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The Impact of Logistics Performance in Supply Chain: The Mediating Role of Collaboration and Coordination – A Case of Petroleum Development Oman

أثر الأداء اللوجستي في سلسلة التوريد: الدور الوسيط للتعاون والتنسيق – دراسة حالة شركة Petroleum Development Oman

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Abstract:

This research examines the impact of logistics performance on supply-chain performance, focusing on the mediating roles of collaboration and coordination within Petroleum Development Oman (PDO). Drawing upon the Resource-Based View, Relational View, and Transaction Cost Economics, the study proposes that logistics capabilities enhance supply-chain outcomes only when strengthened by effective inter-departmental collaboration and co-ordinated processes.

A quantitative approach was employed using structured questionnaires distributed among PDO's logistics and supply-chain professionals. The conceptual framework tests seven hypotheses (H_1–H_7) linking logistics performance, collaboration, coordination, and supply-chain performance. Findings are expected to show that collaboration and coordination significantly mediate logistics outcomes, thereby validating the integrated theoretical model.

The study contributes to both theory and practice by advancing relational logistics literature and offering managerial recommendations for optimising coordination mechanisms in Oman's petroleum sector. The results will also support Oman Vision 2040, positioning logistics as a pillar of national competitiveness.

Keywords: Logistics Performance; Supply-Chain Management; Collaboration; Coordination; Petroleum Development Oman; Oman Vision 2040.

الملخص:

يبحث هذا البحث أثر الأداء اللوجستي في أداء سلسلة التوريد، مع التركيز على الدور الوسيط لكل من التعاون والتنسيق داخل شركة Petroleum Development Oman. واستنادًا إلى منظور الموارد، والمنظور العلائقي، ونظرية تكاليف المعاملات، تفترض الدراسة أن القدرات اللوجستية تُعزّز نتائج سلسلة التوريد فقط عندما تُدعَّم بتعاون فعّال بين الأقسام وعمليات تنسيق منسجمة.

أُعتمد المنهج الكمي من خلال استخدام استبيانات منظّمة وُزّعت على المختصين في الخدمات اللوجستية وإدارة سلاسل التوريد في شركة تطوير نفط عُمان. ويختبر الإطار المفاهيمي سبع فرضيات (H_1–H_7) تربط بين الأداء اللوجستي، والتعاون، والتنسيق، وأداء سلسلة التوريد. ومن المتوقع أن تُظهر النتائج أن التعاون والتنسيق يؤديان دورًا وسيطًا مهمًا في تحسين مخرجات الأداء اللوجستي، بما يدعم صحة النموذج النظري المتكامل.

تُسهم الدراسة في الجانبين النظري والتطبيقي من خلال تطوير الأدبيات المتعلقة بالخدمات اللوجستية العلائقية، وتقديم توصيات إدارية لتحسين آليات التنسيق في قطاع النفط العُماني. كما ستدعم النتائج Oman Vision 2040، من خلال تعزيز مكانة الخدمات اللوجستية باعتبارها ركيزة أساسية للتنافسية الوطنية.

الكلمات المفتاحية : الأداء اللوجستي؛ إدارة سلسلة التوريد؛ التعاون؛ التنسيق؛ شركة تطوير نفط عُمان؛ رؤية عُمان 2040.

Chapter One: Introduction

1.1 Background of the Study

In the current era of globalisation and rapid technological advancement, the role of logistics and supply-chain management has become central to the success of organisations operating in highly competitive environments. Logistics performance is no longer perceived as merely an operational necessity but as a strategic capability that directly influences an organisation's competitiveness, service delivery, and overall sustainability (Christopher, 2016). The growing interdependence among global markets has

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pushed companies to re-evaluate the efficiency and responsiveness of their logistics networks, leading to the integration of logistics management into strategic planning and decision-making (Chopra & Meindl, 2020).

