UNIVERSITY OF EDUCATION, WINNEBA

ELECTRONIC PROCUREMENT PRACTICES AND SUPPLY CHAIN PERFORMANCE: THE MODERATING ROLE OF SUPPLIER INVOLVEMENT IN GHANAIAN CONSTRUCTION FIRMS

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DECLARATION

STUDENT'S DECLARATION

I **Anthony Amoako**, hereby declare that this thesis is the result of my own research under supervision and has not been presented by anyone for any academic award in this or any other university. All references used in the work have been duly acknowledged.

I bear sole responsibility for any shortcomings.

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SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of this work was supervised in accordance with the guidelines for supervision of thesis as laid down by the University of Education, Winneba.

NAME OF SUPERVISOR: DR. ISHMAEL NANABA ACQUAH

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Date: ……...…….

DEDICATION

I dedicate this work to myself for a journey of perseverance and growth. It reminded me that every step, challenge, and late night contributed to the achievement. It is also for my incredible family, whose unwavering belief, endless encouragement, and quiet sacrifices have been the constant pillars of my strength and inspiration. Finally to my cherished friends and colleagues, whose laughter, support and genuine camaraderie illuminated the path and made every moment of this endeavor more meaningful. Your presence in my life has been an invaluable gift, and I share this accomplishment with each one of you.

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LIST OF ACRONYMS

SCP	Supply Chain Performance
PLS-SEM	Partial Least Squares Structural Equation Modeling
SPSS	Statistical Package for the Social Sciences
EPP	Electronic Procurement practices
SI	Supplier Involvement

ABSTRACT

The construction sector is increasingly challenged by inefficiencies in procurement and coordination across its supply chains, leading to delays, cost overruns, and reduced competitiveness. Digital transformation through e-procurement, combined with strategic supplier involvement, has been proposed to address these challenges. This study examines the impact of e-procurement practices and supplier involvement on supply chain performance within the construction industry. Adopting a quantitative research approach with a cross-sectional survey design, data were collected using a structured, close-ended questionnaire administered to a sample of 277 construction firms in good standing, selected through a simple random sampling technique. Data analysis was conducted using both descriptive and inferential statistics, applying SPSS for preliminary analysis and Partial Least Squares Structural Equation Modeling (PLS-SEM) for hypothesis testing. The results indicate a significant positive composite effect of e-procurement practices on supply chain performance, with individual components e-sourcing, e-negotiation, and e-evaluation contributing meaningfully to performance outcomes. Supplier involvement also demonstrates a positive and statistically significant effect, and moderation analysis shows that supplier involvement strengthens the relationship between e-procurement practices and supply chain performance. Additionally, moderated mediation analysis reveals significant indirect effects via e-sourcing and e-evaluation, though the effect via e-negotiation is not supported. The findings underscore the importance of integrating digital procurement tools with supplier collaboration strategies to enhance supply chain effectiveness in the construction sector. The study recommends that construction firms institutionalize e-procurement practices and deepen supplier partnerships as part of their long-term strategic initiatives to improve operational efficiency and competitiveness.

CHAPTER ONE

INTRODUCTION

Electronic procurement (e-procurement) has emerged as a transformative mechanism in modern supply chain management, reshaping how organizations source materials, negotiate with suppliers, and manage contractual relationships (Hallikaset al., 2021). In the construction industry where projects are capital-intensive, time-sensitive, and heavily dependent on coordinated supplier networks the efficiency and transparency of procurement processes can significantly influence overall supply chain performance. In Ghana, the construction sector plays a critical role in national development through infrastructure expansion, urbanization, and employment generation (Oteki, 2019). However, persistent challenges such as procurement delays, cost overruns, limited transparency, and weak supplier coordination continue to undermine project outcomes. Against this backdrop, the adoption of electronic procurement practices presents a promising avenue for enhancing operational efficiency, reducing transaction costs, improving information flow, and strengthening accountability. Yet, technology alone may not guarantee improved performance; the extent to which suppliers are actively involved in procurement processes may determine whether digital systems translate into tangible supply chain gains (Ngugi & Ndeto, 2024; Demberere et al., 2023). Understanding how e-procurement practices influence supply chain performance and how supplier involvement moderates this relationship is therefore essential not only for improving firm-level competitiveness but also for advancing project delivery standards and economic development in Ghana. By examining this interplay within Ghanaian construction firms, the study contributes to both theory and practice, offering insights that can inform policy reforms, managerial strategies, and sustainable industry transformation.

1.0 Background to the Study

The rapid growth and technological advancements in today's global business environment have significantly transformed procurement processes, particularly in the construction industry. Electronic procurement (e-procurement) practices have emerged as a strategic approach to enhancing supply chain efficiency, improving cost savings, and ensuring the timely delivery of goods and services. According to Albinkalil (2021), e-procurement uses electronic systems and digital tools in purchasing processes, including sourcing, ordering, and supplier management. This transition from traditional procurement to digital platforms has enabled construction firms to achieve better coordination, visibility, and performance across their supply chain networks (Hallikaset al., 2021).

Supply chain performance is critical to organisational success, particularly within the construction sector, where operational efficiency, cost reduction, and timely production are essential for competitiveness (Pejić Bach et al., 2023). Effective supply chain performance ensures smooth production processes, reduces lead times, and enhances customer satisfaction. E-procurement practices improve supply chain performance by facilitating transparency, reducing transaction costs, minimising errors, and improving communication between firms and suppliers (Oteki, 2019). For instance, e-procurement tools such as electronic data interchange (EDI), e-catalogues, and procurement software streamline procurement activities, thus enhancing efficiency and decision-making processes (Maina, 2023).

Despite the numerous benefits of e-procurement practices, the extent of their impact on supply chain performance often depends on the involvement of key stakeholders, particularly suppliers (Quesada et al., 2010). Supplier involvement refers to the active participation of suppliers in procurement planning, decision-making, and execution,

which fosters collaboration and mutual value creation (Villena, 2019). Suppliers play a critical role in ensuring the success of e-procurement systems by providing timely and quality inputs, aligning production schedules, and sharing valuable insights for process improvements (Honkala, 2024). However, limited supplier involvement can undermine the effectiveness of e-procurement practices, leading to delays, inefficiencies, and suboptimal supply chain performance (Achieng et al., 2024).

The construction industry in Ghana, a key contributor to its economic growth, has witnessed significant challenges in its supply chain operations, including inefficiencies, delays, and high transaction costs (Hamidu et al., 2023). While global studies highlight the positive effects of e-procurement practices on supply chain performance (Desmond, 2022), empirical research specific to the Ghanaian construction sector remains limited. This knowledge gap is particularly critical as Ghanaian construction firms face challenges such as infrastructural deficits, supplier unreliability, and limited technological adoption (Lawrence & Mupa, 2024). For instance, a study by Yevu et al. (2022) revealed that only a fraction of construction firms in Ghana had fully adopted e-procurement systems, citing a lack of supplier readiness and technological constraints as significant barriers.

Furthermore, while supplier involvement is widely recognised as a moderating factor in enhancing supply chain outcomes, its role in the relationship between e-procurement practices and supply chain performance in Ghanaian construction firms remains underexplored (Ngugi & Ndeto, 2024; Demberere et al., 2023). Studies such as Mafini et al. (2020) and Alsaad et al. (2018) emphasise the importance of supplier collaboration in maximising the benefits of e-procurement systems. However, these studies have primarily been conducted in developed economies, where infrastructural and technological support for e-procurement is more advanced. The findings from such

contexts may not entirely apply to emerging economies like Ghana, where supplier engagement and technological capabilities vary significantly.

Therefore, this study draws insights from the theoretical foundations of the resource-based view (RBV) and relational exchange theory to examine the moderating role of supplier involvement in the relationship between e-procurement practices and supply chain performance in the Ghanaian construction industry. The RBV suggests that firms gain competitive advantages by managing internal resources, such as technology and supplier relationships, while relational exchange theory emphasizes the importance of trust and collaboration in inter-organizational partnerships. By integrating these perspectives, the study will provide valuable theoretical and practical contributions. Empirically, it will offer insights into how supplier involvement enhances or impedes e-procurement effectiveness, guiding policymakers and practitioners in optimizing supply chain performance. The findings will be instrumental in shaping strategies to improve operational efficiency and sustainability within Ghana's construction sector.

This study investigates the relationship between e-procurement practices and supply chain performance, with particular emphasis on the moderating role of supplier involvement within Ghana's construction industry. While earlier discussions highlighted the theoretical and practical relevance of this inquiry, this section further augments the study's scope by examining how varying levels of supplier engagement may either enhance or hinder the effectiveness of e-procurement systems. By contextualizing the analysis within the specific institutional and operational dynamics of the Ghanaian construction sector, the study not only deepens our theoretical understanding of digital procurement integration but also offers targeted, actionable insights for industry stakeholders seeking to optimize supply chain outcomes through strategic supplier collaboration.

1.1 Problem Statement

The construction industry in Ghana plays a pivotal role in national economic development, contributing substantially to gross domestic product and employment generation (Ackah et al., 2014). Despite its strategic importance, the industry continues to experience persistent supply chain inefficiencies, manifested in cost overruns, project delays, poor coordination, and limited transparency in procurement processes (Silvestre et al., 2018; Lawrence & Mupa, 2024). These challenges are particularly pronounced in procurement activities, which account for a significant proportion of construction project costs and critically influence overall supply chain performance (SCP).

In response to similar inefficiencies globally, electronic procurement (e-procurement) has emerged as a strategic digital tool for enhancing supply chain integration, improving process efficiency, reducing transaction costs, and strengthening accountability (Asa & Zosu, 2023; Gunasekaran et al., 2019). However, despite policy encouragement and increasing digitalisation efforts, the utilisation of e-procurement within Ghanaian construction firms remains uneven and largely under-exploited (Lawrence & Mupa, 2024). More importantly, existing empirical evidence on the performance outcomes of e-procurement adoption remains inconclusive, particularly in developing and emerging economy contexts.

Prior studies conducted in Africa and other comparable economies have predominantly examined the direct effects of e-procurement on organisational or supply chain performance, often yielding mixed or context-dependent results. While some studies report positive impacts of e-procurement on efficiency, responsiveness, and transparency (Chukwu et al., 2021; Raghul et al., 2024), others indicate that these benefits are constrained by infrastructural limitations, low digital readiness, and weak

inter-organisational coordination (Agaba & Shipman, 2020; Handfield et al., 2022). In African construction settings in particular, empirical investigations have largely focused on adoption drivers and barriers, with limited attention to how and under what conditions e-procurement translates into improved supply chain performance (Baah et al., 2022; Adda, 2024).

A critical shortcoming in the existing literature is the insufficient theorisation and empirical testing of supplier involvement as a contextual mechanism that conditions the effectiveness of e-procurement systems. Supplier involvement defined as the active participation of suppliers in procurement planning, information sharing, and decision-making processes has been recognised as essential for achieving alignment, trust, and interoperability in digital procurement environments (Mafini et al., 2020; Waller & Liao, 2021). Evidence from studies in Asia and other developing economies suggests that e-procurement delivers meaningful performance gains only when supported by high levels of supplier collaboration and integration (Gunasekaran et al., 2019; Bag et al., 2020). Yet, these insights have rarely been extended to the African construction context, where supplier relationships are often fragmented and transactional.

In Ghanaian construction firms, limited supplier involvement has been associated with weak information exchange, low system compatibility, and resistance to digital procurement platforms, thereby undermining potential supply chain performance gains (Baah et al., 2022; Adda, 2024). Despite this, extant Ghana-focused studies have not empirically examined supplier involvement as a moderating variable in the relationship between e-procurement practices and SCP. Consequently, there remains a significant knowledge gap regarding whether the inconsistent performance outcomes of e-

procurement reported in prior African studies may be explained by variations in supplier involvement levels.

This study addresses this gap by systematically examining the relationship between electronic procurement practices and supply chain performance in Ghanaian construction firms, while explicitly testing the moderating role of supplier involvement. By doing so, the study responds directly to calls in the literature for more context-sensitive and theory-driven analyses of digital procurement outcomes in developing economies (Kache & Seuring, 2017; Micheli et al., 2020). The identified gap provides a clear foundation for the study's hypotheses, which posit that the effectiveness of e-procurement practices in enhancing supply chain performance is contingent upon the degree of supplier involvement. Addressing this gap is essential for advancing theory on digital procurement and supply chain collaboration, while also offering practical insights for construction firms and policymakers seeking to optimise procurement reforms in Ghana.

1.2 Research Objectives

The general objective of the study is to examine the moderating role of supplier involvement in the relationship between e-procurement practices and supply chain performance.

The specific objectives of the study are:

i. To examine the relationship between e-procurement practices and supply chain performance.

ii. To examine the relationship between supplier involvement and supply chain performance.

iii. To analyze the moderating role of supplier involvement on the relationship between e-procurement practices and supply chain performance.

1.3 Research Questions

The study seeks to answer the following questions:

i. What is the relationship between e-procurement practices and supply chain performance?

ii. To what extent does supplier involvement influence supply chain performance?

iii. How does supplier involvement moderate the relationship between e-procurement practices and supply chain performance?

1.4 Significance of the Study

This research is significant because it can enhance understanding of electronic procurement (e-procurement) practices and supplier involvement in improving supply chain performance in Ghanaian construction firms. The findings of this study help inform the development of policies and programs to support Ghanaian construction firms in adopting and benefiting from e-procurement practices in efficient and collaborative ways.

The findings of this study will also benefit supply chain managers and practitioners by providing insights into the crucial role of supplier involvement in enhancing the effectiveness of e-procurement practices, thereby achieving better business performance. Previous research has indicated that firms that integrate supplier collaboration into their e-procurement strategies often experience improved supply chain agility, optimized resource allocation, and more robust competitive positioning

(Makudza et al., 2023). Understanding the dynamics of supplier involvement will allow practitioners to implement strategies that maximise the benefits of e-procurement in a sustainable and scalable manner.

This study will provide practical insights for construction firms seeking to enhance their supply chain performance through strategic e-procurement practices and effective supplier partnerships. This research contributes to a deeper understanding of the complex relationships between e-procurement practices, supplier involvement, and supply chain performance by examining these key elements. Recent studies suggest that engaging suppliers more effectively in procurement processes facilitates data sharing and informed decision-making, which is crucial for optimizing real-time supply chain outcomes (Oliveira & Handfield, 2019). The study will also provide important insights and recommendations for firms, policymakers, and other stakeholders on leveraging supplier involvement in e-procurement to foster supply chain improvement in emerging markets.

Additionally, this study will add to the academic literature on the role of supplier involvement in the efficacy of e-procurement practices and the enhancement of supply chain performance. Research has shown that incorporating innovative e-procurement tools and strengthening supplier collaboration significantly impacts a firm's ability to meet supply chain performance goals (Mafini et al., 2020). This study will help readers understand how supplier involvement influences the relationship between e-procurement practices and supply chain outcomes, offering a resource for scholars, entrepreneurs, and students interested in exploring how collaboration and digital procurement tools can drive performance in the construction sector.

In a nutshell, this study contributes to understanding how e-procurement practices and supplier involvement improve supply chain performance in Ghanaian construction

firms. Findings will inform policy development and support firms in adopting e-procurement effectively. Additionally, the research will provide insights for supply chain managers on enhancing supplier collaboration to optimize procurement strategies. Academically, this study adds to the literature on e-procurement, supplier involvement, and supply chain performance, offering a resource for scholars, entrepreneurs, and students.

1.5 Scope of the Study

The study is geographically limited to the Ghanaian business environment, specifically the construction firms in the Greater Accra region. Accra was selected because intense construction activities characterise the city more than other cities in Ghana. Methodologically, the study employs a quantitative approach, relying on cross-sectional data to establish cause-and-effect relationships between the variables. Although other factors could contribute to supply chain performance, the study focused on the role of supplier involvement in facilitating e-procurement practices and supply chain performance.

1.6 Limitations of the study

While this study offers important insights into the impact of e-procurement practices and supplier involvement on supply chain performance within Ghanaian construction firms, several limitations must be acknowledged.

First, the study is limited by its combined industrial and geographic scope. It focuses solely on construction firms within Ghana, a developing country context. Although this provides rich, sector-specific insight into a crucial and underexplored context, it limits the generalizability of the findings. The construction industry, being highly project-based, fragmented, and often dependent on informal supplier networks, differs

significantly from other sectors such as construction, logistics, or retail. Furthermore, Ghana's regulatory environment, infrastructure readiness, and cultural dynamics surrounding digital technology adoption and buyer–supplier relationships may not be representative of other countries. These contextual and sectoral characteristics constrain the extent to which the study's results can be applied across industries or regions. Future research should therefore extend this inquiry to other industries and international contexts to validate or refine the observed relationships.

Second, the study employed a quantitative, cross-sectional design, using survey data collected at a single point in time. While this approach allows for broad analysis of statistical relationships, it does not capture the dynamic and evolving nature of e-procurement adoption and supplier relationships. In practice, the effects of digital procurement systems and relational strategies may unfold over time, influenced by learning curves, trust development, and policy changes. A longitudinal or mixed-methods approach could have provided deeper insights into causal mechanisms and changes over time.

Third, there is a potential for self-reporting bias, as the study relied on responses from firm managers and procurement officers. Participants may have overestimated the effectiveness of their e-procurement practices or the quality of their supplier relationships due to social desirability or subjective perceptions. While statistical controls and validation procedures were used to reduce this risk, the possibility of measurement bias cannot be completely ruled out.

Finally, the study did not account for firm size, ownership structure, or technological maturity, which could influence both the adoption and effectiveness of e-procurement practices. Larger firms, or those with more advanced IT infrastructure, may experience different outcomes compared to small or resource-constrained firms. Future studies

should consider these organizational variables to enhance the explanatory power of the model.

1.7 Organization of the Study

The study comprises five principal chapters: preliminary pages, references, and an appendix. The primary five chapters are introduction, literature review, research technique, data analysis, summary, conclusion, and recommendation. The introductory chapter presents the study context and the primary issue to be addressed. Chapter two encompasses pertinent literature that underpins the investigation, including empirical reviews, theoretical reviews, conceptual reviews, and a conceptual framework. Chapter three delineates a descriptive research technique focusing on data collection and analysis processes. Chapter four delineates the findings and analyses of the data. Section five encapsulates the study's findings, conclusions, recommendations for future research, and practical applications within the sector.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

The second chapter presents a comprehensive review and analysis of the relevant literature in relation to the study's objectives. Relevant concepts derived from the objectives were discussed and presented. The chapter was grouped into a theoretical review, conceptual review, empirical review, conceptual framework and hypothesis development.

2.1 Conceptual Review

This section discusses the concepts of e-procurement practices, supply chain performance, and supplier involvement.

2.2 The Concept and Evolution of Procurement

Procurement is an essential organizational function concerned with the acquisition of goods, services, and works from external sources (Opuwari, 2024). Historically, procurement was considered an operational activity focused primarily on transactional tasks. However, the concept of procurement has evolved significantly over time. This evolution reflects broader changes in business practices, economic conditions, and technological innovations. As procurement has matured, its role has expanded from administrative support to a core strategic function integral to organizational performance and competitiveness (Nii et al., 2024). This conceptual review traces the development of procurement as a discipline and explores the theoretical and practical underpinnings that have shaped its current form.

In its earliest form, procurement was a basic necessity for the functioning of ancient economies. Archaeological evidence from ancient Egypt, Rome, and Mesopotamia

shows that procurement-like activities were carried out for constructing monuments, managing agricultural surpluses, and sustaining military campaigns (Cohen, 2024). These early practices were characterized by manual transactions, barter systems, and rudimentary record-keeping. However, the modern conceptualization of procurement began to take shape during the Industrial Revolution, when increased production capacity created the need for systematic sourcing and inventory management. Organizations began to institutionalize procurement departments to manage purchasing activities, although the function remained largely clerical in nature (Chipuma, 2024).

The conceptual significance of procurement changed during the world wars of the 20th century. Wartime economies required unprecedented coordination of materials, logistics, and suppliers, highlighting the strategic importance of procurement in resource planning and national defense (Hellberg & Lundmark, 2025). After the wars, procurement continued to gain attention as firms sought efficiency in rebuilding economies. However, it was not until the 1960s and 70s that procurement began to emerge as a formal field of academic and professional interest. The introduction of materials management and early supply chain concepts introduced a broader view of procurement as part of an integrated logistics system (Harland, 2024).

In the 1980s, the global business environment experienced intensified competition, prompting organizations to rethink their internal processes. Procurement theory began to incorporate strategic dimensions, such as supplier selection, total cost of ownership, and value chain integration. Strategic Sourcing emerged as a key concept, emphasizing the importance of aligning procurement strategies with organizational goals (Cooper, 2024). Rather than merely acquiring the cheapest goods, organizations began to consider factors such as supplier capabilities, quality, innovation potential, and risk

exposure. The procurement function started to shift from a cost center to a value creator (Chaput, 2024).

The integration of procurement into broader supply chain management (SCM) frameworks further deepened its conceptual importance. SCM theories emphasized collaboration, responsiveness, and end-to-end visibility, pushing procurement professionals to think beyond organizational boundaries (Coll et al., 2025). Supplier Relationship Management (SRM) gained prominence as a strategic procurement approach that focuses on long-term partnerships with key suppliers. SRM is based on the recognition that sustainable competitive advantage can be achieved through collaboration, innovation, and mutual value creation (Rabaia, 2025).

Technological advancement in the 21st century has profoundly transformed procurement practices and theories. The emergence of e-procurement platforms and enterprise resource planning (ERP) systems enabled the automation of routine tasks, allowing procurement professionals to focus on strategic decision-making (Feikema, 2025). More recently, the application of artificial intelligence (AI), data analytics, and blockchain has reshaped the conceptual landscape of procurement. These technologies support predictive analytics, real-time monitoring, and enhanced transparency, thus reinforcing procurement's role in organizational risk management and performance optimization (Handfield et al., 2020).

One of the most significant conceptual developments in procurement is the incorporation of sustainability and corporate social responsibility (CSR). Sustainable procurement goes beyond economic considerations to include social and environmental dimensions. Theories of sustainable supply chains emphasize ethical sourcing, carbon footprint reduction, and circular economy principles (Singh, 2025). As organizations face increasing scrutiny from regulators, customers, and investors, procurement is now

expected to contribute to ESG (Environmental, Social, and Governance) goals. This shift has led to the integration of sustainability criteria in supplier evaluation and contract management.

Another important conceptual trend is the focus on procurement resilience. The COVID-19 pandemic exposed the vulnerability of global supply chains and underscored the need for agile and resilient procurement strategies (Gartner, 2021). Theories of resilience in procurement emphasize flexibility, redundancy, and responsiveness. Organizations are now reevaluating their supplier networks, diversifying sources, and investing in digital tools that enhance supply chain visibility. As such, procurement is increasingly viewed not only as a strategic enabler but also as a risk mitigator and crisis responder (Chowdhury, 2025).

In the organizational context, procurement has gained increased recognition at the executive level. Chief Procurement Officers (CPOs) are now part of senior leadership teams, tasked with driving innovation, sustainability, and strategic alignment (KPMG, 2019). Conceptually, procurement is no longer confined to tactical activities. It is now embedded in enterprise-wide decision-making processes, contributing to product development, market differentiation, and stakeholder engagement. Procurement performance is measured not only by cost savings but also by its impact on business agility, innovation, and value creation (Rane et al., 2020).

Despite these advances, conceptual challenges remain. There is an ongoing debate regarding the boundaries of procurement versus supply chain management, and the extent to which procurement should influence product design, demand planning, and customer experience (Hines, 2024). Furthermore, the adoption of digital procurement technologies raises ethical concerns related to data privacy, surveillance, and labor displacement. Scholars and practitioners must continue to refine the conceptual

framework of procurement to address these complex and dynamic issues (ASA & ZOSU, 2023).

In conclusion, the evolution of procurement reflects a broader trajectory from operational efficiency to strategic value creation. The conceptual development of procurement has been shaped by historical events, market dynamics, and technological progress. Today, procurement is a multidimensional function that integrates economic, technological, social, and environmental considerations (ASA & ZOSU, 2023). As organizations navigate an increasingly complex global landscape, procurement will continue to evolve both as a practice and as a conceptual field, playing a central role in achieving sustainable and competitive growth (Zabala-Iturriagagoitia, 2022)

2.3 E procurement

E-procurement, or electronic procurement, refers to the use of digital technologies and internet-based systems to manage and execute procurement processes. This concept encompasses a range of tools and platforms that support functions such as e-tendering, e-sourcing, e-invoicing, and electronic data interchange (EDI) (Chan & Owusu, 2022). As organizations increasingly seek efficiency, transparency, and strategic alignment in procurement, e-procurement has emerged as a transformative tool. Over the past two decades, academic literature has extensively explored the concept of e-procurement, focusing on its definitions, applications, benefits, barriers, and critical success factors (Ali, 2025).

