achieve more favourable terms, aggregate demand, and supplier spend that will help to justify a request for volume discounts (Suplari, 2023). Furthermore, AI and data analytics can be applied to automate routine RFP activities. For instance, Guida et al. (2023) study suggests that procurement managers acknowledged AI's impact in automating non-value-added activities, increasing the speed of supplier evaluation, improving the supplier selection and procurement cycle time, and mitigating risks, including poor presentation of product specifications, inappropriate pricing schedules, inaccurate supplier evaluations (Guida et al.,2023; Jahani et al., 2021).

Training and Capability Development: Negotiation skills are essential in selecting the most appropriate suppliers for business needs (Handayani et al., 2022; Luzzini et al., 2014). Procurement teams need to be trained to improve their negotiation skills to enable better terms and conditions for the business. For instance, Stek and Schiele (2021) identified negotiating skills as one of the most required procurement skills because it enables a holistic consideration of both commercial and specific legal terms and conditions that must be agreed upon with the supplier to avoid risks of non-compliance. A summary of the selection and contracting risk mitigation strategies is shown in Table 2-19.

Table 2-19 Selection and contracting risk mitigation strategies (Source: Author)

Strategies	Applications	Reference
Technology: Artificial intelligence and data analytics.	Supplier evaluation and selection	Schoenherr et al., 2023; Ivanov, 2021
	Negotiation support	Jahani et al., 2021.
	RFP, RFP, and commercial evaluation	Guida et al., 2023; Jahani et al., 2021
Training and Capability Development	Negotiation skills	Handayani et al., 2022; Stek and Schiele., 2021; Luzzini et al., 2014.

2.5.3.3 Procurement strategies to mitigate risks in the post-contract phase.

Digitisation, Information Sharing, and Collaboration: To analyse tier-one suppliers' capabilities in today's volatile environment, it has become essential to understand their tier-two and even tier-three supply market interdependencies (Ateş et al., 2018; Taghizadeh et al., 2021; Shabani-Naeeni et al., 2020). Digital technologies such as AI and BDA enhance timely information sharing and visibility of supplier performance and challenges (Bag et al., 2021; Belhadi et al., 2021; Ivanov et al., 2019; Namdar et al., 2018). For example, Jahani et al. (2021) found that procurement digitalization improves information sharing, visibility, and collaboration with suppliers leading to early detection of potential risks with suppliers and their tiers and enabling timely decisions to mitigate potential supply risks (Jahani et al., 2021).

Safety stock: Safety stock can significantly reduce supply risk and mitigate the negative impact of potential supply disruptions by allowing organizations to respond to supply flow variations, problems, or internal production difficulties (Manhart et al.,2020; Grötsch et al., 2013; Lavastre et al., 2012). For instance,

Remko (2020) highlighted that increasing stockpiling and buffer inventory could be helpful to mitigate stockout risks because it helps to deal with emergency requirements. Although holding safety stocks of strategic inventory is costly, the adverse effects of supply shortage outweigh the costs of holding safety stock (Chang et al., 2015).

Supplier Relationship Management (SRM): SRM is an essential enabler of collaboration. Organisations invest in building relationships with upstream suppliers to gather information, increase visibility and reduce supply uncertainties (Chowdhury et al., 2019; Roscoe et al., 2020). Positive buyer–supplier relationships encourage mutual planning, and problem-solving initiates, leading to shared risks and rewards (Prajogo et al., 2018). In a recent study by Schrohnerr et al. (2023), procurement managers highlighted the importance of supplier relationship management (SRM) as a strategy for both proactive and reactive risk mitigation (Schrohnerr et al., 2023).

Supplier Performance Evaluation and Monitoring: Enhancing supplier performance can reduce supplier-related risks and add more value to the organisation's performance (Urbaniak, 2021). To understand the strengths and weaknesses of suppliers, procurement teams periodically evaluate the performance of suppliers against set criteria (Torabi et al., 2015). For example, Sharma et al. (2023) found that organizations can use insights from data analytics to track supplier performance and plan supplier development strategies.

Financial Hedging: Procurement teams mitigate financial risks associated with price and demand fluctuations by proactively setting up contracts with suppliers in an agreed currency and exchange rate (Roscoe et al., 2020). This helps organisations mitigate exchange rate fluctuations and stabilize their sourcing costs and cash flow (Hong et al., 2018).

Postponement: Organisations can mitigate fluctuations in forecasted demand by deploying a postponement strategy (Daultani et al., 2015). Mena et al. (2018) suggested that by holding products in generic forms and delaying activities such

as final assembly, configuration, packaging, labeling, and distribution, organisations increase their responsiveness to variability in demand.

Supplier Development Procurement teams work closely with their critical suppliers to develop improvement initiatives to improve supplier capabilities, address identified issues, and enhance quality and overall performance (Saghiri & Wilding, 2021; Kurniawan et al., 2017). A summary of the risk mitigation strategies in this phase is presented in Table 2-20.

Table 2-20 Post-ontract award risk mitigation strategies (Source: Author)

Strategies	Applications	Reference
Digitisation, Information Sharing, and Collaboration	AI and BDA	Bag et al., 2021; Belhadi et al., 2021; Taghizadeh et al., 2021; Jahani et al., 2021; Shabani-Naeeni et al., 2020; Ivanov et al., 2019; Ateş et al., 2018.
Safety stock	Critical Inventory	Manhart et al.,2020; Van Hoek, 2020; Chang et al., 2015; Grötsch et al., 2013; Lavastre et al., 2012
Supplier Relqationship Management (SRM).	1	Schrohnerr et al., 2023; Chowdhury et al., 2019; Roscoe et al., 2020; Prajogo et al., 2018
Supplier Performance Evaluation and Monitoring	Suppliers	Sharma et al., 2022; Urbaniak, 2021.
Financial Hedging	Currency and exchange rate.	Roscoe et al., 2020; Hong et al., 2018.
Postponement	Products	Mena et al., 2018; Daultani et al., 2015.
Supplier Development	Improvement initiatives	Saghiri & Wilding, 2021; Kurniawan et al., 2017).

In conclusion, while recent studies have highlighted the potential of digital technologies such as AI and BDA to significantly mitigate procurement risks in the pre-contract, selection, and contracting phases, they acknowledged that these technologies are still in their early stages and more research is needed to clarify their actual benefits in PRM. Some studies (Guida et al., 2023; Van Hoek,

2020) suggest that combining such technologies with other traditional strategies could significantly transform the PRM outcome.

2.5.3.4 Factors that influence the selection of procurement risk management strategies in the three procurement phases.

Procurement risk management aims to identify, assess and prioritise potential procurement risks and implement risk management strategies to reduce the risk impact and probability of occurrence. Procurement managers select proactive and reactive strategies to manage procurement risks at different phases. However, the decisions on strategy selection are affected by several factors as shown in Table 2-21.

Criticality of the item purchased: The type of product purchased influences the risk management strategy selected. The Kraljic matrix categorises products into four groups: strategic, bottleneck, leverage, and non-critical. There is no 'one size fits all' strategy. For instance, strategic items have very few suppliers and have a high-risk impact on the core business operations compared to non-critical items, which are non-critical. As such, the risk management strategy for the strategic product would be different from that for non-routine items because of the criticality (Dixit, 2022).

Procurement objective: The procurement organization's overall objective can influence the selection of risk management strategy. Some organisations focus on the security of supply and adopt long-term relationships with suppliers as a strategy to mitigate supply risk. On the other hand, an organisation focused on low prices adopt competitive tendering and supplier diversification as a risk mitigation strategy (Schoenherr et al., 2011).

Buyer-supplier relationships: The relationship between the procurement team and the supplier is an essential factor that could influence risk management strategy decisions. Such good relationships could enable the selection of proactive risk management strategies such as collaboration, information sharing, and supplier development (Reichenbach et al., 2017). On the other hand, such relationships with suppliers lead to high dependency on the supplier because

procurement teams' default to single-source strategies with long term-contracts and a reduced supply base. These relationships expose the organisation to negative consequences as procurement organisations fail to explore risk mitigation strategies that promote opportunities to collaborate with other suppliers with a superior offer (Grötsch et al., 2013).

Technological capabilities: The level of technological capabilities of the procurement organisation strongly influences the choice of procurement risk management strategies. Some studies (Ganash & Kalpana, 2022; Ali et al., 2021) have suggested that using artificial intelligence, machine learning, and data analytics can be leveraged as a proactive risk mitigation strategy to enhance visibility and data sharing (Ali et al., 2021). However, selecting such a strategy depends on the availability of these industry 4.0 skills (Ganash & Kalpana, 2022).

Risk attitude: The procurement team's risk attitude affects procurement strategy selection. Procurement organisations with risk-averse teams focus on strategies that avoid or control potential risks more than procurement teams with risk-takers (Hong & Lee, 2013). However, Lavastre et al. (2012) argued that the management's risk experiences, and maturity levels shape the management of procurement-related risks.

Cost and impact trade-off: Procurement managers can either select strategies to avoid procurement risks, reduce the probability and impact of risk or prepare contingency plans. However, Kırılmaz and Serpil (2017) argued that the procurement risk management strategy selection is mainly influenced by the trade-off between the expected impact of the risk occurrence and the cost of implementing the selected strategy. For example, Jahani et al. (2022) argued that the main procurement digitisation challenge is the cost of implementing I4.0 technologies versus the perceived impact.

Top management support: Research has highlighted the importance of top management support and commitment as a critical factor influencing procurement risk management strategy selection (Nyamah et al., 2023). Top management is responsible for approving financial resource allocations;

therefore, their support is required to invest in procurement mitigation strategies involving financial investments (Tarigan & Siagian, 2021). Ali et al. (2021) highlighted the need for top management to understand the concept of Industry 4.0 and have realistic expectations of the benefits.

Table 2-21 Factors that influence PRM strategy selection (Source: Author)

Influencing Factors	Description	Reference
Criticality of the item purchased	Kraljic classification of items: critical, bottleneck, leverage, or routine	Dixit, 2022, Schoenherr et al., 2011.
Procurement objective	Price focus, supply security, purchasing efficiency, and bundle building	Schoenherr et al., 2011
Buyer-supplier relationships	Transactional, adversarial, relational, preferred customer.	Reichenbachs et al., 2017; Grötsch et al., 2013; Schoenherr et al., 2011.
Technological capabilities	Data analytics, information technology, predictive analytics, and cloud computing	Ganash and Kalpana, 2022; Ali et al., 2021.
Risk attitude	Risk-averse and risk-takers	Hong and Lee, 2013; Lavastre et al., 2012.
Cost and impact trade-off	Cost of strategy implementation and financial impact of risk occurrence	Kırılmaz and Serpil, 2017.
Top management support	Acceptance of PRM strategy and approval of strategy implementation cost	Nyamah et al., 2023; Tarigan and Siagian, 2021.
Firm Size	Number of employees, financial resources, annual revenue	Roscoe et al., 2019; Ali et al., 2021; Lavastre et al., 2012.

Firm Size: The selection of procurement risk management strategy is significantly influenced by firm size. A direct correlation exists between firm size

and the amount of resource slack available because larger firms tend to have more resources than smaller firms (Roscoe et al., 2019). As such, they can invest in technologies and the skills needed to drive the procurement risk management process, unlike smaller firms (Ali et al., 2021). In addition, the more prominent firm have more influence on their suppliers and can collaborate, develop and implement shared risk management strategies with suppliers. Due to resource constraints, smaller firms manage their risks in-house. In comparison, larger firms can apply a share supply management strategy with their suppliers to manage stock and ensure they use collaborative planning, forecasting, and replenishment (CPFR) forecast-sharing tools (Lavastre et al., 2012).

In summary, the decisions on PRM strategies are significantly influenced by the criticality of items purchased, the procurement objectives, the firm size, the type of buyer-supplier relationship, top management support, the technological capabilities of the procurement team, and the risk attitude of procurement teams (Dixit, 2022; Nyamah et al., 2023; Ali et al., 2021; Roscoe et al., 2019; Kırılmaz).

2.6 Discussion and future research

This section discusses critical descriptive and thematic analysis findings and develops a new conceptual framework. Future research directions are then provided.

2.6.1 Key Findings

This study investigated the risk management strategies in the three procurement phases by applying the systematic literature review to analyse 90 articles. To answer the main review question; *How are strategies used to manage risks in the three procurement phases*? the study identified specific risks in each procurement phase. Several tools/techniques used in risk identification, assessment, and mitigation, and risk mitigation strategies in each of the procurement phases were presented. In addition, the factors influencing the

strategy selection were also identified. This review has enabled significant academic findings in the PRM field concerning managing risks in the three procurement phases.

It was found that each procurement phase has unique risks that impact the activities in the next phase if not identified and mitigated (Nyamah et al., 2023). Inadequate stakeholder engagement, inaccurate spend, and supply market issues, wrong sourcing strategies, and poor supplier selection were identified as critical internal risks that negatively impact the overall procurement performance long term (Sharma et al., 2022; Taghizadehet al., 2021; Shabani-Naeeni et al., 2020). In comparison, political issues such as the US-China trade wars and the Russia-Ukraine war and natural risk events such as covid-19 pandemic are significant external risks that severely disrupt the procurement process and negatively impact the organisation's profitability. In the pre-contract phase, procurement risk identification and assessment are the predominant risk management activities using tools/techniques; risk mitigation in this phase has received very little attention. On the other hand, in the selection and contracting phase, tools/techniques were mainly used for supplier risk assessment but not for risk mitigation. In contrast, in the post-contract award phase, there was no particular focus on using tools/techniques to identify, assess, or mitigate procurement risks; these gaps in using tools/techniques present opportunities for future research.

Furthermore, the review indicates growing research interest in procurement digitisation as a strategy to mitigate procurement risks. A few studies (Guida et al., 2023; Bag et al., 2021; Belhadi et al., 2021) proposed using AI and DA to mitigate procurement risks (2-18). However, they acknowledged that these technologies are in the early stages and their actual benefits in PRM still need to be empirically tested. The main factors influencing strategy selection were identified as: the item's criticality, the procurement objective, buyer-supplier relationships, technological capabilities, cost-benefit, top management support, risk attitude, and the firm size. Furthermore, while procurement risks impact

organisations across different regions and continents, extensive studies have been mostly limited to Europe, Asia, and the USA. Other regions like Australia, Africa, North America, and South America have received little attention (Figure 2-5). It is noted that studies in our literature review mostly applied quantitative research methodology based on surveys and case studies against qualitative methods to analyse procurement risk management. Contingency and agency theories are PRM studies' most common theoretical lenses applied. In contrast, eight other theories were used in single studies (Table 2-8). Future researchers could apply other theoretical lenses, such as transaction cost economies (TCE), social exchange theory (SET), and relational view (RV), to investigate PRM strategies.

Overall, the descriptive and thematic analysis indicates an increase in the studies on procurement risk identification, assessment, and mitigation (Enyinda et al., 2017; Ma et al., 2018; Cano-Olivos et al., 2019; Ganesh et al., 2022; Saputro et al., 2022; Handayani et al., 2022; Schoenherr et al., 2023). However, the academic literature still needs a robust PRM approach that addresses risk identification, assessment, and mitigation in the three procurement phases.

2.6.2 Conceptual PRM framework

Based on the insights from the thematic analysis and key findings, a novel conceptual framework has been developed to provide a comprehensive approach to procurement risk management. This framework employs the transaction cost economics (TCE) theory and the social exchange theories as theoretical lenses to better understand procurement risks, the complexities in developing contractual relationships with third parties, and relevant risk mitigation strategies (Tate et al., 2022). As illustrated in Figure 2-9, the conceptual framework integrates risk identification, assessment, and mitigation strategies with the three procurement phases: pre-contract, selection and contracting, and post-contract award. This integration offers a holistic understanding of how PRM

strategies can be successfully developed and implemented to minimise the impact of supply disruptions and enhance procurement performance. This framework serves as a valuable starting point, providing an overview of how the PRM processes comprising of risk identification, assessment, and mitigation interacts with the three procurement phases. Additionally, this model outlines the primary activities involved in each stage of identification and assessment, along with a breakdown of mitigation strategies, tools and techniques employed during the three procurement phases.

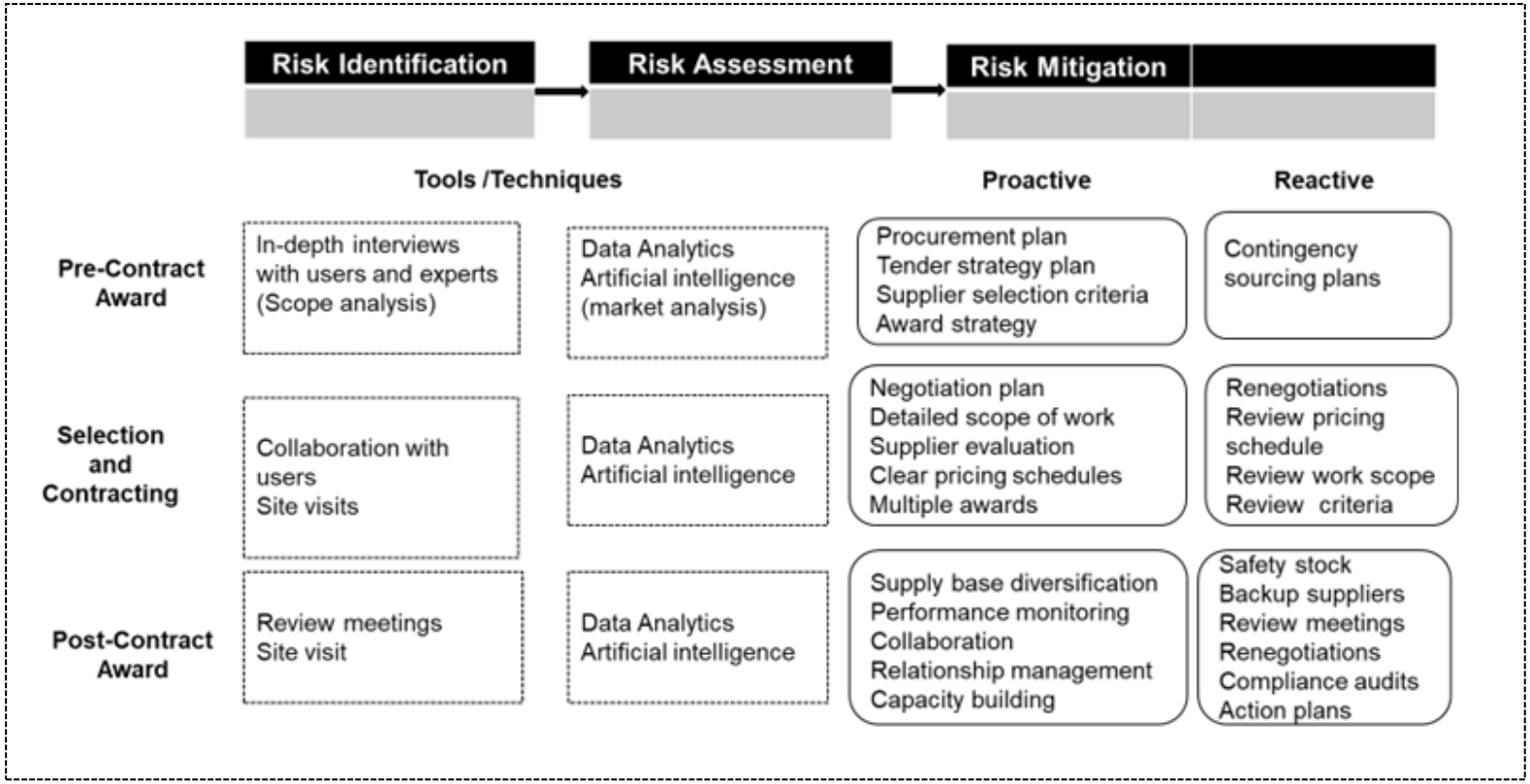


Figure 2-9 Conceptual framework for PRM in the three phases of procurement (Source: Author)

2.6.3 Future research direction

Based on the descriptive and thematic analysis findings, future research in the procurement risk management field should empirically investigate questions such as:

- How are procurement risk management strategies used in the post-contract award phase.
- How are tools/techniques and strategies used to identify, assess and mitigate risks in the post-contract phase?
- How are Artificial intelligence and data analytics used to manage procurement risks in the post-contract phase?
- How are tools/techniques used to mitigate risks in the pre-contract phase?
- What are the factors that influence the digitisation of the procurement process?

2.7 Conclusion

2.7.1 Theoretical implications

First, paper 1 (Chapter 2) of this PhD thesis is the first research to provide a comprehensive review of how risk management strategies are used in the three procurement phases: pre-contract, selection and contracting, and post-contract award. This aligns with Remko's (2020) call for procurement risk management to be considered throughout the procurement phases. This SLR study contributes to the existing literature by aligning the fragmented strands of risk management literature, and systematically synthesizing the procurement risks, the tools and techniques to identify, assess, and mitigate risks, and the risk mitigation strategies in each procurement phase.

Second, paper 1 contributes to the literature by identifying the gaps in the current literature. The SLR revealed that earlier studies in the existing literature have primarily focused on procurement risk identification and assessment in the pre-contract phase (Tavana et al. 2022; Handayani et al., 2022; Ghadge et al., 2017; Cagno et al., 2011), as well as supplier risk assessment in the selection

and contracting phases (Kara et al., 2018; Lockamy & McCormack, 2015; Micheli, 2008). However, studies have largely neglected the tools and techniques to identify, assess, or mitigate procurement risks in the post-contract award phase. As such, this PhD thesis was designed to investigate these unexplored areas, applying transaction cost economics and social exchange theory to provide deeper insights and a more holistic view of procurement risk management.

Third, paper 1 also contributes to the literature by providing a conceptual procurement risk management model, providing a comprehensive approach to risk management in the three procurement phases. This framework employs transaction cost economics (TCE) theory and the social exchange theories as theoretical lenses to better understand procurement risks, the complexities in developing contractual relationships with third parties, and relevant risk mitigation strategies (Tate et al., 2022). The conceptual framework integrates risk identification, assessment, and mitigation strategies with the three procurement phases: pre-contract, selection and contracting, and post-contract award. This integration offers a holistic understanding of how PRM strategies can be successfully developed and implemented to minimise the impact of supply disruptions and enhance procurement performance. This framework serves as a valuable starting point, providing an overview of how the PRM processes comprising of risk identification, assessment, and mitigation interacts with the three procurement phases. Additionally, this model outlines the primary activities involved in each stage of identification and assessment, along with a breakdown of mitigation strategies, tools and techniques employed during the three procurement phases.

This review also opens doors to future PRM research.

2.7.2 Managerial Implications

The literature review and proposed framework are expected to support practitioners in understanding the specific risks in the different procurement phases that could affect performance and provide tools/techniques and strategies

to help identify, assess, and mitigate potential risks. In addition, the framework approach of separating risk identification, assessment, and mitigation strategies at the different procurement phases, help to facilitate top management, users, and procurement managers' decisions on the allocation of organisations' resources to manage the procurement risks that have the most impact on organisations' performance.

2.7.3 Limitations of study

One of the limitations of this study is that First, only 90 peer-reviewed articles were selected for the systematic literature; other relevant publications have been overlooked. Future research could explore using more articles to derive insights and bridge this gap. Second, the conceptual framework is based on secondary information from the literature review. The framework needs empirical validation via qualitative and quantitative research.

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3 PAPER 2: MANAGING PROCUREMENT RISKS IN THE POST-CONTRACT AWARD PHASE: EMPIRICAL EVIDENCE FROM THE MANUFATURING INDUSTRY

Abstract

This research investigates how procurement risk management strategies are used in the post-contract award phase. This paper adopts a qualitative approach

to gain insights into procurement risk management in the post-contract award phase by interviewing 23 procurement professionals across seven industries within the manufacturing sector from June 2023 to November 2023. Transaction cost economics and social exchange theories are used as theoretical lenses to develop and validate a conceptual model that integrates risk identification, assessment, and mitigation into the post-contract award phase. Three key findings were highlighted from this study. First, four categories of procurement risks occur in the post-contract award phase: (1) contract design risks, (2) supplier relationship risks, (3) Ethical risks, and (4) disruption risks. Second, procurement professionals use two main tools/techniques to identify and assess risks and to plan mitigation strategies: (1) Data analytics and artificial intelligence tools, and (2) human engagement techniques: site visits and review meetings. Thirdly, a combination of preventive and reactive strategies is implemented to manage risks in the post-contract award phase.

First the study contributes to the literature by identifying key procurement risk categories and explaining the risk management strategies used in each category through the lenses of TCE and SET. It provides a new evidence-based procurement risk management model that integrates procurement risk identification, assessment, and mitigation strategies into the post-contract award phase.

Keywords – Procurement Risk Identification, Risk Assessment, Risk Mitigation, Strategies, Transaction Cost Economics Theory and Social Exchange Theory.

3.1 Introduction

The procurement risks in the post-contract award phase of buyer-supplier relationships impact the realisation of the overall procurement objective if they occur (Nyamah et al., 2023; Lorentz et al., 2021; Enyinda et al., 2017; Hallikas et al., 2016). On the one hand, inefficiencies within the organisation, such as poor supplier relationship management, supplier dependency, and non-compliance with contract terms and conditions increase procurement risks (Ganesh and

Kalpana, 2022; Hong et al., 2018; Guertler et al., 2015;). On the other hand, external factors such as quality risks, capacity constraints, natural risk events, and geopolitical issues impact the operations of upstream suppliers and lead to delays, shortages, and increased costs when such risks occur (Saputro et al., 2022; Mouloudi et al., 2022; Aghajanian, 2018; Junaid et al., 2020; Song et al., 2017; Lockamy et al., 2015; Hong & Lee, 2013). For example, in 2023, BMW recalled about 90,000 cars because of faulty airbags (Bloomberg, 2023).

To manage procurement risks holistically, researchers have proposed including a comprehensive risk management approach throughout each procurement phase (Nyamah, 2023; Dixit et al., 2022; Van Hoek, 2021; Remko, 2020). A holistic procurement risk management (PRM) process involves 3-stages: (1) the identification of risk events, (2) assessment of the likelihood and impact of risk occurrence, (3) the development of risk mitigation plans to prevent risk occurrence and mitigate risk impact (Ganesh & Kalpana, 2022; Essaber et al., 2021; Aghajanian, 2018). The systematic literature review in Chapter 2 of this thesis revealed that studies have focused on procurement risk identification and assessment in the pre-contract phase (Vieira et al., 2022; Ghadge et al., 2015) and risk assessment in the selection and contracting phase (Hao et al., 2020; Lockamy & McCormack, 2015). However, a holistic procurement risk management strategy that encompasses risk identification, assessment, and mitigation in the post-contract award phase remains significantly under-researched. Yet, addressing these risks enables organisations to adapt their strategies effectively to changing business conditions and maintain a competitive edge (Schoenherr et al., 2023; Remko, 2020).

This paper addresses these gaps and contributes to procurement risk management literature by investigating how procurement risk management strategies are used in the post-contract award phase. The author adopted the procurement professional's perspectives because it allowed a focused understanding of the risks that directly threaten the procurement organisation's

operational continuity, cost efficiency, and strategic objectives. The following research questions addressed:

RQ1. How are procurement risk management strategies used in the post-contract award phase? This primary research question will be answered through semi-structured interviews with procurement professionals and is expected to provide practitioners' perspectives on how procurement risk management strategies are used in the post-contract award phase. This is supported by three sub-questions, which will guide the analysis:

RQa. What are the procurement risks in the post-contract award phase?

RQb. How are procurement risk management strategies used in the post-contract award phase?

RQc How are tools/techniques used to identify, assess, and mitigate procurement risks in the post-contract award phase?

The remaining parts of this paper are organized as follows: Section 2 presents a literature review of procurement risks in the post-contract award phase, the transaction cost economics (TCE) theory, and the social exchange theory as theoretical lenses used to examine procurement risk management in the post-contract award phase. Section 3 demonstrates the research methodology, while section 4 discusses the findings. Section 5 provides a discussion and compares the research findings to the existing literature to enable the development of an empirically driven framework. Finally, section 6 outlines this research's contribution to theory and practice and presents potential areas for future research.

3.2 Theoretical Background

3.2.1 Procurement Risks in the Post-Contract Award Phase

The post-contract award phase is the period after contracts have been awarded to suppliers and involves executing and monitoring supplier activities according to business requirements (Huma et al., 2020; Monczka et al., 2020; Aghajanian, 2018). Any problem that impede the flow of materials and information between the supplier and the buying organisation after supply contracts are awarded is regarded as a post-contract award risk (Nyamah, 2023). In the previous phases, procurement risks are often hypothetical and estimated. However, in the post-contract award phase, procurement risks materialise into real issues such as noncompliance, delays, cost overruns and disputes (Aghajanian et al., 2018). These risks disrupt operations, damage the organisation's reputation and lead to financial losses if they occur, regardless of how well the contract was planned in the earlier phases. This makes it critical to investigate how procurement risk management strategies are used in the post-contract award phase.

Researchers have identified potential post-award risks internal to the organisation such as supplier dependency (Raj et al., 2022; Junaid et al., 2020; Remko et al., 2020; Talluri et al., 2013; Kersten et al., 2011) and supplier relationship management risks (Dixit et al., 2022; Taghizadeh et al., 2021; Kara et al., 2018; Reichenbachs et al., 2017; Hallikas et al., 2016; Grötsch et al., 2013). Other studies have focused on risks external to the organisations such as political risks (Roscoe et al., 2019; Gao et al., 2019; Aghajanian, 2018), natural risk events (Raj et al., 2022; Bag et al., 2021; Lorentz et al., 2021; Taghizadeh et al., 2021), supply risks (Lorentz et al., 2021; Essaber et al., 2021; Chowdhury et al., 2019; Guertler et al., 2015; Hong & Lee, 2013; Grötsch et al., 2013; Micheli, 2008; Micheli, 2008; Zsidisin et al., 2004), price risks (Kara et al., 2018; Hallikas et al., 2016; Fischl et al., 2014) and quality risks (Ghadge et al., 2021; Junaid et al., 2020; Desai et al., 2015; Hong & Lee, 2013).