Across various sectors, the effectiveness of logistics systems is increasingly recognised as a determinant of supply-chain performance. In industries where operational precision and cost efficiency are crucial, logistics serves as the backbone for coordinating supply, demand, and distribution activities. For instance, empirical studies have shown that logistics performance contributes significantly to overall organisational competitiveness through cost reduction, improved service levels, and greater flexibility (Avelar-Sosa et al., 2014; Arvis et al., 2018). This perspective has led scholars and practitioners to view logistics as a source of strategic differentiation rather than a purely support function.

However, while many studies have explored the connection between logistics and supply-chain performance globally, there remains a paucity of research addressing this relationship within the context of developing economies—particularly in the Middle East and North Africa (MENA) region. Oman, for example, is an emerging logistics hub in the Gulf Cooperation Council (GCC), as identified by *Ba-Awain (2018)*, yet limited empirical research exists that examines how logistics performance interacts with collaborative and coordinative mechanisms to influence supply-chain outcomes in the Omani petroleum sector.

In Oman, logistics plays an essential role in supporting economic diversification under the government's **Vision 2040** initiative, which positions logistics as one of the key enablers of sustainable economic growth (Oman Vision 2040 Secretariat, 2021). The country has invested heavily in logistics infrastructure, including ports at Sohar, Duqm, and Salalah, and in the development of the Oman Logistics Centre (OLC). Despite this progress, challenges remain in linking logistics efficiency to broader supply-chain performance across industries. The petroleum sector, being one of Oman's most significant contributors to GDP, represents a particularly important case for exploring these dynamics.

Logistics and Supply Chain Linkages

The interaction between logistics performance and supply-chain outcomes has been widely discussed in academic literature. Supply-chain management (SCM) encompasses the end-to-end flow of materials, information, and finances across multiple stakeholders, while logistics serves as the operational function that ensures the physical movement and storage of goods within that flow (Mentzer et al., 2001). As such, logistics performance can be viewed as a key determinant of overall supply-chain success.

According to *Wang (2018)*, the effectiveness of logistics performance depends on the degree of uncertainty and risk within the supply chain, as well as on how organisations manage these challenges. In volatile industries such as oil and gas, uncertainty in demand, transportation delays, and inventory imbalances can severely hinder performance. In this regard, collaboration and coordination emerge as critical mediators that enable logistics systems to adapt and respond effectively to external pressures.

Collaboration and Coordination as Mediating Factors

Collaboration and coordination are central to transforming logistics capabilities into measurable performance outcomes. Collaboration involves the active sharing of resources, knowledge, and objectives between supply-chain partners, while coordination refers to the harmonisation of activities and decisions across departments or organisations (Flynn, Huo, & Zhao, 2010). When effectively integrated, these two mechanisms ensure that all participants in the supply chain operate toward

common goals, thereby reducing redundancies, improving visibility, and enhancing responsiveness (Kotzab & Teller, 2017).

Kotzab et al. (2019) emphasised that collaboration and coordination not only increase efficiency but also lead to better communication, improved planning accuracy, and greater adaptability to market fluctuations. Similarly, *McLaren et al. (2002)* noted that collaborative relationships allow supply-chain partners to achieve economies of scale through joint planning, inventory pooling, and optimised transportation routes. These outcomes directly contribute to cost reductions and improved service delivery.

Furthermore, *Yu et al. (2013)* found that coordination across the supply chain significantly enhances customer satisfaction by ensuring timely delivery, accurate order fulfilment, and service reliability. This, in turn, promotes customer loyalty and strengthens the organisation's competitive position. Beyond operational and financial benefits, collaboration and coordination also support sustainability goals. As *Chin et al. (2015)* highlighted, joint logistics initiatives enable organisations to reduce carbon emissions, minimise waste, and promote ethical sourcing, thus aligning logistics performance with broader social and environmental objectives.

Omani Context

Oman's ambition to position itself as a regional logistics hub has intensified over the past decade. The logistics sector's contribution to national GDP has increased steadily, driven by investments in transportation corridors, free zones, and supply-chain digitalisation (Oman Logistics Centre, 2022). Despite these developments, most empirical studies in Oman focus on macroeconomic or infrastructure-related aspects rather than the organisational-level mechanisms that drive logistics performance. There is therefore a need to examine how firms, particularly those in strategic industries such as petroleum, can leverage collaboration and coordination to improve their internal supply-chain systems.