The conceptual foundation of e-procurement lies in the broader domain of e-business and information systems. Early studies characterized e-procurement as the automation of transactional procurement processes through electronic means (Chan & Owusu, 2022). The fundamental premise was that digital platforms could eliminate paperwork, reduce cycle times, and lower transaction costs. Scholars have consistently highlighted

these operational benefits, positioning e-procurement as a means to streamline procurement activities, enhance accuracy, and improve supplier communication (Raghul et al., 2024). These early works were instrumental in distinguishing e-procurement from traditional manual procurement and in advocating for its adoption.

Over time, literature has expanded the scope of e-procurement from mere automation to strategic enablement. Researchers have shown that e-procurement can significantly enhance supply chain performance by enabling real-time information sharing and improving supplier selection and management (Raghul et al., 2024). For instance, e-sourcing tools support data-driven decision-making, allowing buyers to analyze supplier capabilities and past performance. Similarly, e-tendering platforms ensure fair competition, transparency, and regulatory compliance. These tools help organizations not only reduce costs but also build more sustainable and resilient supply networks (Amakye, 2023).

A key theme in e-procurement literature is its role in public sector reform. Public procurement is often plagued by inefficiencies, corruption, and lack of transparency. E-procurement has been proposed as a solution to these challenges, especially in developing economies (Yevu et al., 2022). Several studies document how digital procurement systems improve accountability, increase competition, and reduce opportunities for fraud in public procurement (Alves Batista, 2024). Countries such as South Korea, Chile, and Brazil are frequently cited as examples where government-led e-procurement platforms have transformed public spending practices (Odilla, 2025). These cases are used to highlight the governance and institutional impacts of e-procurement.

Despite its benefits, literature also documents several barriers to effective e-procurement implementation. Organizational resistance, lack of IT infrastructure, skill

gaps, and supplier reluctance are frequently identified as obstacles (dos Santos Silva et al., 2025). These challenges are more pronounced in small and medium-sized enterprises (SMEs) and in low-resource settings. Scholars have emphasized the need for change management strategies, stakeholder engagement, and capacity building to ensure successful e-procurement adoption (Egwim et al., 2024). Additionally, data security, system interoperability, and legal frameworks have been critically discussed, especially in cross-border procurement.

Another emerging strand of literature explores the integration of advanced technologies into e-procurement systems. Recent research highlights the adoption of cloud computing, big data analytics, and blockchain as enablers of next-generation e-procurement platforms (Handfield et al., 2020). These technologies enhance system scalability, predictive capabilities, and transactional security. For example, blockchain-based procurement systems can provide tamper-proof audit trails, thereby strengthening transparency and trust among stakeholders (Alves Batista, 2024). Scholars are increasingly examining the interplay between digital maturity and procurement performance, arguing that e-procurement is evolving into a digital procurement ecosystem (Herold et al., 2023).

Furthermore, literature has addressed the relationship between e-procurement and sustainable procurement. Digital tools can facilitate the inclusion of environmental and social criteria in procurement decisions by standardizing evaluation metrics and tracking supplier compliance (Adebayo et al., 2024). For instance, e-procurement platforms can be configured to require suppliers to disclose carbon footprints or labor standards, thus supporting ethical sourcing. This has led to a growing body of work linking e-procurement with corporate social responsibility (CSR) and sustainable supply chain management (Maina, 2023).

From a theoretical perspective, several frameworks have been employed to study e-procurement. The Technology Acceptance Model (TAM), the Diffusion of Innovations Theory, and the Resource-Based View (RBV) are commonly used to analyze adoption drivers, organizational capabilities, and performance outcomes (Pham et al., 2025). These theories help explain the varying degrees of e-procurement success across industries and geographies. For example, the TAM posits that perceived usefulness and ease of use are key determinants of system adoption (Shaengchart, 2023). Meanwhile, the RBV argues that firms with superior IT resources and managerial capabilities are better positioned to leverage e-procurement for strategic advantage.

In terms of measurement, literature has proposed various models to assess the impact of e-procurement (Ngugi, & Ndeto, 2024). These include metrics related to cost savings, procurement cycle time, supplier satisfaction, and compliance levels (Basiru et al., 2023). Some scholars have developed maturity models to evaluate the stages of e-procurement adoption, ranging from basic digital ordering to fully integrated strategic procurement systems. These models offer practical guidance for organizations seeking to benchmark their e-procurement practices and plan future investments (Yevu et al., 2022).

In conclusion, e-procurement has emerged as a vital concept in procurement and supply chain literature (Raghul et al., 2024). It is conceptualized not only as a technological innovation but also as a strategic enabler and governance tool. The literature demonstrates that e-procurement can deliver significant benefits in terms of efficiency, transparency, and sustainability. However, it also acknowledges the socio-technical complexities involved in its implementation. Future research is likely to explore the intersection of e-procurement with emerging technologies, sustainability agendas, and

digital transformation strategies. As such, e-procurement continues to evolve both in practice and as a dynamic area of scholarly inquiry (Raghul et al., 2024).

Table 2.1 Operational definitions of E procurement by various authors

Author(s)	Year	Definition	Key Elements
Ibem & Laryea	2015	E-procurement involves the use of information and communication technology (ICT) to conduct procurement processes in the construction industry.	ICT integration; construction sector focus; process efficiency.
Bag et al.	2020	E-procurement is the modern form of procurement that utilizes advanced technology, internet, and networking systems.	Advanced technology; internet-based; networking systems.
Nandankar & Sachan	2020	E-procurement refers to the application of information and communication technology (ICT) to automate and streamline procurement processes.	ICT application; automation; process streamlining.
Aduwo et al.	2020	E-procurement is the process whereby organizations acquire works, goods, or services primarily via the use of internet-based tools.	Internet-based tools; acquisition of goods/services; organizational procurement.
Addy et al.	2024	E-procurement encompasses the adoption of electronic systems to enhance procurement activities, improving transparency and efficiency in the public sector.	Electronic systems; transparency; public sector efficiency.
Musah et al.,	2025	E-procurement involves the integration of digital technologies to optimize procurement functions, leading to improved firm performance in Ghana's construction sector.	Digital integration; optimization; firm performance; construction sector.

The evolution of e-procurement definitions over the last decade reveals a consistent but gradually expanding conceptualization of the term. While there is broad agreement among scholars on the foundational role of information and communication technology (ICT) in facilitating procurement, the definitions from 2015 to 2025 reflect both

continuity and significant shifts in how e-procurement is framed across different contexts and academic lenses.

On one hand, the enduring emphasis on technology as the backbone of e-procurement underscores a consensus that procurement cannot be considered "electronic" without ICT enablement. Early in the examined period, Belhaouari, (2024) position e-procurement squarely within the operational realm, focusing on the use of ICT to automate procurement processes. This narrow but essentialist view supports the argument that e-procurement is primarily a technical solution aimed at improving efficiency, reducing paperwork, and speeding up transactions. Such definitions are crucial for sectors like construction, where manual procurement has traditionally dominated and inefficiencies are widespread (MARCILIANUS, 2023).

However, this functionalist perspective can be critiqued for its limited recognition of the broader strategic and institutional implications of e-procurement. As the decade progresses, definitions evolve to incorporate broader goals such as transparency, organizational performance, and sectoral transformation. For example, Addy et al. (2024) explicitly define e-procurement as a transparency-enhancing tool in the public sector, challenging earlier definitions that emphasized efficiency alone. Similarly, Musah et al. (2025) argues for e-procurement as a performance-enhancing mechanism within Ghana's construction industry, thereby aligning the technology with firm-level strategic outcomes. These developments suggest a shift from viewing e-procurement as a mere operational tool to seeing it as a lever for institutional change and performance improvement.

This shift introduces a critical argument: e-procurement must be reconceptualized not just as a technological innovation, but as a socio-technical system embedded in organizational and sectoral dynamics. Definitions that reduce e-procurement to the

digitization of forms and transactions fail to capture its transformative potential. For instance, Aduwo et al. (2020) and Bag et al. (2020) adopt definitions that strike a middle ground, recognizing both the technological enablers and the procedural scope of e-procurement (e.g., acquisition of goods/services via internet tools). However, their definitions could still be critiqued for not sufficiently addressing governance, sustainability, or change management aspects, which are now critical in both public and private sectors.

Another point of contention in the literature is the sector-specific framing of e-procurement. While definitions by Musah et al. (2025) focus on the construction industry, others such as Addy et al. (2024) focus on the public sector. This divergence prompts a debate: Should e-procurement be defined universally, or should its definition be contextualized to specific sectors? On the one hand, sector-specific definitions offer precision and relevance, which are essential for designing targeted interventions (Psarommatis et al., 2025). On the other hand, they risk fragmenting the conceptual clarity of e-procurement, making it harder to develop generalized theories or benchmark performance across industries (Islam, 2024).

Furthermore, the evolution of definitions from 2015 to 2025 illustrates a temporal shift in priorities. Early definitions primarily focused on adoption and automation, reflecting the technological limitations of the time. In contrast, later definitions incorporate outcomes such as performance and transparency, reflecting the maturity of e-procurement systems and increased expectations from stakeholders. This progression supports the argument that as digital tools become more entrenched, the focus of scholarly inquiry naturally shifts from technical deployment to impact assessment and strategic alignment (Meinhold et al., 2025).

Yet, despite this evolution, many of the definitions in the literature still lack emphasis on emerging technologies such as blockchain, artificial intelligence, and data analytics tools that are reshaping the very architecture of procurement systems. Scholars like Handfield et al. (2020) touch on these technologies, but most definitions remain anchored in basic ICT terms like "internet-based tools" or "digital systems." This lag suggests a need for future definitions to better incorporate the next generation of e-procurement technologies, reflecting the digital transformation narrative that dominates contemporary business discourse.

In conclusion, while the definitions of e-procurement from 2015 to 2025 provide a robust foundation for understanding the concept, they also reveal conceptual tensions and under-explored dimensions. The field must move beyond definitions rooted solely in efficiency and automation and embrace those that consider e-procurement's strategic, institutional, and technological evolution. Future scholarly work should aim for definitions that are not only inclusive of emerging digital tools but also reflective of the socio-organizational complexities in which e-procurement systems are embedded. This broader conceptual framing is essential for harnessing e-procurement's full potential as both a technological and institutional innovation.

2.3.1 E-procurement practices

There is no universally agreed definition of e-procurement. In this study, e-procurement is defined as an online system that includes four (4) components: electronic sourcing, evaluation, and negotiation (Desmond, 2022). Vaidya and Campbell (2016) define e-procurement as using an internet-based system to fulfil one or more components of the procurement process, such as search, ordering, procurement, negotiation, receipt, and verification of postal transactions. E-procurement is a method of doing business with other businesses that involves using the Internet to identify new suppliers, make

purchases, make payments, and communicate with vendors. (Smart, 2010). The use of information technology to ease business-to-business activities for goods and services is known as e-procurement (Madzimure et al., 2020). The Chartered Institute of Purchase and Supplies (CIPS) describes e-procurement as the electronic use of information and communication technology to improve external and internal purchasing and procurement management procedures, according to King'ori (2013). On the other hand, electronic procurement is an online function that combines information technology with purchasing resources to process orders, connect with contractors, and make purchase choices. Electronic bidding, electronic marketplaces, electronic auctions/reverse auctions, and electronic catalogues are examples of electronic procurement concentrating on one or more phases in the procurement process (Desmond, 2022).

The e-procurement application, in a broader sense, may be regarded as an end-to-end solution that combines and simplifies multiple procurement tasks across the business. E- sourcing, e-negotiation, e-design, and e-evaluation are the four functions of the electronic procurement system (Shafiee et al., 2022; Hsin Chang et al., 2013). The main goals of electronic procurement are to improve transactions between suppliers and buyers, reduce personal needs, save time and money, receive more offers from a wider range of potential bidders, improve coordination, shorten the procurement cycle, eliminate weak points clarification during the tendering period, improvement of the audit trails and transparency and achievement of the best price-performance ratio (Shahin et al., 2022). The strong relationship between buyers and sellers has a positive impact on organizational innovation and supply chain performance (Petrucci et al., 2019). However, e-procurement requires an enabler to function effectively. Handfield et al. (2019) identified pioneers in electronic procurement, emphasizing that the rise of information technology has driven business globalization. As a result, many companies

now operate websites that facilitate their participation in various supply chain activities across different markets. Security methods are crucial when implementing electronic procurement (Nani & Ali, 2020). Companies interested in implementing e-procurement believe system security to be a must-have before moving forward with the implementation. Integrating e-procurement with other organisational systems is critical (Desmond, 2022). Payment gateways, supplier systems (SS), material resource planning (MRP), and enterprise resource planning (ERP) are examples of such systems (ERP) (ERP). A verification procedure should be possible with electronic procurement. This enables third parties to audit supply chain operations, providing participants confidence that they are being carried out correctly. Every sort of notification between the participants in a supply chain should be possible with the notification functionalities of an e-procurement system (Desmond, 2022). Such notifications include receipts, surcharges, and payments, to name a few (Baily et al., 2008). You will need a safe and verified website to reach a large number of target clients all around the world. This information system should assist customers and businesspeople (Rainer et al., 2020). This allows for providing trustworthy, accurate, and authentic information about items and services. Many effective electronic procurement initiatives involve the e-procurement function being completely integrated into business operations and the system being flexible enough to keep up with projected technical advancements (Nicoletti, 2017).

Maddi (2016) points out three different forms of E-procurement. Procurement systems are electronic procurement systems for buyers, Electronic procurement systems for sellers, and online mediators. E-Sourcing, which is used for contract processes and includes tools like e-tendering RFQs (Request for Quotes), and e-procurement, which is used for transactional processes and includes tools like the electronic Catalog, are the

three primary e-procurement processes identified by Baily et al. (2008). The last option is e-payment, which employs virtual computers as tools (procurement cards). E-sourcing uses the internet to make decisions and establish strategies about where and how services or goods should be bought (Eskelinen, 2017). E-procurement is divided into three phases in this model: e-sourcing, e-inquiry, and e-intelligence. This method allows the procurement model to be modified, removing the time-consuming and expensive transaction activity, as Cherian et al. (2020) supported, resulting in shorter cycle times and massive efficiency gains for businesses. Improved business connections with suppliers are enabled by changes in the flow of information, particularly the improved exchange of sensitive information. Traditional procurement techniques provided little openness and less satisfaction in supplier agreements in the past. Improved transparency, a broader geographic reach, faster transaction times, and better pricing are all advantages of e-procurement (Cherian et al., 2020). It entails utilising electronic technologies to automate and streamline a company's procurement operations, increasing efficiency and transparency while lowering costs. Interacting with suppliers is done through a buy-side exchange, whereas dealing with customers is done through a sell-side exchange (Spence et al., 2019). A marketplace is a website where buyers can shop with various suppliers (Vulkan, 2020). In an e-market, the buyer has power since he can analyse most potential providers for a certain product or service and make informed decisions about what to buy and where to acquire it (Anafi, 2021). This informs the consumer about the various products available on the market and the current status of product specs (Houde, 2018).

By making numerous comparisons, the customer has access to information about similar/ same products and services, which include added value so that buyers can determine the correct cost of the product (Womack & Jones, 2015). E-catalogs are

websites that provide information about a vendor's products and services and the ability to order and pay for them online (Desmond, 2022). They allow for two-way real-time communication between the customer and the supplier, as well as informing the buyer about products they may not be aware of, thanks to the fact that permission may be done online. Email can be used to send notifications and confirmations. It is also a way of reacting fast to market conditions and needs by adjusting prices and repackaging products (Rockville, 2019).

In this research, we describe e-procurement as an electronic procurement system with three (3) functions: e-sourcing, e-evaluation and e-negotiation (Mahdillou & Akbary, 2014; Hsin Chang et al., 2013). Developing the purchasing criteria for an e-procurement system is referred to as "e-design." E-sourcing is the method by which a company selects its suppliers using an electronic procurement system; E-negotiation is the method by which a company negotiates a contract using technology; and E-evaluation is the phase in which detailed information about suppliers is gathered in preparation for evaluations and transactions (Faheem & Siddiqui, 2019).

2.3.2 Definition of E-Sourcing

E-sourcing utilizes internet technology to identify potential providers, thereby reducing search expenses (Madzimure et al., 2020). All phases in the procurement process, including expenditure analysis, needs summary, supplier identification, requirements definition, negotiation (request for move-in, offer or offer), reverse auctions, offer evaluations, and contract management, are supported by a web-based platform. Bialas et al. (2016), argued that the operational benefits of e-sourcing include streamlining procedures through easier/faster product/service ordering, less paperwork, more straightforward online assessment, fewer human errors, and lower storage costs. (b) increasing bargaining strength through expenditure transparency, purchasing

aggregation, improved compliance, less non-contractual individual purchases, comparability and competition, efficient market and price processes, information for strategic procurement, and e-purchasing organisations. A few benefits include a 5 to 20% decrease in material prices, a 25 to 30% reduction in procurement cycle times, and a 10 to 15% reduction in time to market (Trkman & McCormack, 2009). However, e-sourcing poses significant challenges to a company, such as the required change management, the resulting new organisational roles, the expected implementation speed, the management of existing suppliers, the definition of a good content management implementation plan, and integration with back-office systems (Manthou et al., 2016).

2.3.3 E-Negotiation

This term describes the electronic negotiating process between business partners (Madzimure et al., 2020). E-negotiation reduces huge costs when acquiring products and services online (Madzimure et al., 2020). Negotiations necessitate a healthy balance of give and take. Striving for a mutually beneficial, courteous, positive relationship would be best. To negotiate well, you must be able to make little concessions on your side while providing something valuable to the other party. Regardless of the aims of the various parties, your approach should promote goodwill. After a successful discussion, both sides are happy and willing to do business again. This tutorial discusses why bargaining is required and provides negotiation methods and techniques.

2.3.4 E-Evaluation

E-evaluation, or electronic evaluation, refers to the process of assessing, measuring, and analyzing performance, knowledge, or skills using digital tools and technologies (Ningsih, 2024). This method leverages electronic platforms, such as online quizzes,

automated grading systems, and data analytics software, to streamline the evaluation process (Owan et al., 2023). e-evaluation is widely used in educational, professional, and organisational settings to provide efficient, accurate, and scalable assessments (Huang et al., 2022). It encompasses various forms, including formative assessments for continuous feedback, summative assessments for final evaluations, and diagnostic assessments to identify strengths and weaknesses (Bhat & Bhat, 2019).

One of the key advantages of e-evaluation is its ability to provide immediate feedback, which is crucial for learning and improvement (Bin Mubayrik, 2020). By utilizing algorithms and artificial intelligence, electronic evaluation systems can analyze responses in real-time, offering personalized insights and recommendations (Dhananjaya et al., 2024). Additionally, E-Evaluation reduces the administrative burden on educators and evaluators by automating tasks such as grading and data collection (Mwalukasa, 2024). This not only saves time but also minimizes human error, ensuring more objective and consistent results.

However, e-evaluation also presents challenges, such as ensuring the security and integrity of assessments, addressing potential biases in automated systems, and maintaining accessibility for all users (Althabatah et al., 2023). Despite these concerns, the growing integration of technology in evaluation processes highlights the transformative potential of e-evaluationin enhancing the accuracy, efficiency, and inclusivity of assessments in various domains (ALKursheh, 2024).

2.4 Evolution of Supply Chain Performance

The concept of supply chain performance has undergone a remarkable transformation over the past several decades. Initially viewed through the narrow lens of operational efficiency, it has evolved into a multidimensional construct encompassing strategic alignment, customer satisfaction, sustainability, and innovation. This evolution reflects

broader shifts in business environments, technological advances, globalization, and changing customer expectations (Islam, 2024).

In the early stages, the focus on supply chain performance was predominantly operational. During the 1950s and 1960s, companies concentrated on construction efficiency and inventory control (Teng et al., 2024). The primary goal was to minimize costs through economies of scale and improve production schedules. Performance metrics were largely internal and centered on measures such as inventory turnover, production lead times, and cost minimization (Islam et al., 2024). This era was characterized by siloed functional departments, where procurement, construction, and distribution operated relatively independently, with limited coordination across the supply chain. Supply chains were considered primarily as linear sequences of activities aimed at delivering goods from raw materials to finished products (Jonsson, 2024).

The 1980s and 1990s marked a critical turning point with the emergence of the concept of Supply Chain Management (SCM). The recognition that organizations no longer compete in isolation but as part of extended networks spurred a broader view of performance (Ruiz et al., 2024). SCM introduced a focus on integration, coordination, and collaboration across multiple supply chain partners, including suppliers, manufacturers, distributors, and retailers. This shift was driven by increasing globalization, market competition, and advances in information technology (Martin & Ibrahim, 2024). Companies began to realize that optimizing individual functions was insufficient; instead, they needed to optimize the entire chain to achieve superior performance (Ahmadirad, 2025).

During this period, supply chain performance metrics expanded to include not only cost and efficiency but also responsiveness and flexibility. The need to meet fluctuating customer demands and reduce time-to-market became vital (Dahinine et al., 2024).

Performance measurement frameworks began to include delivery reliability, order accuracy, and customer service levels (Ghodake et al., 2024). Moreover, the introduction of just-in-time (JIT) and lean construction principles influenced supply chain practices significantly. These methodologies emphasized waste reduction, continuous improvement, and close supplier relationships, which enhanced performance by reducing inventories and improving flow (Cheptoo et al., 2024).

The advent of advanced information and communication technologies (ICT) in the late 1990s and early 2000s accelerated the evolution of supply chain performance (Gammelgaard & Nowicka, 2024). The proliferation of Enterprise Resource Planning (ERP) systems, Electronic Data Interchange (EDI), and later cloud computing enabled real-time data sharing and improved visibility across the supply chain (Smith, 2024). These technologies facilitated better demand forecasting, inventory management, and collaborative planning. Supply chain performance began to be measured not only by operational efficiency but also by the ability to leverage data analytics for predictive insights and decision support (Ghodake et al., 2024).

As supply chains became more complex and global, risk management emerged as a critical component of performance evaluation (Okoye et al., 2024). Events such as natural disasters, geopolitical tensions, and supply disruptions highlighted vulnerabilities in tightly coupled global supply chains (Singh & Modgil, 2025). Consequently, supply chain resilience the ability to anticipate, prepare for, and recover from disruptions became a key dimension of performance. Firms started to incorporate metrics related to risk mitigation, recovery times, and supply chain robustness alongside traditional measures (Zhang et al., 2024).

In recent years, sustainability has profoundly reshaped the understanding of supply chain performance. The growing awareness of environmental and social impacts

associated with supply chain activities has led companies to integrate sustainability metrics into performance frameworks (Jiang et al., 2024). This includes measures of carbon footprint, energy consumption, waste generation, ethical sourcing, and labor practices. Sustainable supply chain management is no longer a peripheral concern but a core strategic priority, driven by regulatory pressures, consumer demands, and corporate social responsibility commitments. Thus, supply chain performance now reflects not only economic outcomes but also environmental stewardship and social equity (Singh, 2025).

The rise of digital technologies such as the Internet of Things (IoT), blockchain, artificial intelligence (AI), and big data analytics represents the latest frontier in the evolution of supply chain performance (Grover et al., 2024). IoT devices enable real-time tracking of goods and assets, enhancing transparency and control. Blockchain technology offers secure and immutable transaction records, fostering trust and traceability (Hossain et al., 2024). AI and machine learning algorithms provide advanced forecasting, optimization, and anomaly detection capabilities. These technologies empower firms to move towards predictive and prescriptive supply chain management, shifting from reactive problem-solving to proactive performance enhancement (Attah et al., 2024).

Moreover, customer-centricity has become a dominant theme in contemporary supply chain performance management. The proliferation of e-commerce and omnichannel retailing has raised customer expectations for speed, customization, and reliability (Agarwal, 2024). Consequently, supply chain performance now includes metrics related to customer experience such as order fulfillment speed, customization options, returns processing, and last-mile delivery efficiency. The ability to rapidly adapt to

changing customer preferences and market conditions has become a competitive differentiator (Jantapoon, 2025).

Another notable trend in the evolution of supply chain performance is the increasing emphasis on collaboration and partnership ecosystems (Marty & Ruel, 2024). Modern supply chains operate as networks rather than linear chains, involving multiple stakeholders who share information, risks, and rewards (Abaku et al., 2024). Performance measurement has expanded to assess the effectiveness of these collaborations, including joint innovation, knowledge sharing, and supplier development. This collaborative approach aligns incentives across the supply chain, driving collective performance improvements (Purwanto et al., 2024).