Researchers have highlighted that these risks have a direct negative impact on an organisation's financial performance if they occur (Nyamah et al.,

2023; Sharma et al., 2022; Ghadge et al., 2021; Junaid et al., 2020; Halikas & Lintukangas, 2016). A high level of reliance on a key supplier can put organisations in significant jeopardy because such dependencies increase their risk exposures to supply disruptions and even reduce operating income by about 30% when such disruptions affect that key supplier (Schoenherr et al., 2023). Understanding these procurement risks is crucial for effective risk management in the dynamic business environment. It enables organisations to select appropriate strategies to safeguard against operational disruptions and financial losses, underscoring the urgency of addressing these risks (Wang et al., 2024; Schoenherr et al., 2023). The complexity of the procurement process amplifies the need for risk management strategies that can help to prevent and reduce the impact of potential risks, particularly in the post-contract award phase. The effective management of procurement risks in the post-award phase is critical to achieving production targets and financial budgets (Nyamah et al., 2023).

Existing literature has primarily addressed risk mitigation strategies in a broad sense, as studies have emphasized several risk management strategies. For example, safety stock has been predominantly suggested over the years (Manhart et al.,2020; Van Hoek, 2020; Chang et al., 2015; Grötsch et al., 2013; Lavastre et al., 2012). However, more recent studies have emphasised strategies such as Supplier Relationship Management (Schoenherr et al., 2023; Chowdhury et al., 2019; Roscoe et al., 2020; Prajogo et al., 2018), Supplier Performance Evaluation and Monitoring (Sharma et al., 2022; Urbaniak, 2021) and supplier development (Saghiri & Wilding, 2021; Kurniawan et al., 2017). Effective procurement risk management in the post-contract award phase requires various tools and techniques to identify, assess, and mitigate risks (Guida et al., 2023). However, the systematic literature review in Paper 1 revealed the limited use of tools and techniques specifically tailored for managing procurement risks in the post-contract award phase.

While various tools and techniques, such as the Procurement risk cube (Cagno et al., 2011), the analytical hierarchy process (Essaber et al., 2021; Dixit

et al., 2022; Enyinda & Mbah, 2016; Schoenherr et al., 2008) Fuzzy AHP (Vieira et al., 2022; Tavana et al., 2022) and artificial intelligence (Ganash & Kalpana, 2022; Sharma et al., 2022; Toorajipour et al., 2021; Bag et al., 2021; Ivanov et al., 2020) have been developed and employed in earlier procurement phases, the application of such tools and techniques in the post-contract phase appears to be less prevalent. Only a handful of studies discussed using tools/techniques for risk management. Pontre et al. (2011) adopted the enterprise risk management (ERM) frameworks to identify procurement risks in the post-contract award, while Dessie et al. (2015) applied the fishbone diagram to assess and map the root causes and impact of post-contract related risks. Hong and Lee (2013) utilized the goal programming model to support supply risk mitigation decisions. However, supplier risks and performance must be continuously identified and assessed once the supplier has been awarded a supply contract and successfully on-boarded into the organisations' supply base (Schoenherr et al., 2023).

3.2.2 Transaction Cost Economics and Social Exchange Theory

This paper is guided by two theoretical lenses: transaction cost economics (TCE) and the social exchange theory (SET). TCE provides a framework for understanding contractual transactions' economic and structural aspects, while SET provides social and relational dimensions of procurement exchanges. Both theories were selected because the combination of the economic focus of TCE with the relational insights of SET provides a more comprehensive explanation of the risks most likely to occur in contractual exchanges with the market in the post-award phase (Wacker et al., 2016). This combination enables the development of contractual and relational governance structures to manage procurement risks holistically (Habib et al., 2022; Wacker et al., 2016). Moreover, both TCE and SET have been extensively used as theoretical lenses to investigate transaction risks and buyer-supplier issues (Habib et al., 2022; Tran et al., 2022; Hoffmann et al., 2011; Kwon et al., 2005).

3.2.2.1 Transaction Cost Economics

Transaction costs refer to the cost of conducting transactions with the market, including the cost of retrieving information, negotiation costs, and monitoring costs (Tate et al., 2022; Wacker et al., 2016). Transaction cost economics (TCE) theory introduced by Ronald Coase (Coase 1937, p. 390 cited in Rindfleisch, 2020) and later refined by the work of Williamson (1983) posits that transaction costs are driven by key determinants such as the degree of asset specificity, uncertainty, and transaction frequency, coupled with human behaviour assumptions of bounded rationality and opportunism (Patil et al., 2023; Tate et al., 2022).

Several studies (Lumineau et al., 2022; Habib et al., 2020; Wacker et al., 2016) have indicated that asset specificity, which refers to the degree to which investments are tailored to specific transactions, often lead to increased dependency on buyer-supplier relationships. Such dependencies increase procurement risks if the supplier fails to meet the contractual obligations (Lumineau et al., 2022; Tate et al., 2022). In a study, Wacker et al. (2016) noted that supplier asset specificity potentially leads to buyer and supplier opportunism. In an early study, Williamson (1985) described opportunism as a situation where organisations pursue self-interest through deceitful means resulting in a dearth of transparency or integrity. Furthermore, uncertainty, recognised as a key construct of TCE, involves unanticipated environmental changes that affect transaction outcomes (Lumineau et al., 2022; Hoffman et al., 2013). Uncertainties such as market volatility, regulatory changes, and disruptions such as natural disasters and wars can impact suppliers' contract execution and pose significant risks to procurement performance by exposing organisations to potential cost increases, supply shortages, and compliance issues. According to Williamson (1985), uncertainty increases the likelihood of opportunism in buyer-supplier relationships because it reduces the organization's planning capabilities and increases the unpredictability of behaviours.

Bounded rationality refers to decision-makers' cognitive limitations in processing information, communicating, and making optimal choices (Tate et al., 2022; Hoffmann et al., 2013). In the context of procurement risk management at the post-award stage, bounded rationality impacts the ability of procurement professionals to foresee potential issues and adapt to changes. For instance, Hoffmann et al. (2013) stated that due to cognitive limitations, contracts are incomplete or fail to anticipate all future contingencies, leading to risks such as cost overruns and delays. In the post-award stage, these TCE constructs have become particularly relevant as organisations must ensure that their suppliers adhere to contractual obligations while managing potential risks such as opportunism, behavioural, and environmental uncertainty (Wang et al., 2024; Cevikparmak et al., 2022; Wacker et al., 2016). Behavioural uncertainty has been described as difficulties in monitoring the contractual performance of exchange partners, and it materializes in form of deliveries issues, poor quality or strategic supply manipulation (Hoffman et al., 2013; Williamson, 1985).

Several studies have adopted TCE as an appropriate theoretical lens to examine supplier-buyer transaction and exchange challenges. For example, Wang et al. (2024) applied TCE in examining risks of opportunism in international buyer-supplier exchanges. They provided governance mechanisms to mitigate such risks, as seen during the COVID-19 pandemic. Castro et al. (2023) emphasized that TCE provides a governance structure to economize transaction costs associated with renegotiations, which are the primary source of procurement cost overruns. Hoffmann et al. (2013) applied TCE to empirically test the relationship between elements of the supply risk management process and supply risk management performance. Cevikparmak et al. (2022) used the TCE framework to examine the intricate relationship between TCE constructs and how firms decide on contract types to mitigate risks associated with contracting. Despite its wide use, TCE has been criticized for focusing on contractual issues and neglecting relational mechanisms that are critical antecedents of explaining relationship-specific risks (Lumineau et al., 2022; Hoffmann et al., 2011). While

TCE provides valuable insights into procurement risk management, TCE does not fully explain certain behavioural factors, such as trust and information sharing (Tate et al., 2022; Habib et al., 2020), which can significantly impact procurement risk management outcomes. For this reason, social exchange theory is selected as a complementary theory to help explain the relational dimensions of PRM that the TCE theory cannot explain.

3.2.2.2 Social Exchange Theory

Social exchanges involve interactions that generate obligations over time (Emerson, 1976). The main idea of SET is that positive interactions over time will produce relational exchange norms such as trust, information sharing, commitment, and flexibility that govern an exchange relationship (Tate et al., 2022; Habib et al., 2020). Mitchell et al. (2012) explained that an exchange consists of a sequence of interconnected interactions where one party receives something because of the (in)activity of the other party. Cropanzano and Mitchell (2005) argued that negotiated exchanges relationships involve a decision process in which the actors negotiate to reach an agreement on the exchange conditions. Alternatively, exchange relationships are reciprocal, where one partner's action leads to another partner's response.

Against this background, the buyer-supplier relationships in the post-award phase are considered negotiated relationships because they are governed by explicitly negotiated terms and conditions within their supply contracts (Hoffmann et al., 2013). Trust, communication, commitment, information sharing, and reciprocity are key relational norms of Social Exchange Theory (SET). These elements evolve over time, establishing guidelines that facilitate the exchange process between organizations (Tate et al., 2022; Plugge & Bouwman, 2015). Over the years, SET has been extensively used by researchers as a theoretical lens to examine the challenges and dynamics in supplier-buyer relationships (Tran et al., 2022; Li et al., 2022; Plugge et al., 2015; Wu et al., 2014; Tanskanen et al., 2014; Narasimhan et al., 2009). Social relationships between supplier and buyer are developed and maintained long-term because they offer economic

rewards and reciprocal benefits to one another. Procurement contracts form the foundation of business transactions, but developing complete contracts is challenging due to limited information and an unpredictable future business environment (Patil et al., 2024). Efforts to create comprehensive contracts can lead to increased transaction costs. However, relational norms such as trust, commitment, communication, and information sharing can help manage the risks associated with implementing incomplete contracts in a dynamic business environment (Boersma et al., 2003).

3.3 Methodology

3.3.1 Research design

This study is based on an abductive research strategy and a qualitative approach. The abductive approach was appropriate for this study because it enabled the author to move iteratively between theory and data collected to reveal meanings and themes, and to uncover patterns and relationships, and capture the dynamic nature of procurement risks (Saunders et al., 2023; Blaikie & Priest, 2017). The qualitative research method is proposed as suitable for investigating phenomena that are not well understood from the perspective of the individuals involved (Edmonson & McManus, 2007). This strategy facilitated the collection of authentic data on diverse explanations of real-life procurement risks, tools, and risk management strategies applied in the post-award phase within the context of the manufacturing sector (Saunders et al., 2023). To ensure the quality of the data collected, only procurement professionals based in the UK with at least five years of procurement experience within the manufacturing sector were chosen.

The UK manufacturing sector was selected as the ideal context for researching procurement risk management (PRM) in the post-award stage because of its vulnerability to several procurement risks. UK Manufacturers heavily depend on suppliers for essential raw materials and components, often spanning multiple countries and involving numerous suppliers and

subcontractors, meaning any disruption in procurement significantly impacts production schedules, product quality, and overall business performance (Deloitte, 2022). The manufacturing sector's persistent shortages of critical parts, the challenges of implementing contingency plans, such as switching suppliers, and the lack of visibility of supplier tiers have impacted their financial performance and increased the sector's vulnerability (Jat et al., 2023). Manufacturers also face complex regulatory and compliance requirements, adding another layer of risk. Given these factors, the manufacturing sector provides a robust and dynamic setting for investigating PRM in the post-contract award phase. The insights from this research can enhance the understanding of PRM in manufacturing, which benefits other sectors by providing practical strategies and tools for managing procurement risks.

3.3.2 Data collection and analysis

The author designed an interview protocol guided by the results of the results of the systematic literature review and the conceptual procurement risk management model. The interview questions were categorised into four sections. The first section included general questions about the respondents, the second section explored procurement risks, the third focused on tools and techniques used for risk identification, assessment and mitigation, while the fourth section focused on procurement risk management strategies. These questions are consistent with the three main components of the procurement risk management model, procurement risks, tools and techniques used, and risk mitigation strategies. Three pilot interviews were conducted to test the language and clarity of the questions. Consent to record interviews were collected from all the twenty-three respondents in writing. Based on the pilot study responses, the questions were confirmed relevant and the insights formed part of the study analysis.

Semi-structured, audio-recorded interviews were conducted from June 2023 to November 2023 to collect data on PRM in the post-contract award phase. Twenty (23) procurement professionals across seven manufacturing industries (Table 3-1), including tools and equipment, chemicals, automotive, chocolate

manufacturing, energy equipment, medical devices, and fashion were interviewed for a total of 23 hours. The spread of industries ensured the variety and richness of data. The Gioia methodology was used for the data analysis.

3.3.3 Data coding and analysis

The Gioia method was selected for the data analysis because of its structured and systematic framework for analysing qualitative data, involving informant-centric terms and codes as a first-order analysis followed by theory-centric concepts and themes as the second-order analysis (Gioia et al., 2013). The Gioia method was appropriate for this study as it enabled the author to capture and interpret how the procurement professions in the study describe procurement risks, tools and techniques used and their risk mitigation strategies applied.

in the first stage of analysis, the interview transcriptions from the Teams platform were cleaned to ensure that the respondents' experiences in managing procurement risks in the post-contract award phase were captured correctly. An inductive approach was used in this first stage. The interview transcripts were read in detail to enable the author to use the participants' own words and lived experiences. Statements with similar wordings describing comparable issues were grouped together into first-order concepts. For example, in describing procurement risks, participants frequently used words and phrases such as defects, delivery issues, wrong specification, incomplete contract terms, rejects, quality issues, price variations, lack of transparency, relationship breakdowns, omissions, incomplete clauses, dependent. These terms reflected participants' direct concerns and perceptions of risk in their procurement activities. While discussing risk management strategies, participants consistently mentioned practices such as communication, collaboration, site visit, interviews, review meetings, renegotiations, insurance cover, buffer stock, compliance audits, corrective action plans, near shoring, and backup suppliers. For tools and techniques, participants used words such as data analytics, descriptive analytics, Power BI, Tableau, machine learning, artificial intelligence, visualizations, Postgres SQL, interviews, review meetings and site visits. At this stage, the

coding remained descriptive and closely tied to the respondents' words used in their statements, without forcing interpretation beyond their stated meanings. These terms were identified as first-order concepts (Appendix A.2, A.3, A.4).

In the second stage of analysis, theoretical themes from existing literature (Schoenherr et al., 2023; Nyamah et al., 2023; Van Hoek, 2020; Roscoe et al., 2019) were used as a guide in the grouping of first-order concepts into higher-level and broader themes, forming the second-order themes. The themes were not pre-defined a priori however; this process was abductive in nature because the grouping of themes was informed by findings from the procurement risk management literature. The author compared the words used by the respondents to describe risks, tools and techniques and mitigation strategies, with the words used in the literature. This stage was essential because it moved the analysis beyond the primary data. It involved constant comparison and iterative analysis between the emerging themes and the existing literature while identifying similarities and differences to enable a broader categorisation of themes (Saunders et al., 2019). For example, words such as defects, delivery issues, rejects, and quality issues were grouped under the broader theme; Supplier performance risks (Junaid et al., 2020; Song et al., 2017), while terms like opportunism, relationship breakdowns and supplier dependency were clustered into supplier relationship risks (Dixit et al., 2022; Taghizadeh et al., 2021; Kara et al., 2018). The second order themes are shown in Appendices A.2, A.3and A.4.

In the third stage, the author aggregated the second-order themes into the overarching research dimensions, including procurement risks, procurement risk management strategies, and tools and techniques (Appendix A.2, A.3 and A.4). This stage was abductive because these dimensions were pre-defined a priori in Paper 1, ensuring consistency and theoretical alignment across the research (Hashim et al., 2024; Nyamah et al., 2023; Schoenherr et al., 2023). Furthermore, these overarching dimensions provided the structure for interpreting the data, showing how procurement professionals' experiences align with and extend

theoretical understandings of procurement risk management in the post-contract award phase.

3.4 Findings

This section presents the respondents' (Buyers) perceptions of procurement risks, their risk management strategies, the tools and techniques used to identify, assess, and mitigate them, and how they are applied within the manufacturing sector. The interview respondents are presented in Table 3-1.

The coded interviews suggest five significant risk categories during the post-contract award phase: supplier performance risks, contract design risks, supplier-relationship risks, ethical risks, and disruption risks.

Table 3-1 ***Interviewee respondents*** **(Source: Author)**

No.	Industry	Products	Job Title	Years of Experience
1	Automotive	Cars	Procurement Manager	7
2			Technical Buyer	5
3	Chemicals	Lubricants	Category Manager	7
4		Additives & modifiers	Procurement Director	11
5		Paint	Strategic Buyer	5
6	Energy equipment	Solar Panels	Category Manager	8
7	Food and beverage	Chocolate	Procurement Manager	7
8			Buyer	7
9			Procurement Lead	7
10		FMCG	Sourcing Specialist	5
11	Tools and equipment	Drilling Tools	Senior Contracts Manager	19
12			Procurement Manager	14
13			Strategic Buyer	5
14			Procurement Lead	11
15			Procurement Manager	20
16			Project Procurement Buyer	16
17			Contracts Manager	14
18			Procurement Manager	11
19	Medical	Bio-Pharmaceutical	Procurement Manager	7
20		Medical Devices	Category Manager	6
21		Medical Devices	Buyer	12
22		Bio-Pharmaceutical	Contracts Manager	5

23	Fashion	Sports Fashion	Procurement Manager	11

3.4.1 Procurement Risks

A summary of the data structure for procurement risks in the post-contract award phase is presented in Appendix A.2.

3.4.1.1 Supplier performance risks.

The first set of risks identified from the interviews were supplier performance risks. Interviewees discussed the risk of poor supplier performance within the context of the quality and the delivery terms and conditions agreed upon in the contract, which is one of the most significant risks that occur after contracts have been signed with the suppliers. For example, respondent 1 highlighted quality risks in the following quotation:

"Quality risk is high, especially when we use new suppliers because we cannot get our products out before the season starts if the supplier delivers bad quality fabrics different from the agreed quality in the contract" (Respondent 1).

Supplier performance risks involving suppliers' deviations from the agreed quality, price, and delivery terms and conditions in the contract were common to all industries. Quality and delivery risks have directly increased procurement and manufacturing costs across industries because they have resulted in production delays, extended project timelines, and reduced profitability. For example, within the chemicals industries, the manufacturers of lubricants stressed that their most significant procurement risks were quality and delivery issues, especially with the base oils, which were critical items that affected all product lines and could stop production of all their products. Respondent 10 highlighted delivery and quality issues in the following quote:

"Delivery according to the agreed schedule and quality is always a problem with some of our suppliers, especially with base oils, which are our key product. If our base oil is not delivered or the quality is not good, the manufacturing of all product lines will be badly affected, and the process will stop". (Respondent 10)

The paint manufacturers highlighted that despite quality issues and regulatory standards regarding hazardous chemicals, they were exposed to severe price variations in sourcing dyes used in producing paints after supply contracts had been awarded. Respondent 14 highlighted this in the following quote:

“The price of dyes is very volatile, and some of our suppliers keep requesting for price variations. This is aside from the challenges we are already facing with raw materials not meeting our chemical specifications and the stringent environmental regulations” (Respondent 14).

The automotive industry has also faced significant challenges with delivery and quality issues, as some suppliers are increasingly unable to deliver critical parts according to the master production schedule. This has led to a halt in production lines, reduced productivity, and increased total procurement costs. Respondent 19 highlighted delivery risks in the following quote:

“Our number one risk is delivery. We manufacture continuously 24/7, three shifts a day, so we need our suppliers to deliver different parts according to the master production schedule. If they do not deliver on time, it will be a critical issue for the company because the production line will be halted” (Respondent 19).

3.4.1.2 Contract-design risks.

The second set of risks identified from the interviews were contract-related risks. Interviewees discussed the risk of poor contract design that affect the implementation of the contract. For example, omitting critical contract clauses lead to ambiguities in the suppliers’ obligations and difficulty enforcing rights. The risk of omission was captured in the following quote:

"It is hard to capture everything in a contract document, but the omission of a critical warranty clause in our contract reduced the supplier's obligation to us, and it led to serious disputes" (Respondent 11).

The lack of proper documentation of negotiated outcomes and variations to contract agreements is discussed as a significant contract-related risk. Interviewees stressed that disputes arise when the suppliers and procurement teams have different recollections or interpretations of what was negotiated and agreed upon, causing friction and potential legal challenges. The absence of detailed documentation forces procurement teams to revisit negotiations with suppliers to clarify terms and resolve misunderstandings. This renegotiation process is not only time-consuming but also costly. The need to renegotiate terms can lead to increased administrative costs and potentially higher prices. The issue of renegotiation was captured from the following quote:

"We did not update a renegotiated price in a contract addendum, and it was a tough one because the supplier's staff who led the negotiations left the company, and our buyer had also moved on. We had to renegotiate with the supplier and ended up paying more (Respondent 2)."

Interviewees also explained how deviations from the agreed contract terms and conditions, such as a change in the product specifications at the contract implementation phase, have led to adverse outcomes, including price increases and delayed parts delivery. When product specifications are altered after the contract has been awarded, it necessitates additional materials and labour or specialized processes not accounted for in the original contract. Suppliers need to renegotiate prices to cover these unexpected expenses, increasing overall procurement costs. Respondent 2 highlighted the impact of change on specification in the following quote:

"A small change in part number for one of our equipment, for instance, led to about 22% increase in price and delayed production (Respondent 2)".

3.4.1.3 Supplier relationship risks

The third set of procurement risks identified was around supplier relationships. Insights from the interviews highlighted various procurement challenges due to the type of relationships developed with the suppliers. For example, most

respondents mentioned supplier dependency as a significant risk in manufacturing because they rely heavily on single-supply relationships or collaborative relationships with suppliers of strategic items who have invested resources in developing customized products specifically for the buying organisation. The dependency on such suppliers has made it challenging to build relationships with other suppliers that offer better prices, technology, and improved quality. This was highlighted by Respondent 3 in the following quote:

" Whether we like it or not, we must buy a part of our main equipment solely from one supplier because that supplier developed the mold specifically for our company" (Respondent 3).

Single-source relationships resulting from asset specificities lead to supplier dependency risks. Such single-source relationships have exposed the manufacturing industries in this study to opportunistic behaviours, such as price increases and performance issues, which increase overall procurement costs. For example, the automotive (car manufacturing) industry maintains single-source relationships with a few critical suppliers who have developed technologically advanced exhaust manifolds and muffler systems that meet stringent carbon emission standards. This issue of dependency was highlighted by Respondent 6:

We have a single-source relationship with our strategic supplier of exhaust manifolds. This relationship gives us a competitive edge because of the supplier's innovation and technological advancement, but we cannot over-negotiate prices even when we know they increase unjustly." (Respondent 6)

Respondents stressed that such dependencies have led to opportunistic behaviours in which the suppliers take advantage of their upper hand to renegotiate stringent terms and conditions during contract renewal. *Respondent* 11 highlighted such opportunistic behaviour in the following quote:

” Pumps are critical to our production, and we single source from a supplier who now insists that we pay 100% of the price upfront before they deliver any replacement pumps; we are stuck with them for now” (Respondent 11).

Similarly, the biopharmaceutical industries are exposed to supplier dependency risk because of the stringent quality tests, FDA audits, and GMP requirements suppliers must undergo. As such, procurement teams find it challenging to explore alternative suppliers as they develop single-supply relationships with a handful of suppliers who have passed the FDA audits. This was discussed by Respondent 21 in the following quote:

“As a buyer, you just have to work with suppliers that have passed FDA audits and continuously follow the GMP process. This makes us develop single-source relationships with suppliers who we trust to maintain excellent integrity track records”. (Respondent 21)

Furthermore, the respondents indicated that the risk of inadequate supplier performance monitoring occur, especially in collaborative relationships where supplier dependency exists. This cascades into performance risks as suppliers become more complacent in their overall service quality. This performance monitoring issues were highlighted by Respondent 2 in the following quote:

"In the past, we did not focus on monitoring the supplier's performance in line with the KPIs in the contracts, and we had to do several variations that had serious cost implications" (Respondent 2)

All the respondents also discussed visibility risks as a significant challenge affecting how supplier relationships are developed and managed. This was discussed by respondent 7:

“Visibility of our global suppliers and the different supply tiers is a major challenge because we cannot assess their risk levels and monitor their performance” (Respondent 7)

3.4.1.4 Ethical risks

The fourth set of risks involved ethical issues. The interviews revealed that a few manufacturing companies are increasingly conscious of ethical risks involving social and environmental issues. For example, the procurement buyers in the chocolate manufacturing industry prioritised environmental risks associated with sourcing cocoa used in chocolate manufacturing as captured in the following quote:

“We are mostly concerned about the risk of buying cocoa beans from suppliers who have sourced their supplies from protected areas.” (Respondent 22).

Buyers also mentioned the social risk exposures from suppliers who engage children to work in their cocoa plantations. Respondent 4 highlighted this child labour issue in the following quote:

"… as a chocolate maker, we are exposed to the risks of child labour in cocoa farms because that is one of the key risks in our industry now" (Respondent 4).

Similarly, the sports fashion procurement manager was more concerned about modern slavery risks associated with child labour, forced labour, poor working conditions, and health and safety issues along their supplier tiers. This was captured in the following:

“As a fashion brand, we can no longer just use any supplier in faraway countries because of the serious implications of social issues like child labour laws" (Respondent 1).

Procurement managers in biopharmaceutical teams prioritize ethical issues related to supplier integrity, waste disposal risks, and GMP compliance risks. These ethical concerns pose a significant threat because, if not properly managed, they negatively impact the organization’s reputation. Respondent 21 stated this in the following quote:

“One of the major risks we look out for is supplier integrity because every supplier must follow that GMP process in manufacturing their materials. If any of our suppliers is found wanting during the FDA audits, it will affect our reputation, which we have worked so hard to build” (Respondent 21).

Similarly, the medical devices procurement manager also identified social and environmental risks associated with waste disposal, as well as the potential impact on their reputation should anything go wrong. This was discussed in the following quote:

“We work in a highly regulated industry and are affected by our suppliers' social and environmental performance. We must bear responsibility for any negative actions from our suppliers, and it is as if our reputation is tied to their actions” (Respondent 20).

Furthermore, the chocolate manufacturing, medical, and sports fashion industries also grapple with visibility issues. For example, the multiple intermediaries in the supply tier of cocoa beans from farmers, traders, and exporters have made procurement within the chocolate industry more complex because they intentionally reduce the visibility and traceability of these raw materials. This lack of visibility has made it difficult for procurement teams to monitor suppliers’ ethical practices while managing their relationships. This was captured in the following:

“We face serious challenges with the visibility of suppliers’ ethical practices along the supply tiers because we work with suppliers who get the products from other farmers” (Respondent 22).

Contrary to this, the automotive, tools and equipment, and energy equipment manufacturing industry participants did not dwell on these ethical risks as a significant concern that required immediate focus.

3.4.1.5 Disruption risks

The fifth set of risks were disruptions that occur in the external business environment. The respondents identified disruption risks as a significant

challenge to achieving procurement objectives. While the recent COVID-19 pandemic affected the procurement activities of all participants in this study, a few have experienced supply challenges because of the Russian-Ukraine war. This was captured in the following quote:

"We have had major products being delayed because of the Russian-Ukraine War" (Respondent 4)

The summary of the procurement risks per industry is shown in Table 3-2 below.

Table 3-2 Mapping procurement risks across Industries (Source: Author)

PROCUREMENT RISKS	Automotive (Cars)	Chemicals (Lubricants , & paints)	Energy Equipment (Solar panels)	Food & Beverage (Chocolates & FMCG)	Tools and Equipment (Drilling tools)	Medical (Devices & Bio-pharma)	Fashion (Sports)
Supplier Performance risks:							
Quality deviations	x	x	x	x	x	x	x
Delivery deviations	x	x	x	x	x	x	x
Price variations	x	x	x	x	x	x	x
Contract design risks:							
Omission of critical contract clauses	x	x	x		x		
Poor documentation of negotiation outcomes			x		x		x
Specification issues		x	x				
Supplier relationship risks							
Suplier dependency	x	x	x	x	x	x	x
Lack of supplier performance monitoring	x			x	x		x
Poor comminication	x	x		x			
Opportunistic behaviours	x	x			x	x	x
Visibility risks	x			x		x	x
Lack of trust	x	x	x	x	x	x	x
Ethical risks: Social							
Forced labour				x			
Child labour				x			
Poor working conditions				x			x
Health and safety		x		x			x
Intergrity risks				x		x	
GMP Compliance risks						x	
Reputation risk	x			x		x	x
Ethical risks: Environmental							
Deforestation				x		x	
Waste management						x	x
Harmful Chemicals		x					x
Disruption risks							
Geopolitical risks	x		x		x		
Natural risks	x	x	x	x	x	x	x

3.4.2 PRM strategies used in the post-contract award phase.

A summary of the data structure for PRM strategies in the post-contract award phase is presented in Appendix A.3. The findings showed that proactive and reactive PRM strategies were used according to the organisations' operational context. There was a common reliance on reactive risk management strategies, often driven by the need to resolve existing challenges rather than to anticipate and prevent potential risks.

3.4.2.1 Proactive strategies

Eighty percent (80%) of the respondents discussed using collaboration, regular review meetings, and constant communication with their suppliers as proactive strategies to build good relationships with their suppliers. Since they have single-source relationships with some key suppliers, such collaborative relationships enable them to identify issues early and develop action plans to address them. The respondents particularly emphasized this in the tools and equipment, medical devices, bio-pharmaceutical industries, and automotive industries as captured from Respondent 11:

"*We must have continuous collaboration and communication with our strategic suppliers as one can never underestimate having a good relationship with your supplier" (Respondent 11)*

Respondents also discussed implementing supplier performance monitoring to identify, assess, and mitigate potential risks. They highlighted the challenges of actively monitoring suppliers with single-source relationships. The procurement professionals from the medical and automotive industries stressed that they conduct site visits and compliance audits to proactively assess suppliers' production processes, quality control measures, and compliance and to enhance collaborative relationships. This was discussed by Respondent 16 in the following quote:

"We visit suppliers' sites to see if they are following all the quality norms which are needed to be followed like the ISO 9001 and GMP (Respondent 16)"

Respondents mentioned including tighter terms and conditions during contract renewals to set more explicit expectations for supplier performance, where these were omitted during the contracting phase. Clauses for regular audits, performance reviews, quality standards, delivery, and service levels are proactively included before the new contract extension date to enable continuous monitoring and early detection of non-compliance to mitigate risks. This strategy was discussed by Respondent 9 as follows:

"We include tighter terms and conditions during contract renewals of contractual agreements to be able to establish a form of mitigation against such performance risks" (Respondent 9).

Only 20% of the respondents in the medical device, fashion, and food and beverage industries used the supply base diversification strategy as a risk mitigation strategy. The respondents noted that this strategy is time-consuming and difficult to implement because of the time required to qualify and assess potential suppliers. However, it has become critical for the procurement teams to gradually implement this strategy because of the negative impact of the supply disruptions during the COVID-19 pandemic. This would enable the organisations to spread their risks by ensuring that if one supplier fails, others can quickly fill the gap.