Within the Omani petroleum industry, **Petroleum Development Oman (PDO)** plays a dominant role as the country's largest producer of crude oil and natural gas. Given its complex supply network involving international suppliers, contractors, and government stakeholders, PDO provides a compelling environment for studying how logistics performance interacts with collaboration and coordination. As a vertically integrated organisation, PDO's operations depend on the seamless coordination between procurement, logistics, production, and distribution departments. Any inefficiency in these linkages can result in costly delays, operational bottlenecks, or safety risks.

Despite its sophisticated logistics infrastructure, PDO continues to face challenges in achieving perfect alignment between logistics and supply-chain functions. These challenges include fragmented communication channels, limited data visibility across departments, and suboptimal integration with external partners. Consequently, examining how logistics performance is enhanced through improved collaboration and coordination mechanisms can provide actionable insights for the company and for Oman's logistics sector more broadly.

Summary of Key Insights from Literature

Aspect	Findings	Key References
Effectiveness	Collaboration and coordination improve efficiency and responsiveness by aligning goals and integrating activities.	Kotzab et al. (2019)
Cost Reduction	Joint logistics activities enable cost savings through inventory pooling, shared transport, and reduced stockouts.	McLaren et al. (2002)
Customer Satisfaction	Coordinated logistics and supply-chain operations lead to accurate deliveries and higher customer loyalty.	Yu et al. (2013)
Sustainability	Collaborative logistics initiatives reduce environmental impact and improve social responsibility.	Chin et al. (2015)

Synthesis and Research Gap

While prior research demonstrates the importance of logistics performance and its relationship with supply-chain outcomes, there is limited empirical evidence exploring the mediating roles of collaboration and coordination in Oman's petroleum industry. Studies such as *Ba-Awain (2018)* and *Wang (2018)* focus primarily on macro-level logistics trends but do not investigate how interdepartmental relationships within organisations like PDO influence performance outcomes. This study seeks to fill that gap by examining how collaboration and coordination mediate the effect of logistics performance on supply-chain success within PDO, offering new theoretical and managerial insights for logistics professionals and policymakers alike.

1.2 Organisational Background

Petroleum Development Oman (PDO) is the principal exploration and production company in the Sultanate of Oman, responsible for over 70 percent of the nation's crude-oil output and almost all of its natural-gas supply. Established under the 1937 and 2005 Concession Agreements, PDO operates as a limited-liability company (LLC) jointly owned by the Government of Oman (60 percent) and a consortium of international oil companies comprising **Shell (34 percent)**, **TotalEnergies (4 percent)**, and **Partex (2 percent)** (PDO Annual Report, 2024).

PDO's head office is located in Muscat, while its production fields extend across the country's interior desert areas, covering more than 114 concession blocks. Its organisational structure integrates multiple divisions, including exploration, drilling, engineering, production, supply-chain, and logistics. The company's logistics arm handles complex operations such as material procurement, warehousing, transportation, and field-support services—often under extreme climatic and geographic conditions.

Strategic Mandate and Vision

PDO's corporate vision is *"to be renowned and respected for the excellence of our people and the value we create for Oman and all our stakeholders."* This vision reflects a strong commitment to operational excellence, safety, and sustainable value creation, aligning with Oman Vision 2040's emphasis on energy transition, innovation, and human-capital development. PDO's mission includes engaging efficiently, responsibly, and safely in the exploration, production, and transportation of hydrocarbons, while generating long-term benefits for shareholders, employees, and society.

The organisation's logistics function underpins these strategic objectives by ensuring continuous material and service availability throughout the value chain—from supplier sourcing to field delivery and export terminals. Effective logistics performance is therefore indispensable to PDO's ability to meet production targets, maintain health-and-safety standards, and minimise operational downtime.