Table 2.2 Operational definition and dimensions of Supply Chain Performance

Author(s)	Year	Operational Definition	Measurement Variables / KPIs
Beamon	2005	Supply chain performance is the ability to meet customer requirements efficiently and effectively.	Cost, quality, delivery, flexibility, inventory levels
Gunasekaran et al.	2007	Performance of the supply chain assessed by its capability to deliver value through cost reduction and service improvement.	Cost reduction, delivery reliability, quality, responsiveness
Li, Ragu-Nathan et al.	2006	Supply chain performance includes operational metrics like delivery reliability, flexibility, and cost.	Delivery reliability, flexibility, quality, cost
Ketchen & Hult	2007	The supply chain's ability to deliver value through efficiency, responsiveness, and adaptability.	Efficiency (cost/time), responsiveness (delivery), adaptability
Christopher & Towill	2008	Performance as the degree of supply chain integration and customer satisfaction.	Integration level, customer satisfaction, service quality
Awaysheh & Klassen	2010	Supply chain performance measured in terms of cost, quality, delivery, and innovation.	Cost, product quality, on-time delivery, innovation rate
Frohlich & Westbrook	2011	Focused on the four pillars of supply chain performance: cost, quality, delivery, flexibility.	Cost, quality, delivery speed, supply chain flexibility

Author(s)	Year	Operational Definition	Measurement Variables / KPIs
Huo, Han & Zhao	2014	Supply chain performance encompasses operational efficiency and strategic responsiveness.	Cost efficiency, delivery reliability, flexibility, responsiveness
Kumar et al.	2017	Performance measurement includes cost efficiency, delivery reliability, and sustainability.	Cost, delivery reliability, environmental performance
Govindan et al.	2018	Emphasized sustainability along with traditional performance metrics.	Economic cost, environmental impact, social responsibility
Ivanov et al.	2020	Performance includes resilience, sustainability, and digital readiness in supply chains.	Resilience (recovery time), sustainability metrics, digital adoption
Dubey et al.	2022	Integration of digital technologies and sustainability in measuring supply chain performance.	Digital maturity, environmental performance, delivery, cost
Sharma & Gunasekaran	2024	Supply chain performance as a balanced measure of efficiency, sustainability, and customer satisfaction.	Cost, delivery, quality, carbon footprint, customer satisfaction

Table 2.2 summarizes the operational definitions and measurement variables of supply chain performance from 2005 to 2025 reveals both continuity and significant evolution in scholarly perspectives. A dominant theme across all the authors is the recognition of cost efficiency as a fundamental dimension of supply chain performance. From Beamon (2005) to Sharma and Gunasekaran (2024), cost management remains central to assessing how well supply chains perform. This continuity reflects the fundamental business imperative to optimize costs related to production, transportation, and inventory holding to maintain competitiveness. Despite the expanding scope of supply chain performance, controlling costs remains a consistent baseline metric.

Similarly, delivery performance is another critical and consistently included variable. Authors such as Li, Ragu-Nathan et al. (2006), Frohlich and Westbrook (2011), and Ivanov et al. (2020) emphasize delivery reliability, speed, and order fulfillment as essential indicators of supply chain success. The persistent focus on delivery highlights

its critical role as the primary link between supply chain efficiency and customer satisfaction. On-time delivery and order accuracy directly impact customer retention and brand reputation, making these measures indispensable for both academic research and practical supply chain management.

Quality emerges as a third fundamental pillar present throughout the literature. Beamon (2005), Awaysheh and Klassen (2010), and Sharma and Gunasekaran (2024) all include quality in their definitions, underscoring its importance as a measure of how well products or services meet required standards. Quality not only affects customer satisfaction but also influences costs related to returns, repairs, and brand equity. The consistent inclusion of quality indicates that supply chain performance is not merely about speed or cost, but also about delivering products that meet or exceed expectations. While cost, delivery, and quality form the traditional core of supply chain performance measurement, later studies introduce additional dimensions reflecting the growing complexity of supply chain environments. Flexibility and responsiveness, emphasized by Ketchen and Hult (2007) and Frohlich and Westbrook (2011), have gained prominence as supply chains face increasing market volatility and demand uncertainty. Flexibility measures the ability to adapt to changes in demand or supply conditions, while responsiveness captures how quickly a supply chain reacts to those changes. These dimensions reflect a shift from purely operational performance to more strategic capabilities necessary for thriving in dynamic markets.

A significant evolution in the concept of supply chain performance is the incorporation of sustainability and environmental considerations, especially from around 2015 onwards. Scholars like Govindan et al. (2018), Ivanov et al. (2020), and Dubey et al. (2022) explicitly include sustainability metrics alongside traditional economic and operational measures. This integration reflects broader societal concerns about climate

change, resource depletion, and ethical sourcing, as well as regulatory pressures on companies to operate responsibly. The addition of sustainability signals a paradigm shift where supply chain performance is not only judged by economic efficiency but also by its impact on the environment and society.

In parallel, the role of digital technologies and resilience has become increasingly prominent in recent years. Ivanov et al. (2020) and Dubey et al. (2022) highlight the importance of digital readiness such as the adoption of IoT, AI, and blockchain technologies and resilience, defined as the ability to anticipate, withstand, and recover from disruptions. These aspects recognize that modern supply chains are complex, interconnected networks vulnerable to various risks including pandemics, geopolitical tensions, and cyber threats. The ability to leverage digital tools for real-time data sharing and predictive analytics improves performance by enhancing transparency, agility, and risk management.

Despite some differences in emphasis, a clear convergence emerges from the literature: supply chain performance is now understood as a multi-dimensional construct that balances operational efficiency, effectiveness, strategic adaptability, sustainability, and technological enablement. This multi-faceted perspective contrasts with earlier views that focused narrowly on cost and delivery metrics. The expanding scope reflects changing business realities where supply chains must not only be efficient but also agile, resilient, sustainable, and customer-focused.

In conclusion, the evolution of supply chain performance definitions and measurement variables over the last two decades demonstrates a profound broadening in both scope and complexity. While cost, delivery, and quality remain foundational, newer dimensions such as flexibility, sustainability, digital maturity, and resilience have become critical in capturing the full picture of supply chain success. This evolution is

driven by globalization, technological advancements, environmental concerns, and shifting customer expectations. Firms that limit their performance assessment to traditional metrics risk overlooking crucial factors that determine competitiveness in today's fast-changing and uncertain markets. To thrive, organizations must adopt a comprehensive, integrated approach to measuring and managing supply chain performance one that balances efficiency with agility, economic goals with sustainability, and operational control with technological innovation.

2.4.1 Key findings of supply chain performance and how it has been used in literature

Supply chain performance has been a focal point of academic inquiry and practical interest over the past two decades, reflecting its critical role in organizational competitiveness and market success. The literature reveals a rich and evolving understanding of what constitutes supply chain performance, how it can be measured, and the implications for business strategy and operations. Early research primarily emphasized traditional operational metrics such as cost efficiency, delivery reliability, and quality standards, which were viewed as the essential pillars supporting a supply chain's effectiveness. Beamon (2005) laid foundational work by conceptualizing supply chain performance through these core dimensions, which aimed to balance cost reduction with timely delivery and product quality. Subsequent studies by Li, Ragu-Nathan et al. (2006) and Gunasekaran et al. (2007) reinforced this triadic framework, providing empirical evidence that firms excelling in these areas tend to achieve superior competitive advantage. Such findings have underpinned a consensus that performance measurement must incorporate multiple dimensions to capture the operational reality of supply chains comprehensively.

However, as globalization and technological advancement accelerated, the focus of supply chain performance literature broadened. Scholars began recognizing that efficiency and effectiveness alone were insufficient to ensure long-term success in volatile and complex environments. This shift is evident in the integration of flexibility and responsiveness as critical performance variables, reflecting the supply chain's ability to adapt to fluctuations in demand, supply disruptions, and market dynamics. Ketchen and Hult (2007) were among the first to argue that supply chains need agility as much as efficiency, highlighting that responsiveness can mitigate risks and exploit new market opportunities. Frohlich and Westbrook (2011) further supported this perspective by identifying supply chain "arcs of integration" that emphasize collaboration and adaptability as essential for improved performance. Their findings suggest that firms with highly flexible and responsive supply chains can better manage uncertainties and sustain competitive advantage in dynamic markets.

In parallel, the emergence of sustainability as a key performance criterion has transformed supply chain performance research, particularly since the mid-2010s. This evolution mirrors growing societal and regulatory pressures on firms to reduce environmental impacts and enhance social responsibility across their supply networks. Govindan et al. (2018) and Dubey et al. (2022) highlight how the inclusion of environmental and social metrics such as carbon footprint, waste reduction, and ethical sourcing enriches traditional performance frameworks. Their empirical studies demonstrate that sustainable supply chain practices are positively correlated not only with regulatory compliance and brand reputation but also with operational efficiencies, such as waste minimization and energy savings. This literature positions sustainability not as an add-on but as an integral dimension of supply chain performance, influencing supplier selection, process design, and strategic decision-making. Consequently,

sustainability has become a vital lens through which supply chain success is evaluated in contemporary research.

Another significant contribution to the understanding of supply chain performance is the increasing emphasis on digitalization and resilience. Ivanov et al. (2020) and Dubey et al. (2022) provide compelling evidence that digital technologies such as the Internet of Things (IoT), artificial intelligence (AI), and blockchain enhance supply chain visibility, coordination, and predictive capabilities. These advances enable firms to detect potential disruptions earlier, optimize resource allocation in real-time, and maintain service levels even under adverse conditions. The COVID-19 pandemic has further accelerated this focus, with researchers documenting how resilient supply chains capable of rapid recovery and adaptation outperform traditional models during crises. Resilience has thus emerged as a critical performance dimension that complements flexibility and responsiveness, offering firms a buffer against uncertainty and shocks. The literature suggests that investments in digital infrastructure and risk management capabilities translate into measurable improvements in supply chain robustness and overall performance.

Throughout these thematic expansions, a key finding across the literature is that supply chain performance is inherently multi-dimensional and context-dependent. No single metric suffices to capture the complexity of performance outcomes; rather, a balanced scorecard approach combining operational, strategic, environmental, and technological indicators is advocated. For example, Sharma and Gunasekaran (2024) argue for integrated performance frameworks that align efficiency with sustainability and customer satisfaction, reflecting a holistic perspective necessary for contemporary supply chains. This multi-dimensionality recognizes that optimizing one area, such as cost, at the expense of flexibility or sustainability can be counterproductive in the long

term. Thus, the literature stresses the importance of trade-offs and balance in performance measurement and management.

In addition, supply chain performance research frequently examines the antecedents and consequences of performance outcomes. Studies often investigate how specific practices such as supplier collaboration, information sharing, lean operations, and green initiatives impact performance metrics. For instance, research by Awaysheh and Klassen (2010) links socially responsible sourcing to improved quality and innovation, while Kumar et al. (2017) highlight the role of sustainable supply chain management practices in enhancing both environmental and economic performance. Furthermore, performance outcomes are connected to broader organizational goals such as competitive advantage, customer loyalty, and financial performance. The literature consistently finds that well-performing supply chains contribute to superior firm-level results, underscoring the strategic importance of investing in comprehensive supply chain capabilities.

Despite these advances, challenges remain in achieving consensus on standardized performance measures. Variations across industries, regions, and firm sizes create complexities in defining universally applicable metrics. Moreover, rapid technological changes and evolving sustainability standards require continuous adaptation of measurement frameworks. Scholars call for more empirical studies that validate new metrics, especially in emerging areas like digital maturity and resilience. Additionally, longitudinal studies are needed to understand how supply chain performance evolves over time and in response to external shocks.

2.4.2 Challenges of Supply Chain Performance

As highlighted in the provided research contexts, supply chain performance is influenced by myriad challenges across various sectors and regions. In the public sector,

particularly in South Africa, the complexity of supply chain management (SCM) due to numerous stakeholders and legislative requirements impedes service delivery, necessitating improved information sharing and stakeholder collaboration to enhance performance (Søreide & Truex, 2013).

Transparency and traceability are also critical issues, with industry practitioners facing difficulties achieving visibility beyond immediate suppliers, data fragmentation, and regulatory compliance, which are essential for building resilience and trust in supply chains (Reynolds, 2024). The digitalisation of supply chains presents challenges, including data integration, cybersecurity, organisational resistance, and financial constraints, particularly for SMEs. However, it offers opportunities for enhanced efficiency and customer satisfaction (Reynolds, 2024). Warehouse management is another concern, with operational challenges such as inventory control, waste management, and limited visibility affecting overall supply chain performance (Sallam et al., 2023).

In the e-commerce sector, supplier relationship management (SRM) is crucial for delivery performance, yet it is hindered by technological adoption barriers, cultural differences, and communication complexities (Glory, 2023). Integrating IoT and big data into supply chains is essential for addressing issues like forecasting and distribution delays, but it requires significant technological advancements and investments (Raman et al., 2018). In Indonesia, the logistics sector faces challenges due to a lack of integrated policies and declining performance in certain areas, highlighting the need for unified logistics strategies to improve national supply chain efficiency (Santoso et al., 2021). Lastly, the global transport sector's supply chain is challenged by environmental concerns, with a need for sustainable practices to reduce emissions and improve productivity, particularly in less developed economies (Shah et

al., 2021). These diverse challenges underscore the complexity of optimising supply chain performance across different industries and regions, necessitating collaborative efforts, technological integration, and strategic policy-making to overcome these hurdles effectively (Odulaja et al., 2023).

2.4.3 Supplier Involvement

Supplier involvement refers to suppliers' active participation in a purchasing organisation's processes and activities, particularly in areas like product development, process improvement, and strategic decision-making (Surmound et al., 2020). As global supply chains become increasingly interconnected and complex, organisations recognise the strategic value of involving suppliers to enhance innovation, efficiency, and competitiveness (Ambos et al., 2021). This concept emphasises leveraging suppliers' expertise, resources, and capabilities to co-create value and achieve mutual benefits (Ferreira, 2019). Supplier involvement can manifest in varying degrees, ranging from operational and tactical contributions to more strategic partnerships that shape long-term organisational objectives (Murfield & Tate, 2017).

Defining supplier involvement requires understanding its integration into an organisation's operational and strategic framework (Alshurideh et al., 2022). On an operational level, suppliers ensure the timely delivery of quality materials and services, contributing to the organisation's efficiency (Moons et al., 2019). At the tactical level, suppliers play a role in medium-term projects such as process optimisation, resource allocation, and quality improvement initiatives (Rathilall, 2024). Strategic involvement encompasses suppliers' participation in shaping innovation, product development, and competitive strategies, enabling the organisation to respond effectively to market demands and technological changes (Jajja et al., 2017). These dimensions highlight the

depth and scope of supplier contributions across different organisational levels (Sauer & Seuring, 2018).

The theoretical foundations of supplier involvement provide insights into its importance and mechanisms (Awan et al., 2019). The Resource-Based View (RBV) underscores how organisations can gain a competitive advantage by integrating suppliers' unique resources and capabilities (Nayak et al., 2022). This perspective highlights that the value derived from supplier relationships often extends beyond transactional exchanges to include knowledge sharing and innovation (Handoko et al., 2018). Transaction Cost Economics (TCE) emphasises minimising transaction costs by fostering closer supplier relationships, which reduces information asymmetry and coordination challenges (Huo et al., 2018). Relational Contract Theory focuses on trust, collaboration, and shared goals as essential to effective supplier partnerships (Nwajei, 2021). Open Innovation Theory demonstrates how external collaborations, including supplier involvement, enhance innovation by leveraging diverse knowledge sources and perspectives (Fisher & Qualls, 2018).

The drivers of supplier involvement stem from both organisational needs and external pressures. The growing emphasis on innovation necessitates collaboration with suppliers who possess technical expertise and unique capabilities that can accelerate product development and foster creativity (Melander, 2017). Cost efficiency is another key driver, as joint problem-solving with suppliers often reveals opportunities to streamline processes and reduce expenses (Cooper, 2024). Market dynamics, such as increased competition and customer demand for customization, push organizations to collaborate more closely with suppliers to meet these challenges (Wang et al., 2017). Technological advancements, including digital tools and platforms, have further

facilitated seamless communication and integration with suppliers, enhancing the feasibility and effectiveness of their involvement (Shee et al., 2018).

Despite its potential benefits, supplier involvement presents several challenges that organizations must navigate (Villena & Gioia, 2018). Coordination complexity arises as aligning objectives, processes, and expectations across organizational boundaries can be difficult, particularly in global supply chains (Turner et al., 2018). Trust issues are a significant barrier, as building and maintaining trust with suppliers requires transparency, consistency, and mutual respect over time (Barrane et al., 2021). Intellectual property risks emerge when organizations share proprietary information with suppliers, necessitating robust agreements and safeguards to prevent data misuse or leaks (Demertzi et al., 2023). Cultural differences between organizations and their suppliers can also hinder collaboration, as varying organizational norms, values, and communication styles may lead to misunderstandings or conflict (Chukwu et al., 2023).

When executed effectively, supplier involvement yields substantial outcomes that enhance organizational performance (Awan et al., 2019). Collaboration with suppliers often results in enhanced innovation, as their expertise contributes to novel products, services, and processes (Melander & Pazirandeh, 2019). Improved product quality is another outcome, as suppliers' involvement in design and production processes ensures higher standards and fewer defects (Melander, 2018). Cost reductions are achieved through joint efforts to identify inefficiencies and implement solutions that benefit both parties (Cooper, 2017). Supplier involvement also increases organizational flexibility, enabling quicker responses to market changes and customer demands (Um, 2017). Furthermore, sustainability gains are realized when suppliers are engaged in initiatives that promote eco-friendly practices, contributing to environmental and social responsibility across the supply chain (Feng et al., 2024).

Organisations can adopt several best practices to optimise supplier involvement and overcome associated challenges (Yadav et al., 2020). Establishing clear objectives and expectations is fundamental, as it provides a shared understanding of the goals and scope of collaboration (Mattessich & Johnson, 2018). Developing collaborative agreements, such as contracts and memoranda of understanding, ensures that roles, responsibilities, and performance metrics are clearly defined (El-adaway et al., 2017). Investing in relationship-building activities fosters trust and mutual respect, which are critical for long-term partnerships (Shin et al., 2020). Leveraging technology, such as digital platforms and communication tools, enhances information sharing and coordination, reducing the risk of miscommunication or delays (Sanni, 2024). Finally, continuously monitoring and evaluating supplier involvement initiatives through performance metrics and feedback mechanisms helps organisations identify areas for improvement and ensure the alignment of supplier contributions with organisational goals (Maestrini et al., 2018).

Supplier involvement represents a strategic approach to enhancing organizational competitiveness and adaptability in today's dynamic markets (Sáenz et al., 2018). By fostering collaboration with suppliers, organizations can unlock new opportunities for innovation, cost efficiency, and sustainability. However, the realization of these benefits depends on careful planning, robust relationship management, and the ability to address challenges effectively (Arnold, 2017). As the business landscape evolves, future research should explore the impact of digitalization, sustainability, and other emerging trends on supplier involvement, providing a roadmap for organizations to harness its full potential (Omol, 2024).

2.5 Theoretical Review

2.5.1 Resource Based View Theory

The Resource-Based View (RBV) serves as a foundational theoretical lens for examining how internal organizational resources contribute to sustained competitive advantage and improved performance. According to Barney (1991) and Barney, Ketchen, and Wright (2011), firms achieve superior performance when they acquire and effectively deploy resources that are valuable, rare, inimitable, and non-substitutable (VRIN). In the context of this study, Electronic Procurement Practices (EPP) are conceptualized as strategic, technology-driven capabilities that serve as enablers of enhanced Supply Chain Performance (SCP).

Recent research emphasizes the importance of digital procurement capabilities as critical intangible assets within the RBV framework. These capabilities include automated sourcing, e-tendering, supplier portals, and data analytics tools that enhance procurement efficiency, supplier coordination, and decision-making (Aboelmaged, 2018; Dey, Bhattacharya, & Ho, 2020). Such practices are not only technologically embedded but also embedded within organizational processes and routines, making them difficult for competitors to replicate thus fulfilling the VRIN criteria.

Empirical evidence supports this view. For instance, Büyüközkan and Göçer (2018) found that the integration of digital procurement systems significantly improves supply chain responsiveness and operational agility, particularly in complex and dynamic environments. Similarly, Ali, Gölgeci, and Arslan (2020) argue that e-procurement systems act as capability enhancers, enabling firms to manage supplier relationships more effectively, optimize procurement cycles, and improve cost-efficiency thereby directly contributing to supply chain performance.

Moreover, Gunasekaran et al. (2017) assert that digital procurement enhances visibility and transparency across the supply chain, leading to improved coordination, reduced lead times, and better risk management. These performance outcomes align with the RBV's emphasis on the strategic deployment of internal resources to achieve a sustainable edge over competitors.

The application of RBV is particularly relevant in emerging economies where resource constraints demand smarter utilization of technology-based solutions. For instance, Boateng, Molla, and Heeks (2019) highlight that e-procurement adoption in Sub-Saharan Africa, though challenged by infrastructure and policy gaps, can yield significant performance benefits when aligned with organizational learning and strategic intent. This suggests that beyond mere adoption, the strategic configuration and integration of EPP within firm capabilities are key to unlocking their performance potential.

Furthermore, dynamic capability theory, an extension of RBV, reinforces the idea that firms must not only possess resources but also develop the ability to adapt, integrate, and reconfigure these resources in response to changing environments (Teece, Peteraf, & Leih, 2016). In this regard, EPP becomes a dynamic capability that allows organizations to continuously align procurement functions with evolving supply chain requirements, ensuring resilience and sustained performance.

In sum, the RBV provides a robust theoretical foundation for examining how Electronic Procurement Practices contribute to Supply Chain Performance. When effectively embedded within organizational structures and complemented by skilled human capital and supportive leadership, EPP serves as a core strategic resource offering firms a durable source of competitive advantage in today's digital and globalized supply chains.

2.5.2 Relational exchange theory

Relational Exchange Theory (RET) is a framework rooted in social exchange theory that emphasizes the importance of relationships, trust, and mutual benefits in fostering long-term partnerships between organizations (Xue et al., 2018). Unlike transactional exchanges, which are short-term and price-driven, relational exchanges are characterized by interdependence, collaboration, and shared goals (Wieland, 2024). This theory has significant implications for supplier involvement, procurement practices, and supply chain performance.

Regarding supplier involvement, RET highlights the role of trust, collaboration, and long-term orientation. Trust is a cornerstone of relational exchanges, enabling buyers and suppliers to share sensitive information, collaborate on innovation, and co-create value (Cooper, 2024). Suppliers are more likely to invest in specialized assets and align their strategies with the buyer's goals when they perceive the relationship as enduring and mutually beneficial (Christopher, 2017). Relational norms such as flexibility, solidarity, and reciprocity foster a cooperative environment where suppliers feel valued and motivated to contribute to the buyer's success (Yaqub, 2013).

In procurement practices, RET shifts the focus from price-based supplier selection to relationship-based criteria. Buyers prioritise suppliers who demonstrate reliability, quality, and a willingness to collaborate, reducing the risk of supply chain disruptions and enhancing overall performance (Bacher, 1996). Traditional procurement relies on rigid contracts to mitigate risks. However, RET advocates for flexible contracts that allow for adjustments as circumstances change underpinned by trust and a shared commitment to achieving mutual goals (Perrone, 2019). Joint planning and forecasting activities are encouraged, enabling buyers and suppliers to share demand forecasts, production schedules, and inventory levels to optimise operations and reduce

inefficiencies. While RET emphasises trust, it also recognises the need for performance monitoring, though this is conducted collaboratively with a focus on continuous improvement rather than punitive measures (Pulakos et al., 2012).

The principles of RET have a profound impact on supply chain performance by fostering collaboration, reducing transaction costs, and enhancing innovation (Zhou et al., 2024). Relational exchanges reduce the need for extensive monitoring and negotiation, allowing suppliers and buyers to focus on value creation rather than managing conflicts (Zhu et al., 2018). Buyers can tap into their expertise and drive innovation by involving suppliers in product development and process improvement, creating an environment where knowledge-sharing and joint problem-solving thrive (Mathrani & Edwards, 2020). Strong relationships built on trust and mutual commitment also reduce the risk of supply chain disruptions, as suppliers are more likely to prioritise the buyer's needs during crises such as raw material shortages or geopolitical uncertainties (Burkhart, 2023). Additionally, relational exchanges lead to higher-quality products, faster delivery times, and better responsiveness to customer demands, enhancing customer satisfaction and strengthening the buyer's competitive position. RET also promotes sustainable procurement practices by encouraging long-term partnerships with suppliers who adhere to ethical and environmental standards, enabling collaboration on initiatives such as reducing carbon footprints and improving labour conditions (Putri, 2025).