"*We have a massive procurement-wide project ongoing to ensure that we have multiple supply sources for our materials and some services. The negative impact of the pandemic made us decide to expand our supply base to gain more flexibility with allocations." (Respondent 20).*

3.4.2.2 Reactive strategies

The primary reactive strategies identified by all the respondents was using safety stock. Safety stock serves as a buffer inventory that can be used when there are supply disruptions or unexpected increases in demand. Maintaining a safety stock of critical components allowed their organisations to continue production seamlessly during a supplier's unexpected problems.

"*We always ensure we have stock of critical spares. It is the oldest strategy in our industry" (Respondent 19)*

The respondents also discussed using review meetings and constant communication with suppliers as a critical mitigation strategy. These meetings were often held more frequently during disruptions to ensure that all parties were aligned and informed about the current situation and any changes in plans. Review meetings were problem-solving sessions where procurement professionals and suppliers collaboratively addressed issues, such as adjusting delivery quantities and production schedules or finding alternative solutions.

"*We sit with the supplier quality team to find the root cause of the problem, and we come up with corrective actions and preventive actions (CAPA)" (Respondent 19)*

Another common reactive strategy mentioned was establishing relationships with backup suppliers. Having pre-approved alternative sources ensures continuity of supply when the primary supplier faces issues. Procurement professionals emphasized the importance of having these backup suppliers ready to activate quickly in case of disruptions.

"We keep another supplier as backup, and if you sense any problem, we ask the other supplier to start the manufacturing. we do not want any production delays." (Respondent 8).

The respondents emphasized the importance of leveraging contract terms and conditions renegotiation when issues arise, such as quality issues, price fluctuations, or delivery delays. The outcomes of such renegotiations are documented as addendums to the main contracts.

"If a supplier is not performing as agreed, instead of terminating the contract, we sometimes call for a meeting to renegotiate some of the terms and conditions like the delivery timelines quality and even include a penalty as an addendum to the main contract" (Respondent 16).

A summary of all the proactive and reactive strategies discussed is shown in Table 3-3.

Table 3-3 PRM- proactive and reactive strategies per industry (Source: Author)

Strategies	Automotive (Cars)	Tools & Equipment (Drilling tools)	Food and Beverage: (Chocolates)	Medical: (Devices & Bio-pharma)	Chemicals: (Lubricants & paints)	Energy Equipment: (Solar panels)	Fashion: Sports
Proactive Strategies:							
Collaboration	x	x	x	x	x		x
Supplybase diversification plans			x	x			x
Performance monitoring				x	x		x
Supplier development							
Advance payment guarantees		x					
Contingency plans		x		x			x
Regular facility inspection				x			
Alternative materials				x			x
Quality tests		x		x			
Near shoring			x				
Specification checkpoints before POs are issued		x		x			
Certificates of assurance					x		
Reactive Strategies:							
Backup Suppliers	x	x	x		x		x
Safety stock	x	x	x	x	x	x	x
Renegotiate contract terms	x	x			x	x	x
Supplier performance audits	x		x	x	x	x	x
Contingency plans		x	x				x
Corrective action plans	x			x			
Quality tests							
Contract Addendums		x			x		
Review meetings	x	x		x			x

3.4.3 Tools and techniques to identify, assess, and mitigate procurement risks.

A summary of the data structure for Tools/Techniques used in the post-contract award phase is presented in Appendix A.4.

3.4.3.1 Data analytics and machine learning

PRM practices in the post-contract award phase within manufacturing industries are being increasingly transformed with the introduction of data analytics and machine learning. Respondents discussed the increasing importance and adoption of data analytics technology as a critical risk identification and assessment tool that has transformed the risk management process within procurement. However, the application level of these technologies differs in each industry. The level of adoption of these technologies is linked to the maturity levels of the procurement organisations. While 74% of the respondents have embraced data analytics in managing their risks, only 28% use machine learning technology to gain real-time visibility of suppliers' performance and proactively monitor risks, demonstrating a higher maturity level.

"We now use data analytics and AI platforms that help us identify and assess our upstream procurement risks in real-time. It is magical" (Respondent 13).

Procurement teams, especially in the automotive, tools and equipment, food and beverage, and medical industries, have integrated data analytics into the supplier performance evaluation process to enable the identification and assessment of supplier risks in the post-contract award phase. Respondents discussed how data analytics tools such as Tableau and Power BI have been used in-house to enhance supply performance monitoring. In the Bio-Pharmaceutical industry, procurement analysts were being trained to use Postgres SQL and Tableau to monitor performance and manipulate available data on suppliers' activities. The application of descriptive analytics was discussed in the following quote:

"We now use data analytics tools to evaluate suppliers' performance such as on-time delivery, acceptance rates, rejects, and so on, using a scoring from 1 to 10. We use Tableau to create a dashboard to see if the supplier is underperforming or going beyond its performance level". (Respondent 19)

In contrast, only the respondents from the food and beverage and medical industries discussed the application of artificial intelligence such as machine learning tools, enabling predictive insights through third-party platforms and data descriptive analytics tools to identify and assess complex procurement risks and propose mitigation strategies for managing them. Respondent 18 discussed this in the following:

"… For example, with the recent earthquake in Morocco, the platform alerted us of our footprints in Morocco, in our second and third-tier suppliers, and also provided information about the suppliers with multi-sites in multiple countries and the closest regions to us to help us quickly decide on mitigation plans". (Respondent 18)

A Respondent from the medical device industry stated that AI-powered data analytics platforms have enabled the visibility of various supply tiers by tracking and mapping their locations and risk levels, especially suppliers of products and services with high supply risks. As captured below:

"These platforms help to track and map our suppliers and supply tiers into different risk categories: green, amber, and red, or low, medium, and high risk. They use variables like location, number of facilities, financial stability, ethical standards, and availability of alternatives" (Respondent 20)

Another Respondent emphasised the lack of AI and data analytical skills and resources within their procurement organisation to enable real-time external situation monitoring for fast decision-making. As a result, they subscribe to third-party platforms that have developed intelligent systems. This was captured in the following discussion:

“We do not have such advanced skills and resources in-house, so we use third-party providers like Integrity Next and Dun& Bradstreet. These are excellent data analytics and AI platforms that provide us with real-time tracking of our suppliers’ risk globally” (Respondent 9).

Some organisations subscribe to dedicated descriptive analytics and machine learning, AI-driven platforms to monitor their global supplier risks and integrate these into their workflow to minimize the high cost of implementing such platforms in-house, considering their budget constraints. This is shown in the following quote.

“…We subscribe to a data analytics platform and AI platform called Rosslyn and integrate this into our workflow. This is cost-effective and helps us with insights for our risk identification and assessment and even mitigation” (Respondent 4)

In addition, a respondent from the medical industry mentioned that it is difficult to find an Artificial Intelligence platform that provides descriptive, predictive and prescriptive analytics for the end-to-end management of all types of risks, so they use more than one platform to monitor different types of risks: ESG, financial, and compliance. This was captured from the following quote:

” Getting one application that does everything at once is very hard. So, we outsource the bits and pieces like ESG or financial risk management to a few data analytics providers and bring the insights back in” (Respondent 10)

Other respondents who do not already use such platforms mentioned that their organisations were trying to decide on the most suitable and cost-effective Artificial intelligence and data analytics platform to enhance the visibility of their suppliers’ performance and risks. This was captured from the following quote:

“We do not currently use any data analytics tools, or artificial intelligence platforms, but we can no longer ignore this technological transformation in supplier risk management. We are looking into integrating one of these data-driven risk management tools to gain real-time visibility and monitoring of our critical global suppliers” (Respondent 17).

3.4.3.2 Human-engagement techniques

Insights from the interviews revealed that respondents commonly use human engagement techniques, including interviews and site visits, to identify procurement risks in the post-contract award phase. All the respondents mentioned regular in-depth interviews with internal users and suppliers to identify risks and assess their impacts as captured by respondent 2:

" We hold monthly review meetings with our critical suppliers and internal stakeholders to discuss issues around delivery delays, specification, equipment issues, and material quality so that we can quickly come up with solutions" (Respondent 2)

Site visits and inspections of supplier facilities and equipment were used as critical observation techniques to assess the quality of suppliers' production, the physical progress of production requirements, milestone achievement, and the quality of materials.

" We also inspect supplier factories to identify and analyse our risks. Sometimes it is now a show and tell process so that we can uncover unforeseen issues and verify their capabilities" (Respondent 1). A summary of the tools/techniques per industry is presented in Table 3-4 below.

Table 3-4 *PRM tools /techniques per industry* (Source: Author)

Tools / Techniques	Automotive (Cars)	Tools & Equipment (Drilling tools)	Food and Beverage: (Chocolates)	Medical: (Devices & Bio-pharma)	Chemicals: (Lubricants & paints)	Energy Equipment: (Solar panels)	Fashion: Sports
Technology: Data analytics	x	x	x	x			x
Machine learning			x	x			
Human engagement:							
Site visits	x	x		x	x		
Review meetings	x	x	x	x	x	x	x

3.5 Discussion and conclusion

This study aimed to investigate how procurement risk management strategies were used in the post-contract award phase in seven manufacturing industries: automotive, tools and equipment, Medical (biopharmaceuticals and medical devices), chocolate manufacturing, energy equipment, chemicals (paint, lubricants, and additives), and fashion. In this discussion section, we synthesize and compare the different procurement risks, the risk mitigation strategies implemented, and the tools and techniques used in the manufacturing industries in our interviews with the existing literature (see Tables 3-5, 3-6, 3-7, 3-8, 3-9).

3.5.1 Supplier performance risks, mitigation strategies, tools/techniques

Based on the analysis of the interview responses, this research identified supplier performance risk as a significant challenge in the post-contract award phase that can significantly impact the manufacturing sector's operational efficiency and financial performance. Suppliers' performance issues, such as poor quality, delivery delays, price increases, and deviations from agreed terms, were highlighted by all the respondents in this study as a significant risk that occur after supply contracts have been awarded. It was noted that in some single-source relationships, the procurement teams found it challenging to carry out thorough performance reviews and these led to suppliers not keeping to the quality and delivery conditions as agreed, and such opportunistic behaviours negatively impact the overall procurement performance.

These findings align with existing literature on supplier performance risks (Junaid et al., 2020; Song et al., 2017; Lockamy et al., 2015; Hong & Lee, 2013), which stated that supplier inefficiencies, including quality issues, price increases, delivery delays might inhibit the realisation of the overall procurement objectives and increase total costs if such risks occur. Transaction cost economics theory emphasizes that supplier dependencies create lock-in situations, leading to opportunistic behaviours as the supplier fails to meet the contractual obligations,

knowing the buyer will be unlikely to switch (Lumineau et al., 2022; Tate et al., 2022). A recent study by Munir et al. (2024) described the potential risk of suppliers failing to deliver the product and service on time as a significant supply chain risk, corroborating the findings from this study.

Table 3-5 Supplier performance risk - similarities and differences between SLR and empirical findings (Source: Author)

Objective	2nd Order Themes from Data Structure	Findings from Literature	References from Literature
Procurement risk	Supplier performance risks	Supplier performance inefficiencies: quality issues, delivery delays, and price increases.	Hashim et al., 2024; Nyamah et al., 2023; Schoenherr et al., 2023; Junaid et al., 2020; Song et al., 2017; Lockamy et al., 2015
PRM strategies	Proactive Strategies: Collaboration, facility inspections, compliance audit, assurance certificates. Reactive Strategies: quality tests, corrective action plans, and supplier performance audits, safety stock, backup suppliers.	Proactive Strategy: Collaboration. Reactive Strategies: Safety stock Backup suppliers.	Van Hoek, 2021; Bag et al., 2021; Urbaniak, 2021. Manhart et al.,2020; Grötsch et al., 2013; Lavastre et al., 2012
Tools / Techniques	Data Analytics Machine learning Review meetings Site visits	Review meetings	Tian et al., 2024; Jackson et al., 2024; Desai et al., 2015

To mitigate supplier performance risks, our participants implemented a combination of proactive and reactive strategies according to the type of performance risk. For example, collaboration, facility inspections, compliance audits, assurance certificates, and payment guarantees were used to mitigate quality risks proactively. While the need for collaboration as a proactive strategy has been supported in previous studies (Van Hoek, 2021; Bag et al., 2021; Urbaniak, 2021), the use of facility inspections, compliance audits, and assurance

certificates and payment guarantees as proactive mitigation strategies in the post-award phase in manufacturing industries has not been given prominence in the existing literature. Furthermore, reactive strategies such as quality tests, corrective action plans, and supplier performance audits were used by respondents to mitigate and reduce the impact of quality risks, while backup suppliers and safety stock were used as reactive strategies to mitigate delivery risks. These findings are consistent with several studies (Manhart et al.,2020; Grötsch et al., 2013; Lavastre et al., 2012) that emphasised that backup suppliers and safety stock can significantly reduce supply risk by allowing organizations to respond to supply variations or supplier production difficulties.

The findings from this study showed that all the industries in this study use human engagement techniques, such as review meetings and a few others combined interviews with site visits, to identify and assess supplier performance risks. The use of review meetings and interviews for risk identification and assessment in the post-contract award phase has not been extensively discussed in the literature review because, in the systematic literature review in Paper 1, only the study by Desai et al. (2015) affirmed the use of in-depth interviews and brainstorming sessions to develop a fishbone diagram for risk identification and assessment. This study also showed that data analytics and machine learning are increasingly embraced in the manufacturing sector to aid supplier performance evaluation and monitoring in addition to the interviews. For example, the automotive, tools and manufacturing, and medical (medical devices and biopharmaceuticals) industries in this study apply data analytical tools such as Power BI, Tableau, or Alteryx to evaluate supplier performance like contract deviations, price variations, on-time delivery, quality levels, service levels, product acceptance rates, rejects, and so on, enabling the identification, assessment, and prediction of suppliers' potential performance issues to help develop appropriate mitigation plans at the post-contract award phase. This finding is not evident in the literature on procurement risk management in the post-contract award phase. These findings lead to the following propositions:

Proposition 1. Supplier opportunistic behaviours increase supplier performance risks and reduce overall procurement risk management outcome in the post-contract award phase.

Proposition 2. Data analytics improves procurement risk management outcome in the post-contract award phase.

Proposition 3. Human engagement techniques influence supplier performance risk mitigation and improve procurement risk management outcome in the post-contract award phase.

3.5.2 Supplier relationship risks, mitigation strategies & tools

Supplier relationship risk was highlighted as a critical area of concern, as various challenges in the post-contract award phase occur because of the types of relationships developed with suppliers. The findings show that single-source supplier relationships were prevalent in the automotive, tools, medical devices, and chemicals manufacturing industries in this study. Such relationships have led to supplier dependency, which increases the risk in the supplier relationship. This finding reinforces the literature on supplier relationship risk in which researchers (Dixit et al., 2022; Taghizadeh et al., 2021; Kara et al., 2018; Reichenbach et al., 2017; Hallikas et al., 2016; Grötsch et al., 2013.) emphasised that single-source relationships with suppliers make it difficult for procurement teams to build relationships with other suppliers who offer better prices, technology, and quality. Similarly, Lumineau et al. (2022) argued that a single-source relationship, especially with suppliers who invest resources in developing customized products specifically for buying organisations create the potential for opportunism, which in turn affects the buyer-supplier relationship. These arguments corroborate TCE's idea that asset specificity increases supplier dependency, possibly leading to the risk of supplier opportunistic behaviours in the relationship between the buyers and suppliers (Tran et al., 2022; Li et al., 2022; Wu et al., 2014).

The analyses showed that collaboration, regular review meetings, and communication were implemented as proactive risk management strategies enabling the development of trust and positive relationships with suppliers or as reactive strategies to resolve existing challenges and mitigate potential risks within the relationship. This finding is well documented in the existing PRM literature (Table 3-6)

Table 3-6 Supplier relationship risk - similarities and differences between SLR and empirical findings (Source: Author)

Objective	2nd Order Themes from Data Structure	Findings from Literature	References from Literature
Procurement risk	Supplier relationship risks	Single-source risk Dependency risk Opportunism risk	Chowdhury et al., 2025; Dixit et al., 2022; Lumineau et al., 2022; Taghizadeh et al., 2021; Kara et al., 2018; Reichenbach et al., 2017
PRM strategies	Proactive Strategies: Collaboration, review meetings, communication Reactive Strategies: Collaboration, review meetings, communication	Proactive Strategy: Collaboration	Schoenherr et al., 2023; Jahani et al., 2021; Chowdhury et al., 2019; Prajogo et al., 2018.
Tools and Techniques	Interviews Site visits Data analytics Machine learning	Data analytical tools and machine learning suggested for insights Interviews not discussed	Wu et al., 2014. Patil et al.,2024; Spreitzenbarth et al., 2024; Tian et al., 2024; Jackson et al., 2024;

For example, Jahani et al. (2021) highlighted the importance of collaboration with suppliers, leading to early detection of potential risks with suppliers and their tiers and enabling timely decisions to mitigate potential risks. Other studies (Schoenherr et al., 2023; Chowdhury et al., 2019; Prajogo et al., 2018) also emphasized the importance of collaboration as a strategy to build

mutual trust and positive relationships with suppliers to enhance risk sharing, mutual planning, and problem-solving to manage risks. Trust and commitment to the relationship were emphasized as key ingredients required to manage supplier relationships. This supports the social exchange theory that positive interactions over time will produce relational exchange norms, such as trust and information sharing, that govern an exchange relationship (Tate et al., 2022; Habib et al., 2020). Furthermore, our findings indicate that selecting collaboration, communication, and review meetings as proactive or reactive strategies depends on how the procurement manager perceives the relationship risk. In the existing literature, less emphasis has been placed on the influence of the procurement manager's perception on the choice of reactive or proactive strategies in the post-contract award phase.

Human engagement techniques, including face-to-face interviews and site visits, which encouraged communication and collaboration, were used to identify and assess procurement risks. This aligns with the social exchange theory, arguing that positive interaction over time enhances information-sharing relational norms (Wu et al., 2014). A handful of procurement professionals also used Data analytical tools to manage their supplier relationships. For example, procurement managers in the medical devices industry used data analytics and artificial intelligence platforms for spend analysis to enable informed decisions and order aggregation to improve negotiations, supplier collaborations, and information sharing while managing various product categories. This finding is consistent with a recent study by Patil et al. (2024) and Spreitzenbarth et al. (2024), which stated that data analytical tools and artificial intelligence could provide insights into buying patterns, trends, and supplier characteristics to increase visibility and guide strategic decision-making in the buyer-supplier relationship. Notwithstanding, studies on using data analytical tools to manage supplier relationship risks at the post-award phase are still nascent. Based on these findings, the following are proposed:

Proposition 4: Trust and commitment between buyer and supplier will reduce the impact of dependency risks in the post-contract award phase.

Proposition 5: Collaboration and communication reduce the risk of opportunism and improve supplier relationship risk management outcomes in the post-contract award phase.

Proposition 7: Trust and commitment between buyer and supplier will reduce the risk of opportunism and improve supplier relationship risk management outcomes in the post-contract award phase.

Proposition 8: Data analytics influences information sharing and improve supplier relationship risk management.

3.5.3 Contract-design risks, mitigation strategies & tools/techniques.

Contract-design risk was another prevalent issue identified in the interviews (Table 3-7). Inadequate documentation of negotiated outcomes and variations to contract agreements or the outright omission of critical contract clauses lead to ambiguities in the suppliers' obligations, often leading to disputes, renegotiations, increased costs, and delays. This finding supports the Transaction Cost Economics (TCE) concept of bounded rationality, which emphasises the inherent cognitive limitations of decision-makers in collecting, processing, and communicating information to enable optimal choices (Wu et al., 2014). Hoffmann et al. (2013) corroborate this finding, stating that bounded rationality hinders the procurement manager's ability to draft contracts that capture all critical terms and conditions that protect the organisation against risks that become apparent in

Table 3-7 Contract-design risk - similarities and differences between SLR and empirical findings (Source: Author)

Objective	2nd Order Themes from Data Structure	Findings from Literature	References from Literature
Procurement risk	Contract-design risks	Incomplete contracts	Harju et al., 2024; Plugge & Bouwman., 2016; Tanskanen., 2014; Hoffmann et al., 2013
PRM strategies	Reactive Strategies: Collaboration Renegotiations Communication	Not discussed	
Tools / Techniques	Machine learning	Risk identification, risk assessment and risk mitigation	Tian et al., 2024; Jackson et al., 2024;

the contract execution. Consequently, contracts are incomplete or fail to anticipate all future contingencies, leading to risks such as scope creep, cost overruns, and delays (Plugge & Bouwman., 2016; Tanskanen., 2014).

To mitigate contract-related risks, the contract managers in this study used reactive strategies, including collaboration, communication, and renegotiations. However, they noted that positive outcomes were more prevalent when there was trust between the supplier and the buyer. While this aligns with Wu et al. (2014), which applied the social exchange theory (SET) to argue that a high level of trust between supplier and buyer facilitates collaboration and enables open communication, willingness, and commitment to work together to resolve contract issues, there is still need for more research on the direct and indirect influence of SET constructs such as trust, information sharing and commitment on contract-related risks. The existing literature has not extensively discussed contract-related risk management strategies.

Respondents suggested that artificial intelligence tools help to identify and mitigate contract-related risk at the post-contract award phase.

The following proposition is developed based on these findings.

Proposition 9: Trust influences contract-related risks by reducing the need for lengthy renegotiations and improving outcomes.

Proposition 10: Trust influences suppliers' willingness to collaborate with the buyer to mitigate the risk of incomplete contract terms in the post-contract award phase.

3.5.4 Ethical risks, mitigation strategies, tools/techniques

The findings show that ethical risks were predominant in the medical device, chocolate manufacturing, and fashion industries (Table 3-8). For instance, procurement managers in chocolate manufacturing and fashion industries are more concerned about ethical risks regarding environmental sustainability issues, including deforestation, waste management, and the use of harmful chemicals, and social issues, including child labour, poor working conditions, and health and safety issues in their supplier tiers. It is indicated that opportunistic behaviours exist upstream of the chocolate manufacturing and fashion industry. Despite this, there are limited studies on managing ethical risks, including environmental and social issues in the past-award contract phase (Rafi-Ul-Shan et al., 2024; Abbate et al., 2022; Köksal & Strahle, 2021). Furthermore, the procurement professions highlighted that the lack of visibility, traceability, and limited data have made it very difficult to identify and manage ethical risks involving environmental and social issues, which are still highly prevalent in the supply tiers of multinational chocolate manufacturers and the fashion industry. Few studies have emphasized that lack of visibility poses a significant challenge in managing suppliers' environmental and social risk of non-compliance after contracts have been awarded (Lafargue et al., 2021).

To manage ethical risks, the analysis showed that, on the one hand, reactive strategies such as compliance audits, supplier development, and

communication were predominantly used in the chocolate manufacturing to manage the gap in non-compliance with social and environmental standards by their supplier tiers especially in developing countries. On the other hand, collaboration, fair-trade guarantees, and compliance certifications have been used proactively to mitigate ethical risks. In the PRM literature, proactive and reactive strategies to manage ethical risks have received limited attention. (Lafargue et al., 2021, Koksal & Strahle, 2021). Furthermore, Data analytics and artificial intelligence tools were utilized to gather insights and monitor suppliers' ethical exposures, especially in the chocolate manufacturing and medical devices industries. Research on data analytics in PRM is still nascent, and research on how data analytics and artificial intelligence can be used in the post-contract stage is still missing.

Table 3-8 Ethical risk - similarities and differences between SLR and empirical findings (Source: Author)

Objective	2nd Order Themes from Data Structure	Findings from literature	References from Literature
Procurement risk	Ethical risks	Environmental issues; deforestation, waste management, harmful chemicals. Social issues: Child labour, poor working conditions	Rafi-Ul-Shan et al., 2024; Abbate et al., 2022; Köksal & Strahle, 202; Lafargue et al., 2021
PRM strategies	Proactive Strategies: collaboration Fair-trade guarantees Compliance certifications Reactive Strategies: Compliance audits, Supplier development Communication	Proactive Strategies: Fair-trade guarantees Reactive Strategy: Supplier audits	Lafargue et al., 2021; Koksal & Strahle, 2021.
Tools / Techniques	Data Analytics Machine learning	Data Analytics Machine learning	Guida et al., 2023; Bag et al., 2021; Belhadi et al., 2021; Tian et al., 2024; Jackson et al., 2024.

This study has addressed this gap and contributed to the literature by demonstrating how manufacturing industries use data analytics and machine learning for risk identification, assessment and mitigation. This aligns with previous studies (Guida et al., 2023; Bag et al., 2021; Belhadi et al., 2021; Jahani et al., 2021) that have discussed the potential of data analytics and machine learning technology in providing supplier risk management solutions. Based on these findings, the following propositions were developed:

Proposition 11: The lack of visibility of supplier tiers negatively impacts ethical risks management in the post-contract award phase.

Proposition 12: Machine learning technologies positively impact supplier risk identification in the post-contract award stage.

Proposition 13: Supplier ethical audits in the post-contract award phase influence ethical risk management outcomes

3.5.5 Disruption risks, mitigation strategies & tools/techniques

All the respondents in this study highlighted disruption risks, including natural disasters and political instability, as a significant risk that significantly impact procurement activities, leading to delays, increased costs, and operational inefficiencies (Table 3-9). In the existing PRM literature, disruption risks are well documented. Over the years, several researchers (Wang et al., 2024; Vieira et al., 2022; Roscoe et al., 2022; Saputro et al., 2022; Mouloudi et al., 2022; Roscoe et al., 2020; Gao et al., 2019; Aghajanian, 2018) have indicated that disruption risks not only have a negative impact on procurement activities after contracts have been awarded but also impact the overall organisational financial performance. Safety stock was the predominant reactive strategy used to

mitigate disruption risk as it enables the organisations to continue operations while addressing issues that arise. This strategy has been frequently discussed in the PRM literature (Schoenherr et al., 2023; Van Hoek, 2020; Manhart et al.,2020; Chang et al., 2015; Grötsch et al., 2013; Lavastre et al., 2012) as researchers have emphasized that while safety stock reduce supply issues during disruptions in the short term, the total cost of holding safety stock adversely impact the total procurement cost and financial performance of the organisation in the long term.

Other reactive strategies, including backup suppliers, contingency plans, communication, information sharing, and review meetings discussed by respondents to mitigate disruption risks, have been discussed in the PRM literature as critical strategies (Junaid et al., 2020). Although not as prevalent in extant literature, some respondents discussed proactive strategies such as supply base diversification, near-shoring plans, capacity building, proactive collaboration, information sharing, and performance monitoring alongside reactive strategies to drive continuous improvement in PRM. However, some of these strategies involve structural changes that require some time to implement.

Table 3-9 Disruption risk - similarities and differences between SLR and empirical findings (Source: Author)

Objective	2nd Order Themes from Data Structure	Findings from literature	References from Literature
Procurement risk	Disruption risks	Natural disasters and political instability.	Wang et al., 2024; Harju et al., 2024; Roscoe et al., 2022; Saputro et al., 2022; Mouloudi et al., 2022; Roscoe et al., 2020; Gao et al., 2019; Aghajanian, 2018
PRM strategies	Proactive Strategies: supply base diversification, near-shoring, capacity building, collaboration, and performance monitoring Reactive Strategies: Safety stock, backup suppliers, contingency plans, communication, and review meetings.	Proactive Strategies: supply base diversification, near-shoring, capacity building, collaboration, and performance monitoring Reactive Strategies: Safety stock, backup suppliers, contingency plans, communication, and review meetings.	Harju et al., 2024; Schoenherr et al., 2023; Kahkonen et al., 2023; Van Hoek, 2020; Roscoe et al. 2020; Manhart et al., 2020; Junaid et al., 2020;
Tools / Techniques	Data Analytics Machine learning	Data Analytics Machine learning	Guida et al., 2023; Bag et al., 2021; Belhadi et al., 2021; Jahani et al., 2021; Tian et al., 2024; Jackson et al., 2024;

Moreover, the single-source relationships in the industry have made it difficult to embrace these strategies. These findings align with the PRM literature which emphasised the need for backup suppliers and a diverse supply base while stating that the negative financial and operational performances of automotive organisations can be linked to the lack of backup suppliers and the high level of supplier dependency that has resulted in production failures from shortages of components, quality issues, and delivery delays (Junaid et al., 2020); Proactive and reactive strategies can co-exist to reduce immediate and subsequent risks (Roscoe et al., 2020; Wieland & Marcus Wallenburg, 2012). Furthermore, the analysis showed that since procurement managers do not know what type of

disruptions and when they will occur, selecting reactive or proactive strategies will depend on the procurement manager's perception of the disruption risk and impact in the post-contract award phase. While some studies (Sato et al., 2020) have explored the impact of perception on risk management in a supply chain context, this has not been explicitly done from a procurement perspective. Based on these findings, the following is proposed.

Proposition 15: The procurement manager's perception of the disruption risk influences the selection of reactive or proactive risk management strategies in the post-contract award phase.

This study revealed that data analytical tools are increasingly used to identify and assess disruption risk. In practice, data analytics is no longer a new concept in procurement; instead, it is a tool that has been integrated into some manufacturing industries' procurement risk management processes. For instance, in the automotive and medical industry, data analytics and predictive analytical tools are used to analyse internal historical data and external supplier and environmental data to uncover patterns to provide insights into future procurement risks. This finding is consistent with a few studies highlighting the potential of data analytics and artificial intelligence in procurement risk management. For example, Handfield et al. (2019) discussed the emerging application areas for data analytics in providing risk alerts, instantaneous visibility to global disruption events, and supply market intelligence.

Other studies (Hallikas et al., 2020; Brintrup et al., 2020) have discussed the potential of data analytics to combine data from various sources to identify and assess risks and trends in the sourcing market. However, the existing literature does not capture the current increase in the implementation of data analytics in managing procurement risks in some manufacturing industries. Furthermore, the analysis showed that the application of artificial intelligence tools in procurement is still very low. While the chocolate manufacturing and

medical device industries use artificial intelligence platforms to receive alerts and monitor disruption risks, others have adopted a wait-and-see strategy to determine the actual benefit of this technology versus the investment. The literature on Artificial intelligence in procurement risk management is still limited. However, some studies (Guida et al., 2023; Handfield et al., 2019) have highlighted the potential of artificial intelligence to facilitate predictive analytics and aid analysis-based risk management. Based on these findings, the following propositions are developed:

Proposition 16: Information sharing positively influences disruption risk identification and assessment in the post-contract award phase.