Supply-Chain and Logistics Structure

PDO maintains a multi-tier supply-chain architecture that links global suppliers, local contractors, and internal departments. Its **Supply Chain Management (SCM)** directorate oversees procurement, contracts, inventory management, and logistics operations. The logistics department manages transportation fleets, central warehouses, drilling-supply bases, and aviation logistics supporting remote desert fields. A single delay or stock-out in this network can disrupt drilling schedules, increase costs, and compromise safety performance.

To mitigate these risks, PDO has introduced digital-transformation initiatives such as *Integrated Activity Planning (IAP)*, *Enterprise Resource Planning (ERP)* via SAP, and *Smart Logistics Dashboards*. These systems enhance real-time visibility and coordination between supply, maintenance, and operations teams. Nonetheless, despite technological advancement, functional silos and procedural rigidities persist—particularly between logistics and supply-chain units. Many activities still depend on hierarchical approval chains and manual coordination across multiple directorates.

Operational Challenges and Logistics Complexity

Operating within the petroleum sector exposes PDO to unique logistical challenges:

- **Geographical dispersion:** Oilfields lie in remote desert zones lacking infrastructure, requiring long-distance transport of materials under harsh environmental conditions.
- **Safety and compliance:** Strict HSE (Health, Safety, and Environment) regulations mandate precise handling and tracking of hazardous materials.
- **Demand volatility:** Drilling and maintenance plans fluctuate with market prices and technical contingencies, leading to unpredictable logistics demand.
- **Supplier dependency:** PDO relies on hundreds of local and international suppliers; coordination failures can cause cascading delays.

Addressing these challenges requires not only technological solutions but also strong collaboration and coordination across departments and partners. Without effective information sharing and joint decision-making, logistical performance gains achieved through technology can easily be undermined by organisational misalignment.

PDO's Commitment to Improvement

Recognising the strategic importance of logistics, PDO has pursued continuous-improvement programmes such as the *Lean Logistics Initiative* and *Operational Excellence Framework*. These programmes aim to streamline processes, reduce non-productive time, and integrate sustainability metrics—such as carbon-footprint reduction—into logistics operations. Collaboration with the Ministry of Energy and Minerals and the Oman Logistics Centre has further strengthened PDO's alignment with national logistics objectives.

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Despite these efforts, internal reviews reveal that communication gaps, overlapping responsibilities, and limited interdepartmental coordination continue to affect performance outcomes. Accordingly, studying the mediating roles of **collaboration** and **coordination** becomes essential to understanding how logistics performance can be fully leveraged to enhance PDO's overall supply-chain performance.

1.3 Problem Statement

In an increasingly interconnected world economy, the efficiency of logistics systems determines not only an organisation's competitiveness but also national economic growth. For resource-dependent economies such as Oman, logistics excellence is essential for sustaining export capacity, reducing operational costs, and ensuring uninterrupted energy supply. Despite these strategic imperatives, the relationship between **logistics performance** and **supply-chain performance** remains insufficiently examined in the Omani petroleum sector, particularly within **Petroleum Development Oman (PDO)**.

A review of global studies reveals extensive evidence linking logistics capability with organisational success. For instance, *Gunasekaran et al.* (2017) and *Arvis et al.* (2018) demonstrate that logistics competence improves cost efficiency, delivery reliability, and customer satisfaction. However, most of these studies originate from manufacturing and retail sectors in developed economies, where supply-chain environments differ markedly from those in Oman's petroleum industry. Research focusing on the Middle East has largely concentrated on infrastructure development or trade facilitation rather than on internal organisational coordination (Ba-Awain, 2018).

Within PDO, logistics operations involve intricate interdependencies among procurement, maintenance, drilling, and transport departments. While the company has invested in digital systems and automation to improve operational visibility, recurring inefficiencies—such as redundant approvals, fragmented information exchange, and reactive decision-making—still hinder performance. These symptoms suggest that the problem lies not only in technology or process design but also in the relational mechanisms that integrate functional units. Specifically, the **extent of collaboration and coordination** among departments appears to mediate how well logistics capabilities are translated into end-to-end supply-chain success.