Despite its benefits, RET is not without challenges. Over-reliance on a few suppliers can create vulnerabilities in the supply chain, and building trust and relational norms can be challenging in global supply chains with diverse cultural contexts (Emma, 2024). Maintaining relational exchanges also requires significant time, effort, and resources, which may not be feasible for all organisations. Nevertheless, the Relational Exchange

Theory provides a robust framework for understanding how trust, collaboration, and long-term orientation can enhance supplier involvement, procurement practices, and supply chain performance (Chang et al., 2015). By fostering relational exchanges, organisations can create resilient, innovative, and high-performing supply chains that deliver sustained competitive advantage. However, successful implementation requires a strategic commitment to building and maintaining strong supplier relationships (Datta, 2017).

2.6 Conceptual Framework and Hypotheses Development

The conceptual framework expresses the study's objectives and empirical evidence supporting the relationship between E-Procurement practices, supply chain performance and supplier involvement.

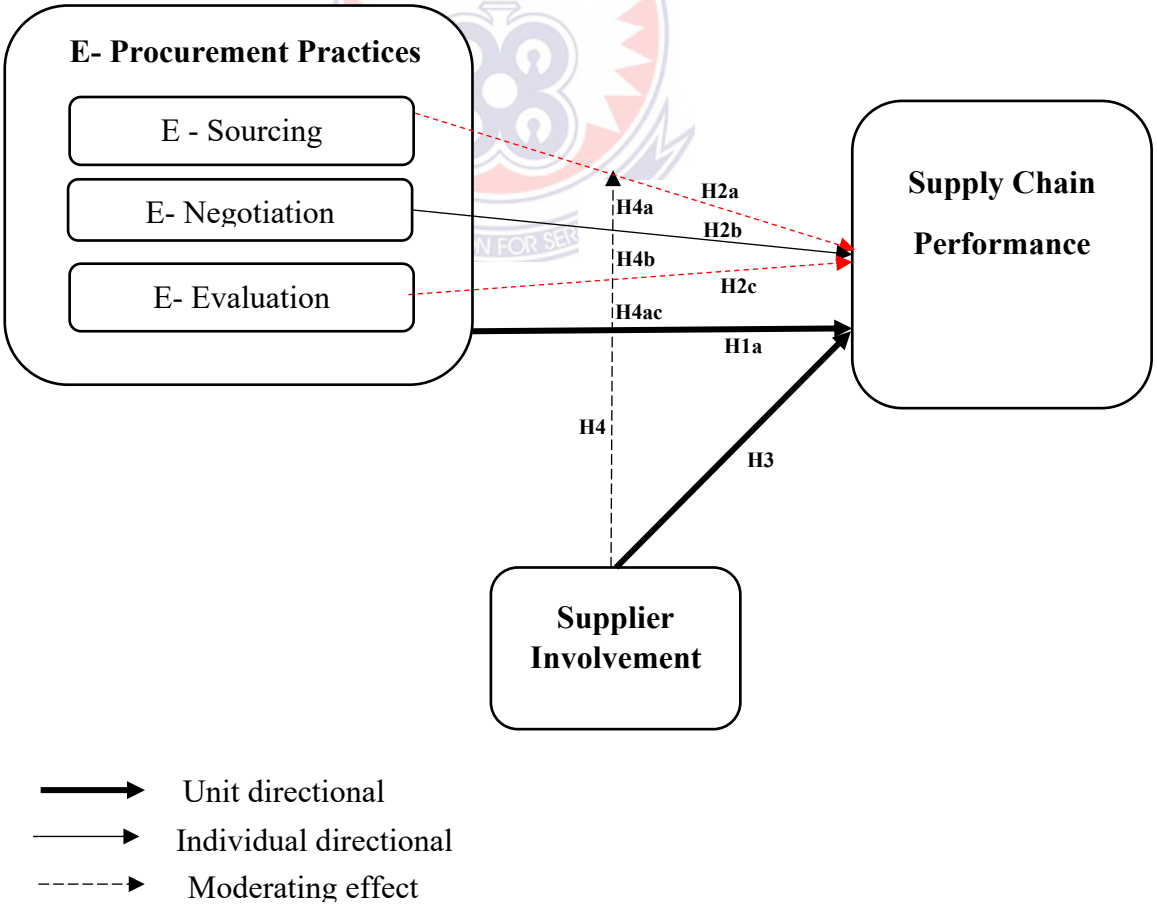

Figure 2.1: Conceptual Framework

2.6.1 E-Procurement practices and supply chain performance

Electronic procurement practices have been a significant area of interest in supply chain management research. Puschmann et al. (2005) explore the successful use of e-procurement in supply chains, particularly focusing on indirect goods supply chain management. The study found that e-procurement practices significantly affected supply chain management. The rationale behind these findings is that if firms can invest in e-procurement, it will lead to supply chain performance. Furthermore, Faheem et al. (2019) study the impact of e-procurement practices, such as electronic design, sourcing, negotiation, and evaluation, on supply chain performance in the Pakistani industry. The study further argued that e-procurement practices the dimensions of e-procurement practices affected supply chain performance. Lee et al. (2007) present the relationship between supply chain linkages and performance, highlighting the importance of strong connections among suppliers, internal integration, and customers for cost containment and reliability. Moreover, Singh et al. (2022) examine the impact of electronic procurement adoption on green procurement practices and sustainable supply chain performance in Malaysian ISO organisations, emphasising the role of technology acceptance in driving these practices. Waithaka et al. (2021) aimed to establish the influence of electronic procurement practices on supply chain performance, highlighting the need for government policies to support the adoption of e-procurement. Similarly, Oteki et al. (2020) focused on electronic material management practices in sugar processing firms in Kenya, emphasising the importance of providing suppliers access to electronic procurement portals to enhance supply chain functions. Furthermore, Puschmann et al. (2005) explored the successful use of e-procurement in supply chains, particularly in indirect goods supply chain management. The study highlighted the role of e-procurement systems in improving supply chain operations.

Kosmol et al. (2019) also introduced the supply chain practice view (SCPV) as a theoretical lens for understanding digital procurement readiness, emphasising the need for collaboration with supply chain partners in digitalisation efforts. Moreover, Jayaram et al. (1998) examined the contribution of procurement lead time (PTL) performance to overall firm performance, underscoring the importance of time-based competition in evaluating supply chain performance. Lee et al. (2007) presented the relationship between supply chain linkages and supply chain performance, focusing on cost-containment and reliability of supply chain partners. These studies collectively highlight the significance of efficient procurement practices in enhancing supply chain performance. In conclusion, the literature review on electronic procurement practices and supply chain performance emphasises the critical role of e-procurement systems, time-based competition, and supply chain linkages in improving overall supply chain operations. Collaborative efforts with supply chain partners and government support for e-procurement adoption are essential for enhancing supply chain performance in various industries.

H1a- E-procurement practices have a significant effect on supply chain performance

2.6.2 E-Sourcing and Supply Chain Performance

Although prior studies largely report positive associations between e-sourcing and supply chain performance, emerging evidence suggests that the benefits of e-sourcing are highly context-dependent and may not always translate into improved operational outcomes. While Ardito et al. (2020), Çankaya (2020), and Li et al. (2022) highlight performance gains from strategic and sustainable e-sourcing practices, these findings are predominantly situated in technologically mature and well-integrated supply chain environments.

In contrast, in developing economies and fragmented industries such as construction, the implementation of e-sourcing systems may introduce operational rigidities, increased bureaucratic procedures, and coordination inefficiencies. Vlachos et al. (2020) emphasize the need for high levels of integration and collaboration for multi-sourcing technologies to yield performance benefits. In contexts where supplier digital capability is uneven, the adoption of e-sourcing platforms may slow procurement cycles rather than enhancing them. Similarly, Narwane et al. (2021) underscore the mediating role of big data analytics in translating digital procurement tools into performance gains, implying that without complementary technological infrastructure, performance improvements may not materialize. Akhil et al. (2023) also demonstrate that external disruptions and crisis conditions moderate the effectiveness of e-sourcing strategies. Within the Ghanaian construction sector, characterised by limited ICT infrastructure, low supplier technological readiness, informal procurement networks, high transaction complexity, and delays in approval processes, e-sourcing systems may increase compliance requirements and procedural formalities, thereby reducing procurement flexibility and responsiveness. This may ultimately weaken supply chain performance indicators such as cost efficiency, delivery reliability, and responsiveness. Therefore, while prior studies largely suggest positive outcomes, the contextual realities of emerging economies justify the possibility of an adverse performance effect. Based on this reasoning, the study hypothesises that:

H2a: E-sourcing has a statistically significant negative effect on supply chain performance.

2.6.3 E – Negotiation and Supply chain performance

E-negotiation and supply chain performance are crucial aspects of modern supply chain management. Madzimure et al. (2020) explored the relationship between e-negotiation, supplier integration, and supply chain performance in small and medium enterprises (SMEs) in South Africa. The study utilised a quantitative approach to survey owners and managers of SMEs in Gauteng Province. The findings shed light on the importance of e-negotiation and supplier integration in enhancing supply chain performance within retail SMEs. Similarly, Choi (2020) delved into supply chain negotiation practice using blockchain technology, particularly in supply chains selling fashionable products. By developing analytical models for traditional and blockchain-supported supply chains, the study highlighted the potential impacts of blockchain on supply chain negotiation and performance. Furthermore, Madzimure (2020) investigated how SMEs can enhance supplier integration through e-design and e-negotiation. Conducted in the Sedibeng region of Gauteng province, the study emphasised the role of e-design and e-negotiation in strengthening relationships with suppliers and improving overall supply chain performance. The study highlighted that design and negotiation significantly affected supply chain performance. On a broader scale, Cvetić et al. (2021) discussed the application of e-negotiation supply chain principles in improving supply chain performance. By comparing traditional and e-negotiation supply chain characteristics, the paper demonstrated how lean approaches can enhance performance for all supply chain participants. In a different context, Zhou (2021) examined the impact of supply chain partnerships and E-negotiations on firm performance, focusing on Chinese construction companies. Through regression analysis, the study explored the associations between firm performance and collaboration with supply chain partners

and e-negotiation, highlighting the importance of cooperation in achieving optimal supply chain performance.

H2b- E-negotiation has a significant effect on supply chain performance

2.6.4 E-Evaluation and Supply Chain Performance

Electronic evaluation (e-evaluation) systems are designed to enhance transparency, accountability, and supplier performance monitoring within supply chains. Studies such as Abdel-Basset et al. (2020) and Sarıçam et al. (2021) demonstrate that structured supplier evaluation frameworks can improve decision-making and long-term sustainability outcomes. Similarly, Singh et al. (2020) and Nagariya et al. (2021) argue that systematic performance evaluation strengthens operational alignment and service efficiency. However, the performance implications of e-evaluation systems are not universally positive. Several studies imply that the effectiveness of electronic evaluation mechanisms depends heavily on contextual readiness, technological infrastructure, and institutional maturity. For instance, Noorizadeh et al. (2020) highlight the complexity involved in supplier productivity modelling and purchasing reallocation, suggesting that poorly calibrated evaluation systems may distort procurement decisions. Fan (2021) further shows that sophisticated financial risk models require advanced analytical capabilities, without which decision accuracy may decline. In developing and project-based industries such as construction, rigid electronic evaluation procedures may generate unintended consequences such as increased bureaucratic bottlenecks, delays in supplier approval processes, over-emphasis on compliance rather than performance outcomes, limited flexibility in urgent procurement situations, and inadequate data quality for meaningful performance scoring. Where digital infrastructure and supplier capabilities are uneven, e-evaluation systems may prioritise documentation completeness over operational responsiveness.

This can reduce agility, slow procurement cycles, and ultimately weaken overall supply chain performance. Within the Ghanaian construction sector, where procurement processes are often time-sensitive and relationship-driven, excessive formalisation through electronic evaluation tools may hinder responsiveness and coordination rather than enhance them. Therefore, despite evidence of positive outcomes in technologically mature environments, contextual constraints may reverse the expected performance benefits. Accordingly, this study hypothesises that:

H2c: E-evaluation has a statistically significant negative effect on supply chain performance.

2.6.5 Supplier involvement and supply chain performance

Supplier involvement plays a crucial role in enhancing supply chain performance. Kang et al. (2020) explored how cross-functional integration influences external partner involvement and promotes new product development project success. This highlights the importance of collaboration between different organisational functions to drive supplier involvement and improve supply chain performance. Benton et al. (2020) studied the influence of supplier engagement on supplier performance, emphasising the significance of investing in supplier relationships to enhance overall supply chain performance. Cheng et al. (2020) focused on social media-based supplier network involvement and its impact on new product performance, highlighting the role of network structure in facilitating effective supplier involvement. Noh (2020) examined the impact of social capital on relationship performance between buyers and suppliers, emphasising the need to understand the resources shared between partners to enhance commitment and performance. The study found that social capital is significant. Furthermore, Ayala et al. (2021) analysed different forms of service supplier

involvement and their effects on servitisation performance, with the grey box configuration showing the best results. This suggests that involving suppliers in service design can improve performance outcomes. Patrucco et al. (2021) discussed the characteristics of supplier performance measurement systems in collaborative innovation projects, underscoring the role of the purchasing department in evaluating supplier performance and driving innovation. Based on empirical observations, we hypothesize that;

H3 Supplier involvement has a significant effect on supply chain performance

2.6.7 Moderating the role of supplier involvement in E-procurement practice and supply chain performance

The impact of supplier involvement on electronic procurement practices and supply chain performance has been a topic of interest in supply chain management. Harris et al. (1998) studied procurement and supply chain management changes and their effect on supplier involvement in UK privatised companies, shedding light on the nature and direction of privatisation-related changes. Paulraj et al. (2006) explored the levels of supplier involvement and their impact on supply integration and performance, highlighting the importance of supplier involvement in enhancing supply chain performance. Standing et al. (2007) delved into hybrid buyer-supplier relationships in global electronic markets, emphasising the significance of collaborative relationships in the electronic procurement process. Additionally, Njenga (2018) found that supplier involvement and employee engagement are crucial in integrating lean procurement methodologies, impacting supply chain performance. They further argued that supplier involvement and employee engagement played a partial moderation effect on supply chain performance. Furthermore, Patrucco et al. (2021) discussed the characteristics of supplier performance measurement systems in collaborative innovation projects,

highlighting the role of the purchasing department in evaluating supplier performance. Shari (2021) focused on enhancing halal procurement practices in Malaysian hotels, emphasising the importance of following halal guidelines to enhance business performance. Kędzia (2024) investigated the impact of supplier involvement in product development on supplier relationship resilience and company performance, emphasising the benefits of collaborative practices in enhancing procurement flexibility. Moreover, David et al. (2024) explored the influence of senior management on supplier selection and procurement performance, highlighting the importance of managerial commitment in moderating the relationship between supplier selection and procurement performance. From the above assertions, we hypothesise that;

H3- Supplier Involvement has a positive moderating effect on the relationship between e-procurement practices and supply chain performance

2.6.8 Moderating role of supplier Involvement on electronic sourcing and supply chain performance

The literature underscores the pivotal role of supplier involvement in enhancing supply chain performance, particularly within electronic sourcing contexts. Several studies highlight that active supplier participation contributes significantly to supply chain integration and operational effectiveness. For instance, Vass et al. (2018) demonstrate that IoT capabilities, which facilitate supplier involvement, bolster supply chain process integration and organizational performance, indicating that technological engagement with suppliers can lead to improved outcomes. Similarly, Phan et al. (2019) find that supply chain quality management practices, which often involve supplier collaboration, have a direct positive impact on operational performance in construction firms, including those in the electronics sector.

Furthermore, the strategic importance of supplier involvement is reinforced by research on relationship quality and risk mitigation. Al-Shboul (2023) emphasizes that supplier involvement moderates the relationship between relationship quality and supply risk mitigation, thereby enhancing overall supply chain performance. This suggests that supplier engagement not only fosters better communication and trust but also mitigates uncertainties that could hinder performance.

Empirical evidence from diverse industries supports these findings. Khan et al. (2022) reveal that earlier supplier involvement influences buyer-supplier relationships, leading to increased dependency and potentially more effective collaboration, which is crucial for electronic sourcing. Additionally, Widijastuti et al. (2021) show that supply chain management practices, which inherently involve supplier participation, positively affect supply chain performance in organic rice supply chains, implying similar benefits in electronics supply chains.

The structural aspects of supplier networks also play a role. Hong et al. (2016) analyze how the configuration of supplier networks impacts firm performance, suggesting that well-structured supplier involvement can enhance supply chain outcomes. Moreover, social capital between buyers and suppliers, as discussed by Noh (2020), facilitates stronger relationships and commitment, further supporting the notion that supplier involvement fosters a more resilient and high-performing supply chain. From the above assertions, we hypothesise that;

H4a- Supplier Involvement has a negative moderating effect on the relationship e-sourcing and supply chain performance

2.6.9 Moderating role of supplier involvement on electronic negotiation and supply chain performance

Benton et al. (2005) highlight that power-driven buyer-seller relationships significantly influence supply chain satisfaction, implying that active supplier engagement can foster more positive outcomes within the supply chain. Similarly, Khan et al. (2022) demonstrate that earlier supplier involvement, alongside other factors such as supplier performance and partnership quality, directly impacts buyer-supplier relationships, suggesting that increased supplier participation can strengthen dependency and collaboration, ultimately benefiting supply chain operations.

Empirical studies further support the positive effects of supplier involvement on supply chain management. Dath et al. (2010) emphasize that supply chain management, viewed from the perspectives of OEMs and suppliers, is a strategic approach that enhances organizational effectiveness, implying that supplier involvement is integral to achieving organizational goals. Al-Shboul (2023) reinforces this by showing that supplier involvement moderates the relationship between relationship quality and supply risk mitigation, indicating that active supplier participation can mitigate risks and improve overall supply chain performance. The integration of electronic practices, particularly electronic negotiation, is also linked to improved supply chain outcomes. Faheem et al. (2019) identify electronic negotiation as one of the key e-procurement practices that impact supply chain performance positively. This aligns with findings by Widijastuti et al. (2021), who suggest that supply chain management practices, including electronic processes, influence supply chain performance, although their focus was on organic rice supply chains.

Furthermore, the structural aspects of supplier networks and collaboration are associated with enhanced performance. Hong et al. (2016) find that the structure of

supplier networks correlates with firm performance, implying that well-involved suppliers within networks contribute to better operational outcomes. Wandfluh et al. (2016) also demonstrate that financial collaboration, which can be facilitated by supplier involvement, plays a role in improving supply chain financing performance. From the above assertions, we hypothesise that;

H4b- Supplier Involvement has a significant and positive moderating effect on the relationship electronic negotiation and supply chain performance

2.6.10 Moderating role of supplier involvement on electronic evaluation and supply chain performance

The existing literature underscores the pivotal role of supplier involvement in enhancing supply chain performance, particularly through its moderating effects on various supply chain practices and outcomes. Cherono et al. (2021) highlight that supplier selection significantly influences supply chain efficiency, suggesting that involving suppliers effectively can lead to improved organizational performance. Similarly, Widijastuti et al. (2021) demonstrate that management practices, which inherently include supplier engagement, impact supply chain performance, especially within specific sectors like organic rice production.

The integration of information technology (IT) capabilities with supplier involvement further amplifies supply chain performance.

Ganbold et al. (2021) find that IT-enabled supply chain integration (SCI), which involves supplier collaboration, positively affects operational metrics such as quality, delivery, and customer service. Notably, their findings suggest that customer integration, a facet of SCI often driven by supplier involvement, has a particularly strong impact on operational performance indicators.

In the context of supplier selection, Utama et al. (2021) propose advanced decision-making frameworks like DEMATEL and ANP to optimize supplier choices, emphasizing that strategic supplier involvement is crucial for effective supply chain management. Moreover, Purwanto et al. (2022) establish that supplier performance and transformational leadership within the supply chain are directly linked to overall supply chain performance, implying that active supplier engagement and leadership are vital for achieving desired outcomes.

The moderating effect of supplier involvement is further supported by studies examining relationship quality and risk mitigation. Al-Shboul (2023) provides empirical evidence that supplier involvement moderates the relationship between relationship quality and supply risk mitigation, especially in developing country contexts. This suggests that supplier engagement can buffer risks and enhance relationship stability, thereby improving supply chain resilience.

Additionally, Agyei-Owusu et al. (2022) emphasize that internal and external supply chain integration, which involves supplier participation, directly enhances operational and firm performance. Their findings imply that supplier involvement acts as a catalyst within the broader supply chain integration framework, reinforcing its positive moderating role.

Finally, the importance of ethical leadership and environmental considerations in supply chain practices, as discussed by Agyabeng-Mensah et al. (2023), indicates that supplier involvement, when aligned with ethical and sustainability principles, can further strengthen supply chain performance outcomes. From the above assertions, we hypothesise that;

H4c- Supplier Involvement has a negative moderating effect on the relationship electronic evaluation and supply chain performance

2.7 Chapter Summary

This chapter comprehensively evaluates relevant literature and explains the theories supporting the study's hypothesis. Emphasis is placed on the relationship between e-procurement practices, supply chain involvement and supply chain performance. Finally, the study develops a conceptual framework based on its review and objectives.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

Chapter three discussed the research method used in the study. The chapter discussed the research philosophy and design, population, sample size, sampling and data collection techniques, various data collection instruments, and procedures for measuring and analysing the data. As a result, this section outlines the methodology used in conducting the entire study. Issues of reliability and ethics were included in this chapter.

3.1 Philosophical Assumptions

Research philosophies refer to frameworks of convictions and assumptions regarding the advancement of knowledge (Akpan, 2022). As mentioned above, the statement implies that one's research philosophy encompasses significant assumptions regarding one's worldview. The underlying assumptions that one holds significantly impact all facets of one's research endeavours. To comprehend one's research philosophy, it is imperative to cultivate the ability of reflexivity, which involves engaging in self-inquiry and questioning one's own beliefs and assumptions with the same level of scrutiny as others (Ide & Beddoe, 2024).

According to scholarly literature, Shan's (2022) research philosophies are characterised by four fundamental assumptions: ontological, epistemological, axiological, and methodological. Distinguishing various philosophies can be achieved by analyzing the disparities and similarities in their ontological, epistemological, and axiological assumptions (Al-Ababneh, 2020).

Ontology pertains to scholars' underlying presumptions regarding the essence of the universe and its existence (Hartmann, 2019). One's ontological assumptions significantly impact the selection of research objects and phenomena, as well as the perspective and methodology employed in the study (Hartmann, 2019).

Epistemology pertains to the underlying presumptions regarding knowledge, such as how we acquire and verify knowledge, the criteria for determining acceptable, valid, and legitimate knowledge, and the methods for conveying knowledge to others (Shan, 2022). The epistemological presuppositions that one adopts significantly impact the nature of the knowledge that can be generated through research (Ngulube, 2015).

Axiology pertains to the significance of values and ethics in the research process. (Saunder et al., 2019). This involves inquiries into how researchers handle their values and those of their research participants. Each theoretical paradigm that can inform business research possesses a distinct methodological orientation, either quantitative, qualitative, or a combination of both (Ngulube, 2015).

This study adopted an epistemology philosophy because the researcher believes knowledge can be drawn from e-procurement practices, supply chain performance, and supplier involvement. The choice of epistemology stems from the presumptions regarding expertise, such as how we acquire and verify knowledge, the criteria for determining acceptable, valid, and legitimate knowledge, and the methods for conveying knowledge to others (Tiwari, 2018).

3.2 Research Paradigm

A research paradigm refers to a comprehensive belief system or worldview that guides how research is conceptualized, designed, conducted, and interpreted (Creswell & Poth, 2018). It encompasses a set of assumptions about the nature of reality (ontology), the nature of knowledge (epistemology), and the methods used to generate that knowledge

(methodology). Paradigms shape how researchers understand phenomena and choose methods accordingly.

Four dominant research paradigms are commonly discussed in social science research: post-positivism, constructivism, advocacy/participatory, and pragmatism (Tuval-Mashiach, 2021).

- Post-positivism assumes that reality exists but can only be understood imperfectly; it emphasizes objectivity, measurement, and hypothesis testing, often through quantitative methods.
- Constructivism posits that reality is socially constructed and subjective, making it suitable for qualitative methods that explore participants' meanings and experiences.
- Advocacy/Participatory paradigms focus on issues of power, inequality, and social change, often involving collaborative approaches that give voice to marginalized groups.
- Pragmatism, in contrast, is problem-centered and flexible, recognizing that researchers can draw from both qualitative and quantitative methods to address practical problems without strict allegiance to any one philosophical stance.

This study aligns with the positivism research paradigm because reality is subjective worldwide; thus, e-procurement practices, supply chain performance, and supplier involvement in Ghana are considered different in other jurisdictions. Epistemologically, what is regarded as acceptable knowledge is objective and emanates from a causal explanation.

The ultimate focus of positivist inquiry is to reveal causal or explanatory relationships that predict the phenomenon studied (Gamlen & McIntyre, 2018). The positivist paradigm holds that research is suitable if it has both internal and external validity and

is objective and reliable (Rose & Johnson, 2020). Positivism typically employs quantitative research techniques to gather information. Under the positivist paradigm, the study's results can be extrapolated (Rose & Johnson, 2020).