Proposition 17: Data analytics positively influences disruption risk identification and assessment in the post-contract award phase.

Proposition 18: Machine learning positively influences disruption risk identification and assessment in the post-contract award phase.

3.5.6 PRM Framework: Evidence-Based

The framework shown in Figure 3-2 integrates procurement risk identification, assessment, and mitigation into the post-contract award phase. This framework was adopted from an earlier conceptual framework (Figure 3-1) developed from the SLR findings in Paper 1.

3.5.6.1 The original conceptual framework

The original conceptual framework, Figure 2-9 in paper 1 provides a comprehensive approach to procurement risk management in the three procurement phases. The framework integrates risk identification, assessment, and mitigation strategies into the three procurement phases: pre-contract, selection and contracting, and post-contract award. The framework focused on the combination of technological tools such as data analytics and machine learning, and human engagement techniques such as site visits and review

meetings used for risk identification and assessment. In addition, the framework also showed the proactive risk management strategies such as supply base diversification, collaboration and relationship management, and reactive risk management strategies such as safety stock, backup suppliers, renegotiations and review meetings that are implemented to manage procurement risks in the three procurement phases. This integration offers a holistic understanding of how tools and techniques PRM strategies can be successfully developed and implemented to minimise the impact of supply disruptions and enhance procurement performance. This framework served as a valuable starting point for procurement risk management in the three procurement phases.

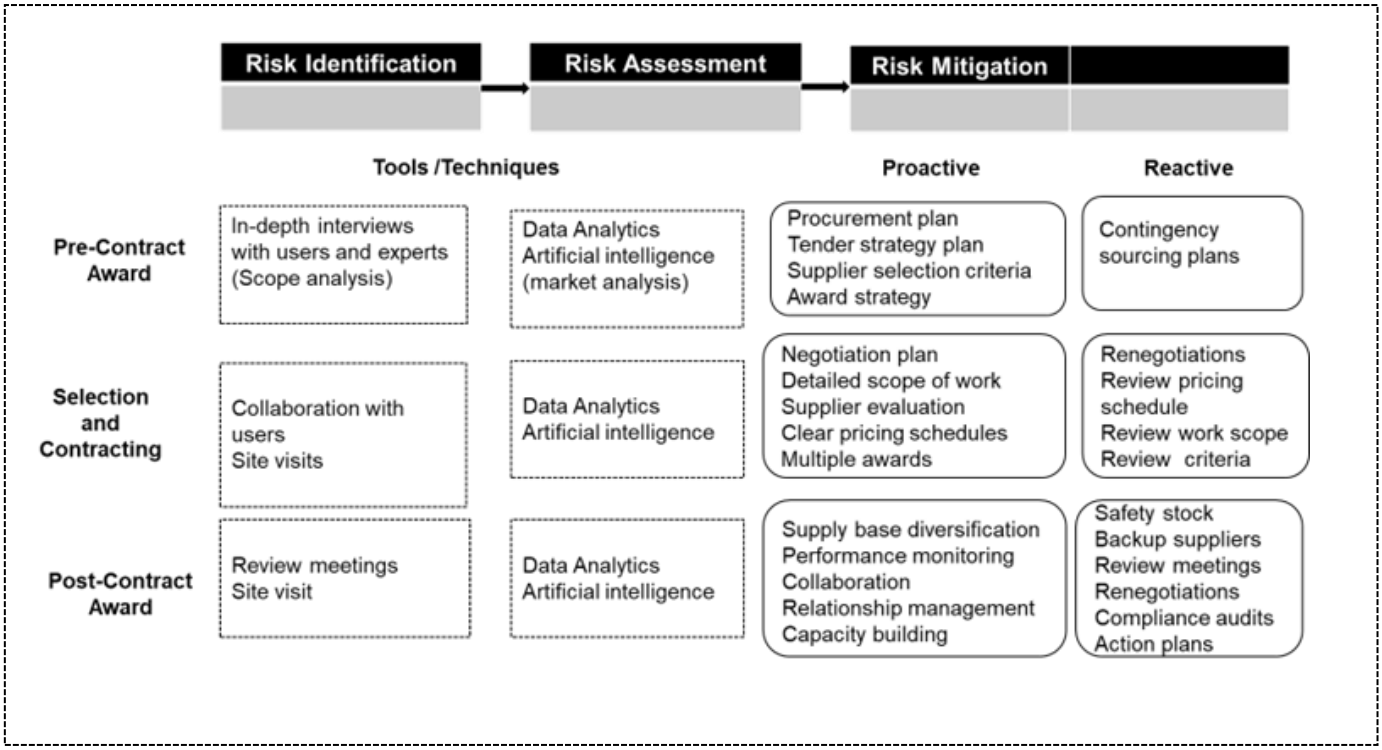


Figure 3.1- Conceptual Framework (Source: Author)

Figure 3-2 below represents the post-contract award part of the conceptual framework.

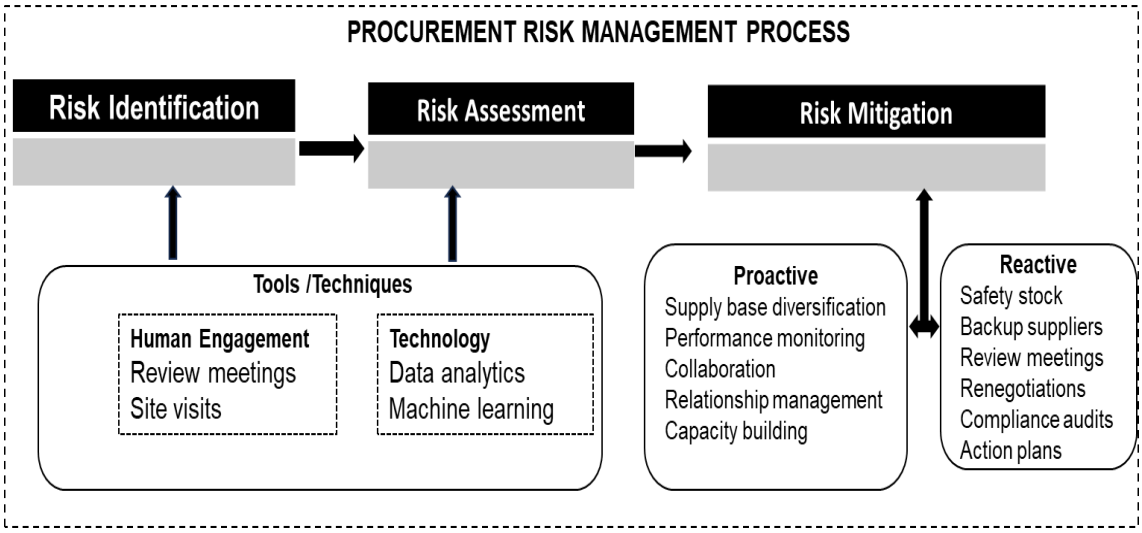


Figure 3-2 Conceptual PRM framework – Post-contract award phase (Source: Author)

3.5.6.2 The Evidence-based PRM framework

Based on the findings from the semi structured interview data from the procurement professionals, the conceptual framework was revised, improved, and validated to capture a more comprehensive PRM process for manufacturing industries. This empirically based procurement risk management model is presented in Figure 3-3.

The major differences between the revised evidence-based model and the conceptual framework is that the evidence-based framework: 1) shows the main activities in the risk identification stage; identify and classify risks, analyse and prioritise risks, and select strategies 2) presents a breakdown of the five different procurement risk categories: supplier performance risk, contract-related risks, supplier relationship risks, ethical risks, and disruption risk, 3) provides a

breakdown of the risk assessment activities in the post-contract award phase: supplier risk analysis, market risk analysis, supplier evaluation, and risk prioritisation, and 4) presents the influencing variables based on the transaction cost economics theory and the social exchange theory.

Overall, the updated model (Figure 3-3) is a practical framework based on empirically driven insights showing how the risk management process; risk identification, assessment, and mitigation strategies can be integrated into the post-contract award phase to achieve a holistic risk management process.

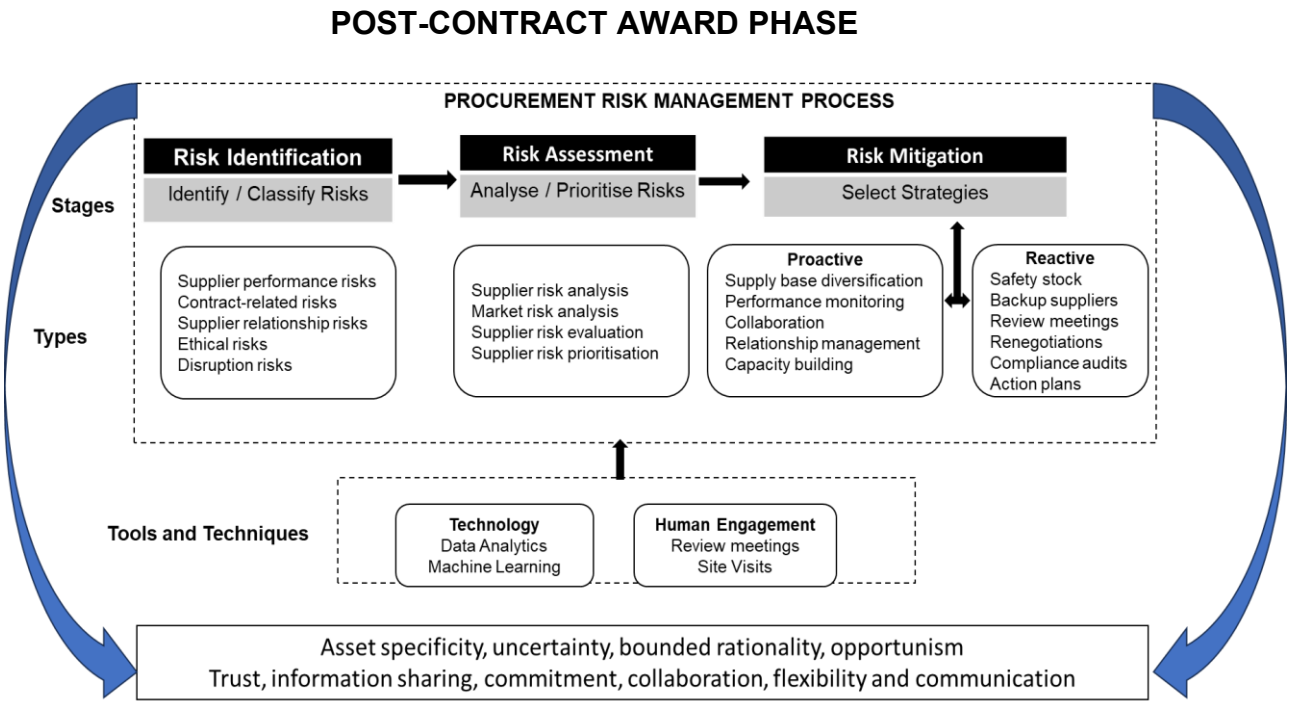


Figure 3-3 Evidence-based PRM framework (Source: Author)

3.6 Conclusions

A review of the literature revealed that a holistic procurement risk management strategy, including risk identification, assessment, and mitigation in the post-contract award phase, is still under-researched despite its importance in enabling organisations to adapt their strategies to changing business conditions (Schoenherr et al., 2023; Nyamah et al., 2023; Remko, 2020). This research investigated how procurement risk management strategies were used in the post-contract award phase by interviewing 23 procurement professionals across seven manufacturing industries.

3.6.1 Theoretical Implications

This research is the first to investigate procurement risk management in the post-contract award phase. The study contributes to the procurement literature by advancing the understanding of procurement risk management in the post-contract award phase in the following ways.

First the study contributes to the literature by identifying key procurement risk categories and explaining the risk management strategies used in each category through the lenses of TCE and SET. The identification of five specific categories of procurement risks, including supplier performance risks, supplier relationship risks, contract design risks, ethical risks, and disruption risks, supports TCE's core assumption that governance structures are required to minimise risks and transaction costs arising from bounded rationality, uncertainty, and opportunistic behaviours. The identification of supplier performance risks and the risk management strategies support TCE assumptions because such procurement risks stem from opportunistic behaviour resulting from single-source relationships and supplier dependency (Raj et al., 2022). Such relationships create lock-in situations that make it difficult for buying organizations to conduct performance reviews, leading to poor quality and late deliveries, aligning with the

findings in current literature (Chowdhury et al., 2025; Hashim et al., 2024; Schoenherr et al., 2023; Dixit et al., 2022; Lumineau et al., 2022). Specifically, this study differs from previous studies because it highlights the combination of proactive strategies, such as facility inspections, compliance audits, and assurance certificates, with reactive strategies, including quality tests, corrective action plans, and supplier performance audits, which have not been extensively applied as risk management strategies in the current literature.

Second, supplier relationship risks and the mitigation strategies highlight the limitations of contractual governance alone, underscoring the importance of relational governance mechanisms, which include human engagement techniques such as review meetings, collaboration, interviews, and site visits. These techniques foster communication, information sharing, and commitment, thereby supporting the SET assumptions and aligning with previous research (Uddin et al., 2024; Tran et al., 2022). In addition, the identification of contract design risks and the findings that procurement professionals use reactive strategies to mitigate such risks show support for economic and social governance mechanisms. Preventive strategies reduce transaction costs by pre-empting risks, while reactive strategies, such as renegotiations, manage risks and draw on the relational strength of SET to resolve issues. In the context of procurement risk management during the post-contract award phase, these contract-related risks have received relatively little attention in recent studies (Harju et al., 2024; Plugge & Bouwman., 2016; Tanskanen., 2014).

Third, this study also contributes to the PRM literature by providing empirical evidence on how manufacturing industries use data analytics and machine learning tools for risk identification, assessment, and mitigation in the post-contract award phase. The research on data analytics and machine learning in procurement is still in its early stages. In the current literature, studies have discussed the potential of data analytics and artificial intelligence in supply chain management (Tian et al., 2024; Spreitzenbarth et al., 2024; Kang et al., 2024; Belhadi et al., 2021; Jahani et al., 2021; Tian et al., 2024). A few studies have

provided frameworks on how artificial intelligence can be used in negotiation with suppliers (Herold et al., 2025) and to optimise the procurement process (Guida et al., 2025; Guida et al., 2023). However, empirical research on how machine learning predictive capabilities and data analytics technologies are specifically used for procurement risk management in the post-contract award phase is still scarce. This study makes a significant contribution by providing empirical evidence on how to utilize the predictive capabilities of machine learning and data analytics for procurement risk management in the post-contract award phase.

Fourth, this study contributes to the literature by providing a new evidence-based procurement risk management model that integrates procurement risk identification, assessment, and mitigation strategies into the post-contract award phase. The model offers 1) a breakdown of the five different procurement risk categories: supplier performance risk, contract-related risks, supplier relationship risks, ethical risks, and disruption risk, 2) a breakdown of the risk assessment activities in the post-contract award phase: supplier risk analysis, market risk analysis, supplier evaluation, and risk prioritisation, and 3) combines human engagement techniques with technological tools to identify and assess procurement risks and to develop appropriate proactive and reactive mitigation strategies. The integration of human engagement techniques, such as review meetings, reinforces the social exchange theory, which emphasizes the importance of positive interactions leading to relational norms, including information sharing and commitment, and enabling the risk management activities highlighted in the model, aligning with the findings of Saglam et al. (2022).

3.6.2 Practical implications

This empirical study offers procurement professionals practical insights into a holistic PRM process at the post-contract award phase. The study provides evidence that increase procurement professionals' understanding of the procurement risks affecting procurement performance. It also provides guidance

on the selection and deployment of tools/techniques and strategies to identify, assess, and mitigate potential procurement risks.

3.6.3 Limitations and future research directions

In this qualitative research, 23 carefully selected procurement professionals from seven industries within the manufacturing sector were interviewed to gain insights into how procurement risks are managed in the post-contract award phase. The small sample size of procurement professionals interviewed limit the generalization of this research findings and propositions to all industries within the manufacturing sector.

Future researchers should explore this subject further and examine the validity of the propositions by expanding the number of procurement professionals and the manufacturing industries selected for interviews. Second, building on the findings of this research, it is recommended that future studies examine contract-design risks in the selection and contracting phase since this risk category has not been extensively researched despite its impact on procurement costs and buyer supplier relationships. Third, the author also recommends future research to focus on the role of machine learning in procurement risk management and its impact on procurement performance.

3.7 References to Chapter 3

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4 Paper 3: MANAGING PROCUREMENT RISKS IN THE POST-CONTRACT AWARD PHASE: THE INTERPLAY BETWEEN TRANSACTION COST ECONOMICS AND SOCIAL EXCHANGE THEORY

Abstract

The purpose of this study was to investigate how sociological mechanisms influence procurement risks, including exchange risks and transaction costs, and procurement risk management performance in the post-contract award phase. This paper empirically tests a hypothesized model using survey data and the partial least squares structural equation modelling method.

This study has the following new findings. First, information sharing has a positive influence on procurement risk management performance. Second, commitment has a positive influence on procurement risk management performance. Third, flexibility has a positive influence on procurement risk management performance. Fourth, switching costs have a negative influence on procurement risk management performance. Fifth, negotiation costs have a negative influence on procurement risk management performance.

This study makes several contributions to the procurement literature. First, this study contributes to the literature by empirically establishing a direct negative relationship between switching costs and procurement risk management performance, as well as between negotiation costs and procurement risk management performance in the post-contract award phase. Second, this study contributes new empirical evidence that combining trust with information sharing, commitment, and flexibility offers more reliable pathways through which organisations can mediate the negative effects of switching costs on PRM performance than using trust alone.

Keywords –Procurement Risk Management Performance, Transaction Cost Economics Theory, Social Exchange Theory.

4.1 Introduction

Procurement managers face challenges in managing procurement risks in exchange relationships after contracts have been awarded and signed (Cui et al., 2025). In the post-contract award phase, procurement risks include both exchange risks and transaction costs (Tate et al., 2022; Rindfleisch, 1997). Exchange risks such as opportunistic behaviour and environmental uncertainty, hinder the realization of the desired value from the supply market (Williamson, 1985). Environmental uncertainty refers to the inability of organisations to predict the rate of environmental changes or the difficulty in confirming market information or the actions of supply chain players (Wang et al., 2024; Lui et al., 2009). Such uncertainties expose organizations to potential transaction costs that arise from the need to gather more information about the market and renegotiate contract terms (Tate et al., 2022; Rindfleisch, 1997). Furthermore, complexities in exchange relationships result in the need to change suppliers, giving rise to switching costs (Lee & Park, 2021; Barthélemy & Quélin, 2006; Poppo & Zenger., 2002).

In recent years, environmental uncertainty has created instability, making it challenging for procurement managers to respond and adapt adequately (Saglam et al., 2022; Kurniawan et al., 2017; Poppo et al., 2016). The US-China trade war, the Russia-Ukraine war, and the COVID-19 pandemic have increased uncertainty in the business environment, resulting in multiple disruptions across manufacturing industries and substantial financial losses (Ma et al., 2024; Çıkmak & Ungan, 2022). For instance, the Russia-Ukraine war led to shortages of car parts and raw materials, and manufacturers like Toyota, Land Rover, Ford, Audi, Porsche, and Honda outrightly stopped production in Russia and paused the production of certain vehicles across Europe, leading to substantial losses (KPMG, 2023). Automotive manufacturers have struggled to find alternative suppliers for raw materials and parts, therefore affecting their profitability (Business Insider, 2023). In 2024, based on supply constraints of V6 and V8 engines, Audi's operating profit decreased by 51.9% (Media-Audi, 2024). These

events exemplify how environmental uncertainty can create substantial transaction costs and increase procurement risks.

Supplier opportunistic behaviours increase procurement costs in the post-award phase and impacts profitability (Wacker et al., 2016; Wang et al., 2015; Dahlstrom & Nygaard, 1999). As such, the strategic management of exchange risks and transaction costs has become critical to improving risk management performance in the post-contract award phase. TCE theory has emphasised using contractual mechanisms to manage exchange relationships (Tate et al., 2022). However, contracts are mostly incomplete as bounded rationality, which refers to the cognitive limitations of humans, makes it almost impossible for procurement managers to have complete contracts that anticipate all possible events and provide adequate contingency clauses (Lumineau et al., 2022; Tate et al., 2022; Cao et al., 2015). Previous researchers (Shahzad et al., 2018; Wacker et al., 2016) have proposed managing buyer-supplier relationship performance through contractual and relational governance.

Relational contract governance including constructs such as trust, communication, flexibility and commitment are critical in developing a cooperative environment between organisations in exchange relationships, leading to improved performance (Poppo et al., 2002; Liu et al., 2009; Liu, et al., 2017). The role of these sociological mechanisms has been studied in the extant literature (Kim & Choi, 2015; Wang et al., 2014; Prahinski & Benton, 2004). For instance, Thorngrawd et al. (2020) investigated the role of flexibility in managing supplier performance and developing competitive advantage. Huo et al (2014) studied the mediating role of information sharing between international competition and supply chain performance. Ahimbisibwe et al., (2014) and Nyaga et al. (2022) investigated the role of trust on supplier performance. Although prior literature recognises the critical role of relational mechanisms in managing relationships, debate exists on whether such mechanisms complement contractual governance mechanisms or can outrightly substitute contractual governance mechanisms (Wang et al., 2024, Zhang et al., 2020; Cao and Lumineau, 2015). Moreover, no

research has empirically investigated the role of relational governance mechanisms on procurement risks, including exchange risks and transaction costs and procurement risk management performance in the post-contract award phase. To address this gap, this paper seeks to answer the following research question

RQ: How can sociological mechanisms influence procurement risks, including exchange risks, transaction costs, and procurement risk management performance in the post-contract award phase?

This study contributes to the literature by providing new empirical evidence that combining trust and information sharing, commitment, and flexibility jointly mediate the negative influence of switching costs on PRM performance. The mediating influence of these SET mechanisms on switching cost and procurement risk management performance had not been previously studied in the literature. These findings provide support for SET by validating the strength of SET constructs as mechanisms in managing risks associated with switching costs. This study also contributes to TCE by revealing that relational mechanisms can effectively manage the risks associated with high switching costs, rather than relying solely on contractual governance mechanisms.

The remaining parts of this paper are organized as follows: Section 4.2 presents the theoretical background, including transaction cost economics and social exchange theory. The hypothesis development, and the research model are presented in section 4.3 and 4.4. The research methodology is described in section 4.5 while the data analysis and the SEM results are discussed in section 4.6. Section 4.7 presents this research's contribution to theory and practice, the research limitations and future research directions.

4.2 Theoretical Background and Research Hypotheses

4.2.1 Theoretical foundation

This study focuses on procurement risk management in the post-contract award phase. Transaction cost economics and social exchange theories are applied as theoretical foundations to explain the procurement risks organisations face in this phase and the risk management mechanisms. TCE theory was selected as appropriate because of its focus on risk elements of uncertainty and transaction costs, which are also central to procurement risks in the post-contract award phase (Hoffman et al., 2013). The social exchange theory was selected because it provides sociological mechanisms such as trust, information sharing, commitment, and flexibility to manage procurement risks in exchange relationships after contracts have been signed.

4.2.1.1 Transaction cost economics

Transaction cost economics (TCE) theory examines the exchange risks and transaction costs in inter-organizational economic relationships to define the best governance structure (Williamson, 1993). According to TCE, transaction costs are driven by key determinants such as the degree of asset specificity, uncertainty, and transaction frequency, coupled with human behaviour assumptions of bounded rationality and opportunism (Patil et al., 2023; Tate et al., 2022). In this research, environmental uncertainty and opportunistic behaviours are identified as critical risks that occur in exchange relationships in the post award contract phase (Wang et al., 2015; Wacker et al., 2016; Hoffman et al., 2013), while negotiation costs and switching costs are critical elements of transaction cost that increase procurement risks (Tate et al., 2022; Lee & Park, 2021; Shazad et al., 2018; Blut et al., 2016). This study considers procurement risks in the post-contract award phase as a combination of exchange risks and transaction costs. Bounded rationality described as the inherent cognitive limitations of decision-makers in collecting, processing, and communicating information to enable optimal choices, is not examined as a distinct exchange risk

in this research. This is because it is considered an underlying condition of human decision making which does not by itself generate risks in exchange transactions, rather, contributes to exchange risks when there is environmental uncertainty (Wu et al., 2014). Environmental uncertainty reflects market volatility and information unverifiability, which is conceptualized as the limited cognitive ability of procurement managers to predict business needs and market supply (Wang et al., 2024; Handley & Benton, 2012). Bounded rationality makes it challenging to include exhaustive contract clauses that will protect the business when there's risk of environmental uncertainty (Krishnan et al., 2016).

Similarly, asset specificity is not examined as a standalone procurement risk because it doesn't by itself create a risk event, rather it is viewed as a condition that creates a situation of asymmetric dependence (Poppo et al., 2016; Wathne and Heide, 2000), thereby increasing vulnerability to risks of opportunistic behaviour, renegotiations and switching costs. First, earlier studies (Zhou & Poppo, 2010; Williamson, 1996; Geyskens et al., 2006; Rossetti and Choi, 2005; Williamson, 1996) emphasised that because customised assets cannot be redeployed to other transactions, a high level of asset specificity result in opportunistic behaviour risk in exchange relationships. For instance, suppliers renege on the initial agreed terms, not procure the required quality inputs and not prioritize optimal delivery of products, leading to delays, stockouts or quality issues (Wathne and Heide, 2000). Second, asset specificity is also a condition that leads to high negotiation costs, which is a critical element of transaction cost in exchange relationships (Narayanan et al., 2015; Geyskens et al., 2006). Negotiation costs, described as the time and resources spent on bargaining and legal reviews to agree on divisions of costs and benefits, and manage disputes, plays a pivotal role in determining transaction outcomes (Shazad et al., 2018; Gulbrandsen et al., 2017; Cousins et al., 2008, Kaufmann & Carter, 2006). For instance, Reuer & Arino, (2002) found that asset specificity increases the risk of contractual renegotiations, suggesting that the greater the transaction-specific

investment in an exchange relationship, the greater the odds of altering agreements after contracts have been signed.

Third, asset specificity also gives rise to switching costs, which is described as the financial burden and time required to change suppliers and reintegrate outsourced activities (Lee & Park, 2021; Blut et al., 2016). The failure and premature termination of an exchange relationship involving customised assets investments, leads to sizable sunk costs that will negatively affect the organisation's finances, if they switch to another supplier (Poppo et al., 2016). For instance, Barthélemy & Quélin, (2006) emphasised that because asset specificity involves investments in tailor-made assets, it makes it quite costly to switch suppliers or reintegrate an outsourced activity. For these reasons, the procurement risk categories in this research include supplier opportunistic behaviour, environmental uncertainty, negotiation costs and switching costs.

4.2.1.2 Social exchange theory

Social exchange theory (SET) examines the social interaction between two entities involved in such an interaction to achieve a positive economic outcome (Saglam et al., 2022; Ali & Khalid, 2017). The main idea of SET is that positive interactions over time will produce relational exchange norms such as trust, commitment, information sharing, and flexibility that govern an exchange relationship (Tate et al., 2022; Habib et al., 2020). Trust has been identified as a cornerstone of exchange relationships (Narasimhan et al., 2009). For instance, Wu et al. (2014) argued that trust fosters a better working environment between organisations and suppliers by enhancing collaboration, reliability of contracts, and reducing risks. As organizational relationships evolve after contracts have been signed, the degree of mutual commitment is impacted. Commitment has been defined as the desire/willingness to maintain or improve a business relationship (Saglam et al., 2022). It involves the belief that an ongoing relationship between an exchange partner is important and warrants maximum efforts at maintaining it (Morgan & Hunt,1994). SET emphasizes that commitment

is critical in developing long-term exchange relationships that ensure partners are prudent and will not act opportunistically (Park et al., 2012; Yang et al., 2008; Paulraj et al., 2008).

Information sharing involves real-time sharing of accurate and timely information on material flow, production forecasts, shipping and billing, and engineering changes with procurement and supply chain partners in exchange relationships (Wang et al., 2014; Salzarulo & Jacobs, 2014). From an exchange relationship perspective, SET emphasizes the criticality of information sharing in promoting information transparency and collaboration (Fan et al., 2017). Furthermore, flexibility, a critical SET construct, enhances the ability to adapt processes, strategies, and contract terms in response to unforeseen changes. reducing rigidity and inefficiencies (Caniels & Gelderman, 2010). Such flexibility acts as a mechanism to reduce transaction costs associated with uncertainty and demand fluctuations, without bearing excessive renegotiation costs. For instance, Thongrawd et al. (2020) argued that flexibility, a proactive combination of the flexibility of the product, volume, distribution, and response, helps to reduce losses in the context of cost, time, and effort. Flexibility as an SET construct has not been extensively examined in the literature.

4.2.1.3 Contract Theory

Contract Theory, which originated from economics and law, is focused on how contracts are designed to align incentives between exchange parties under conditions of incomplete information and potential opportunism (Hart & Holmstrm, 1986; Bolton et al., 2004). In procurement contexts, contracts are not merely legal instruments but also governance mechanisms that define roles, allocate risks, and specify remedies for non-performance (Lumineau et al., 2022; Zhang et al., 2020; Shazard et al., 2018). Since contracts are incomplete, and are unable to specify every possible future contingency, they introduce risks related to interpretation, enforcement, and potential renegotiation (Kőszegi et al., 2014). While Contract Theory remains relevant, its focus on contract design provides

limited explanatory power for understanding the relational and behavioural dimensions that emerge once contractual agreements are in place. Based on these limitations, the Contract Theory was not used as the theoretical lens in this study.

Transaction cost economics (SET) theory and social exchange theory (SET) provide a more comprehensive explanation of procurement risk management in the post-contract award phase. TCE emphasizes the exchange risks and transaction cost elements such as asset specificity, uncertainty, and opportunistic behaviours, and the role of governance structures in minimizing transaction costs (Williamson, 1985), while SET highlights the importance of relational norms such as trust, reciprocity, and commitment in sustaining exchange relationship (Blau, 1964). Therefore, TCE and SET were selected as more appropriate theoretical lenses for this research since they capture both the economic aspects and relational dynamics (Habib et al., 2020; Wacker et al., 2016) that underpin effective procurement risk management in the post-contract award phase.

4.3 Hypothesis Development: SET constructs

4.3.1 Sociological mechanisms: trust, information sharing, commitment and flexibility

Trust plays a fundamental role in developing positive buyer-supplier relationships (Zhang et al., 2022; Brown et al., 2019.). Trust has been conceptualised to exist in a Buyer-Supplier relationship when both parties in the relationship have confidence in each other's reliability and integrity (Wang et al., 2019; Morgan and Hunt, 1994). This research argues that trust is the foundational construct in SET that influences other relational factors such as commitment, information sharing, and flexibility. Trust in buyer-supplier relationships is developed through social interactions, allowing each partner to anticipate that the other will act according to their preferences and priorities (Poppo et al., 2015). Trust has been acknowledged as a cornerstone for other SET variables in the existing literature.

For example, Wang et al. (2014) emphasized that trust is an effective mechanism that encourages information sharing.

H1a. Trust positively influences information sharing between Buyer and supplier

Brown et al., (2019) observed that trust in exchange relationships increases commitment as partners become emotionally connected. Nyaga et al (2010) also emphasised that trust positively impacts commitment for both buyers and suppliers. Furthermore, Johnston et al. (2004) stated that trust is a pre-condition for relationship development, emphasizing that higher levels of trust lead to increased collaborative activities. In an earlier study, Morgan and Hunt (1994) argued that trust and commitment work in tandem, not just one or the other, resulting in corporative behaviours that enhance the outcomes in exchange relationships. Based on this, the hypothesis is developed:

H1b. Trust positively influences Commitment between Buyer and Supplier

Trust in exchange relationships encourages flexibility. For instance, Young-Ybarra & Wiersema (1999) highlighted that trust leads to flexibility in adjusting existing arrangements within exchange relationships. This leads to the following hypothesis:

H1c. Trust positively influences Flexibility between Buyer and supplier

4.4 Transaction cost economics, sociological mechanisms and procurement risk management performance

This section draws on constructs obtained from both Transaction Cost Economics (TCE) and Social Exchange Theory (SET). While TCE emphasises opportunistic behaviour, environmental uncertainty, negotiation cost and switching cost as critical procurement risks that disrupt procurement activities in the post-contract award phase (Wang et al., 2024), SET highlights sociological constructs including trust, commitment, information sharing and flexibility as mechanisms that can reduce the negative impact of procurement risks, thereby improving procurement

risk management performance. Combining TCE and SET theoretical perspectives provides a more holistic understanding of how procurement risk management strategies are used in the post- contract award phase.

4.4.1 Supplier opportunistic behaviour, sociological mechanisms and procurement risk management performance.

Supplier opportunistic behaviour, an essential assumption in TCE, is detrimental to buyer-supplier relationships in the post-contract award phase because it undermines long-term collaboration, jeopardises performance, increases monitoring costs and exploitation (Wang et al., 2015; Liu et al., 2009; Wuyts & Geyskens, 2005). Such behaviours are manifested in several deceptive forms, including exaggerating difficulties, shirking, distorting or disguising the truth, and lying (Wang et al., 2024). When suppliers do not act in the interest of the buyer-supplier relationships, the buying organisation becomes vulnerable to the potential adverse effect of the risk of supplier opportunistic behaviour (Liu et al., 2009). For example, a supplier seeking to benefit at the expense of the buyer by breaching agreements, withholding information, or withdrawing promises can disrupt procurement plans, increase procurement exchange risks and transaction costs (Wang et al., 2015). Procurement risk management typically depends on the buying organization's and suppliers' collaborative efforts to identify and mitigate potential risks (Fan et al., 2017). Eckerd et al. (2017) emphasised that opportunistic behaviours impede collaboration and prolong or weaken the buying organisation's risk management efforts, undermining risk management performance. Therefore, risk management performance is reduced when suppliers exhibit opportunistic behaviours in the post-contract award phase of the manufacturing sector.

H2a. Supplier opportunistic behaviour has a negative influence on procurement risk management performance.

Researchers in the procurement and supply management literature have proposed using more stringent contract terms to safeguard against opportunistic behaviours. However, this strategy alone encourages opportunistic behaviour surrounding actions that are not specified within contracts. (Poppo and Zenger, 2002). For instance, the global pandemic triggered opportunistic behaviours in international buyer-supplier exchanges, as parties were more focused on personal interest around resource allocation, leading to disagreements about contractual obligations (Wang et al., 2024). This study suggests that a combination of trust and information sharing creates a positive relationship atmosphere between buyers and suppliers, leading to collaborative problem-solving behaviours. Dyer & Chu (2003) and Fan et al. (2017) discussed how trust also encourages the free flow of critical information, thereby enhancing transparency and reducing opportunistic behaviour. Therefore, trust and information sharing enable organisations to circumvent supplier opportunistic behaviours and improve procurement risk management performance.

H2b. Trust and information sharing jointly mediate the negative influence of supplier opportunistic behaviour on procurement risk management performance.

Based on TCE assumptions, opportunistic behaviour such as misrepresentation or withholding critical information increases monitoring, enforcement, and renegotiation costs, leading to an overall increase in transaction costs (Wacker et al., 2016; Rindfleisch & Heide, 1997; Williamson, 1985). Trust and commitment, as key constructs of SET, act as relational mediators that reduce the need for extensive governance and controls (Brown et al., 2019; Kim & Choi., 2015). For instance, exchange relationships built on trust and commitment are better positioned to work collaboratively to manage risks because the partners prioritise long-term goals and relationship continuity over short-term gains (Padgett et al., 2020; Morgan & Hunt, 1994). Based on this, the author argues that trust and commitment reduce the disruptive effects of opportunistic tendencies on procurement risk management outcome (Liu et al.,

2009; Poppo & Zenger, 2002). Based on this, the following hypothesis is developed.

H2c. Trust and commitment jointly mediate the negative influence of supplier opportunistic behaviour on procurement risk management performance.

A trusting relationship fosters mutual understanding, enabling suppliers to be flexible in responding to changes in buyer needs, including product delivery, volume, and production modifications (Chirra & Kumar, 2018). Trust and flexibility exist within the context of SET, and they jointly reduce opportunistic behaviours and their associated transaction costs, as suppliers exhibit cooperative problem-solving behaviours to achieve procurement goals (Thongrawd et al., 2020). There are relatively few studies that have examined the joint use of trust and flexibility, which are key SET constructs. Nyaga et al. (2010) discussed that trust in exchange relationships increases supplier flexibility and encourages cooperative behaviours (Nyaga et al., 2010). Moreover, He et al. (2014) highlighted that the absence of trust among exchange parties hinders supplier flexibility and increases opportunistic behaviours. Combining trust and flexibility in procurement relationships creates a synergistic effect that reduces supplier opportunistic behaviour and leads to improved procurement risk management outcomes. Based on this argument, the following hypothesis is developed:

H2d. Trust and flexibility jointly mediate the negative influence of supplier opportunistic behaviour on procurement risk management performance.

H2e. Trust mediates the negative influence of supplier opportunistic behaviour on procurement risk management performance.

4.4.2 Environmental uncertainty, sociological mechanisms, and procurement risk management performance.

Environmental uncertainty leads to inefficiencies as organizations struggle to manage unforeseen procurement risks (Huo et al., 2016; Hoffman et al., 2013).

Environmental uncertainty is one of the key constructs of TCE, which assumes that bounded rationality makes it challenging to predict future environmental changes and draft contracts with exhaustive clauses to manage potential changes. (Krishnan and Geyskins., 2016; Hoffman et al., 2013). Unanticipated changes in technology, supply, and demand volume can make contracts outdated as the agreed terms no longer cover the business needs (Yang et al., 2017; Rindfleisch & Heide, 1997). In the post-award phase, it be difficult to amend the contract terms and conditions, leading to renegotiations, delivery delays, price escalations, quality issues, payment disputes, and even contract termination (Huo et al., 2016). Such uncertainties increase contract monitoring, assessment, and enforcement costs, thereby increasing procurement risks (Hawkins et al., 2013; Wang et al., 2015). Hoffman et al., (2013) found that environmental uncertainty is negatively associated with a supply risk management performance.

H3a. Environmental uncertainty has a negative influence on procurement risk management performance.

The application of SET constructs to conceptualise procurement risk management strategy decisions during environmental uncertainties enables organisations to go beyond traditional contractual governance by building resilient exchange relationships (Poppo & Zenger, 2002). Environmental uncertainty limits transparency (Krishnan and Geyskins., 2016). However, timely and valuable information sharing, a critical SET mechanism, signals cooperation, leading to a constructive outcome (Yang et al., 2017). Trust enables timely sharing of sensitive information such as production plans, inventory, and demand forecasts, allowing buyers and suppliers to exchange short-term and long-term plans, which helps create a shared vision for future collaboration (Huo et al., 2014; Liu et al., 2009). High levels of trust facilitate knowledge exchange, improving decision-making and reducing risks (Zaheer et al., 1998).

H3b Trust and information sharing jointly mediate the negative influence of environmental uncertainty on procurement risk management performance.

Trust gives rise to mutual understanding and commitment in buyer-supplier relationships and restrict disputes introduced by environmental uncertainties in the post-contract award phase (Wang et al., 2024; Poppo & Zenger, 2002; Morgan & Hunt, 1994). Consistent with the SET logic, Narayanan et al. (2014) highlighted that trust facilitates commitment, open collaboration, communication, and cooperative problem-solving, reducing the risk impact associated with adapting to unforeseen changes during environmental uncertainties (Narayanan et al., 2014). Based on this, the author developed the following hypothesis.

H3C. Trust and commitment jointly mediate the negative influence of environmental uncertainty on procurement risk management performance.

The transaction cost theory states that high uncertainty increases transaction costs, comprising of coordination costs and transaction risks. These transaction costs are very difficult to measure (Hoffman et al., 2013). However, supplier trust and flexibility, core SET constructs, encourage suppliers and buyers to adapt contract terms, processes, or strategies in response to unforeseen changes (Thongrawd et al., 2020). This reduces the exchange risks and inefficiencies resulting from environmental uncertainty (Sanchez & Perez, 2005).Trust and flexibility act as a response mechanism to environmental uncertainty, when organizations increase their flexibility in more uncertain environments to better adapt to changing conditions (Ustundag & Ungan, 2019; He et al., 2014). This adaptability enhances procurement risk management by fostering proactive approaches to mitigating risks and ensuring continuity despite external disruptions. Based on this, the following hypotheses are developed:

H3D. Trust and flexibility jointly mediate the negative influence of environmental uncertainty on procurement risk management performance.

As businesses develop trust in their relationships with suppliers, they develop more adaptive strategies that improve their ability to respond to uncertainty (Ustundag & Ungan, 2019; He eta al., 2014). Environmental uncertainty, which is deeply rooted in TCE, increases unpredictability and

procurement risks in exchange transactions, reducing management control over operations (Yang et al., 2017). Based on SET assumptions, trust is regarded an effective SET tool for reducing uncertainty, as it enables buyers and suppliers to feel more confident in their collaborative planning (Li, Poppo, & Zhou, 2008). Furthermore, trust reduces uncertainty, when contracts terms are difficult to enforce due to changing business environment (Nyaga et al., 2010). To reduce procurement risks and improve procurement risk management performance, firms must build trust to maintain stable relationships and collaborative relationships (Saglam et al., 2022; Mora-monge, 2019; Yang et al., 2017). Based on this, the following hypotheses are developed:

H3e. Trust mediates the negative influence of environmental uncertainty on procurement risk management performance.

4.4.3 switching cost, Sociological mechanisms, and procurement risk management performance.

Switching costs, which refer to the financial burden and time required to change suppliers and reintegrate outsourced activities, is a significant risk that increases transaction costs and impacts procurement risk management performance (Lee & Park, 2021; Blut et al., 2016). High asset specificity and dedicated investments in exchange relationships constrain an organization's ability to switch suppliers due to the high costs of transitioning to an alternative supplier (Barthélemy & Quélin, 2006). Moreover, high switching costs create lock-in situations, supplier dependency, and the potential for opportunistic behaviour necessitating rigorous monitoring efforts, thereby increasing costs associated with managing the exchange relationship (Harju et al., 2024). These relationships in the post-contract award phase had not been previously studied in the literature, despite switching costs' potential to increase organisations' risks. Empirical evidence is still needed to understand the influence of switching costs on procurement risk

management performance in the post-contract award phase of manufacturing sector.

H4a. Switching costs have a negative influence on procurement risk management performance.

Switching costs lock organisations into inefficient relationships (Wang et al., 2021). Switching costs act as barriers to supplier substitution, reducing the flexibility of buyers to develop other supply relationships especially under conditions of supplier failure and uncertainty (Lee & Park, 2021). The presence of trust and information sharing, which are critical SET constructs, in buyer-supplier relationships buffers the negative effect of switching costs on the relationships and reduces procurement risk of changing suppliers (Liu et al., 2009). Trust encourages parties to disclose information more openly and this mitigates the dependency risks and rigidity caused by switching costs. Yang et al., (2022) provided empirical evidence that trust, and information sharing, enable adaptive buyer-supplier behaviour, reduce conflict, and enhance recovery capability even in the face of disruption and uncertainty. Based on these, this study argues that the combination of trust and information sharing reduce the risk of switching cost and improves risk management outcomes. The following hypothesis is developed.

H4b. Trust and information sharing jointly mediate the negative influence of switching cost on procurement risk management performance.

Decisions about terminating a contract and switching suppliers are usually based on issues about the sociological expectations between the buyer and supplier in an exchange relationship (Habib et al., 2020; Whitten & Wakefield, 2006). For instance, Huo et al. (2014) and Nyaga et al. (2010) highlighted that trust and commitment encourages information exchange between suppliers and the buying organisation and improves decision-making to help manage risks in exchange relationships. Similarly, earlier studies (Kwon & Suh, 2005; Sharma & Patterson, 2000; Kumar et al., 1995; Morgan & Hunt, 1994) highlighted that in

addition to economic contributions, key SET constructs including commitment and trust can sustain relationships and reduce the risks of contract termination. Based on these, the following hypothesis is developed.

H4c. Trust and commitment jointly mediate the negative influence of switching costs on procurement risk management performance.

Flexibility as a key SET construct, has been highlighted as an enabler of risk management as it enables suppliers and buying organisations to adapt quickly to market conditions and supply disruptions (Ustundag & Ungan ,2020). Johnston et al., (2004) highlighted that trust facilitates the development of cooperative behaviours in buyer- supplier relationships, leading to flexibility in arrangement and shared planning when conflicts or disruptions occur. In the procurement literature, extensive research on switching costs, a key element that increases transaction costs from TCE, and its impact of procurement risk management is still missing. Empirical study is still needed to understand the influence of trust and flexibility on switching cost and procurement risk management performance in the manufacturing sector. Based on this, the following hypotheses are developed:

H4d. Trust and flexibility jointly mediate the negative influence of switching costs on procurement risk management performance.

H4e. Trust mediates the negative influence of switching costs on procurement risk management performance.

4.4.4 Negotiation cost, sociological mechanisms, and procurement risk management performance.

Negotiation cost is a critical component of transaction costs in procurement exchange relationships (Herold et al., 2025; Thomas et al., 2013). According to Transaction Cost Economics (TCE), bounded rationality limits procurement managers' ability to anticipate risks and include necessary contingent clauses in contracts due to their limited cognitive capabilities (Williamson, 1985; Zaheer et al., 1998; Lumineau et al., 2022). As a result, complex and uncertain procurement

environments increase the need for contract renegotiations, as contract terms need to be adjusted to reflect the changes in business circumstances (Tate et al., 2022). High negotiation costs can increase procurement risks in business relationships, as extensive contract discussions delay order placements, lead to inventory shortages, cause costly contract modifications, and result in higher contract monitoring costs (Zaheer et al., 1998). Negotiation cost as a critical element of TCE has not been extensively studied in the procurement literature, despite its ability to increase transaction cost. Empirical evidence is still needed to establish the influence of negotiation costs on procurement risk management performance in the post-contract award phase of manufacturing sector.

H5a Negotiation costs have a negative influence on procurement risk management performance.

When negotiation costs are high, companies struggle to make timely changes to procurement strategy, leading to a higher risk of procurement failure (Lumineau et al., 2022). The presence of trust in a buyer supplier relationship enables collaborative buyer-supplier relationships, leading to reduced dependence on costly formal negotiation processes. Trust facilitates information sharing, enabling transparent and faster negotiations and rapid conflict resolution during disruptions.

H5b. Trust and information sharing jointly mediate the negative influence of negotiation cost on procurement risk management performance.

Commitment as a key SET construct, encourages relational stability and reduces the transaction costs that are incurred due to lengthy renegotiations, contract monitoring, and enforcement (Williamson, 1985). For instance, Shazad et al. (2018) found that commitment was significant in effectively governing exchange relationships. Zaheer et al. (1998) found that inter-organizational trust reduces negotiation costs as negotiations can be quickly and easily successful because of relationship partners' commitment. Based on this, the author infers that the combination of trust and commitment reduces the negative effect of

negotiation cost and helps improve risk management performance. The following hypothesis is developed.

H5c. Trust and commitment jointly mediate the negative influence of negotiation cost on procurement risk management performance.

Additionally, trust combined with flexibility reduces the transaction cost associated with lengthy renegotiations, contract termination, or supplier exit (Habib et al., 2017), enabling more efficient responses to dynamic conditions. While studies have demonstrated that trust serves as a fundamental SET mechanism in developing and maintaining exchange relationships, the impact of trust and flexibility has not been extensively studied. Based on these, the following hypotheses are developed.

H5d. Trust and flexibility jointly mediate the negative influence of negotiation cost on procurement risk management performance.

H5e. Trust mediates the negative influence of negotiation cost on procurement risk management performance.

4.4.5 Sociological mechanisms and procurement risk management performance.

Procurement risk management performance refers to the effectiveness of a buying organisation to confront opportunities and threats in its environment, address supplier reliability issues, and develop mutually agreed strategies to minimise operational disruptions, reduce cost, enhance supplier compliance, and improve organisational performance (Liu et al., 2018; Hoffman et al., 2013). Wacker et al. (2016) found that higher levels of uncertainty increase transaction costs. Pfohl et al., (2010) emphasised that elevated coordination costs and transaction risks lead to poorer procurement risk management outcomes. Furthermore, in the post-contract award phase, effective procurement risk management relies on ongoing supplier cooperation rather than contractual enforcement alone (Grover & Malhotra, 2003). For instance, Hoffman et al. (2013)

emphasised that organisations with trusting relationships with suppliers can deal with uncertainties better and reduce information asymmetries.

Supplier trust and flexibility are also vital for organisations to overcome risks efficiently in exchange relationships, enabling competitive advantage. Saglam et al. (2021) found that flexibility positively affects Supply chain risk management performance. Commitment ensures suppliers collaborate with buying organisations and invest time and resources to generate mutually desired outcomes. Information sharing is critical in mitigating the adverse effects of opportunistic behaviour (Fan et al., 2017). The transparent and consistent sharing of accurate information between exchange parties reduces information asymmetry, uncertainty, and the need for excessive control mechanisms (Wang et al., 2014; Poppo & Zenger, 2002). For instance, past research (Lui et al., 2018; Narayanan et al., 2015; Huo et al., 2014; Nyaga et al., 2010) suggested that information sharing fosters collaboration by enabling a better understanding of the buying organization's and suppliers' business requirements and challenges. Recent research (Ma et al., 2024; Oliveira & Handfield, 2019) has emphasized that in relationships between organizations and suppliers, accurate information sharing, driven by data analytics, plays a critical role in enhancing responsiveness in disruptions.

Based on these, the following hypotheses are developed:

H6a information sharing positively influences procurement risk management performance.

H6b. Commitment positively influences procurement risk management performance.

H6c. Flexibility positively influences procurement risk management performance

H6d. Trust positively influences procurement risk management performance

4.5 Research Models

The transaction cost economics (TCE) and social exchange theory (SET) are used as theoretical lenses to understand procurement risk management and generate hypotheses presented in Section 4.3. Both theories were selected because TCE provided a framework for understanding the procurement risks that are prevalent in the post award-contract phase including opportunistic behaviour, environmental uncertainty, switching cost and negotiation cost. While SET provided insights into how sociological constructs including trust, information sharing, commitment and flexibility can be used as relational governance mechanisms to reduce the impact of procurement risk on procurement risk management performance. In line with the arguments of Habib et al., (2020), the author argues that both TCE and SET theories are complementary.

The hypotheses provide the foundation for improving procurement risk management performance in the post-contract award phase, as illustrated in the research models in Figure 4-1 and Figure 4-2. The models present four distinct Procurement risks consisting of two exchange risks: supplier opportunistic behaviour and environmental uncertainty, and two transaction costs, switching costs and negotiation costs. Figure 4-1 shows the conceptual framework based on the combined sociological mechanisms, trust, information sharing, commitment and flexibility. The model:

1) Delineates the direct negative influence of procurement risks (supplier opportunistic behaviour, environmental uncertainty, switching cost and negotiation costs), on procurement risk management performance (H2a, H3a, H4a, H5a).
2) Shows the direct influence of trust on information sharing, commitment and flexibility (H1a, H1b, H1c).
3) Depicts the joint role of trust and information sharing as mediators to reduce the negative influence of procurement risks on procurement risk management performance (H2b, H3b, H4b and H5b).

4) Demonstrates the joint role of trust and commitment as mediators to reduce the negative influence of procurement risks on procurement risk management performance (H2c, H3c, H4c and H5c).
5) Shows the joint role of trust and flexibility as mediators to reduce the negative influence of procurement risks on procurement risk management performance (H2d, H3d, H4d and H5d).
6) 4) Shows the direct influence of sociological mechanisms (information sharing, commitment and flexibility) and procurement risk management performance (H6a, H6b, H6c).

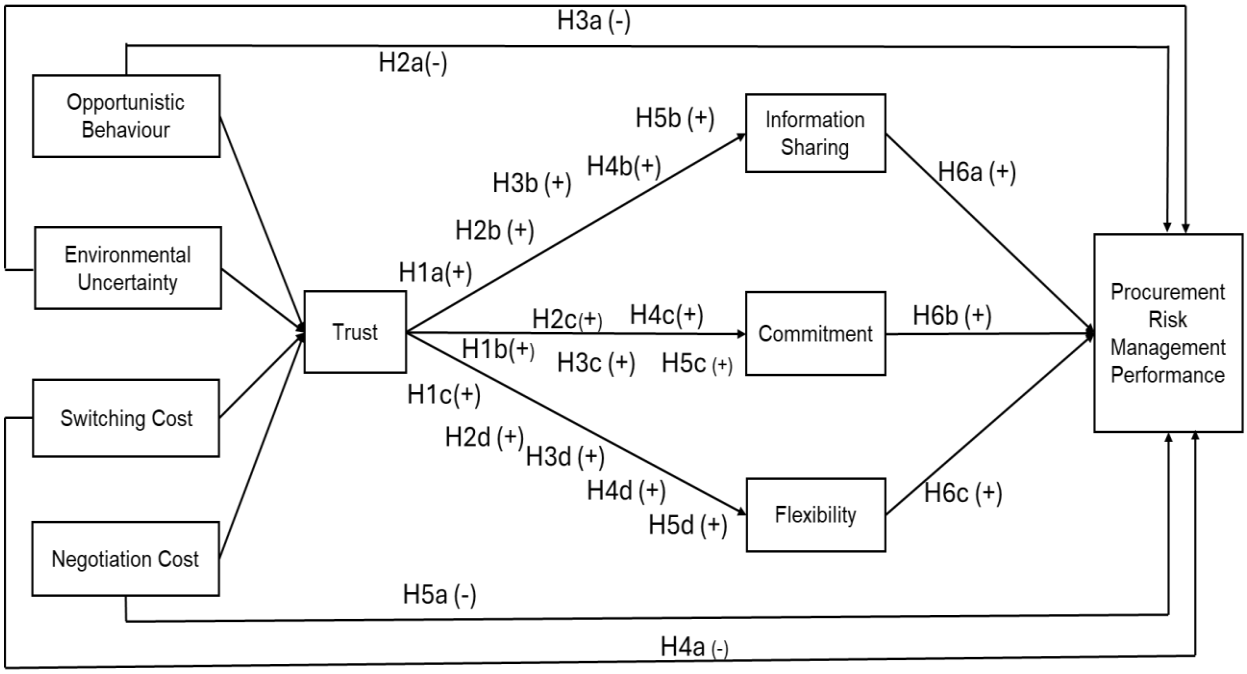


Figure 4-1 Research Model A- (Combined TCE and SET Constructs)
(Source: Author)

Figure 4-2 below shows the conceptual framework based on a single sociological mechanism, Trust. The model:

1) Delineates the direct negative influence of procurement risks (supplier opportunistic behaviour, environmental uncertainty, switching cost and negotiation costs), on procurement risk management performance (H2a, H3a, H4a, H5a).
2) Depicts the joint role of trust as a mediator to reduce the negative influence of procurement risks on procurement risk management performance (H2e, H3e, H4e and H5e).

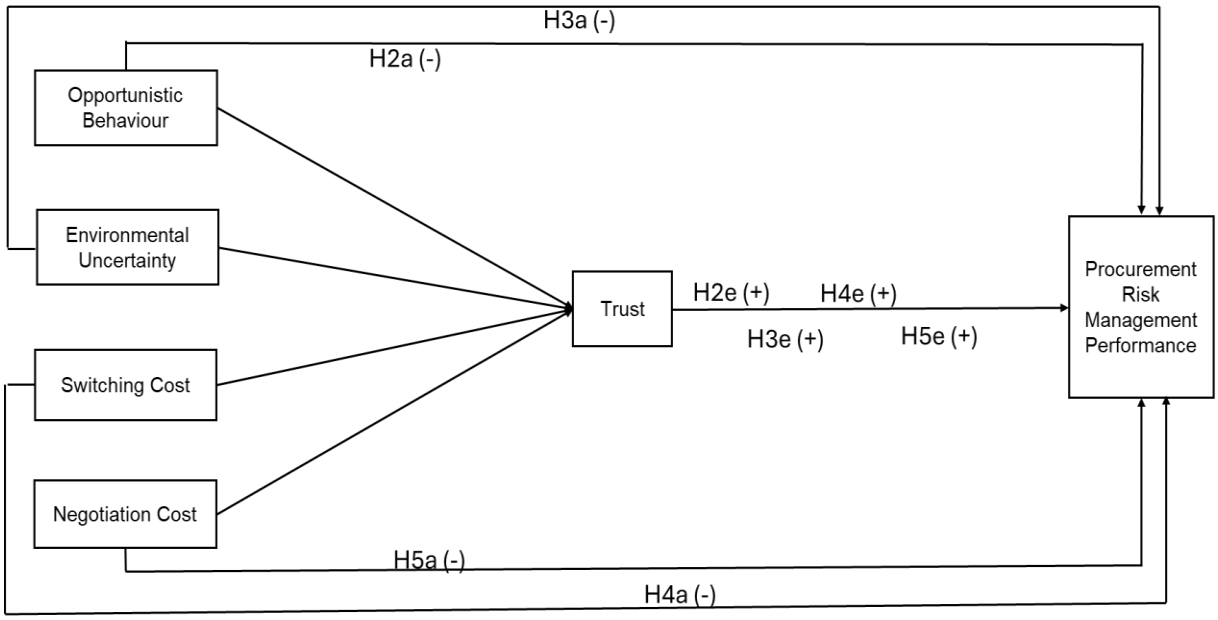


Figure 4-2 Research Model B (SET construct) (Source: Author)

4.6 Research Methodology

4.6.1 Survey design and measurement

This exploratory study is based on a deductive research strategy, and a quantitative approach was applied using survey data from a questionnaire. The survey strategy has been commonly applied in studying supply chain risk management and was selected because it allowed the collection of data from procurement professional in the USA, enabling a robust analysis (Nayal and Raut, 2021; Saglam et al., 2020; Padgett et al., 2020; Liu et al., 2018; Hoffman et al., 2013). Questionnaires allowed a standardized data collection format, contributing towards reliability. The Survey strategy is suitable for collecting data to ascertain the relationships between different variables and to present results using descriptive and inferential statistical techniques (Saunders et al., 2023). The survey questionnaire consisted of two sections. The first section collected the respondents' demographic information, including job titles, years of experience, industry, and location. A screening question that required the respondents to include text responses about what procurement risk management meant to them was included to ensure that only responses that demonstrated an understanding of the research topic were accepted.

The second section of the questionnaire contained the measurement items for each construct. Academic researchers with expertise in survey methodology and procurement and supply chain management reviewed the questionnaire. The measurement items for all constructs were developed based on Churchill's (1979) procedure for developing measures with desirable reliability and validity properties. The measurement items applied were developed through an extensive review of similar constructs used in previous research in which the scales were initially assessed for validity and reliability. For example, the supplier opportunistic behaviour scales are taken from Liu et al. (2009), the environment uncertainty scales from Yang et al. (2017), the switching cost scales from Lee & Park (2021), and the negotiation cost scales from Shahzad et al. (2018). The measurements were defined as reflective indicators, which refer to observed

variables that are assumed to be caused by an underlying construct. Reflective indicators are used in this study because the author assumes that the procurement risk constructs cause the observed measurements (Hair et al., 2017; Sadagopan & Rosado, 2018). The measurement items are shown in Appendix B.1. A seven-point Likert scale was used to measure each item. The 7-likert scale is preferred because it captures more variance in responses and helps the differentiation between related but distinct constructs compared to the 5-likert scale measure (Wang et al., 2024; Shahzad et al., 2018).

4.6.2 Data collection and quality assessment

A self-administered electronic survey was created digitally in Qualtrics, a software platform that facilitates secure data processing and efficient management of respondents. Data for this research were collected through Qualtrics, Inc third-party data collection service because it enabled the author have access to a wide range of quality and valid data on time (Inman and Green, 2018). The target samples were procurement professionals in the USA automotive industry within the manufacturing sector with job roles such as Procurement Managers, Procurement Specialists, Buyers, Contract Managers, and Contract Specialists with a minimum of three years of procurement and supply experience. Three years were set as a minimum to ensure participants had a good understanding of procurement risks and quality data was collected. The inclusion and exclusion criteria for selecting respondents is presented in Table 4-1. The USA was selected as the research context because it has the second-largest automotive manufacturers in the world (Statista, 2023). Also, the US automotive have suffered from enormous procurement and supply crises ranging from inventory challenges to semiconductor shortages, uncertainties, disruptions, supplier performance issues, and price swings (Deloitte, 2023). All these made the automotive industry suitable to investigate procurement risk management in the

post-contract award phase. All respondents in the survey were guaranteed anonymity and confidentiality.