The positivist research paradigm was adopted to assist the researcher in gathering data, analysing it, and presenting the results unbiasedly to establish a relationship between the variables (e-procurement practices, supply chain performance, and supplier involvement). Under the positivist paradigm, the study's findings can be generalised to the entire population (Park, 2020).

3.3 Research Design

A research design refers to a systematic and structured framework or strategy that outlines the procedures and methods for conducting a research study (Sileyew, 2019). It outlines the requisite procedures for acquiring the information essential for structuring or resolving research problems (Zina, 2021). There are three main types of research design: descriptive, explanatory, and exploratory (Saunders, Lewis, & Thornhill, 2019).

- **Descriptive research design** is used to systematically describe a phenomenon, population, or situation. It focuses on answering the "what" questions and is often employed when the objective is to present factual and accurate details about existing conditions or practices without investigating causal relationships (Creswell & Creswell, 2018).
- **Explanatory research design** seeks to establish cause-and-effect relationships between variables. It is typically guided by hypotheses and involves testing theoretical propositions using empirical data, often through quantitative methods (Saunders et al., 2019).

- **Exploratory research design**, on the other hand, is used when little is known about a phenomenon. It aims to generate insights, identify patterns, or formulate questions and hypotheses for future studies. It is usually qualitative in nature and highly flexible (Robson & McCartan, 2016).

Based on the study's nature and from a deductive point of view (examining relationships and testing hypotheses), the study adopted the causal or explanatory research design to explore the cause-and-effect relationship between e- procurement practices, supply chain performance, and supplier involvement.

Descriptive research is inappropriate because it focuses on describing phenomena rather than explaining the relationships between variables (Loeb et al., 2017). This study aims to establish cause-and-effect relationships, which requires going beyond mere description to identify and test the factors influencing the outcomes. Descriptive research would not provide the depth needed to examine the causal links between e-procurement practices, supply chain performance, and supplier involvement (Pandita & Ray, 2018).

An exploratory research design is not suitable for this study, as it is typically aligned with an inductive research approach where researchers seek to generate theories or hypotheses by identifying patterns and insights from qualitative or open-ended data (Ushaka, 2019). In contrast, this study adopts a deductive approach, which involves testing predefined hypotheses derived from existing theories. Therefore, the focus on examining established relationships such as the link between e-procurement practices and supply chain performance warrants the use of an explanatory design rather than an exploratory one.

3.4 Research Approach

The term "research approach" refers to processes and procedures involving data collection, analysis, and interpretation. Research approaches are broadly categorized into quantitative, qualitative, and mixed methods approaches, each guided by distinct philosophical and methodological assumptions (Creswell & Creswell, 2018; Mulisa, 2022).

- A quantitative research approach is typically associated with positivist or post-positivist paradigms and emphasizes objectivity, measurement, and statistical analysis. It involves the collection of numerical data to test hypotheses, identify patterns, and examine relationships between variables, often using structured instruments such as surveys or experiments (Creswell & Creswell, 2018; Saunders, Lewis, & Thornhill, 2019).
- In contrast, a qualitative research approach is aligned with interpretivist or constructivist paradigms and seeks to understand phenomena through the subjective experiences, meanings, and perspectives of participants. It relies on non-numerical data, such as interviews, focus groups, and observations, and is typically used to explore complex social or organizational processes in depth (Denzin & Lincoln, 2018; Silverman, 2021).
- A mixed methods approach integrates both quantitative and qualitative strategies within a single study to draw on the strengths of each. This approach is often grounded in the pragmatic paradigm and is particularly valuable for addressing complex research questions that require both statistical generalizability and contextual understanding (Creswell & Plano Clark, 2018).

These approaches provide the foundational structure upon which research designs and methodological choices are developed, allowing researchers to align their methods with the nature of the problem under investigation.

This study is considered quantitative because the nature of reality is tested through hypothesis and pre-existing theories (Resource based view theory and relational exchange theory). Additionally, a quantitative approach was employed to gain an in-depth understanding of the cause-and-effect relationship between e-procurement practices, supply chain performance, and supplier involvement. Once again, using a closed-ended questionnaire as a data collection tool is subjected to numerical analysis using statistical techniques (Hansen & Świderska, 2024).

3.5 Research Strategy

Research strategies vary depending on whether a study adopts a quantitative, qualitative, or mixed methods approach (Saunders et al., 2019). In quantitative research, strategies such as survey and experimental designs are commonly used. These strategies involve the collection of numerical data and are suited for hypothesis testing and identifying patterns or relationships among variables in a structured and statistically measurable way (Saunders, Lewis, & Thornhill, 2019).

Qualitative research, on the other hand, employs strategies such as case studies, grounded theory, and phenomenology. These strategies are focused on understanding human experiences and social phenomena in depth, often through interviews, observations, and document analysis, with the goal of generating rich, contextual insights rather than generalized facts (Creswell & Poth, 2018).

In mixed-methods research, strategies are designed to integrate both qualitative and quantitative procedures within a single study. These include designs where both forms of data are collected either sequentially or concurrently, allowing the researcher to

triangulate findings and gain a more comprehensive understanding of the research problem (Creswell & Plano Clark, 2018). The nature of the research questions therefore determines the choice of strategy, the objectives of the study, and the type of data needed to generate valid and meaningful results (Leavy, 2022).

This study adopts a quantitative survey strategy, which aligns with its explanatory design and deductive approach. The survey strategy enables the collection of standardised data from a large sample, facilitating the testing of hypotheses related to e-procurement practices, supplier involvement, and supply chain performance in Ghana's construction sector. It is appropriate for generating statistically reliable findings that can be generalized across the target population (Saunders et al., 2019).

3.6 Study Area

The study was conducted on registered construction firms in Greater Accra. Among Ghana's 16 regions, the Greater Accra Region is the smallest, covering an area of 3,245 square kilometres (Adibo, 2022). This represents 1.4 per cent of the country's total land area. The Greater Accra region is the most urbanised in Ghana, with urban centres accounting for 87.4 per cent of the region's total population (Songsore, 2020).

Greater Accra was selected for this study because it hosts many well-known construction firms (Lucy & Samuel, 2019). The region's diverse customer base and competitive market make it an ideal setting to explore how e-procurement practice impacts supply chain performance and the role of supplier involvement in this process (Ghadge et al., 2019). In addition, Accra's business environment is dynamic, with a high degree of competition and customer expectations (Osei et al., 2019). This makes it a fertile ground for studying how construction firms adopt e- procurement practices and how they affect supply chain performance.

3.7 Study Population

The target population for this study consisted of construction firms located in the Greater Accra Region of Ghana. This region was selected due to its status as the nation's capital and its distinctive characteristics, including significant urban diversity, concentrated infrastructural activity, and sustained economic growth, all of which make it a strategic hub for examining procurement practices in the construction sector. According to the Association of Ghana Industries database (2025), the population of registered construction firms in good standing in Ghana amounts to 900 as of February 2025. This study only focused on registered construction firms that is in good standing in Greater Accra.

The reason for registered construction firms is that they are recognised by local authorities and comply with regulations and standards (Lambin & Thorlakson, 2018). This ensures that the establishments included in the study meet legal and operational requirements, providing a more reliable and valid dataset. Moreover, registered construction firms typically adhere to industry standards and best practices, providing a consistent basis for comparing findings across different establishments (Osei et al., 2019). This uniformity is crucial for examining the relationships between e-procurement practices, supply chain performance, and supplier involvement.

The construction sector is closely tied to the industries, and studying construction firms in the Greater Accra Region provides insights into how the industry caters to local and international tastes, impacting the overall supply chain performance (Yeboah, 2022). Rahi (2017) defined population as all factors (people, things, and activities) the researcher intends to study similarly; Casteel and Bridier (2021) described the population as a group of people a researcher is interested in gathering vital information and drawing a conclusion. The population comprises construction firms in Accra that

are in good standing and have a registered or renewed license. According to the Association of Ghana Industries (2025), the number of registered construction firms in Greater Accra that are in good standing as of February 2025 is nine hundred (900). This research concentrates on registered construction firms in good standing in Greater Accra.

3.8 Sample size determination

The sample size is fundamental in quantitative research that involves testing associations and hypotheses. Sample size refers to the number of elements selected from a target population and from which data is gathered (Lakens, 2022). Sample size can affect the accuracy of the result and the choice of appropriate statistical analysis techniques (Mascha & Vetter, 2018). The present study used the Yamane sample size formula to determine the sample size for the study.

Yamane Formula

$$n = \frac{N}{1+N\,(e)^2}$$

Where:

- n is the sample size.
- N is the population size.
- e is the desired level of precision (expressed as a decimal).

e= 5% = 0.05

$$n = \frac{900}{1+900(0.05)^2}$$

n = 277

3.8.1 Sample and Sampling Procedure

Sampling is selecting a percentage or a representative of the entire population (Lohr, 2021). Casteel and Bridier (2021) define a sample as a population subset with common characteristics. The authors emphasised that a population sample consists of that proportion of the number of units selected for investigation. There are two types of sampling: probability and non-probability sampling. According to Shamsudin et al. (2024), probability sampling is a statistical technique in which each member of the population has a known, non-zero chance of being chosen for the sample. The method ensures that every member of the population has an equal chance of being selected, thereby enabling the use of statistical techniques to make valid generalizations about the entire population based on the characteristics of the sample (Lohr, 2021). Simple random, stratified, systematic, and cluster sampling are probability sampling approaches. In contrast, non-probability sampling does not rely on random selection and does not provide an equal opportunity for every member of the population to be included in the sample (Valliant et al., 2018). Instead, people are chosen according to availability, convenience, or the researcher's discretion. Quota, Purposive, Snowball, and Convenience sampling are standard non-probability sampling techniques (Shamsudin et al., 2024). Non-probability sampling can be more useful in some circumstances where random selection is difficult, although being less rigorous in terms of generalizability.

The study adopted a probability sampling technique and used simple random sampling because of the sample frame made available to the researcher by the Association of Ghana Industries database (2025). Simple random sampling ensures that every population element has an equal chance of selection. According to Casteel and Bridier (2021), simple random sampling is the most effective technique for extracting a

representative sample when applied to large samples. The simple random was deemed appropriate because of the availability of the sample frame (thus, the list of construction Firms). A simple random sampling technique was used to select the determined respondents. The study adopted Taherdoost's (2023) technique for randomising;

i. Definition of population: The study clearly defines the population of interest based on inclusion criteria which is (277 registered construction firms in Greater Accra).
ii. Determine the sample size: The sample size was determined using Taro Yamane's formula (201).
iii. Assign a unique identifier (number or label) to each individual or unit in the population
iv. Randomly select the sample using number tables and number allocation.
v. Contact and include units/respondents in your study (physical and in-person).

Finally, the study adopted Sanes's (1987) criteria for the selection of construction firms, as cited by Kusi and Acheampong (2018);

i. Construction firms must be registered and renewed license and have a good standing
ii. Must have procurement and supply chain directors, line procurement and supply chain relationship managers, officers, or heads
iii. Must pay their dues to (AOGI) and attend the annual meeting of the Association of Ghana Industries

The study adopted a simple random sampling technique to select both the participating firms and the individual respondents within those firms. First, the sampling frame consisted of 277 registered construction firms in the Greater Accra Region, from which a sample of 201 firms was drawn using Taro Yamane's (1967) formula. A unique

identification number was assigned to each firm, and random numbers were generated using a random number table to select firms for inclusion (Taherdoost, 2023).

Once the firms were selected, individual participants within each firm were also selected using simple random sampling. Each participating firm was asked to provide a list of eligible personnel who met predefined inclusion criteria based on Sanes's (1987) framework, as cited in Kusi and Acheampong (2018). These criteria included: (i) being a registered procurement or supply chain professional, such as a director, manager, officer, or relationship head; (ii) holding a current role in procurement or supply chain functions; and (iii) being actively involved in industry-level engagement, such as membership in the Association of Ghana Industries (AGI).

From each firm's list of eligible personnel, respondents were assigned unique identifiers. Using random number generation, one qualified individual was randomly selected per firm to ensure impartiality and reduce selection bias. This two-stage simple random sampling process, first at the firm level, then at the respondent level, ensured that each participant had an equal and independent chance of being selected, enhancing the representativeness and validity of the data collected.

3.8.2 Sample plan

Table 3.1 Presents the Sample plan for the study.

Table 3.1 Sample plan

Sampling Plan	
Total Population	List of registered construction firms in good standing in Greater Accra, Ghana 900 According to AOGI (2025)
Sampling Elements	Procurement and supply directors, line managers, heads and officers
Sample Frame	Association of Ghana Industries Database (2025)
Sampling size	Two hundred and seventy-seven (277)

3.8.3 Data Collection Instrument

A primary data collection instrument, more precisely, a close-ended questionnaire, was employed in this study. This was appropriate because of the research approach and research design used. Explanatory study designs are naturally structured. Therefore, organised primary data collection procedures are required (Taherdoost, 2021). A questionnaire is a tool for collecting data that consists of closed-ended and open-ended questions given to research respondents to acquire the respondents' objective thoughts on a subject (Dalati & Marx Gómez, 2018); similarly, Karunarathna (2024) defined a questionnaire as a collection of questions approved for use by respondents in data collection.

Questionnaires are the most common data-gathering tool in research and can measure issues crucial to business and growth (Pandey & Pandey, 2021). A questionnaire is suitable for gathering information from a large number of people. It aids in collecting objective data from a large group to ensure reliable and valid responses. The individual items on the questionnaire were carefully extracted from validated literature. E-procurement practices had eleven items; supplier involvement comprised five items, and supply chain performance also had six items. The questionnaire is divided into four sections. Section A discusses the demographics of the respondents. Section B of the questionnaire addressed E-procurement practices (i.e., e-evaluation, e-negotiation and e-sourcing). Supply involvement and supply chain performance are addressed in sections C and D, respectively. The respondents' thoughts were assessed using a seven-point Likert scale. The decision to use a seven-point Likert scale, ranging from 'Strongly Disagree' to 'Strongly Agree,' was intentional. This scale provides a finer degree of granularity compared to a more common five-point scale, which can sometimes force respondents into a neutral middle ground. A wider scale allows participants to express

more nuanced views, particularly when their opinions do not fit neatly into a three or five-point structure. The seven-point Likert scale was appropriate because, according to Vartiainen et al. (2020), it suggests that the seven-point Likert scales help capture the central tendency of respondents' opinions. The midpoint of the scale often represents a neutral or indifferent position. At the same time, the other points allow for distinctions in the strength of agreement or disagreement, creating a more nuanced understanding of the study variables (Vartiainen et al., 2020).

A close-ended questionnaire was chosen as the preferred instrument due to its advantages over the other instruments (Patturaja et al., 2018). Questionnaires are simple to construct, cost-effective, yield uniform results, and preserve high confidentiality. However, strategies for gathering data are needed to ensure validity and reliability (Pandey & Pandey, 2021)

3.9 Data Collection Procedures

The data collection exercise was conducted for two months. Emails and phone calls were made to the list of randomly selected construction firms to ensure smooth data collection. The various construction firms' sample elements knew the study's objective and purpose. This made it easier for the respondent to provide accurate information for the questions. The researcher administered the questionnaires to various construction firms, and the estimated duration for answering the questionnaire was 40–60 minutes. Procurement and supply directors, managers, and heads, as well as officers, responded to questions on e-procurement practices, supply chain performance, and supplier involvement. The duration gave the respondents ample time to read and understand the questions before responding. In each selected firm, only one individual respondent participated in the survey. The respondents included individuals occupying key procurement and supply chain roles: directors, managers or heads, and officers in

various construction firms. The rationale for using a single individual within each firm was to ensure consistency in responses, reduce intra-firm variability and avoid conflicting answers that may arise when multiple respondents from the same firm participate in the survey. This allowed the individual informant to provide informed and reliable responses on e-procurement practices and supply chain performance. Contact details were exchanged after the data was administered. The researcher contacted the respondent at least once to remind them of the questionnaires. As a result, questionnaires were received on time despite the busy schedules of the respondents.

3.10 Operationalization of variables

This section describes how the study variables were measured to fulfill research aims. All measuring items included the literature reviews of e-procurement practices, supply chain performance, and supplier involvement. Table 3.2 reveals that all variable indicators were based on in-depth literature reviews. This is because the table shows the different places from which the indicators were taken. As a result, a pre-test was done on two construction firms. This was done to see if the indicators of the different constructs were suitable quality measures in the context of e-procurement practices, supply chain performance, and supplier involvement.

Table 3.2 Operationalization of Constructs

Variables	Operationalisation	Sources
E-procurement practices	E-procurement practices refer to the use of digital tools and platforms to support and enhance procurement activities, including supplier sourcing, evaluation, and negotiation. These practices involve the adoption of e-sourcing systems to identify and engage suppliers, electronic evaluation tools to assess project performance and stakeholder collaboration, and electronic negotiation systems to ensure efficient, reliable, and unbiased negotiation processes.	Rotich et al., 2016; Yuan et al., 2004
Supplier involvement	Supplier involvement refers to the active participation and collaboration of key suppliers in a firm's strategic processes, particularly in product design, development, and continuous improvement initiatives. It includes integrating supplier expertise early in the development cycle, maintaining consensus on their strategic importance, involving them in cross-functional teams, and aligning supply chain processes and technologies to facilitate effective collaboration.	Feng et al., 2010; Vonderembse & Tracey,1999
Supply chain performance	Supply chain performance refers to the effectiveness and efficiency of a firm's supply chain in meeting customer requirements and operational goals. It encompasses the ability to adapt to demand changes, consistently deliver high-quality and defect-free products, ensure timely and complete order fulfillment, and minimize various forms of waste throughout the supply chain.	Pamela et al. (2009)

3.10.1 Variable and Measurement

The various constructs used to measure the variables were rigorously identified from the existing research. All the constructs were adopted and modified to work better with the study. The research focused on the three main study variables: E-procurement practices, supply chain performance, and supplier involvement. E-procurement practices items were adapted from (Rotich et al., 2016; Yuan et al., 2004). Similarly, supply chain performance measures were adapted from Pamela et al. (2009). Lastly, supplier involvement measures were adapted from (Feng et al., 2010; Vonderembse & Tracey,1999). All the constructs were modified to suit the study. The variables and their respective measurement items are presented in Table 3.3.

Table 3.3 Measurement Items

Items	Cronbach Alpha	Sources
E -SOURCING		Rotich et al., 2016; Yuan et al., 2004)
My organisation uses the e-sourcing platform to improve the search for prospective suppliers.		
My firm utilises e-sourcing to obtain timely information about the offerings of various suppliers.	0.755	
My organisation uses e-sourcing to improve strategic alliances with key suppliers.		
E-EVALUATION		
The adoption of electronic evaluation tools has improved our project monitoring efficiency.		
Electronic evaluation enhances collaboration between project teams and stakeholders.	0.899	
I trust the system to provide consistent and reliable results.		
The electronic evaluation system integrates seamlessly with our current workflows.		
E-NEGOTIATION		
My organisation trusts electronic negotiation platforms to provide fair and unbiased negotiations.		
Electronic negotiation minimises errors and misinterpretations in agreements.	0.703	
Utilising the electronic negotiation system within my firm has enhanced the efficiency of our negotiation processes.		
The electronic negotiation system in my organisation is user-friendly and easy to navigate.		
SUPPLY CHAIN PERFORMANCE		
Our supply chain can easily adapt to changes in demand.	0.763	Pamela et al., (2009)
This organization's primary supply chain has the ability to deliver zero-defect products to final customers		
This organization's primary supply chain can eliminate late, damaged, and incomplete orders to final customers		
This organization's primary supply chain can deliver products precisely on time to final customers		
This organization's primary supply chain has the ability to minimize all types of waste throughout the supply chain		
SUPPLIER INVOLVEMENT		
We have continuous improvement programs that include our key suppliers	0.873	Feng et al., 2010; Vonderembse & Tracey,1999
Our organisation has a strong consensus in our firm that supplier involvement is needed in product design/development		Feng et al., 2010; Vonderembse & Tracey,1999

Our key suppliers have a major influence on the design of new products	
We involve key suppliers in the product design and development stage.	
We redesign our supply chain processes to integrate advanced technologies seamlessly.	
We have representatives from our suppliers on our company's product design teams	

3.11 Reliability and Validity of the research instrument

The validity and reliability of the study were considered to ensure the consistency and content validity of the instrument. When it comes to validity, Cook and Reichardt (1979) define it as the best available estimation of the truthfulness of a given inference. Reliability is defined as the ability of an instrument to provide accurate and consistent results over time in the same situation and with the same people (Yilmaz, 2013). The instrument's consistency is an essential consideration in the evaluation of reliability. The most widely used internal consistency metric is Cronbach's alpha. Cronbach's alpha is the most reliable method for determining the reliability of the questionnaire.

Cronbach's alpha must be greater than 0.7 to ensure the reliability of the research instrument (Bujang et al., 2018). The composite reliability criterion is used to assess the reliability of the construct. The composite reliability must be at least 0.7 (Hair et al., 2017). Also, the outer loadings of an indicator must be greater than 0.7 for reliability (Hair et al., 2012). The composite reliability and convergent validity help decide whether an item with an outer loading between 0.4 and 0.7 should be kept (Hair et al., 2017). The average variance extracted (AVE) must be greater than 0.5 to ensure convergent validity (Hair et al., 2017). The construct's discriminant validity was examined using the heterotrait-monotrait ratio of correlations (HTMT).

The square root of AVE must be higher than the correlation between the reflective construct and all other Fornell-Lacker constructs (Henseler et al., 2015; Voorhees et al.,

2016). Similarly, the HTMT values should not exceed 0.90 to prove discriminant validity. (Henseler et al., 2015). Almanasreh (2019) argues that if the measurements in the questionnaire fully represent the instrument's content, an instrument has content validity.

The researcher pretested the instrument to ensure the questionnaire was free from spelling mistakes, poor phrasing, and confusing questions. It is widely accepted that questionnaires do not appear independently; instead, they are developed, shaped, and modified to ensure validity. The questionnaire was submitted to marketing experts, peers, and lecturers for approval and correction before being administered to the respondent.

3.12 Data Analysis and Questionnaire adaptation process

SmartPLS 4 and SPSS version 25 were employed for data processing and analysis. Completed questionnaires were first coded and screened in SPSS to check for missing values, outliers, and data entry errors. The cleaned dataset was then exported from Excel as a comma-separated values (CSV) file and imported into SmartPLS 4 for structural equation modelling analysis. The use of SmartPLS 4 was considered appropriate for this study due to its robustness in handling complex research models, interaction effects, and non-normal data distributions, which are common in behavioural and management research (Ramayah et al., 2017).

Partial Least Squares Structural Equation Modelling (PLS-SEM) was preferred over Covariance-Based SEM (CB-SEM) for several methodological reasons. First, the primary objective of the study was predictive and explanatory in nature, focusing on maximising the explained variance in supply chain performance and assessing the moderating role of supplier involvement rather than confirming an established theory. Second, PLS-SEM is well suited for models that include interaction terms and

formative or reflective constructs, as well as studies conducted in emerging economy contexts where data normality and large sample requirements for CB-SEM may be difficult to satisfy (Hair et al., 2019). Third, PLS-SEM is particularly appropriate for exploratory and theory-extension studies, making it suitable for examining the underexplored moderating effects of supplier involvement in the relationship between e-procurement practices and supply chain performance.

The measurement model in this study was specified as reflective, consistent with prior research on e-procurement, supplier involvement, and supply chain performance. Questionnaire items were adapted from validated scales used in previous empirical studies to ensure content validity and contextual relevance. Minor wording modifications were made to reflect the construction industry context in Ghana, while preserving the original meaning of the constructs. To further ensure validity, the adapted instrument was reviewed by subject matter experts in procurement and construction management, and a pilot study was conducted to assess clarity, relevance, and reliability of the items. Feedback from the pilot test informed minor refinements to item wording before the final data collection.

Both descriptive and inferential statistics were employed in the analysis. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to analyse respondents' demographic characteristics using SPSS version 25. Inferential analysis was conducted using PLS-SEM in SmartPLS 4 to test the hypothesised relationships among e-procurement practices, supply chain performance, and supplier involvement. A consistent bootstrapping procedure with 5,000 resamples was applied to estimate path coefficients, t-statistics, and p-values, in line with established PLS-SEM guidelines (Hair et al., 2019). This approach enabled robust

assessment of both direct and moderating effects, thereby addressing the study's research objectives

3.13 Common method bias

According to Jordan and Troth (2020), common method bias (CMB) arises when data for all key variables such as independent, dependent, moderating, and mediating variables are collected using the same measurement method or source, which can inflate or distort the observed relationships among those variables due to shared method variance. To mitigate common method bias (CMB), this study incorporated both procedural and statistical strategies, as recommended by Jordan and Troth (2020). Procedurally, steps were taken during the data collection phase to reduce the likelihood of bias. At the initial stage of the survey, participants were presented with an information cover sheet clearly outlining the purpose of the study, assuring confidentiality, and emphasizing that there were no right or wrong answers. This was intended to reduce evaluation apprehension and encourage honest, thoughtful responses. Additional procedural remedies included the careful design of question order to minimize priming effects and the use of simple, neutral language to avoid leading questions.