Table 4-1 Inclusion and exclusion criteria for shortlisting respondents. (Source: Author)

Criteria	Inclusion Criteria	Exclusion Criteria
Location	USA	All other countries
Industry	Automotive industry	All other industries
Job role	Procurement Managers, Procurement Specialists, Buyers, Contract managers, Contract Specialists and any other procurement job title	All other job roles
Years of procurement experience	minimum 3 years	Less than 3 years

4.6.2.1 Sampling technique and response

To establish the validity of the survey items and determine whether the respondents understood the questions as offered, a pilot survey was carried out with 20 procurement professionals. Based on the responses, two of the items were reworded to improve understanding. This study employed a non-probability sampling technique and respondents were selected through volunteer opt-in panels from Qualtrics (Saunders et al., 2019). Non-probability sampling technique was appropriate for this study because it enabled collection of relevant data from participants with direct experiences in procurement processes and risk management practices. The survey was published on the Qualtrics platform and data collection period was two months. 678 respondents filled the questionnaire.

Data quality screening criteria including job roles, years of procurement experience, and a survey screening question that required text responses showing respondents' understanding of procurement risk `management (PRM) were used to screen the data.

The author only accepted 313 valid responses and rejected 365 that did not pass the quality assessment checks. Some respondents provided answers that were vague, irrelevant, or non-informative to the screening questions. For example, in response to the question "What does procurement risk management mean to you?", responses such as "It means everything to me", "A big company that works with the city and metals", and "Not sure" did not demonstrate any understanding of procurement risk management and were therefore excluded. The questionnaire also included a predefined list of procurement roles with an "Other" option for participants to include their job titles if not listed. Some participants selected "None of the above" indicating that their job roles were outside procurement and supply management, and their responses were rejected. Additionally, some respondents provided job titles unrelated to the study, such as "truck driver", and such responses were also rejected because they did not reflect relevant experience in procurement risk management.

The minimum sample size for Partial Least Squares Structural Equation Modeling (PLS-SEM) is determined by the "ten-times rule," which states that the sample should be at least ten times the largest number of structural paths directed toward any endogenous variable (Hair et al., 2021; Henseler et al., 2014). In this study, the structural model had 23 paths, indicating a minimum required sample size of 230 respondents. The sample size of 313 valid respondents therefore exceeds the recommended minimum, confirming that the data collected were sufficient to ensure the reliability and validity of the PLS-SEM results.

To ensure that respondents engaged thoughtfully with the questionnaire items, responses in which participants selected the same value across all items on the seven-point Likert scale were excluded. For instance, responses with '5'

across all questions were rejected because such uniformed responses suggested that the participants quickly filled in the questionnaire without thoroughly considering each question. Overall, the rigorous screening process ensured that the selected 313 responses were from participants with appropriate procurement experience and genuinely engaged with the questions. This careful validation strengthened the reliability and validity of the study findings, providing confidence that the results accurately reflect the perspectives of individuals with relevant knowledge and experience in procurement risk management.

To further assess the quality of the data sets, the Kurtosis and Skewness of the data was calculated on Microsoft excel to assess the symmetry of the data distribution (Joseph F. Hair et al., 2016). Skewness measures distribution behaviour if it stretches left or right from the mean, while Kurtosis measures the distribution for pointedness and flatness of the distribution. The Kurtosis was 0.12, while the skewness was -0.83, less than the cutoff point of ±1. In addition, Harman's single factor test was also done in SPSS to check common method bias, and according to the unrotated factor solution, the first 103 factors account for 30.52% of the variance, indicating that no factor accounts for most of the covariance among the measures (Fuller et al., 2016). This result showed that common method bias was not an issue in this research.

4.7 Data Analysis and Result

Partial least squares structural equation modelling (PLS-SEM) was used to estimate the relationships among the constructs and to test the research hypotheses. The Smart PLS 4.0 software application is well recognised in the supply chain field to assess relationships between constructs (Steinle et al., 2020; Aghajanian, 2018). PLS-SEM was selected over the co-variance SEM method as appropriate for the data analysis for the following reasons. First, PLS-SEM maximised the explained variance of procurement risk management performance, which is the endogenous latent construct in this research (Hair et

al., 2017; Sarstedt et al., 2014). Second, this method simultaneously evaluated the multiple TCE and SET variables in this research, enabling the author to predict and explore new relationships and assess the direct consequences of procurement risks on procurement risk management performance, and the mediating influence of sociological mechanisms (Nyamah et al., 2023; Jihadi et al., 2020). Third, SEM enabled the author to determine the validity, reliability and the predictive power of research model developed based on the TCE and SET theory (Hair et al., 2017). Fourth, unlike the covariance methods such as AMOS and LISREL, which are dependent on large sample sizes and assume normality of data distribution, PLS-SEM works well with small sample sizes, does not assume a normal distribution, and offers robust results (Saglam et al., 2020; Ustundag & Ungan, 2020).

The structural equation model is analysed and interpreted in two phases: assessing the reliability and validity of the measurement model and evaluating the structural model. The measurement model assessment evaluates how well the indicators (observed variables) represent the latent constructs, while the structural model captures the relationships between the constructs represented in the path coefficients, which represents the strength and direction of relationships (Hair et al., 2017, p.321).

4.7.1 Measurement model assessment

The measurement assessment of our model is based on the guidelines of Hair et al. (2017) to affirm the reliability and validity of all nine constructs. The nine constructs are opportunistic behaviour, environmental uncertainty, switching cost, negotiation cost, trust, information sharing, commitment, flexibility, and procurement risk management performance, as shown in Figure 1. The Smart PLS4.0 software used the PLS-SEM algorithm to calculate critical parameters for the measurement model assessment, including indicator reliability, internal consistency, and convergent validity (Tian et al., 2024; Bhilat et al., 2024; Shahid

et al., 2023; Hair et al., 2017). The measurement model dimensions are presented in Table 4-2.

4.7.1.1 Reliability and validity report

The validity and reliability results are presented in Table 4-3. First, the outer loadings report assessed the indicator reliability, which shows the degree of item reliability. Researchers (Wang et al., 2015; Hair et al., 2017) recommend outer loadings to be ideally at a minimum of 0.7 for established items. In this study, all the outer loadings were greater than 0.7 except for two outer loadings for the constructs: Supplier opportunistic behaviour and Environmental Uncertainty, which were less than 0.6, therefore, removed from the assessment.

The outer loadings for all measurement items presented in Table 4-3 demonstrate indicator reliability. Second, the internal consistency reliability of the model items was measured by Cronbach's Alpha values, whose minimum value should be 0.7 for established constructs (Hair et al., 2017, p.113). The report shows that all our constructs had values greater than 0.7, demonstrating indicator reliability. Third, composite reliability (CR), which measures internal consistency, was greater than the critical threshold of 0.7, indicating internal consistency reliability (Hair et al., 2017, p.113). Fourth, the average variance extracted (AVE) was used to measure the convergent validity. AVE provides information about the proportion of variance of the indicators explained by the construct. As a rule of thumb, a cut-off value of 0.5 (50%) of the variance should be attributed to the factor (Hair et al., 2017), and all our constructs achieved convergent validity with values greater than 0.5

Fifth, discriminant validity shows the level of distinction between constructs in a model and was assessed using the (HTMT), whose value should be less than 0.9 liberally, and the heterotrait- Monotrait ratio should not include any value of 1 (Hair et al., 2017). The HTMT report (Appendix B.3) showed that discriminant validity is established in this study as all HTMT confidence interval values were

below 1. Sixth, the level of multi-collinearity (see Appendix B.4) between the constructs was also assessed using the variance inflation factor (VIF), and all VIF values were below 5, thus indicating no significant multi-collinearity issue (Hair et al., 2017). A summary is of the description of the measurement model dimensions is presented in Table 4-3

Table 4-2 Measurement model dimensions (Source: Author)

No	Dimension	Description
1	Outer loadings	Assessed the indicator reliability
2	Internal consistency	Assessed the indicator reliability
3	Composite reliability	Measured internal consistency
4	Average variance	Measured the convergent validity.
5	Discriminant validity	Showed the level of distinction between constructs in a model
6	Mult- collinearity	Showed the level of correlation between constructs

Table 4-3 Measurement model reliability and validity report (Source: Author)

Constructs	Items	Loadings	Cronbach's alpha	Composite reliability (rho_a)	Average variance extracted (AVE)
Supplier Opportunistic Behaviour	SupOB_ Exploitation	0.841	0.923	0.987	0.843
	SupOB_ Non-Compliance	0.956			
	SupOB_Renegotiation	0.953			
Environmental Uncertainty	EnUty_Demand Uncertainty	0.808	0.701	0.724	0.623
	EnUty_Product Availability	0.726			
	EnUty_Features_Unc	0.830			
Sw itching Cost	Sw CtSw itching Cost_Finan	0.833	0.868	0.871	0.653
	Sw CtSw itching Cost_Opera	0.780			
	Sw CtSw itching Cost_Proce	0.818			
	Sw CtSw itching Cost_Sup T	0.811			
	Sw CtSw itching Cost_Syste	0.798			
Negotiation Cost	NgtCt_Bargaining Cost_EC	0.772	0.853	0.853	0.63
	NgtCtBargaining Cost_RMC	0.811			
	NgtCtBargaining Time_EC	0.830			
	NgtCtBargaining Time_RMC	0.810			
	NgtCtBargaining_PT	0.745			
Trust	Trust_Dependability_C	0.826	0.856	0.862	0.635
	Trust_Dependability_F	0.824			
	Trust_Honesty_ S	0.838			
	Trust_Reliability	0.756			
	Trust_Transparency	0.736			
Commitment	Commit_ DeRe	0.833	0.846	0.849	0.619
	Commit_ Eff	0.782			
	Commit_ Ex	0.734			
	Commit _Ma	0.803			
	Commit_rel	0.780			
Information Sharing	InfShRelevant Informa_Inv	0.753	0.849	0.853	0.625
	InfShRelevant Informat_PC	0.805			
	InfShTimely Information	0.859			
	InfShTransparency_Events	0.782			
	InfShTransparency_Forcast	0.749			
Flexibility	FlxAdaptability_ST Capa	0.781	0.856	0.858	0.635
	FlxFlexibility_LTE	0.795			
	FlxNegotiation Flexibil	0.829			
	FlxSup Adaptability_Adj	0.744			
	FlxSup Flexibility_Resp	0.833			
Procurement Risk Management Performance	ProRkPerf_Reso Allo	0.815	0.871	0.872	0.565
	ProRkPerf_ Mangt_Agil	0.721			
	ProRkPerf_Min Freq	0.715			
	ProRkPerf _Bett	0.737			
	ProRkPerf _Inte	0.734			
	ProRkPerf_Mitigat_Min Eff	0.728			
	ProRkPerf_Mitigation_Conf	0.803			

4.7.2 Structural assessment

The Smart PLS program was utilized to calculate the structural model. After ensuring the model had no reliability and validity problems, bootstrapping with 5000 samples was used to enable the author to generate stable and reliable R^2 values, standard errors and *p*-values and to determine the statistical significance of the path coefficients (Hair et al., 2017). The R^2 values are assessed to check the model's explanatory power. PLSpredict /CVPAT was used to calculate the Q^2 to confirm the predictive power and values greater than 0.2 imply the model has predictive relevance (Chin, Marcolin and Newsted, 2003).

4.7.2.1 R^2 assessment of mediation mechanisms

In structural equation modelling, the R-squared (R^2) value serves as a key indicator of a model's explanatory power, quantifying the proportion of variance in the endogenous variable that is explicated by the exogenous variables. (Afum et al., 2020). In this study, structural assessment is used to test two alternative procurement risk mediation scenarios. On the one hand, Hypotheses H2e, H3e, H4e and H5e uses, trust, a core SET construct, as the sole sociological mediating mechanism to influence the negative effect on procurement risks on procurement risk management performance. On the other hand, Hypotheses H2b, H2c, H2d, H3b, H3c, H3d, H4b, H4c, H4d, H5b, H5c and H5d provide a comprehensive perspective proposing that the combination of SET constructs used as sociological mechanisms: trust and information sharing, trust and commitment, trust and flexibility, jointly mediates the negative impact of procurement risks on procurement risk management performance.

Joint mediation mechanism: In this structure presented in Figure 4-3, the endogenous variable is procurement risk management performance (PRORISKPERF), while the exogenous variables are trust (TST), information sharing (INFSH), commitment (CMMT), and flexibility (FLEXI).

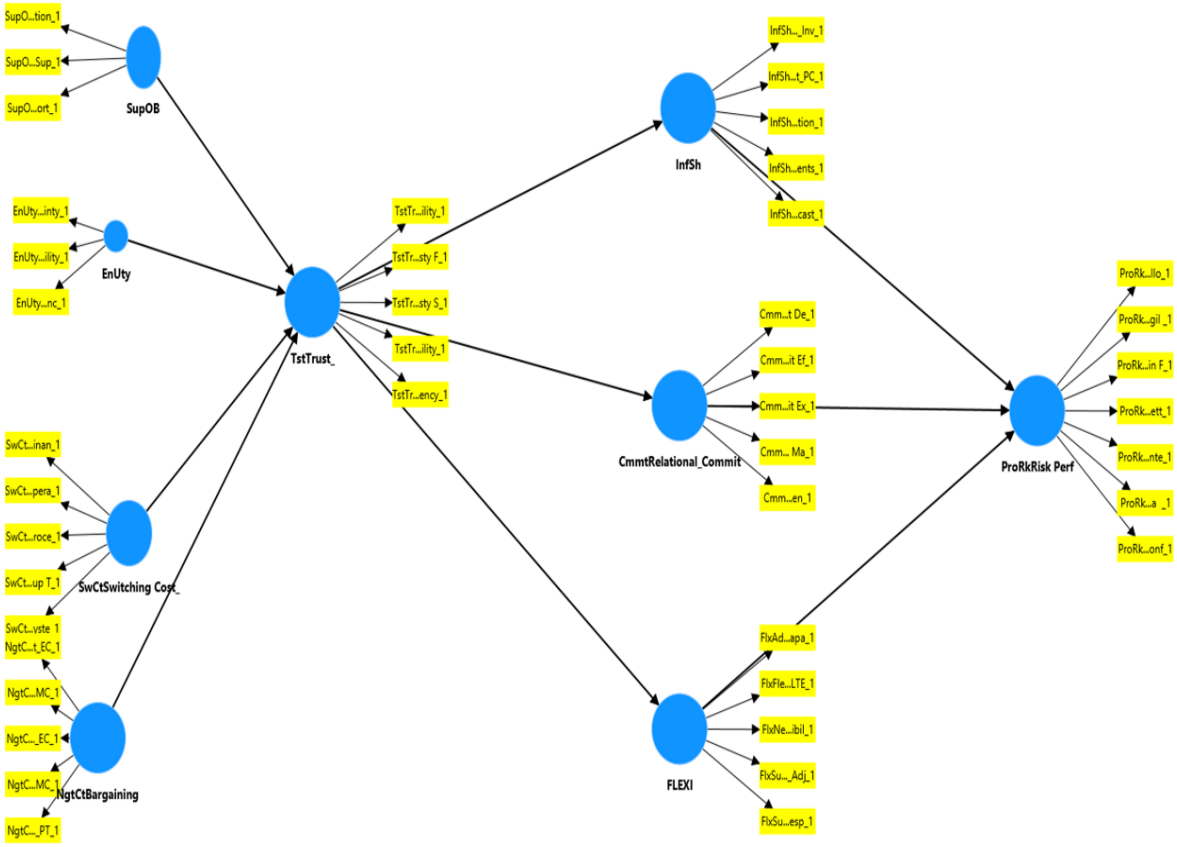


Figure 4-3 Joint Mediation Structure (Source: Author)

The result is presented in Table 4-4 and shows that the R^2 values of TST, INFSH, CMMT, FLEXI, and PRORISKPERF were calculated as 0.430, 0.515, 0.480, 0.550, and 0.691 consecutively.

This result shows that the overall structural model for joint mediation mechanisms explains 69.1% of the variance of procurement risk management. performance, 43% of trust, 51.5% of information sharing, 48% of commitment, and 55% of flexibility. Secondly, the Q^2 value for each of the variables is greater than 0.2, meaning that the PLS-SEM model has an overall out-of-sample predictive relevance and can generally be used to predict new data (Hair et al., 2017).

Table 4-4 Joint Mediation R^2 (Source: Author)

	R^2	R^2 (adj)	Q^2predict	RMSE	MAE
Tst	0.430	0.423	0.398	0.788	0.565
InfSh	0.515	0.514	0.414	0.773	0.578
Cmmt	0.480	0.478	0.400	0.782	0.598
Flexi	0.550	0.549	0.474	0.731	0.580
ProRisk Perf	0.691	0.688	0.423	0.767	0.594

Single mediation mechanism: A second R^2 is calculated using trust as the sole mediating mechanism. In this structure, the exogenous variable is trust (TST), and the endogenous variable is procurement risk management performance (PRORISKPERF as shown in Figure 4-4.

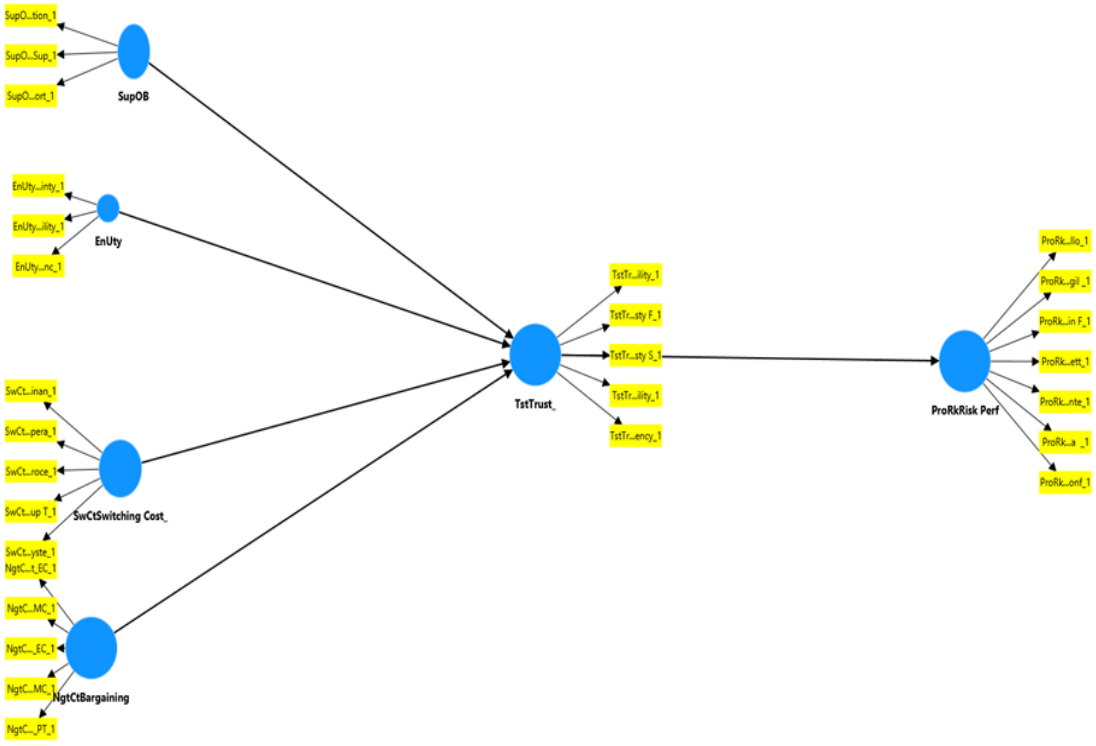


Figure 4-4 Single mediation structure (Source: Author)

The result is presented in Table 4-5 and the R^2 value for trust is 0.43, and 0.5 for PRORISKPERF. This indicates that structural model with trust as a single mediating mechanism explains only 51% of the variance in procurement risk management performance and 43% of trust. The Q^2 value for Trust and procurement risk management performance are greater than 0.2 meaning that the PLS-SEM model has an overall out-of-sample predictive relevance and can generally be used to predict new data.

Table 4-5 Single Mediation R^2 (Source: Author)

	R^2	R^2 (adj)	Q^2predict
Tst	0.430	0.423	0.398
ProRisk Perf	0.510	0.502	0.418

4.7.2.2 Direct effects reports

Table 4-6 Direct effects report (Source: Author)

		β	STD Erro	T -Statistics	P- values	Result
H1a	Trust -> InfSh	0.718	0.046	15.736	0.000	Supported
H1b.	Trust -> Cmmt	0.693	0.040	17.399	0.000	Supported
H1c.	Trust -> Flexi	0.742	0.037	19.979	0.000	Supported
H2a	SupOB -> ProRkRisk Perf	-0.031	0.041	0.770	0.441	Rejected
H3a	EnUty -> ProRkRisk Perf	0.059	0.044	1.346	0.178	Rejected
H4a	SwCt -> ProRkRisk Perf	-0.131	0.044	2.987	0.003	Supported
H5a	NgtCt-> ProRkRisk Perf	-0.346	0.045	7.737	0.000	Supported
H6a.	InfSh -> ProRisk Perf	0.253	0.075	3.365	0.001	Supported
H6b.	Cmmt -> ProRisk Perf	0.393	0.066	5.935	0.000	Supported
H6c.	Flexi -> ProRisk Perf	0.265	0.074	3.568	0.000	Supported

The direct effects report on the standardized coefficients (β-values) of the relationships, standard error, t-statistics, and the P-values calculated by the PLS-SEM bootstrapping approach are presented in Table 4-6. In the analysis, all hypothesis with p-value > 0.1 were rejected, while those with p-values < 0.01 were supported. Based on this, the results supported hypotheses H1a, H1b, H1c, Meaning that there's a direct relationship between trust and the other sociological variables. Hypotheses H2a (p-value and H3a were not supported, indicating that supplier opportunistic behaviour and environmental uncertainty do not directly influence procurement risk management performance in the post- contract award phase. Furthermore, the results confirm a direct negative relationship between switching cost and procurement risk management performance, and negotiation cost and procurement risk management performance (H4a, H5a). Information sharing, commitment and flexibility positively influence procurement risk management performance H6a, H6b, H6c),

4.7.2.3 Specific indirect effects reports

The specific indirect report in structural equation modelling (SEM) is the statistical report that shows how much and how significantly one variable affects another through that specific pathway (Hair et al., 2017). In this study, this report provides the test results to confirm that sociological mechanisms mediate the negative

impact of procurement risks on procurement risk management performance. The report is split into two categories, the first report (shown in Table 4-5) shows the mediating influence of the joint sociological mechanisms, while the second report (Table 4-6) shows the mediating influence of trust as a single mechanism.

Specific indirect effects report (Joint mediation mechanism): In the specific indirect report presented in Table 4-7, Hypotheses H2b, H2c, H2d, H3b, H3c and H3d were rejected because of their weak and statistically insignificant p-values which were greater than 0.05 (Hairs et al., 2017). This indicates that first, trust and information sharing do not jointly mediate the negative influence of supplier opportunistic behaviour on procurement risk management performance. Second, Trust and commitment do not jointly mediate the negative influence of supplier opportunistic behaviour on procurement risk management performance. Third, Trust and flexibility do not jointly mediate the negative influence of supplier opportunistic behaviour on procurement risk management performance. Fourth, Trust and information sharing do not jointly mediate the negative influence of environmental uncertainty on procurement risk management performance. Fifth, Trust and commitment do not jointly mediate the negative influence of environmental uncertainty on procurement risk management performance. Sixth, Trust and flexibility do not jointly mediate the negative influence of environmental uncertainty on procurement risk management performance.

Table 4-7 Specific indirect effects report (Joint mediation mechanism)
(Source: Author)

		β	STD Erro	T -Statistics	P- values	Result
H2b.	SupOB ->Tst -> InfSh -> ProRisk Perf	-0.009	0.013	0.698	0.485	Rejected
H2c.	SupOB ->Tst -> Cmmt -> ProRisk Perf	-0.013	0.018	0.751	0.453	Rejected
H2d.	SupOB -> Tst -> Flexi -> ProRisk Perf	-0.010	0.012	0.767	0.443	Rejected
H3b.	EnUty -> Tst -> InfSh ->ProRisk Perf	0.017	0.014	1.177	0.239	Rejected
H3c.	EnUty -> Tst -> Cmmt -> ProRisk Perf	0.025	0.019	1.320	0.187	Rejected
H3d.	EnUty -> Tst -> Flexi-> ProRisk Perf	0.018	0.015	1.193	0.233	Rejected
H4b.	SwCt_ ->Tst -> InfSh -> ProRisk Perf	0.036	0.016	2.315	0.021	Supported
H4c.	SwCt_ ->Tst -> Cmmt -> ProRisk Perf	0.055	0.020	2.746	0.006	Supported
H4d.	SwCt -> Tst -> Flexi -> ProRisk Perf	0.039	0.019	2.075	0.038	Supported
H5b.	NgtCt-> Tst -> InfSh -> ProRisk Perf	0.097	0.033	2.941	0.003	Supported
H5c.	NgtCt -> Tst -> Cmmt -> ProRisk Perf	0.145	0.033	4.430	0.000	Supported
H5d.	NgtCt -> Tst -> Flexi ->ProRisk Perf	0.105	0.031	3.404	0.001	Supported

The P-values for H4b, H4c, H4d, H4e, H5b, H5c, H5d and H5e were all supported because they their p-values were less than 0.05 (Hairs et al., 2017), demonstrating significant mediation influence of sociological mechanisms between switching costs and procurement risk management performance and negotiation costs and procurement risk management performance.

Specific indirect effects report (Single mediation mechanism):

Table 4-8 presents the specific indirect report with trust as the single mediation mechanism. Hypotheses H2e and H3e were rejected meaning that trust does not have a significant mediating influence. However, hypotheses H4e and H5e were supported, demonstrating the mediation influence of trust on switching cost and negotiation cost.

Table 4-8 Specific indirect effects report (Single mediation mechanism).
(Source: Author)

		β	STD Erro	T -Statistics	P- values	Result
H2e.	SupOB -> Tst-> ProRkRisk Perf	-0.034	0.044	0.771	0.441	Rejected
H3e.	EnUty -> Tst -> ProRkRisk Perf	0.066	0.049	1.341	0.180	Rejected
H4e.	SwCt ->Tst -> ProRkRisk Perf	0.142	0.047	3.034	0.002	Supported
H5e.	NgtCt-> Tst -> ProRkRisk Perf	0.381	0.042	9.152	0.000	Supported

The structural assessment results (Tables 4.7 and 4.8) showed eight strong statistical evidence that: first, trust and information sharing jointly mediate the negative influence of switching cost on procurement risk management performance. (Hypothesis H4b: P-value = 0.021). Second, trust and commitment jointly mediate the negative influence of switching costs on procurement risk management performance (Hypothesis H4c; P-value = 0.006). Third, trust and flexibility jointly mediate the negative influence of switching costs on procurement risk management performance (Hypothesis H4d: P-value = 0.038). Fourth, trust mediates the negative influence of switching costs on procurement risk management performance (Hypothesis H4e: P-value = 0.002). Fifth, trust and information sharing jointly mediate the negative influence of negotiation cost on procurement risk management performance (Hypothesis H5b: P-value = 0.003). Sixth, trust and commitment jointly mediate the negative influence of negotiation cost on procurement risk management performance (Hypothesis H5c: P-value = 0.000). Seventh, trust and flexibility jointly mediate the negative influence of negotiation cost on procurement risk management performance (Hypothesis H5d: P-value = 0.001) Eight, trust mediates the negative influence of negotiation cost on procurement risk management performance (Hypothesis H5e: P-value = 0.000).

Comparing joint mediation and single mediation mechanisms.

The study compared the specific indirect report of using trust as a single mediation mechanism, and trust and information sharing, trust and commitment, and trust and flexibility as joint mediation mechanisms. The results supported

hypothesis H4b, H4c, H4d, and confirming that trust and information sharing, trust and commitment, and trust and flexibility jointly mediate the negative influence of switching costs on procurement risk management performance (see Table 4-7). The result also supported (H4e), confirming that trust mediates the negative influence of switching costs on procurement risk management performance. However, the R^2 assessment reports indicate that trust combined with other sociological mechanisms, provided a higher explanatory power (R^2) of 69% for the variance in procurement risk management performance (see Table 4-4), compared to 51% explanatory power when trust is used as a single mediation mechanism (see Table 4-5). This reveals that the joint use of sociological mechanisms provides a more reliable mediation pathway than trust a single mechanism.

4.8 Discussion and conclusion

Combining transaction cost economics (TCE) Social exchange theory (SET) as theoretical lenses, this study investigated how sociological mechanisms jointly influence the impact of procurement risks on procurement risk management (PRM) performance in the post-award contract phase. TCE was used to understand procurement risks including supplier opportunistic behaviour, environmental uncertainties, switching costs, and negotiation costs (Shahzad et al., 2018, Blut et al., 2016), while SET was used to understand four critical relational constructs that act as risk management mechanisms including trust, information sharing, commitment and flexibility (Saglam et al., 2022; Thongrawd et al., 2020; Fan et al., 2017; Wang et al., 2014). The author developed 27 hypotheses and based on the data form 313 procurement professionals, made the following findings and contributions.

First, the analysis supported hypotheses H1a, that trust positively influences information sharing between buyer and supplier, aligning with previous studies in the literature (Yang et al., 2022; Wang et al., 2014). Hypothesis H1b was supported, suggesting that trust positively influences commitment between buyer and supplier, also aligning with previous studies (Mungra et al., 2020; Brown et al., 2019). Hypothesis H1c was also supported, confirming that trust positively influences flexibility between buyer and supplier and aligning with Young-Ybarra & Wiersema (1999). Together, these findings support the key premise of social exchange theory (SET) which posits that positive interactions over time will produce relational exchange norms (Li et al., 2022; Habib et al., 2020; Wu et al., 2014). In addition, while these findings provide empirical support for previous studies in the literature (Yang et al., 2022; Chowdhury et al., 2021; Mungra et al., 2020; Brown et al., 2019; Kim & Choi, 2015; Young-Ybarra & Wiersema, 1999) this study uniquely provides empirical validation of the influences between these SET constructs specifically in the post-award contract phase of manufacturing industry.

Second, Hypothesis H2a posited a direct negative relationship between opportunistic behaviour and procurement risk management performance. Hypothesis H3a also proposed a direct relationship between environmental uncertainty and procurement risk management performance. These relationships in the post-contract award phase had not been previously tested in the literature. However, the results of the analysis were opposite of what the author expected. Hypotheses H2a and H3a were rejected because the influence of both key TCE constructs, supplier opportunistic behaviour and environmental uncertainty on procurement risk management were statistically insignificant.