Clear and detailed instructions were provided to help respondents understand how to appropriately answer each section of the questionnaire. These instructions explained the meaning of the scale items and how to use the response format accurately. To enhance clarity and consistency in responses, the questionnaire employed a 7-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (7). This format was chosen to capture a more nuanced range of attitudes and perceptions across the different constructs measured, including e-procurement practices, supplier involvement, and supply chain performance. To limit the ability of respondents to

perceive the relationship between their answers for each question and the subsequent analysis, the survey questions were ordered randomly. This strategy was selected as respondents were required to evaluate all the variables contained in the study. When assessing statistical methods, if the variance inflation factor (VIF) values in the inner model, as determined by a comprehensive collinearity test, are all less than or equal to 5, it can be inferred that the common method bias does not influence the model (Kock, 2015).

Multicollinearity results utilising SMART PLS 4 exhibited VIF values less than five, thus suggesting that the data results are free of frequent method bias concerns. Collected data was imported into Microsoft Excel (version 16) to ease computation and evaluation. The coding and entry of responses to each question on the questionnaire were carried out on the SMART PLS software for the primary analysis. Structural equation modelling (SEM) was the critical analytical approach for the investigation. SEM can be applied to different study domains, including psychology, social sciences, economics, and marketing (Sarstedt et al., 2021). It allows for the analysis of complex interactions and the testing of theoretical models that contain latent variables. It provides a vital tool for academics to examine and comprehend their data's underlying structures and processes.

3.14 Ethical Consideration

Ethics are crucial in scientific study. Ethics are the rules or standards that govern our conduct and interactions (Saunders et al., 2012). Before administering the questionnaires, the heads and managers knew the study's goal. A clause ensuring respondents' confidentiality and anonymity was included in the questionnaire introduction. Participants were informed of the study's objectives and methodology.

The participants were told that their answers would be treated with respect and kept confidential and that they were participating in a study that would only be used for academic purposes.

They were disallowed from writing their names on the questionnaire to safeguard the participants' confidentiality. The possible benefits of the study to the participants were also explained. Participants were informed that they would not be compensated for their participation. Once again, every relevant literature included in the study (whether paraphrased, summarised, or quoted) was properly cited to prevent plagiarism.

Finally, when my supervisors and other colleagues checked grammar errors and screened my questionnaire, they permitted me to proceed with data collection.

3.15 Chapter Summary

This chapter described and explained the research method and procedures employed in the study. The chapter discussed the research philosophy. The post-positivist research philosophy was used because of the nature of the research and the objectives. The positivist philosophy believes in the objectivity of scientific inquiry. The study's research design was also discussed. Data collection procedures and statistical methods were described, and the research population and the sample were examined. Research instruments were evaluated for their validity and reliability. Smart PLS-SEM 4 was a powerful analytical instrument for reaching the study's primary objective. The ethical consideration was also discussed.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION OF RESULTS

4.0 Introduction

This chapter presents the results of the data analysis conducted in this study. Structural equation modeling (SEM) was employed as the primary analytical technique to assess both the measurement model and the structural model, using SmartPLS. Additionally, SPSS was used to perform descriptive statistical analysis, including percentages, means, and standard deviations. The findings are reported in relation to the study's hypotheses and are interpreted with reference to existing literature to highlight areas of convergence or divergence with prior research.

4.1 Response rate

A total of 400 questionnaires were distributed to construction firms in the Greater Accra Region. Out of these, 350 questionnaires were returned, yielding an initial response rate of 87.5%, calculated based on the number of questionnaires distributed. Following data screening for completeness, consistency, and response accuracy, 20 questionnaires were excluded due to substantial missing data and response irregularities. Consequently, 330 valid responses were retained for the final data analysis.

The minimum required sample size had been determined a priori using Taro Yamane's (1967) formula. The decision to distribute more questionnaires than the calculated requirement was intentional, aimed at compensating for anticipated non-response, unusable responses, and participant ineligibility. Such oversampling procedures are widely endorsed in survey research methodology to ensure that the final dataset satisfies statistical adequacy despite attrition (Earl Babbie, 2021).

4.2 Demographic characteristics of the sample

The demographic and organizational characteristics of the respondents are presented in Table 4.1. These descriptive statistics include variables such as gender, age, education level, job position, firm size, years in operation, number of employees, and annual revenue. This section presents the descriptive results of the study, focusing on the demographic characteristics of the respondents and the organizational profiles of the participating firms. Table 1 provides a summary of these characteristics, based on data collected from a valid sample of 277 respondents. The gender distribution shows that 59.6% of the respondents were male, while 40.4% were female, indicating a male-dominated respondent pool. In terms of age, the majority fell within the 24–29 (30.3%) and 30–35 (27.4%) age brackets, with a mean age category of approximately 3.0 (SD = 1.17), suggesting that most respondents were young to middle-aged professionals. Regarding educational background, nearly half of the respondents (49.8%) held a first degree, followed by 36.1% with a master's degree, 7.9% with secondary education, and only 6.1% with a doctorate. The average education level had a standard deviation of 2.41 (SD = 0.77), reflecting that most respondents had attained at least a bachelor's degree.

Table 4.1 Background Information of Respondents

Variable	Category	Frequency (n)	Percentage (%)	M	SD
Gender	Male	165	59.6	—	—
	Female	112	40.4		
Age	23 years and below	28	10.1	2.97	1.17
	24–29 years	84	30.3		
	30–35 years	76	27.4		
	36–40 years	47	17.0		
	41 years and above	42	15.2		
Educational Background	Secondary	22	7.9	2.41	0.77
	1st Degree	138	49.8		
	Master's Degree	100	36.1		
	Ph.D./Doctorate	17	6.1		
Position in the Firm	CEO	32	11.6	3.45	1.56
	General Manager	45	16.2		
	Operations Manager	38	13.7		
	Relationship Head/Officer	66	23.8		
	Logistics/Supply Chain Manager	41	14.8		
	Others	55	19.9		
Firm Years in Operation	< 1 year	10	3.6	3.52	1.36
	1–5 years	67	24.2		
	6–10 years	73	26.4		
	11–15 years	51	18.4		
	16–20 years	39	14.1		
	21 years and above	37	13.4		
Number of Employees	< 10	34	12.3	3.24	1.13
	11–50	69	24.9		
	51–100	72	26.0		
	101–500	59	21.3		
	> 500	43	15.5		
Annual Revenue (GHS)	< 500,000	81	29.2	1.86	0.78
	500,000 – 1,000,000	114	41.2		
	Above 1,000,000	82	29.6		

In terms of firm roles, 23.8% of respondents were in relationship management positions, 16.2% were general managers, and 14.8% were logistics or supply chain managers. The mean coded position in the firm was 3.45 (SD = 1.56), suggesting a wide spread of mid- to senior-level roles among the participants. With regard to the number of years in operation, the largest group of firms had been in existence for 6 –10 years (26.4%), followed by 1–5 years (24.2%) and 11–15 years (18.4%), with a relatively even distribution across the other categories. This reflects a mix of both emerging and established firms.

Overall, the descriptive analysis highlights a sample of relatively young, well-educated professionals occupying a variety of managerial roles in firms with diverse operational histories. These characteristics suggest a knowledgeable and experienced respondent base, suitable for further analytical procedures in the study.

4.3 Normality Test

This section aims to assess whether the data meet the assumption of normality, which is a key prerequisite for many multivariate statistical techniques, including structural equation modeling. Testing for normality ensures that the distribution of the dataset approximates a normal distribution, which supports the validity of subsequent inferential analyses.

In quantitative research, assessing the normality of data is a foundational step before conducting advanced statistical analyses, particularly those involving multivariate techniques such as structural equation modeling (SEM). Normality refers to the extent to which data follow a normal distribution, which is symmetric and bell-shaped. While PLS-SEM (Partial Least Squares Structural Equation Modeling) is known to be robust to non-normal data, evaluating univariate normality helps ensure that the measurement properties of items are sound and that statistical estimates are stable (Hair et al., 2021).

This study assessed normality using two statistical indicators: skewness (which measures the asymmetry of distribution) and kurtosis (which measures the peakedness or flatness of distribution).

According to George and Mallery (2010) and Kline (2011), skewness values between -1 and +1 are considered acceptable for most psychometric purposes, and kurtosis values between -1 and +1 indicate no severe departure from normality. In this study, skewness values across all measured items ranged from -0.883 to 0.018, while kurtosis values ranged from -0.78 to 0.284. These values fall well within the acceptable range, indicating that none of the items exhibited problematic distributional properties.

The e-procurement practices construct was assessed across three sub-dimensions: e-sourcing, e-evaluation, and e-negotiation. All items under e-sourcing (e.g., use of platforms to identify suppliers, obtain timely information, and improve strategic alliances) displayed skewness values between -0.535 and -0.393 and kurtosis values between -0.348 and 0.211, suggesting mild left-skewed distributions, but nothing that violates normality assumptions.

For e-evaluation, which included statements such as improved project monitoring, collaboration, system trust, and workflow integration, skewness ranged from -0.545 to -0.03 and kurtosis from -0.592 to -0.433. The relatively low negative skew and flat kurtosis values indicate moderate uniformity in responses, suggesting that most respondents agreed with the items, with minimal concentration at the extremes.

Items under e-negotiation showed similar trends. Skewness values ranged from -0.261 to 0.018, and kurtosis from -0.78 to -0.419, implying nearly symmetric distributions and relatively light tails. These results indicate that respondents generally had balanced perceptions of negotiation tools, with no extreme clustering or spread in their responses.

The supplier involvement construct exhibited the most negatively skewed items, with skewness values ranging from -0.883 to -0.623. Kurtosis values, however, remained moderate, ranging from -0.515 to 0.284. The left skew suggests that most respondents tended to agree or strongly agree with the statements, especially those related to including suppliers in product design, process redesign, and decision-making. The data indicate a positive consensus on the value of supplier involvement but without problematic distributional issues. Despite the relatively higher skewness, the kurtosis values remain within acceptable thresholds, implying no concern for peakedness or heavy tails.

Items related to supply chain performance showed the most normally distributed values. Skewness values were the closest to zero, ranging from -0.509 to -0.209, and kurtosis ranged from -0.252 to 0.023. These results suggest that responses were well-balanced, with a near-normal distribution across statements assessing adaptability, defect elimination, waste reduction, and delivery performance. These patterns imply reliable measurement properties for this construct, with minimal response bias.

In summary, the skewness and kurtosis statistics confirm that all measured items in the dataset satisfy univariate normality assumptions, with no items exceeding critical thresholds. The values suggest that although a few items, particularly within the supplier involvement construct, show mild negative skew, these do not present significant threats to distributional assumptions. Since PLS-SEM is not heavily dependent on normality, the data are considered suitable for further analysis. Nonetheless, the near-normal distribution supports the validity of inferential analyses, enhances the stability of path coefficients, and strengthens the robustness of bootstrapping procedures in SEM estimation.

Table 4.2 Normality Test

Items	Questions	Skewness values	Std. Error	Kurtosis values
E-procurement practices				
E-sourcing	My organisation uses the e-sourcing platform to improve the search for prospective suppliers.	-0.453	0.991	-0.348
	My firm utilises e-sourcing to obtain timely information about the offerings of various suppliers.	-0.393	0.981	-0.139
	My organisation uses e-sourcing to improve strategic alliances with key suppliers.	-0.535	1.021	0.211
E-evaluation	The adoption of electronic evaluation tools has improved our project monitoring efficiency.	-0.545	0.987	-0.296
	Electronic evaluation enhances collaboration between project teams and stakeholders.	-0.389	0.972	-0.592
	I trust the system to provide consistent and reliable results.	-0.093	0.923	-0.431
	The electronic evaluation system integrates seamlessly with our current workflows.	-0.03	0.947	-0.433
E-negotiation	My organisation trusts electronic negotiation platforms to provide fair and unbiased negotiations.	-0.102	1.062	-0.54
	Electronic negotiation minimises errors and misinterpretations in agreements.	-0.11	1.119	-0.78
	Utilising the electronic negotiation system within my firm has enhanced the efficiency of our negotiation processes.	0.018	1.048	-0.419
	The electronic negotiation system in my organisation is user-friendly and easy to navigate.	-0.261	1.121	-0.66
Supplier involvement	We have continuous improvement programs that include our key suppliers	-0.815	1.023	0.048
	Our organisation has a strong consensus in our firm that supplier involvement is needed in product design/development	-0.674	0.947	0.284

	Our key suppliers have a major influence on the design of new products	-0.623	1.067	0.04
	We involve key suppliers in the product design and development stage.	-0.883	1.123	-0.082
	We redesign our supply chain processes to integrate advanced technologies seamlessly.	-0.837	1.065	-0.515
Supply chain performance	Our supply chain can easily adapt to changes in demand.	-0.262	0.983	-0.205
	This organization's primary supply chain has the ability to deliver zero-defect products to final customers	-0.362	0.981	-0.083
	This organization's primary supply chain can eliminate late, damaged, and incomplete orders to final customers	-0.509	0.975	0.023
	This organization's primary supply chain can deliver products precisely on time to final customers	-0.209	0.945	0.013
	This organization's primary supply chain has the ability to minimize all types of waste throughout the supply chain	-0.444	1.027	-0.182
	Our supply chain can easily adapt to changes in demand.	-0.221	1.03	-0.252

4.4 Partial Least Square-Structural Equation Modelling

Partial Least Squares (PLS) is a statistical method used in multivariate analysis. It is advantageous when dealing with datasets that include many samples (Memon et al., 2021). Structural Equation Modelling (PLS-SEM) is a statistical methodology employed to establish and analyse the associations among latent variables that cannot be directly seen in a research investigation. Partial Least Squares Structural Equation Modelling (PLS-SEM) has been frequently utilised in various academic disciplines, including but not limited to the social sciences, marketing, and information systems (Sarstedt et al., 2019).

According to Hair et al. (2019), two main approaches constitute PLS-SEM: the measurement and structural models. The measurement model characterises the relationship between observed variables (indicators) and latent variables (Hair et al., 2017). Once the measurement model has been established, PLS-SEM analyses the structural model, which examines the links between latent variables. In the context of a structural equation model, the relationships between latent variables are commonly depicted as paths (Hair et al., 2017).

4.5 Assessment of Measurement Model

In assessing the measurement model, factor loadings, reliability and validity (AVE, HTMT and Fornel-Larcker) of the construct should be determined (Hair et al., 2019).

5.5.1 Factor Loadings

The factor loading is a numerical value that assesses how much an observed variable correlates with a latent component. The numerical values play a crucial role in comprehending how each indicator effectively captures the fundamental construct and the degree to which the construct accounts for the variability observed in the indicator.

A threshold value of 0.7 or higher is deemed suitable for the outer loading in Partial Least Squares Structural Equation Modelling (PLS-SEM). However, a loading between 0.6 and 0.7 is considered appropriate when its deletion will not significantly increase the AVE (Hair et al., 2021). Table 5 shows that factor loadings are suitable for this model because most loading values are above the threshold of 0.6.

In practical terms, a factor loading represents how strongly an observed variable is linked to an underlying, unobserved concept, also known as a latent construct. Essentially, it tells us how well each question or measurement item reflects the idea it is intended to measure. Higher loading values indicate that the variable is a good representation of the construct, meaning the construct explains a large portion of the variation in that variable. In Partial Least Squares Structural Equation Modeling (PLS-SEM), a factor loading of 0.6 or higher is generally considered strong and desirable. However, loadings between 0.6 and 0.7 can still be acceptable, especially if removing them would not meaningfully improve the Average Variance Extracted (AVE), which is a measure of how much of the variance in the indicators is captured by the construct. Based on the information in Table 5, the factor loadings in this model are considered suitable, as the majority of them exceed the 0.6 benchmark, suggesting that the measurement items reliably reflect their intended constructs and support the validity of the measurement model.

4.5.2 Reliability of Construct

Reliability, also known as internal consistency, assesses how much the items or questions within a measurement instrument correlate. It is typically measured using statistical techniques like Cronbach's alpha and composite reliability. High internal consistency reliability suggests that the items consistently measure the same underlying construct. Cronbach’s alpha and composite reliability values of 0.7 and above are good,

consistent reliability dependability (Hair et al., 2019). Table 3 shows an acceptable reliability threshold since all constructs have composite reliability and Cronbach Alpha values above 0.7.

4.5.3 Convergent Validity and Average Variance Extracted (AVE)

Convergent validity assesses the extent to which items that are theoretically related to the same construct are empirically correlated. One of the most commonly used metrics for establishing convergent validity in Partial Least Squares Structural Equation Modeling (PLS-SEM) is the Average Variance Extracted (AVE). AVE reflects the average proportion of variance in a set of observed variables that a latent construct can explain (Hair et al., 2021). According to the generally accepted threshold, an AVE value of 0.50 or higher indicates adequate convergent validity, meaning that the construct explains at least 50% of the variance in its indicators (Fornell & Larcker, 1981).

In this study, all constructs demonstrated AVE values exceeding the recommended minimum of 0.50, confirming that a substantial portion of variance is captured by the latent constructs rather than by measurement error. This implies that the scale items converge well in representing their respective theoretical constructs such as e-procurement practices, supplier involvement, and supply chain performance thus supporting the validity of the measurement model.

With convergent validity established through acceptable AVE values and high factor loadings, the analysis proceeds to assess discriminant validity, which ensures that constructs are empirically distinct from one another.

Table 4.3: Outer loadings, Cronbach Alpha, Composite reliability and AVE

Constructs	Loading Value	Cronbach's alpha	Composite reliability (rho_a)	Average variance extracted (AVE)
E-procurement practices				
E- sourcing		0.804	0.810	0.717
ES1	0.863			
ES2	0.824			
ES3	0.854			
E- evaluation		0.805	0.814	0.634
EE1	0.688			
EE2	0.793			
EE3	0.867			
EE4	0.826			
E-negotiation		0.803	0.809	0.628
EN1	0.786			
EN2	0.778			
EN3	0.819			
EN4	0.786			
Supply chain performance		0.894	0.894	0.702
SCP1	0.850			
SCP2	0.865			
SCP3	0.787			
SCP4	0.836			
SCP5	0.850			
Supplier involvement		0.843	0.848	0.616
SI1	0.818			
SI2	0.833			
SI3	0.835			
SI4	0.722			
SI5	0.706			

Source: Smart PLS Output (2025)

Practical Meanings

The empirical results provide strong evidence that electronic procurement practices are well established and meaningfully embedded in the operational routines of construction firms. The high outer loadings, Cronbach's alpha, composite reliability, and average variance extracted values indicate that e-sourcing, e-evaluation, and e-negotiation are consistently understood and applied across construction projects. In practical terms, this

suggests that procurement officers, project managers, and contract administrators in construction firms rely on structured digital systems for supplier identification, bid evaluation, and negotiation. These systems support routine activities such as electronic tendering, online submission of quotations, and digital comparison of bids, thereby reducing manual errors, paperwork delays, and opportunities for non-transparent practices that have traditionally characterised procurement in the construction sector.

4.5.4 Validity of Construct

The concept of construct validity holds significant importance within measurement modelling. Construct validity is the degree to which a measurement or assessment instrument effectively captures and represents the fundamental construct or notion it is designed to measure (Hair et al., 2017). Put another way, construct validity evaluates the extent to which a measurement accurately captures the intended construct it is designed to measure (Hair et al., 2019).

Discriminant validity refers to the extent to which a construct is empirically distinct from other constructs in a model. Two widely accepted techniques for assessing discriminant validity in PLS-SEM are the Fornell–Larcker criterion and the Heterotrait–Monotrait ratio (HTMT). The Fornell–Larcker criterion, proposed by Fornell and Larcker (1981), compares the square root of the Average Variance Extracted (AVE) of each construct with the correlations between that construct and all others in the model. Discriminant validity is established when the square root of a construct's AVE is greater than its highest correlation with any other construct (Hair et al., 2017). On the other hand, the HTMT ratio, introduced by Henseler et al. (2015), measures the ratio of between-construct correlations (heterotrait–heteromethod) to within-construct correlations (monotrait–heteromethod). HTMT values below 0.85 (or

0.90 in more lenient contexts) are typically considered indicative of adequate discriminant validity (Henseler et al., 2015; Memon et al., 2021).

The HTMT values and Fornell–Larcker scores were therefore used to evaluate constructs' discriminant validity in this study. To verify the model using HTMT, the results should be less than 0.85 (Henseler et al., 2015). Table 4.4 indicates that the values measuring HTMT are all below this threshold. Similarly, applying the Fornell–Larcker method requires that the values in the rows and columns corresponding to the diagonal elements are significantly higher than those not on the diagonal (Hair et al., 2017). Table 4.4 further indicates that all items on the diagonals have values greater than those not on the diagonal in the corresponding rows and columns, thereby confirming discriminant validity.

As previously reported in Tables 4.4 and 4.5, the results from both the Fornell–Larcker criterion and the HTMT ratio confirm that the constructs in this study are empirically distinct and meet the recommended thresholds for discriminant validity.

Practical Meanings

The discriminant validity results further indicate that the different dimensions of e-procurement perform distinct but complementary roles within construction supply chains. E-sourcing, e-evaluation, and e-negotiation are not perceived as overlapping activities, but as sequential and functionally differentiated processes. In real construction settings, this reflects a procurement workflow in which suppliers are first digitally identified and prequalified, then objectively assessed using electronic evaluation criteria, and finally engaged through structured negotiation platforms. This separation of functions enhances accountability and reduces disputes during project execution, as suppliers clearly understand the basis on which they were selected and contracted.

Table 4.4: Heterotrait Monotrait (HTMT) ratio

	EE	EN	ES	SI	SCP	SI x ES	SI x EN	SI x EV
E- evaluation								
E- Negotiation	0.711							
E- sourcing	0.658	0.542						
Supplier involvement	0.771	0.714	0.724					
Supply chain performance	0.632	0.517	0.541	0.527				
Supplier involvement x E-sourcing	0.133	0.048	0.253	0.091	0.239			
Supplier involvement x E-negotiation	0.028	0.072	0.038	0.056	0.071	0.534		
Supplier involvement x E-evaluation	0.098	0.056	0.126	0.078	0.194	0.651	0.722	

Source: Smart PLS Output (2025)

The HTMT ratio, introduced by Henseler et al. (2015), compares the correlations between constructs to the correlations within constructs. HTMT values below 0.90 are considered indicative of adequate discriminant validity (Henseler et al., 2015; Memon et al., 2021). As shown in Table 4.4, all HTMT values in this study are below the 0.90 threshold, confirming the distinctiveness of the constructs.

Table 4.5: Fornell-Larcker Criterion

	EE	**EN**	**ES**	**SI**	**SCP**
E- evaluation	**0.796**				
E- Negotiation	0.652	**0.792**			
E- sourcing	0.533	0.438	**0.846**		
Supplier involvement	0.632	0.585	0.598	**0.784**	
Supply chain performance	0.539	0.444	0.462	0.459	**0.84`**

Source: Smart PLS Output (2025)

The Fornell–Larcker criterion evaluates discriminant validity by comparing the square root of each construct's Average Variance Extracted (AVE) with its correlations with other constructs (Fornell & Larcker, 1981). Discriminant validity is established when the square root of a construct's AVE is greater than its highest correlation with any other construct (Hair et al., 2017). Table 4.5 shows that all diagonal values are greater than the corresponding off-diagonal correlations, thereby satisfying the Fornell–Larcker criterion.