Third, Hypotheses H2b, H2c, H2d, H3b, H3c, H3d proposed that combining trust with information sharing, commitment and flexibility jointly mediate the negative influence of supplier opportunistic behaviour on procurement risk management performance. The results were statistically insignificant, and the hypotheses were rejected. Hypotheses H3b, H3c, H3d also

posited that combining trust with information sharing, commitment and flexibility jointly mediate the negative influence of environmental uncertainty on procurement risk management performance. The results were also statistically insignificant, and the hypotheses were rejected. Similarly, hypotheses H2e and H3e were also rejected because the findings did not support using only trust as a mediation mechanism for supplier opportunistic behaviour and environmental uncertainty.

These findings imply that social exchange theory mechanisms are not sufficient on their own to understand and manage procurement risk impact in the post-contract award phase. Furthermore, these findings reinforce TCE's perspective of using formalised contractual mechanisms to govern buyer–supplier relationship to manage uncertainty and opportunistic behaviours (Habib, 2020; Williamson, 1981). This finding is aligned with prior research by Wang et al., (2024) which suggested that that SET constructs are not enough, and organisations need to include other contractual governance mechanisms to complement sociological mechanisms. This study contributes to the complement-substitute debate about the use of contractual and sociological mechanisms in inter-organisational governance (Wang et al., 2024, Zhang et al., 2020; Shazard et al., 2018; Cao and Lumineau, 2015).

Fourth, H4a Hypothesised that switching costs have a negative influence on procurement risk management performance. H4a was supported, suggesting a direct relationship between switching costs and procurement risk management performance. While a previous study examined the link between switching costs and transaction cost (Barthélemy &. Quélin), the influence of switching costs on procurement risk management performance had not been previously studied in the literature. H5a Hypothesised that negotiation costs have a negative influence on procurement risk management performance and this was also supported. This finding extends the literature and support TCE's perspective that both the cost of switching suppliers, and negotiation costs are key drivers of transaction costs that increase risks in exchange relationships (Tate et al., 2022).

Fifth, Hypothesis H4b, H4c, and H4d proposed that trust and information sharing, trust and commitment, and trust and flexibility jointly mediate the negative influence of switching costs on procurement risk management performance. Hypothesis H4b, H4c, and H4d were supported. Hypothesis (H4e) was also supported, confirming that trust alone mediates the negative influence of switching costs on procurement risk management performance. While switching cost has not been extensively studied in the literature, previous researchers have examined the relationships between switching cost and sustainable supplier relationships (Lee & park, 2021), switching cost, sustainability and financial performance (Guandalini et al., 2019), switching costs and buyer-supplier relationship value (Geiger et al., 2012) and switching cost and behaviour (Whitten & Wakefield 2006). However, the mediating influence of SET mechanisms on switching cost and procurement risk management performance had not been previously studied in the literature.

The findings from this study extends the literature and contribute to SET by validating SET key assumptions that positive interactions produce relational exchange norms that govern an exchange relationship. The findings also confirm the strength of SET constructs as mechanisms in managing risks associated with switching cost. This study also contributes to TCE by revealing that relational mechanisms can effectively manage the risks associated with high switching cost, instead of solely relying on contractual governance mechanisms.

Sixth, Hypotheses H5b, H5c, and H5d, proposed that trust and information sharing, trust and commitment, and trust and flexibility jointly mediate the negative influence of negotiation costs on procurement risk management performance. Hypotheses H5b, H5c, and H5d were supported. Hypothesis H5e was also supported, confirming that trust mediates the negative influence of negotiation costs on procurement risk management performance. The empirical findings of these mediating relationships which had not been tested in previous studies, extends the literature in two-folds. It contributes to SET by validating SET assumptions about relational norms, confirming the effectiveness of SET

constructs as procurement risk management mechanisms to reduce negotiation costs in the post-contract award phase. The findings also contribute to TCE by confirming that relational mechanisms can be used as a substitute to be formalised governance mechanisms in managing negotiation costs.

Seventh, the results provide new empirical finding that combining trust with information sharing, commitment and flexibility offers more reliable pathways through which organisations can mediate the negative effect of switching cost on procurement risk management performance than using trust alone. This finding is based on the R^2 assessment reports which showed that trust combined with other sociological mechanisms, provided a higher explanatory power (R^2) of 69% for the variance in procurement risk management performance (see Table 4-4), compared to 51% explanatory power when trust is used as a single mediation mechanism. This comparison had not been studied in the procurement literature. This finding contributes to SET by emphasising the strategic value of SET relational norms in managing long-term relationships.

Eighth, the results also provide new empirical finding that combining trust with information sharing, commitment and flexibility offers more reliable pathways through which organisations can mediate the negative effect of negotiation cost on procurement risk management performance than using trust alone. This is also based on the higher explanatory power (R^2) of 69% of using joint mechanisms. This finding also contributes to SET, underscoring the importance of SET norms in not only improving buyer-supplier relationships but also reducing transaction costs.

4.8.1 Contribution to theory

This study makes several contributions to the extant literature. A summary of the contributions to theory is presented below.

First, this study contributes to the procurement and supply literature by empirically establishing a direct negative relationship between switching costs

and procurement risk management performance, as well as between negotiation costs and procurement risk management performance in the post-contract award phase. In the current procurement and supply literature, researchers have been interested in procurement risks related to the COVID-19 19-pandemic (Chase et al., 2025; Yildiz et al, 2025; Khan et al., 2025; Wang et al., 2024; Khuan et al., 2023; El Baz & Ruel, 2021) and geopolitical disruptions (Carnovale et al., 2025; Bednarski et al., 2025; Zheng et al., 2025; Roscoe et al., 2022). A few studies have examined the link between switching costs and sustainable relationships (Lee & Park, 2021; Geiger et al., 2021; Guandalini et al., 2019), whereas studies on negotiation costs remain scarce in the literature (Dudek et al., 2007). Despite the roles of switching costs and negotiation costs as drivers of transaction costs that impact organisations' financial performance (Cao & Lumineau, 2015; Zaheer et al., 1998), there is still a limited understanding of procurement risks stemming from switching costs and negotiation costs, as well as their influence on PRM performance. This study's focus on switching costs and negotiation costs as critical procurement risks is a significant contribution to the existing literature, enhancing the understanding of procurement risks that emerge during the execution stage after contracts have been signed, particularly in manufacturing industries where asset specificity is high.

Second, this study contributes to the literature by providing empirical evidence that trust has a positive influence on information sharing, commitment, and flexibility during the post-contract award phase. These findings support the key premise of social exchange theory (SET), which posits that positive interactions over time will produce relational exchange norms (Li et al., 2022; Habib et al., 2020; Wu et al., 2014), aligning with previous studies (Yang et al., 2022; Chowdhury et al., 2021; Mungra et al., 2020; Brown et al., 2019; Kim & Choi, 2015; Wang et al., 2014; Young-Ybarra & Wiersema, 1999). Specifically, this study contributes to the existing body of literature by providing empirical evidence that trust, information sharing, commitment, and flexibility have a direct and positive impact on procurement risk management performance during the

post-contract award phase. This direct link has not been discussed in the literature.

Third, this study contributes to the literature by providing new empirical evidence that combining trust and information sharing, commitment, and flexibility jointly mediate the negative influence of switching costs on PRM performance. The mediating influence of these SET mechanisms on switching cost and procurement risk management performance had not been previously studied in the literature. These findings provide support for SET by validating the strength of SET constructs as mechanisms in managing risks associated with switching costs. This study also contributes to TCE by revealing that relational mechanisms can effectively manage the risks associated with high switching costs, rather than relying solely on contractual governance mechanisms.

Fourth, this study also contributes empirical evidence that combining trust with information sharing, commitment, and flexibility jointly mediates the negative influence of negotiation costs on PRM performance. The empirical findings of these mediating relationships, which had not been previously tested, extend the literature in two ways. It contributes to SET by validating SET assumptions about relational norms, confirming the effectiveness of SET constructs as procurement risk management mechanisms to reduce negotiation costs in the post-contract award phase. The findings also contribute to TCE by confirming that relational mechanisms can be used to complement contractual governance mechanisms in managing negotiation costs, aligning with the findings from Cao & Lumineau (2015) and Zaheer et al. (1998).

Fifth, this study suggests that combining trust with information sharing, commitment, and flexibility cannot jointly mediate the negative influence of supplier opportunistic behaviour on procurement risk management performance. It also provides empirical evidence that combining trust with information sharing, commitment, and flexibility cannot mediate the negative influence of environmental uncertainty on procurement risk management performance. This study contributes to the literature by empirically challenging the sufficiency of

sociological mechanisms in procurement risks management of environmental uncertainty and supplier opportunistic behaviours in the post-contract award phase, while validating the importance of integrating contractual governance to complement sociological mechanisms. This study aligns with the findings of Wang et al. (2024), which suggest that sociological mechanisms are not sufficient mediating mechanisms. Furthermore, it contributes to the complement-substitute debate by suggesting that organisations need to include contractual governance mechanisms to complement sociological mechanisms in managing exchange risks (Lumineau et al., 2022; Zhang et al., 2020; Shazard et al., 2018; Cao & Lumineau, 2015).

Sixth, this study also contributes new empirical evidence that combining trust with information sharing, commitment, and flexibility offers more reliable pathways through which organisations can mediate the negative effects of switching costs on PRM performance than using trust alone. Furthermore, the study also contributes new empirical findings that combining trust with information sharing, commitment, and flexibility offers more reliable pathways through which organisations can mitigate the negative effects of negotiation costs on PRM performance than using trust alone. Previous studies have suggested different combinations of SET constructs in managing buyer-supplier relationships (Yang et al., 2022; Chowdhury et al., 2021; Mungra et al., 2020; Brown et al., 2019; Morgan & Hunt, 1994). However, the comparison between using these combinations and relying solely on trust as a mediation mechanism has not been discussed in the literature. This study contributes to the existing literature by suggesting that combining SET constructs provides a more robust procurement risk governance effect than using them in isolation in the post-contract award phase. This also validates the core SET assumptions regarding the necessity of reciprocal behaviors and relational norms in managing exchange relationships (Saglam et al., 2022; Ali & Khalid, 2017).

4.8.2 Contribution to practice

First, this study provides procurement professionals with practical insights into the critical procurement risks that arise during the post-contract award phase, following contract signing. It highlights the need to mitigate switching costs and negotiation costs as these risks negatively influence procurement risk management performance. Second, this study equips procurement professionals with a clearer understanding of how to manage switching costs and negotiation costs and improve risk management performance by designing a more robust governance strategy that incorporates a combination of sociological mechanisms, including trust, information sharing, commitment, and flexibility. Furthermore, based on the mediating role of sociological mechanisms between procurement risks and procurement risk management performance, the author recommends that procurement teams and organisations develop positive professional relationships with suppliers, especially strategic ones, and consider developing practices to enhance buyer-supplier relationships.

Third, this study contributes explicitly to the procurement professionals' risk management ability, equipping them with the knowledge to combine sociological mechanisms, including trust, information sharing, commitment, and flexibility, with contractual governance mechanisms to mitigate supplier opportunistic behaviours and environmental uncertainties in the post-contract award phase. The author suggests that managers should encourage their procurement teams to proactively develop positive relationships by holding review meetings that promote information sharing and commitment and be flexible in their approach to procurement risk management.

4.8.3 Limitations and future research areas.

First, the PLS-SEM analysis and results in the study were based on questionnaire survey data from 313 procurement professionals from the USA automotive manufacturing industry. The small sample size limits the generalization of this research findings to all industries within the manufacturing sector. Future researchers should explore gathering and using larger data from other countries to examine the validity of the results.

Second, future studies can use another data analytical method to test the same hypotheses. Third, switching costs and negotiation costs as transaction have not been extensively studied in the literature, even though they are critical drivers of transaction costs. Future research can focus specifically on investigating how switching costs influence transaction costs in the health sector. Fourth, building on this study's findings that relational mechanisms are not sufficient mediators of environmental uncertainties, the author encourages future researchers to investigate how contractual mechanisms can be combined with relational mechanisms to manage environmental uncertainty in the post-contract award phase.

Fifth, this study focused on sociological mechanisms as mediators between negotiation costs and procurement risk management performance. Future studies should examine how organisational culture as a moderator, the relationship between negotiation cost and procurement risk management performance.

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5 CONCLUSION

5.1 Introduction

The main aim of this PhD research was to investigate how procurement risk management strategies are used to manage procurement risks in the post-contract award phase in manufacturing organisations. The thesis followed a PhD by papers format, comprising three studies: a systematic literature review (Paper 1), an abductive qualitative study (Paper 2), and a quantitative investigation using structural equation modelling (Paper 3). The overarching research question was "*How are procurement risk management strategies used in the post-contract award phase?". This thesis has* three key research objectives:

1) To investigate how procurement risk management strategies are used to manage risks in the three procurement phases: Pre-contract, selection & contracting, post-contract award.

2) To develop an evidence-based procurement risk management model for managing procurement risks in the post-contract award phase.

3) To evaluate how sociological mechanisms influence procurement risks including, exchange risks and transaction costs, and procurement risk management performance in the post-contract award phase.

The remaining parts of this conclusion chapter are organized as follows. Section 5.2 presents a summary of each of the studies in this thesis and illustrates their individual contributions to answering the research question. It also shows how all the studies are interlinked, mapping the relevant findings to the research objectives. The theoretical contribution of this thesis to the procurement and supply body of knowledge, the contribution to practice, thesis limitations and future research directions are then presented in Section 5.3.

5.2 Review of research findings and objectives

This section provides a summary of the key findings in Chapters 2, 3, and 4, (shown in Figure 5-1), demonstrating how each chapter achieves the research objectives and contributes to answering the overarching research question.

The first research objective is addressed in Chapter 2 (Paper 1). A systematic literature review of 100 peer-reviewed journal articles revealed the procurement risks, tools, techniques, and strategies used to manage procurement risks in the extant literature (Nyamah et al., 2023; Vieira et al., 2022; Dixit et al., 2022; Aghajanian, 2018; Hong & Lee, 2013). Based on the review of the articles, the author developed a conceptual procurement risk management framework to manage risks in the three procurement phases. The framework integrated risk identification, assessment, and mitigation into the three procurement phases: pre-contract, selection and contracting, and post-contract award. This conceptual framework suggests that a more holistic risk management approach can be achieved by combining in-depth interviews, collaboration, and site visits with data analytics and artificial intelligence tools to identify and assess risks and implementing a combination of proactive and reactive strategies. This paper contributes to the procurement and supply chain literature by systematically synthesising risk management strategies in the three procurement phases.

The second research objective is addressed in Chapter 3 (paper 2). The qualitative study presents an in-depth investigation into how procurement risk management strategies are used in the post-contract award phase. The review of empirical data from procurement professionals across seven manufacturing industries showed that organisations are impacted mainly by risks from contract design, supplier relationship, ethical, supplier performance, and disruption issues in the post-contract award phase, and organisations implement a combination of data analytics, artificial intelligence tools, and human-engagement techniques to manage these risks. The author compared these findings with the conceptual framework in the SLR study. Based on this, the conceptual framework was

revised, improved, and validated, resulting in the development of an evidence-based model for procurement risk management in the post-contract award phase. This model presents a three-stage risk management process, including risk identification, assessment, and mitigation, supported by five critical activities: identifying and classifying risks, analysing and prioritising the risks, and selecting appropriate mitigation strategies. Additionally, it specifies the types of risks to consider, the types of analysis to conduct, and the types of proactive and reactive strategies for mitigation. The model also integrates technological tools and human engagement techniques to support each stage of the process, highlighting key risk management variables grounded in transaction cost economics and social exchange theory. Paper 2 findings contribute to the procurement and supply literature by providing empirical evidence on how procurement risk management strategies are used in the post-contract award phase.

The third research objective is addressed in Chapter 4 (paper 3). The quantitative study statistically assessed the mediating influence of sociological mechanisms on procurement risks and procurement risk management performance. The procurement risks included: supplier opportunistic behaviour, environmental uncertainty, switching costs and negotiation costs, while the sociological mechanisms included trust, information sharing, commitment and flexibility. A statistical comparison is made between using trust alone as a sociological mediation mechanism and using a combination of trust with information sharing, commitment and flexibility as a sociological mediation mechanism. The findings from the survey- based PLS-SEM study provided new empirical evidence that the combined use of sociological mechanisms provide more reliable pathways through which organisations can mediate the negative effect of switching cost and negotiation cost on procurement risk management performance than using trust alone. In addition, the study also revealed that sociological mechanisms, whether single or combined, cannot mediate the negative effects of supplier opportunistic behaviour and environmental uncertainty on procurement risk management performance. The study also

validated prior understanding that trust positively influences information sharing, commitment, and flexibility (Morgan and Hunt,1994; Young-Ybarra & Wiersema,1999; Wang et al.,2014).

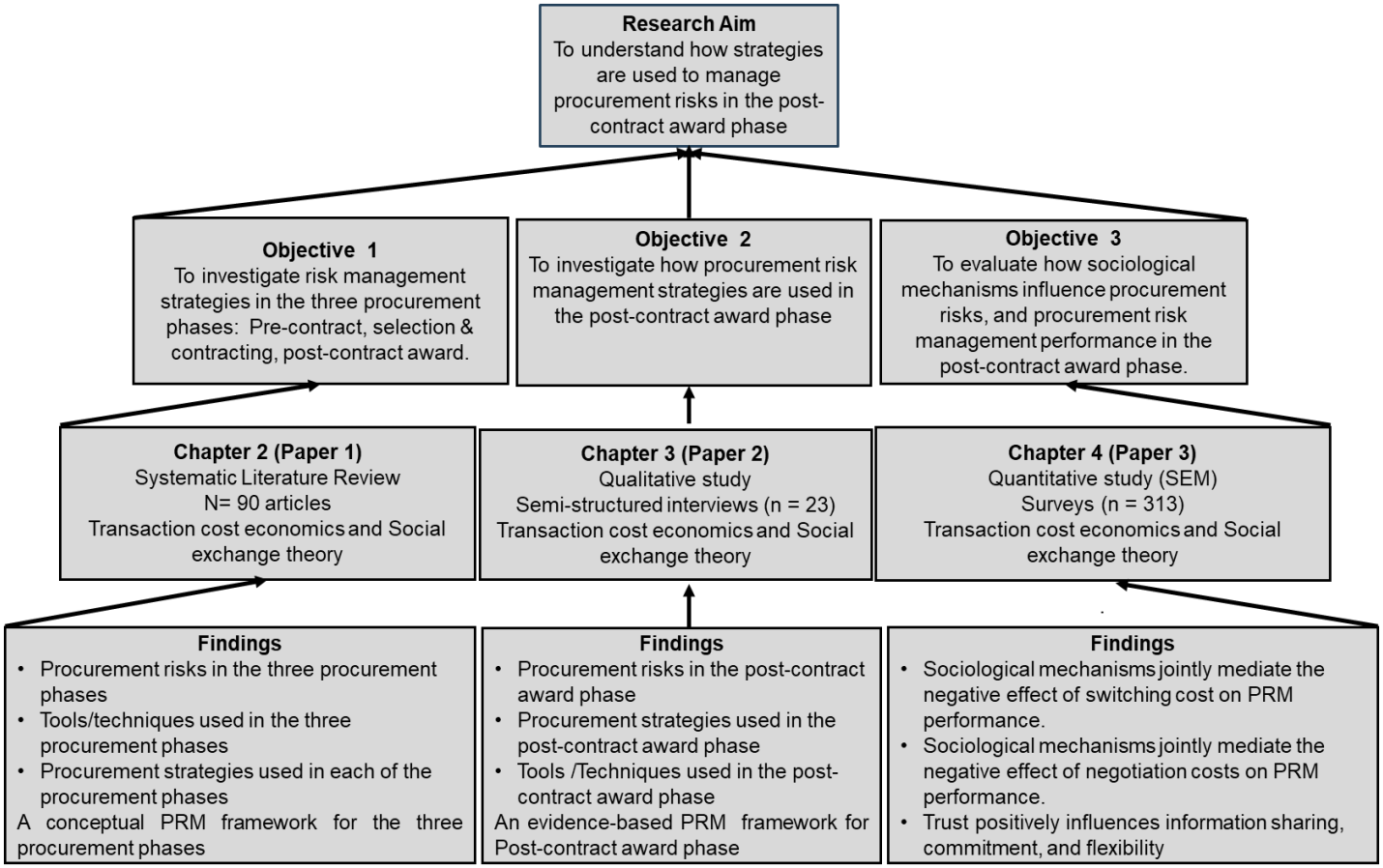


Figure 5-1 Overview of thesis studies alignment with research objectives (Source: Author)

5.3 Contributions

5.3.1 Contribution to knowledge

The primary aim of this thesis was to investigate how strategies are used to manage procurement risks in the post-contract award phase. Transaction cost economics and social exchange theory were applied as its theoretical framework, with the manufacturing sector as its context. This PhD thesis provide several contributions to procurement and supply chain body of knowledge. It extends the current understanding of procurement risk management in the post-award contract phase, elaborating relevant theories to gain deeper insight into procurement risk management, exhibiting the value of qualitative and quantitative methods and providing the basis for future research directions.

5.3.1.1 Paper 1 (Chapter 2) contributions

First, paper 1 (Chapter 2) of this PhD thesis is the first research to provide a comprehensive review of how risk management strategies are used in the three procurement phases: pre-contract, selection and contracting, and post-contract award. This aligns with Remko's (2020) call for procurement risk management to be considered throughout the procurement phases. This SLR study contributes to the existing literature by aligning the fragmented strands of risk management literature, and systematically synthesizing the procurement risks, the tools and techniques to identify, assess, and mitigate risks, and the risk mitigation strategies in each procurement phase.

Second, paper 1 contributes to the literature by identifying the gaps in the current literature. The SLR revealed that earlier studies in the existing literature have primarily focused on procurement risk identification and assessment in the pre-contract phase (Tavana et al. 2022; Handayani et al., 2022; Ghadge et al., 2017; Cagno et al., 2011), as well as supplier risk assessment in the selection and contracting phases (Kara et al., 2018; Lockamy & McCormack, 2015; Micheli, 2008). However, studies have largely neglected the tools and techniques to

identify, assess, or mitigate procurement risks in the post-contract award phase. As such, this PhD thesis was designed to investigate these unexplored areas, applying transaction cost economics and social exchange theory to provide deeper insights and a more holistic view of procurement risk management.

Third, paper 1 also contributes to the literature by providing a conceptual procurement risk management model, providing a comprehensive approach to risk management in the three procurement phases. This framework employs transaction cost economics (TCE) theory and the social exchange theories as theoretical lenses to better understand procurement risks, the complexities in developing contractual relationships with third parties, and relevant risk mitigation strategies (Tate et al., 2022). The conceptual framework integrates risk identification, assessment, and mitigation strategies with the three procurement phases: pre-contract, selection and contracting, and post-contract award. This integration offers a holistic understanding of how PRM strategies can be successfully developed and implemented to minimise the impact of supply disruptions and enhance procurement performance. This framework serves as a valuable starting point, providing an overview of how the PRM processes comprising of risk identification, assessment, and mitigation interacts with the three procurement phases. Additionally, this model outlines the primary activities involved in each stage of identification and assessment, along with a breakdown of mitigation strategies, tools and techniques employed during the three procurement phases.

5.3.1.2 Paper 2(Chapter 3) contributions

First, the qualitative study in paper 2 (Chapter 3) contributes to the literature by providing a new empirical evidence-based procurement risk management model that integrates procurement risk identification, assessment, and mitigation strategies into the post-contract award phase. The model offers 1) a breakdown of the five different procurement risk categories: supplier performance risk,

contract-related risks, supplier relationship risks, ethical risks, and disruption risk, 2) a breakdown of the risk assessment activities in the post-contract award phase: supplier risk analysis, market risk analysis, supplier evaluation, and risk prioritisation, and 3) combines human engagement techniques with technological tools to identify and assess procurement risks and to develop appropriate proactive and reactive mitigation strategies. The integration of human engagement techniques, such as review meetings, reinforces the social exchange theory, which emphasizes the importance of positive interactions leading to relational norms, including information sharing and commitment, and enabling the risk management activities highlighted in the model, aligning with the findings of Saglam et al. (2022).

Second, paper 2 (Chapter 3) identification of five specific categories of procurement risks, including supplier performance risks, supplier relationship risks, contract design risks, ethical risks, and disruption risks, supports TCE's core assumption that governance structures are required to minimise risks and transaction costs arising from bounded rationality, uncertainty, and opportunistic behaviours. The findings support the existing procurement and supply literature that substantial and dynamic risks emerge from interactions and engagement with third parties after contract award (Schoenherr et al., 2023; Junaid et al., 2020), The identification of supplier performance risks and the risk management strategies support TCE assumptions because such procurement risks stem from opportunistic behaviour resulting from single-source relationships and supplier dependency (Raj et al., 2022). Such relationships create lock-in situations that make it difficult for buying organizations to conduct performance reviews, leading to poor quality and late deliveries, aligning with the findings in current literature (Chowdhury et al., 2025; Hashim et al., 2024; Schoenherr et al., 2023; Dixit et al., 2022; Lumineau et al., 2022). Specifically, this study differs from previous studies because it highlights the combination of proactive strategies, such as facility inspections, compliance audits, and assurance certificates, with reactive strategies, including quality tests, corrective action plans, and supplier

performance audits, which have not been extensively applied as risk management strategies in the current literature.

Third, paper 2 (Chapter 3) also contributes to the PRM literature by providing empirical evidence on how manufacturing industries use data analytics and machine learning tools for risk identification, assessment, and mitigation in the post-contract award phase. The research on data analytics and machine learning in procurement is still in its early stages. In the current literature, studies have discussed the potential of data analytics and artificial intelligence in supply chain management (Tian et al., 2024; Spreitzenbarth et al., 2024; Kang et al., 2024; Belhadi et al., 2021; Jahani et al., 2021; Tian et al., 2024). A few studies have provided frameworks on how artificial intelligence can be used in negotiation with suppliers (Herold et al., 2025; Jackson et al., 2024) and to optimise the procurement process (Guida et al., 2025; Guida et al., 2023). However, empirical research on how machine learning predictive capabilities and data analytics technologies are specifically used for procurement risk management in the post-contract award phase is still scarce. This study makes a significant contribution by providing empirical evidence on how to utilise the predictive capabilities of machine learning and data analytics for procurement risk management in the post-contract award phase.

5.3.1.3 Paper 3 (Chapter 4) contributions

First, the quantitative study in paper 3 (Chapter 4) contributes to the procurement and supply literature by empirically establishing a direct negative relationship between switching costs and procurement risk management performance, as well as between negotiation costs and procurement risk management performance in the post-contract award phase. In the current procurement and supply literature, researchers have been interested in procurement risks related to the COVID-19 19-pandemic (Chase et al., 2025; Yildiz et al, 2025; Khan et al., 2025; Wang et al., 2024; Khuan et al., 2023; El Baz & Ruel, 2021) and geopolitical

disruptions (Carnovale et al., 2025; Bednarski et al., 2025; Zheng et al., 2025; Roscoe et al., 2022). A few studies have examined the link between switching costs and sustainable relationships (Lee & Park, 2021; Geiger et al., 2021; Guandalini et al., 2019), whereas studies on negotiation costs remain scarce in the literature (Dudek et al., 2007). Despite the roles of switching costs and negotiation costs as drivers of transaction costs that impact organisations' financial performance (Cao & Lumineau, 2015; Zaheer et al., 1998), there is still a limited understanding of procurement risks stemming from switching costs and negotiation costs, as well as their influence on PRM performance. This study's focus on switching costs and negotiation costs as critical procurement risks is a significant contribution to the existing literature, enhancing the understanding of procurement risks that emerge during the execution stage after contracts have been signed, particularly in manufacturing industries where asset specificity is high.

Second, paper 3 (Chapter 4) also contributes to the literature by providing empirical evidence that trust has a positive influence on information sharing, commitment, and flexibility during the post-contract award phase. These findings support the key premise of social exchange theory (SET), which posits that positive interactions over time will produce relational exchange norms (Li et al., 2022; Habib et al., 2020; Wu et al., 2014), aligning with previous studies (Yang et al., 2022; Chowdhury et al., 2021; Mungra et al., 2020; Brown et al., 2019; Kim & Choi, 2015; Wang et al., 2014; Young-Ybarra & Wiersema, 1999). Specifically, this study contributes to the existing body of literature by providing empirical evidence that trust, information sharing, commitment, and flexibility have a direct and positive impact on procurement risk management performance during the post-contract award phase. This direct link has not been discussed in the literature.

Third, paper 3 (Chapter 4) also contributes to the literature by providing new empirical evidence that combining trust and information sharing, commitment, and flexibility jointly mediate the negative influence of switching

costs on PRM performance. The mediating influence of these SET mechanisms on switching cost and procurement risk management performance had not been previously studied in the literature. These findings provide support for SET by validating the strength of SET constructs as mechanisms in managing risks associated with switching costs. This study also contributes to TCE by revealing that relational mechanisms can effectively manage the risks associated with high switching costs, rather than relying solely on contractual governance mechanisms.

Fourth, paper 3 (Chapter 4) contributes empirical evidence that combining trust with information sharing, commitment, and flexibility jointly mediates the negative influence of negotiation costs on PRM performance. The empirical findings of these mediating relationships, which had not been previously tested, extend the literature in two ways. It contributes to SET by validating SET assumptions about relational norms, confirming the effectiveness of SET constructs as procurement risk management mechanisms to reduce negotiation costs in the post-contract award phase. The findings also contribute to TCE by confirming that relational mechanisms can be used to complement contractual governance mechanisms in managing negotiation costs, aligning with the findings from Cao & Lumineau (2015) and Zaheer et al. (1998).

Fifth, paper 3 (Chapter 4) suggests that combining trust with information sharing, commitment, and flexibility cannot jointly mediate the negative influence of supplier opportunistic behaviour on procurement risk management performance. It also provides empirical evidence that combining trust with information sharing, commitment, and flexibility cannot mediate the negative influence of environmental uncertainty on procurement risk management performance. This study contributes to the literature by empirically challenging the sufficiency of sociological mechanisms in procurement risks management of environmental uncertainty and supplier opportunistic behaviours in the post-contract award phase, while validating the importance of integrating contractual governance to complement sociological mechanisms. This study aligns with the

findings of Wang et al. (2024), which suggest that sociological mechanisms are not sufficient mediating mechanisms. Furthermore, it contributes to the complement-substitute debate by suggesting that organisations need to include contractual governance mechanisms to complement sociological mechanisms in managing exchange risks (Lumineau et al., 2022; Zhang et al., 2020; Shazard et al., 2018; Cao & Lumineau, 2015).

Sixth, paper 3 (Chapter 4) also contributes new empirical evidence that combining trust with information sharing, commitment, and flexibility offers more reliable pathways through which organisations can mediate the negative effects of switching costs on PRM performance than using trust alone. Furthermore, the study also contributes new empirical findings that combining trust with information sharing, commitment, and flexibility offers more reliable pathways through which organisations can mitigate the negative effects of negotiation costs on PRM performance than using trust alone. Previous studies have suggested different combinations of SET constructs in managing buyer-supplier relationships (Yang et al., 2022; Chowdhury et al., 2021; Mungra et al., 2020; Brown et al., 2019; Morgan & Hunt, 1994). However, the comparison between using these combinations and relying solely on trust as a mediation mechanism has not been discussed in the literature. This study contributes to the existing literature by suggesting that combining SET constructs provides a more robust procurement risk governance effect than using them in isolation in the post-contract award phase. This also validates the core SET assumptions regarding the necessity of reciprocal behaviors and relational norms in managing exchange relationships (Saglam et al., 2022; Ali & Khalid, 2017).

5.3.2 Contribution to practice

The PhD thesis on procurement risk management makes significant contributions to practice.

First, the findings from this thesis provide procurement professionals with a deeper understanding of the procurement risk management process. It informs practitioners of the specific risks and tools/techniques to identify, assess, and mitigate potential risks in each of the procurement phases. It also helps them to understand the risk management strategies. The findings of this review will guide procurement professionals in developing appropriate sourcing strategies during the pre-contract phase, while also enhancing the supplier evaluation process to prevent the selection of high-risk suppliers into their organisation's supply base during the selection and contracting phase. Additionally, the findings provide actionable insights and mitigation strategies for practitioners in the post-contract award phase, enabling them to guard against delays and stockouts.

Second, the qualitative study in this thesis provides procurement professionals with practical insights into the Procurement risk management process at the post-contract award phase. The evidence-based procurement risk mitigation model offers practitioners a structured and holistic approach to risk management. It serves as a plan for undertaking the essential activities required to identify, assess and mitigate procurement risks in manufacturing organisations. It also suggests strategies for identifying, assessing, and mitigating potential procurement risks. The model also provides an understanding of how technological tools, such as data analytics and artificial intelligence, are combined with human engagement techniques, including interviews and site visits, to enable practitioners to identify and classify, analyse, and prioritize risks and to select appropriate proactive and reactive strategies in the post-contract award phase.

Third, the quantitative study in this thesis provides procurement professionals with practical insights into the critical procurement risks that arise during the post-contract award phase, following contract signing. It highlights the need to mitigate switching costs and negotiation costs as these risks negatively influence procurement risk management performance.

Fourth, this study equips procurement professionals with a clearer understanding of how to manage switching costs and negotiation costs and improve risk management performance by designing a more robust governance strategy that incorporates a combination of sociological mechanisms, including trust, information sharing, commitment, and flexibility. Furthermore, based on the mediating role of sociological mechanisms between procurement risks and procurement risk management performance, the author recommends that procurement teams and organisations develop positive professional relationships with suppliers, especially strategic ones, and consider developing practices to enhance buyer-supplier relationships.

Fifth, this study contributes explicitly to the procurement professionals' risk management ability, equipping them with the knowledge to combine sociological mechanisms, including trust, information sharing, commitment, and flexibility, with contractual governance mechanisms to mitigate supplier opportunistic behaviours and environmental uncertainties in the post-contract award phase. The author suggests that managers should encourage their procurement teams to proactively develop positive relationships by holding review meetings that promote information sharing and commitment and be flexible in their approach to procurement risk management.

Overall, this thesis will help to guide top management, and procurement managers' decisions on the allocation of organisations' resources to manage the procurement risks and improve performance in the post award contract phase. Organisations can adapt the models to suit their risk management context.

5.3.3 Limitations and future research directions

While this PhD thesis offers valuable insights into procurement risk management, through a multiple approach, there are several limitations that affect the interpretation and generalisation of the research findings.

First, the SLR is based on the existing body of knowledge on procurement risk management, a domain within supply chain management that is still evolving

and underexplored. One possible explanation for this is that studies have primarily focused on broader supply chain risk management, such as logistics because historically, procurement was regarded as a tactical administrative task rather than a strategic contributor to the business. These assumptions have led to studies overlooking the role of procurement decisions and processes in the post-contract award as a strategic contributor to business performance, thereby not prioritizing procurement research.

Second, although the systematic literature review followed a robust method for identifying and selecting 90 peer-reviewed articles for analysis using well-developed search strings, the author has overlooked other relevant publications not retrieved by the search strings.

Third, in this qualitative research, 23 carefully selected procurement professionals from seven industries within the manufacturing sector were interviewed to gain insights into how procurement risks are managed in the post-contract award phase. While the respondents were professionals with experience in the procurement field, the reliance on data based on personal perspectives from a small sample size of professionals per industry introduce personal bias and limit the generalizability of these research findings to all industries within the manufacturing sector.

Fourth, the PLS-SEM analysis and results in the study were based on questionnaire survey data from 313 procurement professionals from the USA automotive manufacturing industry. The small sample size limits the generalization of these research findings to all industries within the manufacturing sector. Future researchers should explore the gathering and use of larger datasets from other countries to examine the validity of the results.

Fifth, switching costs and negotiation costs have not been extensively studied in the literature, despite being critical drivers of transaction costs. Future research can focus specifically on investigating how switching costs influence transaction costs in the health sector.

Sixth, building on this study's findings that relational mechanisms are not sufficient mediators of environmental uncertainties, the author encourages future researchers to investigate how contractual mechanisms can be combined with relational mechanisms to manage environmental uncertainty in the post-contract award phase.

Seven, this study focused on sociological mechanisms as mediators between negotiation costs and procurement risk management performance. Future studies should examine how organisational culture acts as a moderator in the relationship between negotiation cost and procurement risk management performance.

5.3.4 Concluding remarks

To the best of the author's knowledge, this is the first study to comprehensively investigate procurement risk management across the three procurement phases, specifically employing a multiple methods approach to examine how procurement risk management strategies are utilized in the post-contract award phase. The application of transaction cost economics and social exchange theory as theoretical lenses provided the author a suitable theoretical framework for researching this phenomenon. Paper 1 contributed to objective 1, Paper 2 contributed to objective 2, and Paper 3 contributed to objective 3.

Overall, this PhD thesis has made significant contributions to the current body of knowledge on procurement risk management in the post-contract award phase, laying a solid foundation for future researchers to build upon.

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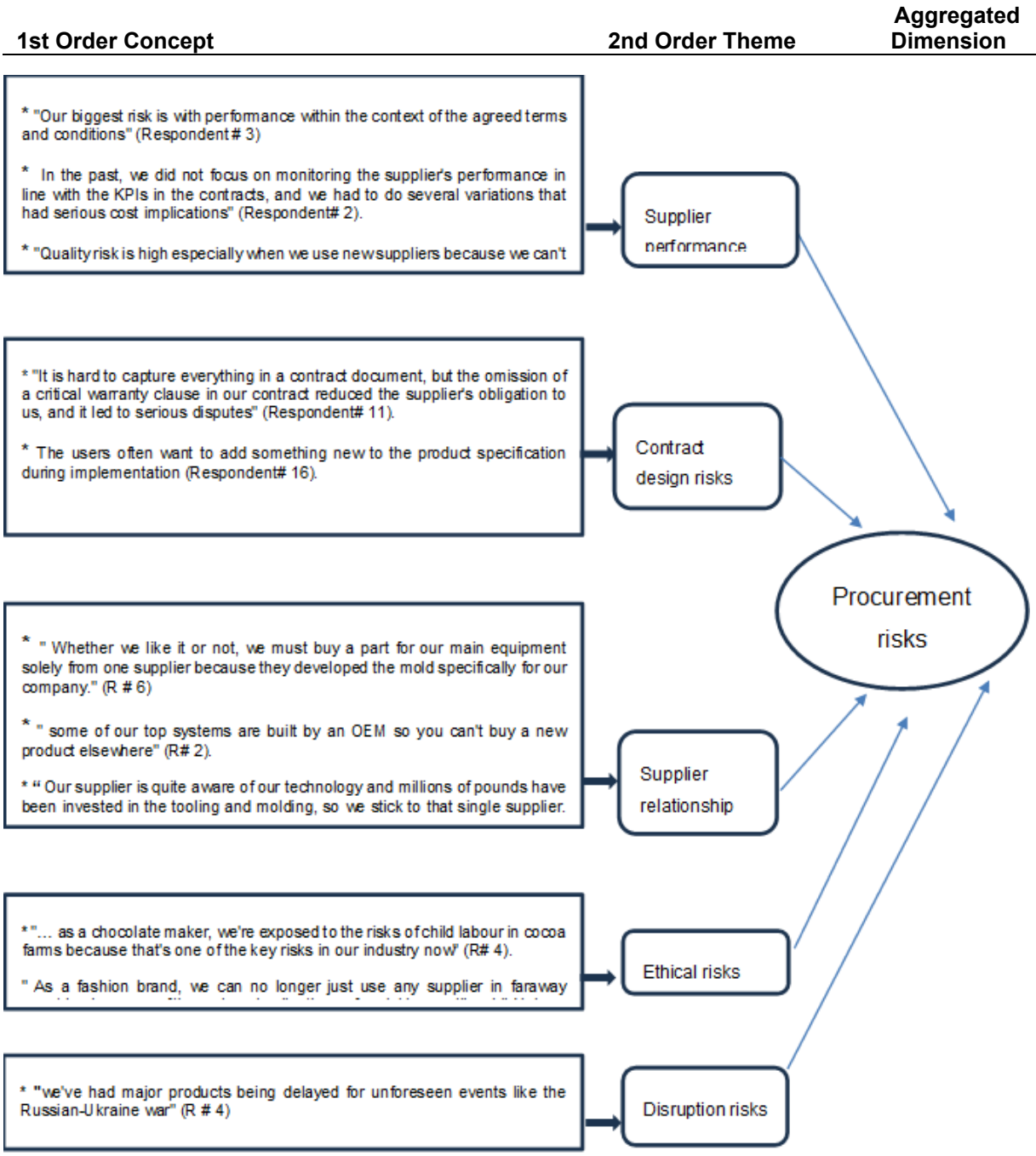
Appendix A Appendices of Chapter 3

A.1 Appendix - Interview Protocol (Source: Author)

General Questions
1. Please briefly describe your job role and personal experience in your company and the industry.
2. What does procurement risk management mean to you?
Please answer the following questions based on your experience.
Procurement risks in the post-award contract phase.
3. In your experience, what types of procurement risks typically arise in the post-contract phase; after you have awarded a contract to a supplier?
4. Do you classify your purchased items/services into different categories? For example, Strategic, Bottleneck, Leverage, and Routine categories
5. Do these risks affect all your categories of procured items in the same way in the post-contract phase?
Tools/techniques used in procurement risk identification, assessment, and mitigation in the post-contract phase.
6. What tools/ techniques do you apply to identify procurement risks that may occur in the post-contract phase?
7. What tools/techniques do you apply to assess and prioritise these procurement risks in the post-contract phase?
8. What tools/ techniques do you apply to manage the risks in the post-contract phase?
9. With data analytics and artificial intelligence technologies emerging, do you apply any of these technologies to identify, assess or mitigate risks in the post-contract phase?
10. How do you adopt these technologies (data analytics and artificial intelligence) to help identify, assess, or mitigate procurement risks?
Procurement risk mitigation strategies used in the post-contract award phase.
11. What procurement risk mitigation strategies does your company apply in the post-contract phase?
12. How do you differentiate the procurement risk mitigation strategies to apply among your suppliers?
13. What role do artificial intelligence and data analytics play in mitigating procurement risks in the post-contract phase?

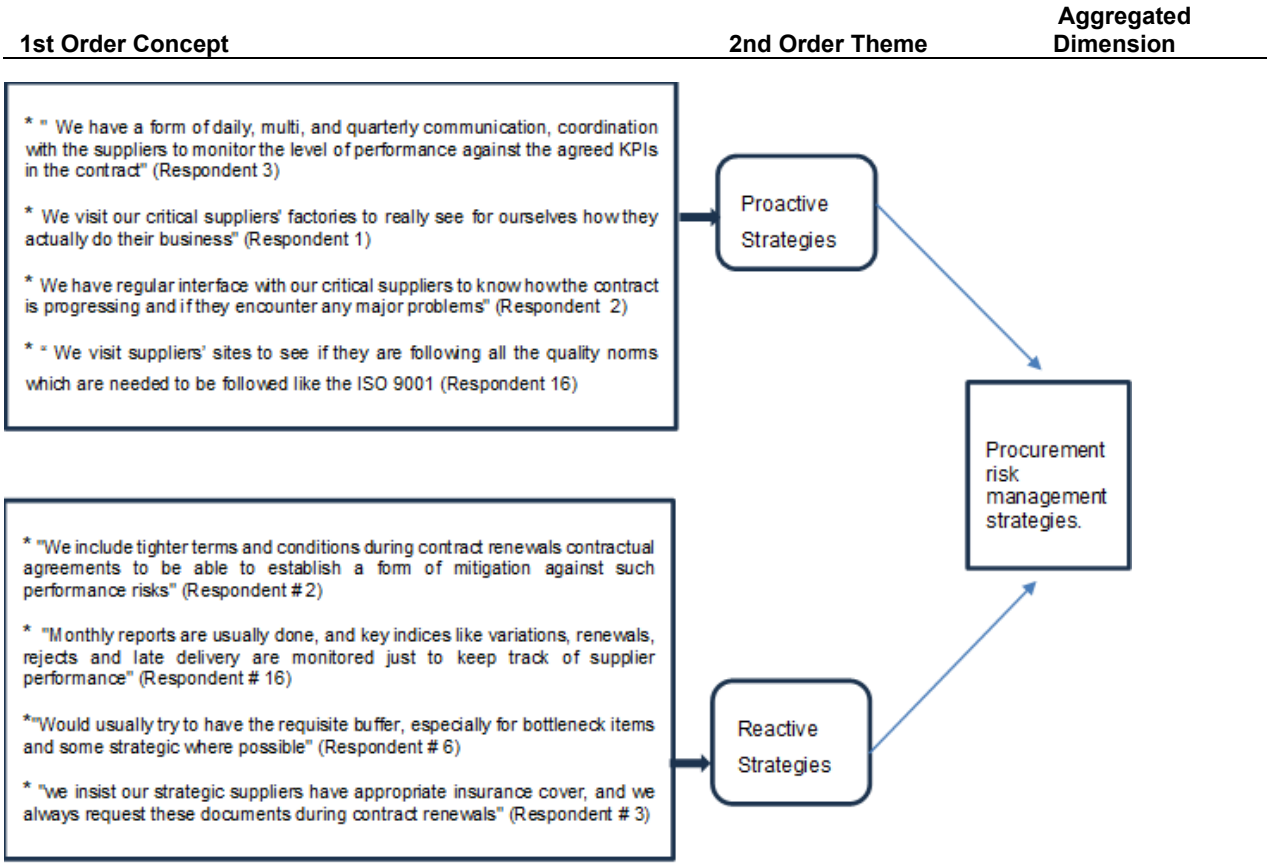
A.2 Appendix - Data Structure for Procurement Risks

(Source: Author)



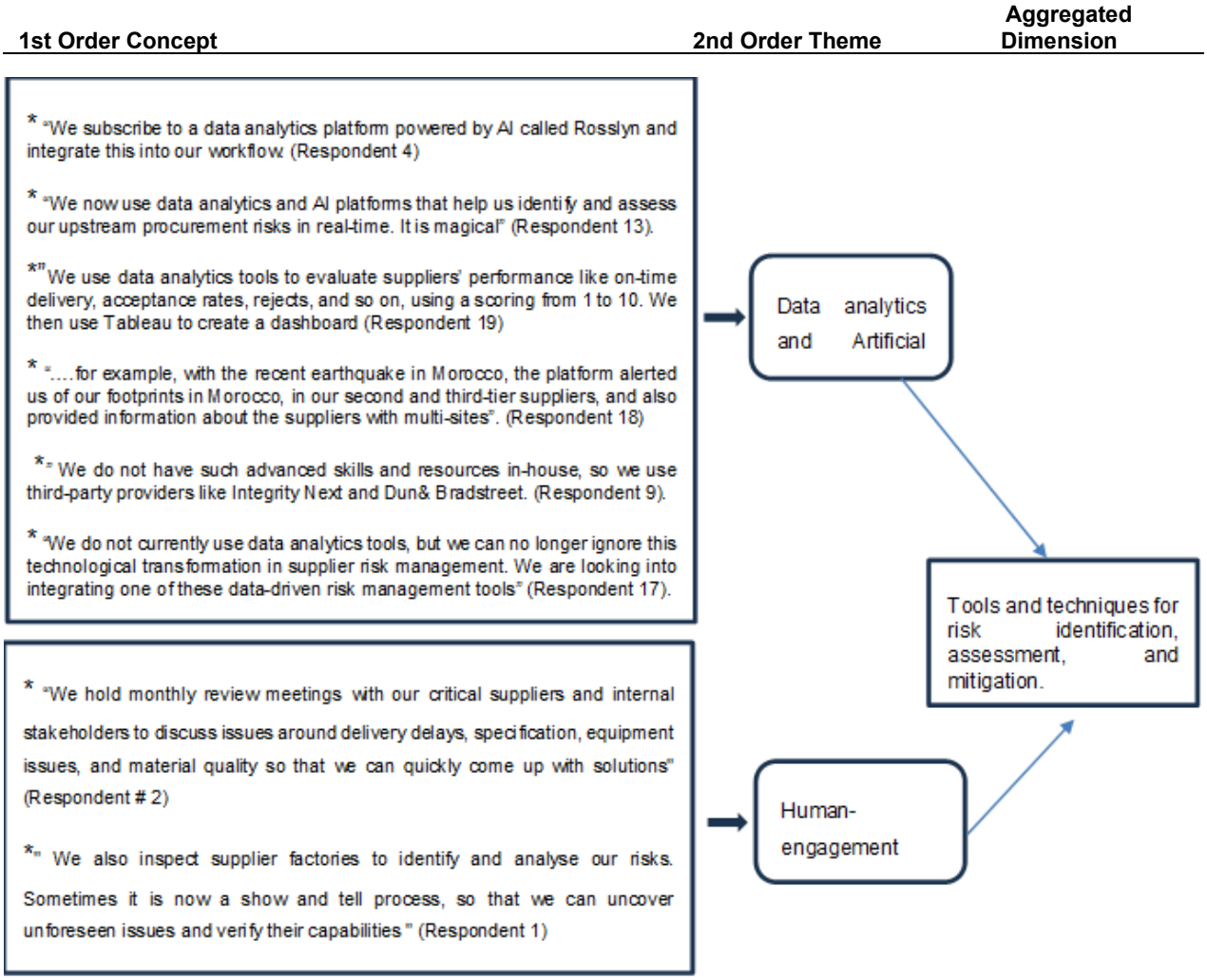
A.3 Appendix - Data Structure for PRM Strategies

(Source: Author)



A.4 Appendix - Data Structure for Tools/Techniques

(Source: Author)



Appendix B Appendices of Chapter 4

B.1 Appendix B.1- Measurement Scale

Constructs	Measurement items	Subset	Theories	Source adapted from
Supplier opportunistic behaviour	1. Our main suppliers sometimes lie about certain things in order to protect their interests	Misrepresentation	TCE	Wang et al., 2015, Liu et al., 2009; Rokkan et al., 2003
	2. Our suppliers often fail to deliver promises, as described in the contract, for their own interests	Non-compliance with agreed terms		
	3. Our suppliers often take advantage of ‘‘holes’’ in our contract to enhance their own interests	Exploitation		
Environmental uncertainty	1. The technology in our industry is changing rapidly	Technological uncertainty	TCE	Yang et al., 2017; Zhou & Poppo, 2010
	2. Prices change frequently in our supply market	Market uncertainty		
	3. Product features change frequently in our supply market	Technological uncertainty		
Behavioural uncertainty	1. It is difficult to measure the performance of our key suppliers.	Supplier Performance	TCE	Poppo et al., 2016; Zhou &Poppo, 2010
	2. It is difficult to evaluate if our key suppliers follow our recommended operating procedures.	Supplier compliance		
	3. We don't have accurate reports about our suppliers' activities	Supplier information		
Switching Cost	1. It takes a lot of time to switch suppliers	Process-related switching cost	TCE	Lee and Park 2021; Barthélemy and Quélin, 2006.
	2. It takes a long time to reintegrate the outsourced activity	Operational adjustment costs		
	3. It cost a lot of money to switch suppliers	Financial costs		
Negotiation Cost	We have easy negotiations with our suppliers over sharing the burden of costs (not explicitly covered by the contract) when our key suppliers' raw material costs increase.	Bargaining cost	TCE	Zaheer et al. 1998; Shahzad et al., 2018
	We have quick negotiations with our suppliers over sharing the burden of costs (not explicitly covered by the contract) when our key Suppliers' raw material costs increase.	Time		Zaheer et al., 1998

Constructs	Measurement items	Subset	Theories	Source adapted from
Trust	1. We trusts our key suppliers to keep their promises.	Reliability	SET	Kim & Choi, 2015; Nyaga et al., 2010; Lui et al., 2009
	2. Our suppliers are likely to be transparent with us if problems arise	Transparency		
	3. Our suppliers will be ready and willing to offer us support, if circumstances change.	Dependability		
Information Sharing	1. Our key suppliers share the production planning schedules with us.	Timely information	SET	Huo et al., 2014
	2. Our key suppliers share their production capacity information with us.	Relevant information		
	3. Our key suppliers share their inventory information with us.	Relevant information		
Flexibility	1. Our key suppliers respond flexibly.	Supplier flexibility	SET	Habib et al., 2020
	2. Our key suppliers adjust rapidly according to changing circumstances.	Adaptability		Ustundag and Ungan, 2020; Swafford et al., 2006
	3. Our key suppliers work out a new deal when circumstances change.	Negotiation flexibility		
	4. Our key suppliers' lead time can be expedited/changed.			
	5.Our key suppliers' short-term capacity can be influenced.	Adaptability		
Commitment	1. Our suppliers expect this relationship to continue for a long time.	Relational	SET	Nyaga et al., 2010
	2. Our suppliers are committed to our organisation.	Relational		
	3. Our suppliers have invested considerable effort and time in building a strong relationship with our organisaton.	Relational		
Procurement risk management performance	1. In recent years, we were able to (taking into account the industry cycle) minimize the frequency of procurement and supply risks occurring	Risk mitigation	TCE	Saglam et al., 2022; Lui et al., 2018
	2. In recent years, we were able to (taking into account the industry cycle) minimize the magnitude of the effect of occurring procurement and supply risks.	Risk mitigation		
	3. Our organisation's ability to confront opportunities and threats in the environment is better compared to recent years.	Risk mitigation		

B.2 Appendix B.2 – Survey Questionnaire

General Questions

1. Please describe your job role
2. How many years of Procurement experience do you have?
3. How would rate your relationship with your key suppliers? (Bad, Good, Neither Good nor Bad)
4. What does procurement risk management mean to you?

Survey questions are based on a 7-point Likert scale as follows:

> (1) Completely Disagree, (2) Mostly Disagree, (3) Somewhat Disagree, (4) Neither Agree nor Disagree, (5) Somewhat Agree, (6) Mostly Agree and (7) Completely Agree.

Please rate the extent to which you agree or disagree with the following statements.

Supplier Opportunistic Behaviour

1. Our suppliers often fail to deliver promises, as described in the contract, for their own interests
2. Our suppliers often take advantage of ‘‘holes’’ in our contract to enhance their own interests
3. Our suppliers sometimes breach informal agreements between our organisations to maximize their own benefits

Environmental Uncertainty

1. Prices change frequently in our supply market
2. The volume of components required from our key suppliers is subject to unpredictable fluctuations.
3. Availability of major products in the market is highly uncertain

Switching Cost

1. It takes a lot of time to switch suppliers
2. It takes a long time to reintegrate the outsourced activity
3. It costs a lot of money to switch suppliers
4. It takes a lot of time to switch process
5. It costs a lot of money to switch System

Negotiation Cost

1. We have easy negotiations with our suppliers over sharing costs when our key suppliers' raw material costs increase.
2. We have easy negotiations with our suppliers over sharing costs when our business units request engineering changes.
3. We have quick negotiations with our suppliers over sharing costs when our key suppliers' raw material costs increase
4. We have quick negotiations with our suppliers over sharing costs when our business units request engineering changes.
5. It is very easy to negotiate prices and payment terms with our key supplier

Trust

1. We believe our key suppliers are concerned about our interests when making important decisions
2. We can count that our supplier's future decisions will not adversely affect us
3. Our suppliers will be ready and willing to offer us support if circumstances change.
4. We believe in our key suppliers because they are sincere
5. When it comes to things that are important to us, we can depend on our suppliers' support.

Information Sharing

1. Our key suppliers share their production planning schedules with us.
2. Our key suppliers share their production capacity information with us.
3. Our key suppliers share their inventory information with us.
4. We share the order forecasting information with our key suppliers.
5. Both parties are expected to keep each other informed about events that may affect the other party.

Flexibility

1. Our key suppliers respond flexibly to requests for changes
2. Our key suppliers adjust rapidly according to changing market needs
3. Our key suppliers work out a new deal when circumstances change.
4. Our key suppliers' lead time can be expedited/changed.
5. Our key suppliers have the capability to make changes in different amounts of order

Commitment

1. Our suppliers expect this relationship to continue for a long time.
2. Our suppliers are committed to our organisation.
3. Our suppliers have invested considerable effort and time in building a strong relationship with our organisation.
4. Our organisation plans to do everything in its power to maintain the relationship among our supply chain partners.
5. Our organisation will continue to devote necessary resources to strengthen the relationship with our key suppliers.

Procurement Risk Management Performance

1. In recent years, we have been able to minimize the frequency of procurement and supply risks occurring
2. In recent years, we have been able to minimize the magnitude of the effect of procurement and supply risks.
3. Our organisation's ability to confront opportunities and threats in the environment is better compared to three years ago.
4. Our procurement and supply risk management is better than that of our competitors
5. Our organisation's resource input into risk management (e.g., material elements and efforts) is better compared to three years ago.
6. Our organisation's level of agility has increased compared to three years ago.
7. Our organisation's level of integration with our key suppliers has increased compared to three years ago.

B.3 Appendix B.3 – HTMT Result (Source: Author)

Constructs	Heterotrait-monotrait ratio (HTMT)
EnUty <-> Cmmt	0.505
FLEXI <-> Cmmt	0.856
FLEXI <-> EnUty	0.486
InfSh <-> Cmmt	0.859
InfSh <-> EnUty	0.420
InfSh <-> FLEXI	0.921
NgtCt <-> Cmmt	0.715
NgtCt <-> EnUty	0.386
NgtCt<-> FLEXI	0.811
NgtCt <-> InfSh	0.759
ProRisk Perf <-> Cmmt	0.896
ProRisk Perf <-> EnUty	0.506
ProRisk Perf <-> FLEXI	0.864
ProRisk Perf <-> InfSh	0.864
ProRisk Perf <-> NgtCt	0.753
SupOB <-> Cmmt	0.104
SupOB <-> EnUty	0.227
SupOB <-> FLEXI	0.070
SupOB <-> InfSh	0.040
SupOB <-> NgtCt	0.091
SupOB <-> ProRisk Perf	0.047
SwCtt_ <-> Cmmt	0.463
SwCt_ <-> EnUty	0.566
SwCt_ <-> FLEXI	0.473
SwCt_ <-> InfSh	0.444
SwCt_ <-> NgtCt	0.271
SwCt_ <-> ProRkRisk Perf	0.503
SwCt_ <-> SupOB	0.177
Trust_ <-> Cmmt	0.805
Trust_ <-> EnUty	0.429
Trust_ <-> FLEXI	0.858
Trust_ <-> InfSh	0.839
Trust_ <-> NgtCt	0.712
Trust_ <-> ProRisk Perf	0.811
Trust_ <-> SupOB	0.036
Trust_ <-> SwCt	0.411

B.4 Appendix B.4 – Collinearity Report (Source: Author)

	VIF
CmmtRelational_Commit De_1	2.116
CmmtRelational_Commit Ef_1	1.753
CmmtRelational_Commit Ex_1	1.632
CmmtRelational_Commit Ma_1	1.925
CmmtRelational_Commitmen_1	1.723
EnUtyDemand Uncertainty_1	1.443
EnUtyProduct Availability_1	1.337
EnUtyProduct Features_Unc_1	1.346
FlxAdaptability_ST Capa_1	1.823
FlxFlexibility_LTE_1	1.893
FlxNegotiation Flexibil_1	2.152
FlxSup Adaptability_Adj_1	1.586
FlxSup Flexibility_Resp_1	2.151
InfShRelevant Informa_Inv_1	1.781
InfShRelevant Informat_PC_1	1.990
InfShTimely Information_1	2.360
InfShTransparency_Events_1	1.753
InfShTransparency_Forcast_1	1.722
NgtCtBargaining Cost_EC_1	1.780
NgtCtBargaining Cost_RMC_1	1.956
NgtCtBargaining Time_EC_1	2.300
NgtCtBargaining Time_RMC_1	2.087
NgtCtBargaining_PT_1	1.520
ProRkRisk Manag Reso Allo_1	2.234
ProRkRisk Managemen_Agil _1	1.738
ProRkRisk Managemen_Min F_1	1.635
ProRkRisk Management_Bett_1	1.698
ProRkRisk Management_Inte_1	1.793
ProRkRisk Mitigat_MinMa _1	1.706
ProRkRisk Mitigation_Conf_1	2.355
SupOBExploitation_1	3.103
SupOBNon-Compliance_Sup_1	3.693
SupOBRenegotiation_Opport_1	3.725
SwCtSwitching Cost_Finan_1	2.201
SwCtSwitching Cost_Opera_1	1.702
SwCtSwitching Cost_Proce_1	1.983
SwCtSwitching Cost_Sup T_1	2.135
SwCtSwitching Cost_Syste_1	1.959
TstTrust_Dependability_1	2.044
TstTrust_Honesty F_1	2.080
TstTrust_Honesty S_1	2.178
TstTrust_Reliability_1	1.675
TstTrust_Transparency_1	1.603