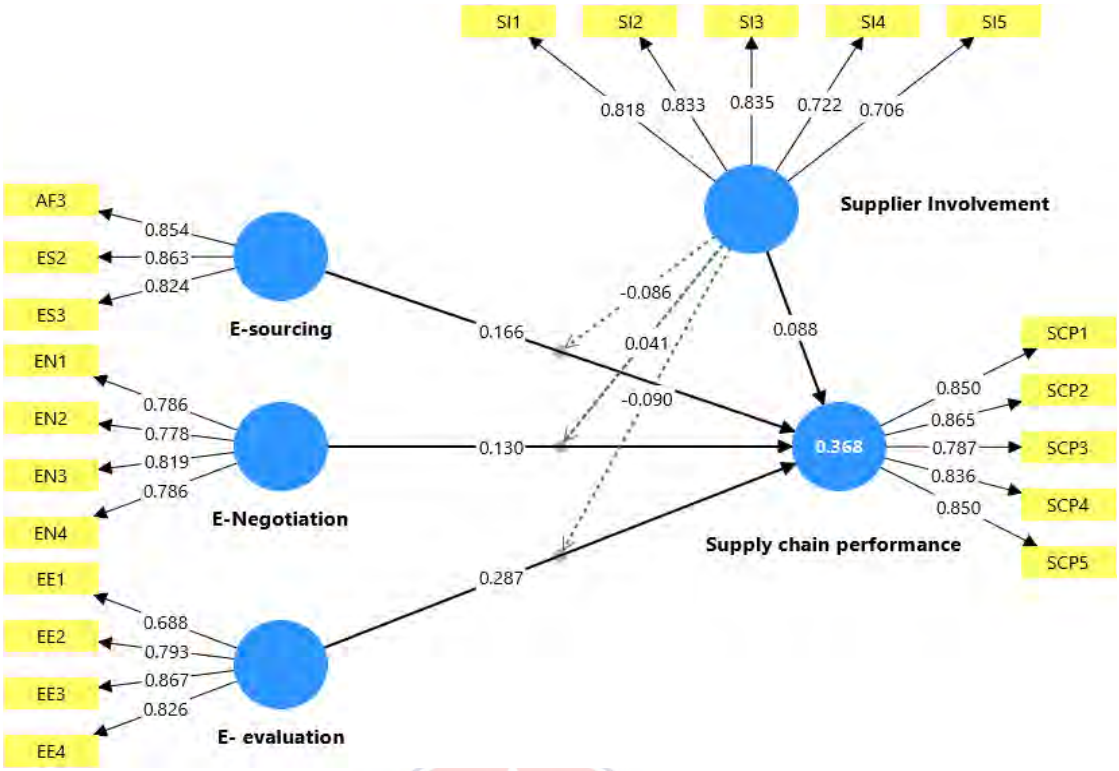

Figure 4.1: PLS-SEM Measurement Model Output

4.6 Assessment of Structural Model

After ensuring the constructs in the model are valid and reliable, the next step is to assess the structural model. According to Hair et al. (2017), to evaluate the structural model, you need to check multicollinearity, determine the significance of path coefficients and calculate the coefficient of determination (explanatory power and predictive power).

4.6.1 Multicollinearity Test

The outcomes in Table 4.6 provide a severe test of multicollinearity, a critical assumption in structural equation modeling (SEM), that, if not upheld, could distort path coefficients and undermine the interpretability of the model. The assessment relies on the Variance Inflation Factor (VIF), a widely accepted diagnostic tool for evaluating

the extent to which predictor variables are linearly correlated. Hair et al. (2017) tell us that a VIF value exceeding five typically signals a potential multicollinearity problem.

Contrary to anticipated concerns, the findings demonstrate no significant threat of multicollinearity within the dataset. All VIF values reported are comfortably below the conservative threshold of 5, with the highest observed value being 3.615 (for EE2). This is well within acceptable limits and suggests that the explanatory variables do not exhibit problematic redundancy. Scholars argue for a stricter threshold (e.g., 3.0) to ensure even greater diagnostic sensitivity; however, most variables remain compliant even under this stricter standard. Only a few items, like SI1 (3.024) and EE2 (3.615), approach or slightly exceed this stricter threshold; yet their presence does not justify claims of critical multicollinearity. Instead, these mildly elevated figures reflect meaningful theoretical overlap rather than statistical redundancy particularly in constructs that naturally share conceptual proximity. Hence, the study used the threshold of <5 to assess the issues of multicollinearity.

Practical Meanings

The absence of multicollinearity among the constructs indicates that digital procurement decisions in construction firms are not dominated by a single factor or actor. Instead, procurement outcomes reflect the combined but independent contributions of sourcing platforms, evaluation mechanisms, negotiation processes, and supplier participation. Practically, this suggests that construction firms maintain balanced procurement governance structures in which digital tools support, rather than replace, professional judgment. Engineers, quantity surveyors, procurement officers, and suppliers retain distinct roles, which is critical in managing complex construction projects involving multiple materials, timelines, and contractual obligations.

Table 4.6: Multicollinearity Results

Items	VIF Values
EN1	2.103
EN2	1.673
EN3	1.956
EN4	1.574
ES1	1.653
ES2	1.962
ES3	1.171
EE1	2.934
EE2	3.615
EE3	2.862
EE4	1.625
SCP1	2.529
SCP2	2.113
SCP3	2.504
SCP4	1.833
SCP5	1.234
SI1	3.024
SI2	1.942
SI3	2.123
SI4	1.221
SI5	2.201

Source: Smart PLS Output (2025)

Moreover, the distribution of VIF values among different constructs shows an even spread that denotes no one item being responsible for inflating the variance of any other item. The items report low VIFs. To sum up, the VIF diagnostics decisively militate against any suggestion of multicollinearity-related bias in this study's estimation procedures

4.6.2 Coefficient of determination

The adjusted R-squared, commonly represented as R^2_adj or R-squared adjusted, is a revised form of the R-squared (R^2) metric that incorporates the influence of the number of independent variables present in a regression model. The R-squared coefficient indicates the extent to which the independent variables account for the variability observed in the dependent variable. However, the adjusted R-squared coefficient

considers the potential negative impact of including irrelevant or redundant independent variables in the model, adjusting the value accordingly (Henseler et al., 2015). Therefore, the modified R^2 statistic is a reliable indicator of the extent to which the independent factors elucidate the variation in the dependent variable. According to the results presented in Table 4.7, the R-square value for supply chain performance is 0.368, indicating that 36.8% of the variance in supply chain performance is explained by the combined effects of the independent variables namely, the three dimensions of e-procurement practices (e-sourcing, e-evaluation, and e-negotiation) and supplier involvement. This suggests that the model has moderate explanatory power, meaning that a substantial proportion of the variability in supply chain performance among construction firms can be attributed to the extent and quality of their digital procurement practices and collaborative supplier engagement.

Q^2 is employed in partial least squares (PLS) regression to evaluate the prediction efficacy of the model. The coefficient of determination, denoted as Q^2, quantifies the predictive accuracy of a model about the dependent variable when it is employed for prediction purposes. The concept resembles the R-squared (R^2) metric used in ordinary least squares regression, while it is specifically adapted to the unique properties of Partial Least Squares (PLS). A Q^2 value > 0 for exogenous variables is preferred. Table 4.7 shows that the Q2 values of supply chain performance is 0.352. This indicates that the independent variables namely, e-sourcing, e-evaluation, e-negotiation, and supplier involvement collectively exhibit a predictive relevance (Q^2) of 0.352 for supply chain performance, the dependent variable. This indicates that the model possesses good out-of-sample predictive ability, with 35.2% of the variance in supply chain performance accurately predicted by the specified antecedents. According to Henseler et al. (2015), a Q^2 value greater than zero confirms predictive relevance, and the closer the Q^2 value

is to the R^2 value, the stronger the model's predictive power. In this case, a better predictive performance of the PLS-SEM model can be inferred (See Table 4.7).

The term "F-Square" refers to the change in the coefficient of determination (R-Square) that occurs when an external variable is excluded from the model (Hair et al., 2021). Table 4.7 presents F^2 values ranging from small, medium to large effects (Hair et al., 2017). The moderating variables on e- procurement practices and supply chain performance has the smallest effect size of 0.006, 0.010 and 0.008. By implication, implementing supplier involvement and e procurement within the Ghanaian context has a minor effect on supply chain performance.

Practical meanings

The structural model results show that electronic negotiation has the strongest influence on supply chain performance, explaining a substantial proportion of performance variation. This finding has important practical implications for construction firms, as it indicates that performance improvements such as timely material delivery, cost control, and reduced project disruptions are driven primarily by how contracts are negotiated rather than merely how suppliers are sourced or evaluated. Digitally supported negotiations enable clearer contract terms, better price transparency, and more reliable delivery commitments, which help to minimise variation claims, disputes, and supplier opportunism during project execution. While e-sourcing and e-evaluation contribute to performance, their direct effects are comparatively smaller, suggesting that many construction firms may already be sourcing and evaluating suppliers electronically, but do not fully realise performance gains until these processes are reinforced through effective negotiation.

Supplier involvement plays a meaningful, though modest, moderating role in the relationship between e-procurement practices and supply chain performance. In

practical construction contexts, this implies that involving suppliers early in procurement discussions enhances coordination, improves material specifications, and reduces the likelihood of rework or delays, particularly for specialised construction inputs. However, the relatively small effect sizes indicate that supplier involvement alone is insufficient to drive performance improvements unless it is supported by formal digital procurement systems. This reflects the reality of construction projects, where collaboration must be balanced with structured controls to manage cost, quality, and risk.

The positive predictive relevance of the model confirms that electronic procurement practices and supplier involvement are not only associated with current performance outcomes but are also useful in anticipating future project performance. Construction firms that strengthen their digital negotiation capabilities, improve supplier collaboration mechanisms, and maintain transparent evaluation processes are more likely to achieve sustained improvements in efficiency, responsiveness, and reliability across successive projects. The overall model fit further suggests that the relationships tested reflect real operational dynamics within the construction sector, where supply chain performance emerges from the interaction of digital capabilities and relational governance rather than from isolated technological adoption.

Overall, the findings demonstrate that electronic procurement practices in the construction sector generate tangible performance benefits when they are strategically implemented and supported by appropriate levels of supplier involvement. The results underscore the importance of moving beyond basic adoption of e-procurement tools towards a more integrated approach that emphasises negotiation quality, structured collaboration, and balanced procurement governance in construction supply chains.

Table 4.7: Coefficient of Determination Diagnostic

Construct	R^2	Adjusted R^2	F^2	Q^2
E-evaluation -> supply chain performance	0.368(SCP)	0.365	0.059	0.352 (SCP)
E- negotiation -> supply chain performance			0.014	
E-sourcing -> supply chain performance			0.025	
Supplier involvement->supply chain performance			0.032	
Supplier Involvement x E- evaluation -> Supply chain performance			0.006	
Supplier Involvement x E-Negotiation -> Supply chain performance			0.010	
Supplier Involvement x E-sourcing -> Supply chain performance			0.008	

Source: Smart PLS Output (2025)

The magnitude effect size (f^2) of 0.02, 0.15, and 0.35 indicate small, medium, and large effects (Kelley & Preacher, 2012).

4.6.3 Model fitness

In Partial Least Square-Structural Equation Modelling (PLS-SEM), the Standardized Root Mean Square Residual (SRMR), Root Mean Square of Approximation (d_ULS), Goodness of fit (d_G), Chi-Square and Normed Fit Index (NFI). According to Dash and Paul (2021), a model is deemed fit when SRMR and d_ULS < 0.08. d_G < 0.10. Chi-square with non-significant value (>0.05) satisfied model fitness. When considering NFI, the model is considered fit when the saturated and estimated model values are closer to 1. On this note, the model is deemed fit for the study as shown in Table 4.8

Table 4.8: Summary of Model Fit

	Saturated model	Estimated model
SRMR	0.061	0.061
d_ULS	0.051	0.094
d_G	0.917	0.916
Chi-square	2882.485	2849.273
NFI	0.837	0.838

Source: SMART PLS 4 Output (2025)

4.6.4 Assessment of Path Coefficients and Significance Level

Path coefficient is assessed by evaluating the significance of the path, the relevance, and the nature of the hypotheses. To assess the path coefficient, bootstrapping with 5,000 subsamples was performed using the Smart PLS 4.00 software, drawing from 277 distinct circumstances. A path coefficient is significant at the 5% level if zero does not fall into the 95% confidence interval (Hair et al., 2017).

The path coefficients' relevance is usually measured by values ranging from -1 to +1, indicating strong negative or positive relationships (Henseler et al., 2015). The path coefficients indicate that, holding all other exogenous factors constant, a change in endogenous construct values is associated with standard deviation unit changes in a specific exogenous construct. For example, a path coefficient value of 0.213 shows that when the exogenous construct increases by one standard deviation unit, the endogenous construct will increase by 0.213 standard deviation units.

In structural equation modeling, t-values are used to test the statistical significance of hypothesized relationships between constructs. The commonly accepted threshold for significance at the 5% level (two-tailed test) is 1.96. Therefore, hypothesized paths with t-values greater than 1.96 are considered statistically significant, indicating that the relationship is supported by the data. Conversely, paths with t-values less than 1.96 are

not statistically significant and are rejected in terms of hypothesis support (Henseler et al., 2015). Table 4.8 gives details of path coefficient values. From Table 4.9, hypotheses were tested for direct, synergic, and indirect effects among hypothesised relationships.

Figure 4.2 shows the structural model indicating the p- values and path coefficient

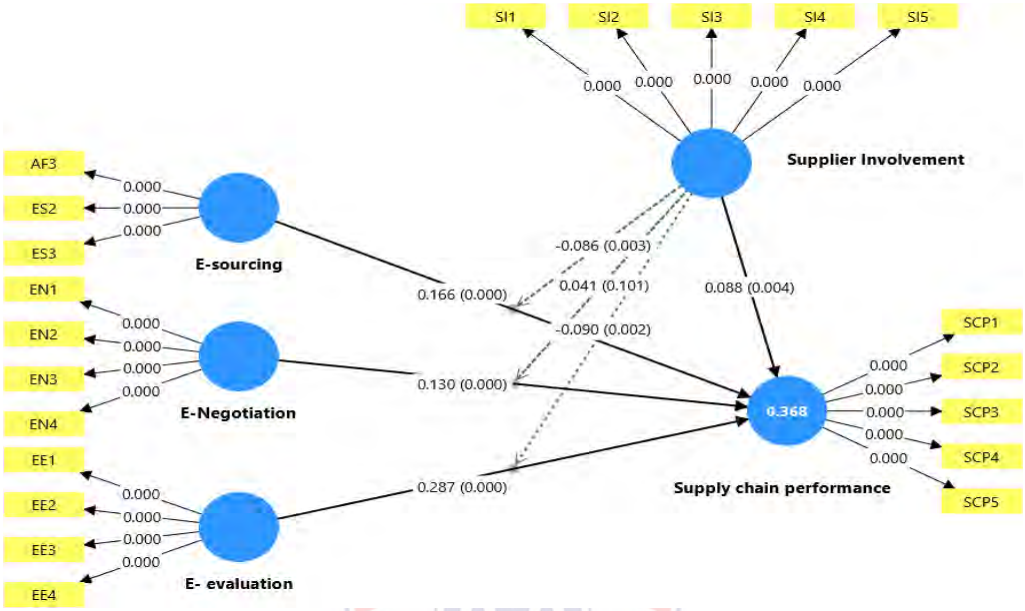

Figure 4.3 shows the structural model indicating the p- values and path coefficient

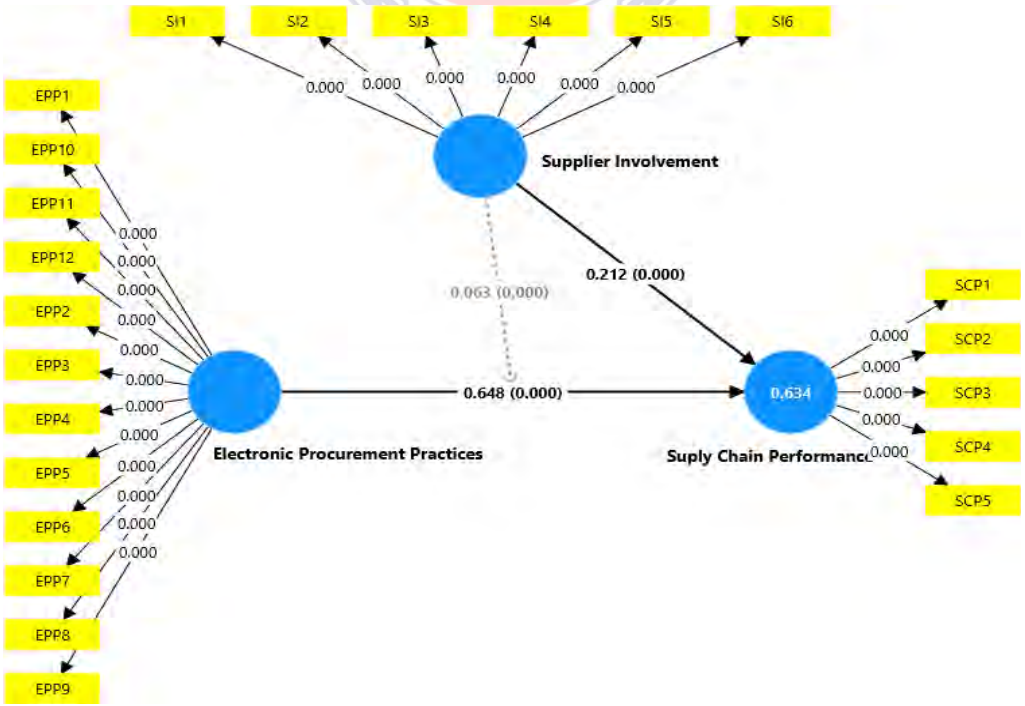

Table 4.9: Path Coefficient and Hypotheses Diagnostics

s/n	Hypotheses	Path Coefficient (O)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	Remarks
	Composite Direct Effect:					
H1a	E- procurement practices -> supply chain performance	0.648	0.020	32.265	0.000	Supported
	Individual Directional Effect:					
H2a	E-sourcing -> supply chain performance	0.166	0.030	5.443	0.000	Supported
H2b	E- negotiation ->supply chain performance	0.130	0.029	4.510	0.000	Supported
H2c	E- evaluation -> supply chain performance	0.287	0.034	8.450	0.000	Supported
H3	Supplier involvement -> supply chain performance	0.088	0.031	2.890	0.004	Supported
	Composite Moderating Effect:					
H4	E- procurement practices x supplier involvement -> supply chain performance	0.063	0.011	5.531	0.000	Supported
	Individual Moderation Effect:					
H4a	Supplier involvement x E-sourcing - > supply chain performance	-0.086	0.029	2.969	0.003	Not Supported
H4b	Supplier involvement x E- negotiation -> supply chain performance	0.041	0.025	1.641	0.101	Not supported
H4c	Supplier involvement x E- evaluation -> supply chain performance	-0.090	0.030	3.026	0.002	Not Supported

Source: Smart PLS Output (2025)

Table 4.9 presents the structural model results, encompassing the composite direct effects, individual direct effects, and moderating effects involving e-procurement practices, supplier involvement, and supply chain performance. The results indicate that the overall construct of e-procurement practices exerts a strong and statistically significant positive effect on supply chain performance ($\beta = 0.648$, $t = 32.265$, $p = 0.000$). The magnitude of the coefficient, coupled with the exceptionally high t-statistic, confirms a robust and substantive relationship. This finding suggests that the integrated adoption of digital procurement systems substantially enhances supply chain outcomes. Accordingly, Hypothesis H1a is supported. The result demonstrates that when e-sourcing, e-negotiation, and e-evaluation are implemented collectively as a coordinated system, they function as a strategic capability that strengthens operational efficiency, coordination, and overall supply chain effectiveness.

116At the individual dimensional level, all three components of e-procurement practices show positive and statistically significant relationships with supply chain performance. E-sourcing has a positive and significant effect ($\beta = 0.166$, $t = 5.443$, $p = 0.000$), indicating that electronic sourcing mechanisms contribute meaningfully to performance improvement. Hypothesis H2a is therefore supported. E-negotiation also demonstrates a positive and statistically significant effect ($\beta = 0.130$, $t = 4.510$, $p = 0.000$). Although the coefficient is comparatively smaller, the relationship remains statistically robust. Hypothesis H2b is supported. E-evaluation records the strongest effect among the three dimensions ($\beta = 0.287$, $t = 8.450$, $p = 0.000$), suggesting that digital performance monitoring and supplier assessment mechanisms exert the greatest relative influence on supply chain performance. Hypothesis H2c is supported. Collectively, these findings confirm that each dimension independently contributes to

performance enhancement, with e-evaluation emerging as the most influential predictor.

Supplier involvement also shows a positive and statistically significant effect on supply chain performance ($\beta = 0.088$, $t = 2.890$, $p = 0.004$). Although the magnitude of the effect is modest relative to the e-procurement dimensions, its statistical significance indicates that collaborative engagement with suppliers contributes meaningfully to performance outcomes. Hypothesis H3 is therefore supported. The analysis further examined whether supplier involvement moderates the relationship between overall e-procurement practices and supply chain performance. The composite interaction term is positive and statistically significant ($\beta = 0.063$, $t = 5.531$, $p = 0.000$), confirming that supplier involvement strengthens the overall effect of e-procurement practices on supply chain performance. Hypothesis H4 is supported. This result suggests that digital procurement systems generate stronger performance gains when accompanied by active supplier engagement.

A more granular examination of the interaction effects reveals nuanced outcomes. The interaction between supplier involvement and e-sourcing is negative but statistically significant ($\beta = -0.086$, $t = 2.969$, $p = 0.003$). Although e-sourcing independently enhances performance, higher levels of supplier involvement weaken this specific relationship. Hypothesis H4a is not supported based on statistical significance; however, the direction of the effect indicates a dampening influence. Similarly, the interaction between supplier involvement and e-evaluation is negative and statistically significant ($\beta = -0.090$, $t = 3.026$, $p = 0.002$). This suggests that greater supplier involvement reduces the strength of the positive relationship between e-evaluation and supply chain performance. Hypothesis H4c is not supported, though the moderating effect operates in a constraining direction. In contrast however, the interaction between

supplier involvement and e-negotiation is positive but not statistically significant (β = 0.041, t = 1.641, p = 0.101). Because the p-value exceeds the 0.05 threshold, this moderating effect is not supported. Consequently, Hypothesis H4b is rejected.

In summary, six out of the nine hypotheses (H1a, H2a, H2b, H2c, H3, and H4) are supported. All direct relationships are statistically significant, and the overall moderating effect of supplier involvement is confirmed. However, at the dimensional level, supplier involvement exhibits differential moderating influences, weakening the effects of e-sourcing and e-evaluation while showing no significant moderating impact on e-negotiation. These findings indicate that while e-procurement practices generally enhance supply chain performance, the influence of supplier involvement is conditional and varies depending on the specific procurement activity.

4.7 Discussion of results

This section critically discusses the key findings from the structural model analysis by interpreting the observed relationships in light of the study's objectives, hypotheses, and extant literature. Rather than reiterating statistical outcomes, the discussion focuses on explaining why specific relationships are strong or weak and how these findings reflect the operational realities of Ghana's construction sector. By integrating Resource-Based View (RBV) and Relational Exchange Theory (RET), the discussion situates e-procurement practices and supplier involvement within the broader dynamics of digital transformation and relational governance in developing-country construction supply chains.

The findings demonstrate that e-procurement practices substantially enhance supply chain performance in Ghanaian construction firms, highlighting the strategic importance of digital procurement systems in a sector historically characterised by

manual processes, fragmented supplier networks, and limited transparency. In practice, the use of e-sourcing portals, electronic tendering, and digital contract documentation enables construction firms to reduce procurement cycle times, improve cost control, and enhance project delivery reliability. From an RBV perspective, these systems function as strategic organisational capabilities that allow firms to convert operational inefficiencies into performance advantages, particularly in an environment marked by material price volatility and logistical uncertainty. The alignment of this finding with prior studies (Hsin Chang et al., 2013; Pattanayak & Punyatoya, 2020) reinforces the argument that digital procurement creates value across diverse contexts, while its relevance in Ghana underscores its importance in settings where procurement informality has long constrained performance (Ameyaw et al., 2019).

The comparatively modest effect of e-sourcing on supply chain performance reflects important contextual realities within Ghana's construction industry. Although e-sourcing platforms broaden supplier access and improve transparency, their effectiveness depends heavily on supplier digital readiness. Many small and medium-sized material suppliers, particularly those operating outside major urban centres such as Accra and Kumasi, lack the technical capacity or infrastructure to fully engage with digital sourcing systems. As a result, construction firms often revert to hybrid sourcing approaches that combine digital platforms with traditional relationship-based selection. This helps explain why e-sourcing improves performance but not as strongly as other e-procurement dimensions. The finding aligns with Kimutai and Ismael (2016) and illustrates that digital sourcing capabilities must be complemented by supplier onboarding and capacity development to realise their full potential in fragmented construction supply chains.

E-negotiation also demonstrates a positive but weaker influence on supply chain performance, reflecting the tension between digital efficiency and culturally embedded negotiation practices in Ghana. While electronic negotiation tools improve documentation, reduce misunderstandings, and enhance contractual clarity, negotiation in Ghana's construction sector remains deeply relational and face-to-face in nature. Pricing, delivery terms, and variations are often resolved through personal engagement and informal dialogue, especially in long-standing buyer–supplier relationships. From a RET perspective, this explains why digital negotiation tools alone may not fully capture the relational trust and flexibility required in construction contracting. The relatively weaker effect therefore reflects uneven adoption across firms, with larger contractors more likely to embrace digital negotiation than smaller firms that rely on interpersonal bargaining (Mafini et al., 2020).

In contrast, e-evaluation emerges as the strongest individual predictor of supply chain performance, underscoring the centrality of supplier monitoring and accountability in construction procurement. In Ghanaian construction projects, inconsistent material quality, delivery delays, and subcontractor underperformance are common challenges. Digital evaluation systems enable firms to systematically track supplier performance, compare historical outcomes, and make evidence-based decisions regarding supplier retention and development. From an RBV standpoint, e-evaluation enhances decision-making quality by transforming performance data into a valuable strategic resource. At the same time, RET helps explain why transparent evaluation systems can strengthen relational governance by clarifying expectations and reducing ambiguity. The stronger effect of e-evaluation suggests that monitoring and feedback mechanisms may be more mature or impactful than other digital practices in Ghana's construction context, where performance failures carry significant cost and schedule implications.

Supplier involvement shows a positive but relatively modest direct effect on supply chain performance, indicating that collaboration exists but remains limited in depth and structure. In many Ghanaian construction firms, supplier involvement is often informal, occurring through ad hoc consultations rather than structured early supplier involvement or co-design processes. While involving suppliers improves coordination and problem-solving, hierarchical management styles and transactional procurement norms frequently constrain meaningful participation. From an RBV perspective, this limits the extent to which supplier knowledge and expertise can be fully leveraged as strategic resources. RET further suggests that although trust-based relationships exist, they are not always institutionalised through formal collaboration frameworks, which may explain the modest strength of the relationship.

The individual moderation analysis focusing specifically on the negative but statistically non-significant interaction effect provides an important context-sensitive insight into how supplier involvement shapes digital procurement outcomes within Ghana. A negative yet non-significant moderating coefficient indicates that although supplier involvement tends to weaken the relationship between a particular e-procurement dimension and supply chain performance, this weakening tendency is not strong enough to be interpreted as empirically reliable. Our study suggest that the result is theoretically meaningful because it signals directional tension between relational governance and digital process formalisation, even though statistical evidence does not confirm a stable moderating influence. Prior studies caution that excessive formalisation of digital supply processes can weaken relational capital and reduce adaptability in emerging-economy supply chains (Gunasekaran & Ngai, 2008; Trkman et al., 2010).

Within Ghanaian procurement environments characterised by infrastructural constraints, evolving digital maturity, and relationship-oriented contracting traditions this pattern suggests that supplier involvement may introduce subtle frictions into technologically mediated processes without exerting a consistently measurable performance impact. Supplier participation can complicate standardized digital workflows through informal adjustments, expectations of flexibility, or reliance on interpersonal trust, dynamics that remain central to exchange relationships in many developing contexts (Asare & Prempeh, 2020; Obeng et al., 2023). These relational elements may slightly dampen the efficiency of rigid digital mechanisms, producing a negative interaction tendency. However, because the effect is statistically non-significant, such influences are neither systematic nor sufficiently strong across firms to materially alter performance outcomes.

Theoretically, this finding supports a boundary-condition interpretation of moderation, suggesting that supplier involvement does not universally strengthen technological capability effects. Instead, its influence depends on contextual alignment between relational governance structures and digital control systems. When alignment is weak, relational participation may dilute technological objectivity, particularly in evaluation-oriented processes where impartiality is critical (Carr & Kaynak, 2007; Krause et al., 2018). Yet the absence of statistical significance indicates that such tensions vary across organizations, implying heterogeneity in institutional quality, digital competence, and supplier dependency.

Importantly, a negative but non-significant moderation effect should not be treated as theoretically trivial. Rather, it signals latent structural complexity within procurement systems and suggests that additional contextual moderators may condition when

supplier involvement becomes beneficial or counterproductive. Such outcomes often point to the presence of unobserved heterogeneity and indicate the need for more fine-grained theorisation, subgroup analysis, or multi-level modeling in future research.

Overall, this result strengthens the study's scholarly contribution by demonstrating that moderation effects must be interpreted through three lenses simultaneously: statistical strength, directional meaning, and institutional context. In the Ghanaian setting, the evidence indicates that supplier involvement does not consistently alter the performance contribution of certain e-procurement practices, yet its negative directional tendency reveals underlying tensions between relational engagement and technological standardisation an insight that advances both theory refinement and context-specific understanding of digital supply chain governance.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This section concludes the entire study. This chapter also highlights the implications of the study and recommendations. The study's primary purpose is to examine the moderating role of supplier involvement in the relationship between e-procurement practices and supply chain performance.

5.2 Summary of Findings

The purpose of this section is to present the objectives of the study and describe the methodological approach employed to address them. The study was designed to investigate the influence of e-procurement practices and supplier involvement on supply chain performance within the construction sector. The specific objectives of the study were:

i. To examine the relationship between e-procurement practices and supply chain performance.
ii. To examine the relationship between supplier involvement and supply chain performance.
iii. To analyze the moderating role of supplier involvement on the relationship between e-procurement practices and supply chain performance.

The study adopted a quantitative research approach using a cross-sectional survey design. This design was appropriate because it allowed for data collection from a large sample of construction firms at a single point in time, thereby facilitating the testing of hypothesized relationships among constructs. The target population comprised construction firms operating within the Accra Metropolitan Assembly. From this

population, 277 firms in good standing were selected through a simple random sampling technique, ensuring representativeness and minimizing sampling bias. Data were gathered using a structured, close-ended questionnaire designed to capture measures of e-procurement practices, supplier involvement, and supply chain performance. The data analysis was conducted in two stages. First, descriptive and preliminary analyses were performed using SPSS to summarize sample characteristics and assess data reliability. Second, inferential analysis was undertaken using Partial Least Squares Structural Equation Modeling (PLS-SEM). This technique was chosen due to its robustness in handling complex models and its suitability for testing both direct and moderating relationships. The analysis assessed measurement validity and reliability, followed by hypothesis testing within the structural model.

5.2.1 Effect of e-procurement practices and Supply chain performance

The study provides robust empirical support for the positive impact of e-procurement practices on supply chain performance. The direct effects analysis reveals a strong and statistically significant relationship between the adoption of e-procurement systems and improvements in supply chain outcomes, with a high path coefficient of 0.648 and an exceptionally strong t-statistic of 32.265. These findings confirm that e-procurement practices explain a substantial portion of the variance in supply chain performance among Ghanaian construction firms.

5.2.2 Supplier Involvement and Supply Chain Performance

The study establishes a statistically significant but modest positive relationship between supplier involvement and supply chain performance (path coefficient = 0.088; t = 2.890), highlighting the strategic value of engaging suppliers in procurement planning, innovation, and performance improvement. For Ghanaian construction firms, early

supplier involvement helps address recurring challenges such as inconsistent material quality, delivery delays, and limited technological capacity. By fostering collaboration, trust, and information sharing, firms can build more synchronised, flexible, and resilient supply chains crucial in a context vulnerable to external shocks like inflation and import restrictions. The findings suggest that such involvement not only improves operational metrics like delivery reliability and cost efficiency but also enhances long-term competitiveness. Importantly, supplier collaboration complements digital procurement efforts by reinforcing relational resilience, ensuring that technology adoption is supported by strong, transparent supplier relationships.

5.2.3 Moderating Role of Supplier Involvement in E-Procurement and Supply Chain Performance

The study confirms that supplier involvement significantly moderates the relationship between e-procurement practices and supply chain performance (path coefficient = 0.063; t = 5.531), amplifying the effectiveness of digital procurement systems. This finding highlight that while e-procurement enhances efficiency and transparency, its full strategic value emerges when paired with active supplier engagement. For Ghanaian construction firms, this integration facilitates better coordination, shared planning, and faster responses to disruptions. Involving suppliers in e-platforms promotes joint decision-making, real-time updates, and tailored system functionality enhancing adoption and insight generation. Rather than serving as a supplementary process, supplier involvement acts as a strategic enabler that transforms e-procurement from a transactional process into a collaborative, performance-enhancing capability. In Ghana's rapidly digitising construction sector, balancing technological investments with relational governance is essential for building sustainable and resilient supply chains.

5.3 Conclusion

This study has provided robust and nuanced insights into the intricate relationships between e-procurement practices, supplier involvement, and supply chain performance, focusing on their applicability and implications within Ghanaian construction firms. Through direct and moderating effect analyses, the study offers a multidimensional understanding of how technology-driven procurement practices and strategic supplier collaboration intersect to enhance supply chain efficiency, responsiveness, and sustainability.

The study confirms a strong and statistically significant relationship between e-procurement practices and supply chain performance (path coefficient = 0.648), highlighting the strategic role of digital procurement in enhancing efficiency, transparency, and responsiveness in Ghana's construction sector. Disaggregated components e-sourcing, e-negotiation, and especially e-evaluation each contribute uniquely to performance improvements by supporting competitive bidding, streamlined agreements, and data-driven supplier assessment. Crucially, supplier involvement not only has a direct though moderate effect on performance but also significantly enhances the impact of e-procurement through joint planning, shared learning, and relational alignment. However, individual moderation results reveal complexities: supplier involvement positively enhances e-procurement overall yet negatively moderates e-sourcing and e-evaluation, while showing no significant effect on e-negotiation suggesting that rigid digital systems may inadvertently exclude less tech-savvy or informal suppliers in Ghana's diverse market. These findings emphasize the need for a balanced approach that combines digital efficiency with contextual flexibility and relational governance. For Ghanaian firms, this means embedding e-procurement within broader strategies of supplier inclusion, training, and co-development to build

agile, adaptive supply chains. Beyond operational gains, the integration of technology and collaboration marks a strategic pivot toward smarter, more sustainable procurement systems aligned with national development goals. Accordingly, government and industry actors should invest in digital readiness and supplier capacity-building initiatives to create an inclusive, future-ready procurement ecosystem. Ultimately, the study positions e-procurement and supplier involvement not as isolated practices but as interdependent pillars of a modern, resilient, and globally competitive construction supply chain.

5.4 Theoretical implications

This study is grounded in the Resource-Based View (RBV) and Relational Exchange Theory (RET), which together provide a robust theoretical foundation for explaining how digital procurement capabilities and inter-firm relationships influence supply chain performance (SCP). By empirically examining these relationships within the Ghanaian construction sector, the study advances both theories and makes several explicit contributions to knowledge.

First, with respect to the relationship between e-procurement practices and supply chain performance, the findings extend the Resource-Based View by empirically demonstrating that e-procurement systems function as strategic organisational capabilities rather than merely operational tools. RBV posits that firms achieve superior performance when they possess valuable, rare, inimitable, and non-substitutable resources (Barney, 1991; Teece, 2018). While prior studies have applied this logic primarily in manufacturing and developed-economy contexts, empirical evidence from construction industries in developing economies has remained limited and inconclusive. By showing that e-procurement practices significantly enhance SCP in Ghanaian construction firms, this study provides context-specific empirical validation

of RBV and extends its applicability to a sector characterised by project-based operations, fragmented supply chains, and historically weak digital adoption.

Second, the study contributes to Relational Exchange Theory by empirically confirming the positive effect of supplier involvement on supply chain performance. RET emphasises the role of trust, commitment, and relational norms in reducing transaction costs and improving exchange outcomes (Dwyer et al., 1987; Hawkins et al., 2019). Although RET has been widely applied in inter-organisational research, its explanatory power in emerging economies where procurement relationships are often transactional and governance mechanisms are weak has been questioned. The finding that supplier involvement significantly improves SCP demonstrates that relational governance mechanisms remain effective even in such environments. This contribution strengthens RET by showing that relational norms are not context-bound to advanced economies, but are equally relevant in developing-country construction supply chains.

Third, and most importantly, the study makes a novel theoretical contribution by integrating RBV and RET through the examination of supplier involvement as a moderating mechanism. While RBV focuses on firm-specific resources such as digital procurement systems, it offers limited explanation of the conditions under which these resources generate performance gains. By demonstrating that supplier involvement strengthens the relationship between e-procurement practices and SCP, the study identifies a critical boundary condition of RBV, showing that digital resources realise their full value only when embedded within strong relational contexts. Simultaneously, the findings extend RET by illustrating how digital technologies act as enablers of relational exchange, rather than substitutes for trust and collaboration. This integrated perspective advances theory by explaining how resources and relationships jointly shape supply chain performance in construction procurement.

Overall, the study contributes to knowledge in three specific ways: empirically, by providing robust evidence from the Ghanaian construction sector; contextually, by addressing a setting underrepresented in digital procurement research; and theoretically, by bridging RBV and RET to explain the conditional effects of e-procurement on supply chain performance. These contributions respond directly to calls for more context-sensitive and integrative theoretical models in supply chain and procurement research.

5.5 Managerial Implications

While the theoretical implications advance scholarly understanding, the findings also offer clear and actionable guidance for managers and policymakers in the construction sector. The results demonstrate that e-procurement practices significantly enhance supply chain performance, indicating that construction firms should move beyond partial or symbolic adoption of digital tools and instead pursue a holistic implementation of integrated e-procurement platforms. Managers are encouraged to align e-sourcing, e-evaluation, and e-negotiation systems to achieve efficiency gains, reduce procurement cycle times, and improve coordination across projects.

At the functional level, the findings indicate that e-evaluation exerts the strongest influence on supply chain performance. This highlights the managerial importance of transparent, standardised, and data-driven evaluation processes in construction procurement. Managers should prioritise the development of clear digital evaluation criteria, automated audit trails, and objective supplier performance metrics to minimise opportunism and enhance accountability. Although e-sourcing and e-negotiation also contribute to performance, the results suggest that their benefits are maximised when embedded within robust evaluation frameworks.

The positive effect of supplier involvement on SCP underscores the need for construction firms to reconceptualise suppliers as strategic partners rather than transactional entities. Managers can enhance performance by involving suppliers in early-stage planning, technical discussions, and quality assurance processes. Such involvement improves information sharing, fosters trust, and reduces the likelihood of project delays and rework outcomes that are particularly critical in complex construction projects.

The moderating role of supplier involvement further implies that investments in e-procurement technology alone are insufficient. Managers must actively encourage supplier participation in digital procurement systems by providing training, ensuring system compatibility, and creating incentives for collaborative engagement. The disaggregated moderation results suggest that supplier involvement is particularly important in e-sourcing and e-evaluation activities, while e-negotiation may require stronger internal control due to its strategic and contractual sensitivity. This calls for differentiated managerial strategies that balance collaboration with governance.

Finally, the findings have important implications for policymakers and industry regulators. Given disparities in digital readiness across construction firms, targeted capacity-building programmes, shared digital infrastructures, and industry-wide guidelines for e-procurement adoption could help smaller firms participate more effectively in digital supply chains. Such interventions would support more inclusive and uniform improvements in supply chain performance across the construction sector

5.6 Recommendations

The purpose of this section is to propose actionable recommendations for practitioners, policymakers, and industry stakeholders based on the findings of the study. These

recommendations aim to help construction firms and their partners leverage e-procurement practices and supplier involvement to enhance supply chain performance.

First, the study demonstrated that e-procurement practices have a significant and positive impact on supply chain performance. Construction firms should therefore prioritize the institutionalization of comprehensive e-procurement systems that integrate e-sourcing, e-negotiation, and e-evaluation modules. Such systems should not be adopted in a piecemeal fashion but embedded as part of broader organizational strategy to ensure long-term efficiency and competitiveness.

Second, the results showed that the individual components of e-procurement, particularly e-evaluation, are critical drivers of supply chain effectiveness. Managers should focus on developing transparent, data-driven evaluation mechanisms that reduce favoritism and opportunism while strengthening accountability. At the same time, structured e-sourcing and e-negotiation should be adopted to widen supplier access and secure value for money in procurement processes.

Third, supplier involvement was found to have a positive influence on supply chain performance. Construction firms are therefore encouraged to treat suppliers as strategic partners rather than transactional actors. This requires involving them in planning, quality assurance, and innovation-related activities, which can build stronger relationships and foster long-term collaboration.

Fourth, the findings revealed that supplier involvement amplifies the overall effect of e-procurement on performance. Firms should therefore invest in supplier training, digital literacy programs, and joint platforms that allow for seamless participation in e-procurement processes. Public-private partnerships may also be considered to provide suppliers especially small and medium-sized enterprises (SMEs) with the technical support needed to engage effectively in digital procurement.

Finally, the moderation results showed that supplier involvement strengthens the impact of e-sourcing and e-evaluation but not e-negotiation. Managers should therefore prioritize engaging suppliers in collaborative sourcing and evaluation activities, while retaining greater internal control over negotiation processes. Industry associations and regulators can complement these efforts by introducing national guidelines and frameworks that encourage the adoption of e-procurement standards across the sector.

5.7 Limitations and Further Research Directions

While this study provides valuable insights into the relationships between e-procurement practices, supplier involvement, and supply chain performance, it has limitations. Recognizing these limitations is essential for accurately interpreting the results and guiding future research efforts that can deepen understanding and expand the theoretical and practical contributions of this work.

One of the primary limitations of this study lies in its combined industrial and geographic scope. The research is specifically focused on construction firms operating within Ghana a developing country context that offers valuable sector-specific insights. However, this narrow focus limits the broader applicability of the findings. The construction industry is uniquely characterized by project-based operations, fragmented supply chains, and high levels of subcontracting, which may not be representative of other industries such as construction or retail. Additionally, Ghana's socio-economic, regulatory, and technological environment may differ significantly from those of other countries, particularly in terms of digital infrastructure, procurement policies, and cultural attitudes toward supplier relationships. These contextual and industrial differences may influence how e-procurement practices and supplier involvement interact to impact supply chain performance. As such, future research should aim to test

the generalizability of these findings by extending the study to other sectors and more diverse geographic contexts, including both developed and emerging economies.

Second, the study is cross-sectional, capturing data at a single point in time. While this allows for assessing relationships among variables, it does not account for longitudinal changes or the dynamic evolution of procurement practices and supplier relationships. As firms continue to digitise and adapt to external pressures such as global supply chain disruptions, the impact of e-procurement and supplier involvement may change over time. A longitudinal design could better capture these trajectories and provide more robust causal insights.

Third, the study largely relies on self-reported data collected through structured questionnaires. This approach is subject to common method bias, including social desirability and perceptual distortion. While statistical techniques can partially control for these biases, the risk remains that respondents may overestimate the maturity or success of their procurement systems or underreport challenges related to supplier involvement. Future research could benefit from triangulating responses with objective performance data, such as procurement system usage logs, supplier defect rates, or lead time records.

A fourth limitation pertains to the measurement constructs and the granularity of analysis. While e-procurement was broken down into e-sourcing, e-negotiation, and e-evaluation, other essential components, such as e-invoicing, contract management, and payment systems, were not included. Likewise, supplier involvement was treated as a broad construct. Future research could dissect it into more specific relational activities such as joint decision-making, innovation co-development, and collaborative risk management to better understand its dimensions and relative impact.

Furthermore, the moderating effects found in the study, particularly the negative effects on e-sourcing and e-evaluation, open the possibility of underlying mechanisms that were not captured in the current model. These could include supplier resistance to digital tools, lack of trust in digital systems, or discrepancies in digital maturity levels. These nuanced interactions warrant further exploration to understand why specific digital tools underperform in relationally rich contexts.

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APPENDIX

SURVEY QUESTIONNAIRE

Dear respondent,

This questionnaire was designed by a final-year postgraduate student at the University of Education, Winneba. As part of the programme, the researcher is required to present a research paper (Thesis) on "E-Procurement Practices and Supply Chain Performance: The Moderating Role of Supplier Involvement." You are kindly invited to participate in this study by providing your opinions and experiences concerning the selected constructs. All responses will be kept confidential and used solely for academic purposes. Your participation is greatly appreciated.

You are required to tick [√] your response using the seven-point Likert Scale, where Strongly Disagree (SD) = 1, Disagree (D) = 2, Somewhat Disagree = 3, Indifferent/Not Sure = 4, Somewhat Agree = 5, Agree (SA) = 6, and Strongly Agree =7

SECTION A: RESPONDENT'S BIOGRAPHY AND COMPANY PROFILE

When completing this questionnaire, please tick **[√]** in the applicable box or provide an answer as applicable.

1. Gender: [ ] Male [ ] Female

2. Age: [ ] 23 years and below [ ] 24–29 years [ ] 30–35 years
[ ] 36–40 years [ ] 41 years and above

3. Educational Background:
[ ] Secondary [ ] 1st Degree [ ] Master's Degree [ ] Ph.D./Doctorate

4. Please, indicate your area of expertise (e.g., logistics and supply chain management, relationship head/ officers, procurement management, operations management, etc.) _____

5. Please indicate your position in the firm [ ] CEO [ ] General Manager
[ ] Operations Manager [ ] Relationship head/ officers [ ] Logistics/Supply Chain Manager [ ] Others

6. Number of years the firm has been in operation:
[ ] Less than 1 year [ ] 1-5 years [ ] 6-10 years
[ ] 11-15 years [ ] 16-20 years [ ] 21 years & above

7. Number of employees in the firm:
[ ] Less than 10 employees [ ] 11-50 employees [ ] 51-100 employees
[ ] 101-500 employees [ ] More than 500 employees

8. Firm's annual revenue (in Ghana Cedis)?
[ ] Less than 500,000 [ ] 500,000 – 1,000,000 [ ] Above 1,000,000

SECTION B: ELECTRONIC PROCUREMENT PRACTICES (Source: Rotich et al., 2016; Yuan et al., 2004)

Indicate the extent to which you disagree or agree with each statement by checking the appropriate number from 1 to 7, using the following scale:

1 = Strongly Disagree **2 = Disagree** **3 = Somewhat Disagree** **4 = Indifferent/Not Sure** **5 = Somewhat Agree** **6 = Agree** **7 = Strongly Agree**	
E -SOURCING	
My organisation uses the e-sourcing platform to improve the search for prospective suppliers.	1 2 3 4 5 6 7
My firm utilises e-sourcing to obtain timely information about the offerings of various suppliers.	1 2 3 4 5 6 7
My organisation uses e-sourcing to improve strategic alliances with key suppliers.	1 2 3 4 5 6 7
E-EVALUATION	
The adoption of electronic evaluation tools has improved our project monitoring efficiency.	1 2 3 4 5 6 7
Electronic evaluation enhances collaboration between project teams and stakeholders.	1 2 3 4 5 6 7
I trust the system to provide consistent and reliable results.	1 2 3 4 5 6 7
The electronic evaluation system integrates seamlessly with our current workflows.	1 2 3 4 5 6 7
E-NEGOTIATION	
My organisation trusts electronic negotiation platforms to provide fair and unbiased negotiations.	1 2 3 4 5 6 7
Electronic negotiation minimises errors and misinterpretations in agreements.	1 2 3 4 5 6 7
Utilising the electronic negotiation system within my firm has enhanced the efficiency of our negotiation processes.	1 2 3 4 5 6 7
The electronic negotiation system in my organisation is user-friendly and easy to navigate.	1 2 3 4 5 6 7

SECTION C: SUPPLIER INVOLVEMENT (Source: Feng et al., 2010; Vonderembse & Tracey,1999)

Indicate the extent to which you disagree or agree with each statement by checking the appropriate number from 1 to 7, using the following scale:

1 = Strongly Disagree ***2 = Disagree*** ***3 = Somewhat Disagree*** ***4 = Indifferent/Not Sure*** ***5 = Somewhat Agree*** ***6 = Agree*** **7 = Strongly Agree**	
SUPPLIER INVOLVEMENT	
We have continuous improvement programs that include our key suppliers	1 2 3 4 5 6 7
Our organisation has a strong consensus in our firm that supplier involvement is needed in product design/development	1 2 3 4 5 6 7
Our key suppliers have a major influence on the design of new products	1 2 3 4 5 6 7
We involve key suppliers in the product design and development stage.	1 2 3 4 5 6 7
We redesign our supply chain processes to integrate advanced technologies seamlessly.	1 2 3 4 5 6 7
We have representatives from our suppliers on our company's product design teams	1 2 3 4 5 6 7

SECTION E: SUPPLY CHAIN PERFORMANCE Source: Pamela et al. (2009)

Indicate the extent to which you disagree or agree with each statement by checking the appropriate number from 1 to 7, using the following scale:

1 = Strongly Disagree ***2 = Disagree*** ***3 = Somewhat Disagree*** ***4 = Indifferent/Not Sure*** ***5 = Somewhat Agree*** ***6 = Agree*** **7 = Strongly Agree**	
SUPPLY CHAIN PERFORMANCE	
Our supply chain can easily adapt to changes in demand.	1 2 3 4 5 6 7
This organization's primary supply chain has the ability to deliver zero-defect products to final customers	1 2 3 4 5 6 7
This organization's primary supply chain can eliminate late, damaged, and incomplete orders to final customers	1 2 3 4 5 6 7
This organization's primary supply chain can deliver products precisely on time to final customers	1 2 3 4 5 6 7
This organization's primary supply chain has the ability to minimize all types of waste throughout the supply chain	1 2 3 4 5 6 7

Thank you for participating in the survey