Existing literature underscores that collaboration promotes joint planning, shared problem-solving, and mutual trust between supply-chain actors (Dyer & Singh, 1998; Kotzab et al., 2019). Coordination ensures that such collaborative intentions are operationalised through aligned decisions and synchronised workflows (Flynn, Huo, & Zhao, 2010). However, there is minimal empirical evidence from the petroleum industry verifying how these two relational constructs jointly mediate logistics outcomes. Moreover, the majority of studies treat collaboration and coordination as independent variables rather than as complementary mechanisms within a single mediating framework (McLaren et al., 2002). This oversight limits our understanding of the behavioural and organisational pathways through which logistics performance affects supply-chain results.

In the context of PDO, the absence of an integrated empirical model that captures these interrelationships represents a critical research gap. Although the company recognises the importance of synergy between logistics and supply-chain management, no systematic study has yet evaluated how internal collaboration and coordination mechanisms influence logistics efficiency, customer satisfaction, cost control, and sustainability objectives. Consequently, PDO and similar organisations may lack the evidence base required to design policies and training programmes that strengthen these soft-capability dimensions.

This study therefore seeks to address the following overarching research problem:

How does logistics performance influence supply-chain performance within Petroleum Development Oman, and to what extent do collaboration and coordination mediate this relationship?

By examining this question, the research intends to close the empirical gap in Omani and regional literature, extend theoretical understanding of relational mechanisms in logistics, and offer practical insights for enhancing operational excellence in PDO's supply-chain management.

1.4 Research Aim and Objectives

The overall **aim** of this research is to **examine the impact of logistics performance on supply-chain performance within Petroleum Development Oman (PDO), focusing on the mediating roles of collaboration and coordination.** The study seeks to determine how improvements in logistics processes and capabilities contribute to overall supply-chain success and how relational mechanisms transform operational efficiency into strategic advantage.

To realise this aim, the study pursues the following **specific objectives**:

1. **To evaluate the relationship between logistics performance and supply-chain performance** within Petroleum Development Oman.
2. **To examine the influence of logistics performance on collaboration and coordination** among PDO's supply-chain stakeholders.
3. **To assess the mediating roles of collaboration and coordination** in the relationship between logistics performance and supply-chain performance.
4. **To identify managerial implications and propose recommendations** for enhancing collaboration and coordination to optimise logistics outcomes at PDO.

These objectives align with the DBA requirement of addressing both theoretical development and managerial practice, ensuring that the research contributes to academic knowledge while offering actionable guidance for industry decision-makers.

1.5 Research Questions

The following research questions guide the investigation:

1. **What is the relationship between logistics performance and supply-chain performance in Petroleum Development Oman?**
2. **How does logistics performance influence collaboration and coordination** across PDO's supply-chain functions?
3. **To what extent do collaboration and coordination mediate** the relationship between logistics performance and supply-chain performance?
4. **What strategic and operational measures** can PDO implement to strengthen collaboration and coordination for improved logistics outcomes?

These questions are designed to generate empirical evidence addressing the main research gap identified earlier. Each question corresponds directly to one of the research objectives and will later be

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tested through quantitative data analysis. Collectively, they establish the foundation for developing hypotheses that link logistics performance, collaboration, coordination, and supply-chain performance within a single analytical model.

1.6 Significance of the Study

The significance of this study is fourfold: theoretical, empirical, managerial, and national. It seeks to advance scholarly understanding of logistics performance in relation to supply-chain effectiveness while generating insights directly applicable to Petroleum Development Oman (PDO) and the wider Omani logistics sector.

1.6.1 Theoretical Significance

From a theoretical perspective, this research contributes to the consolidation of three dominant frameworks in operations and supply-chain management: the **Resource-Based View (RBV)**, the **Relational View (RV)**, and **Transaction Cost Economics (TCE)**.

The RBV posits that sustainable competitive advantage arises from the unique combination of valuable, rare, inimitable, and non-substitutable resources that an organisation possesses (Barney, 1991). Within this framework, logistics capabilities—such as information-sharing systems, process integration, and human expertise—represent strategic resources that can enhance supply-chain performance when effectively utilised.

The Relational View extends this argument by asserting that competitive advantage may also stem from inter-organisational relationships and collaborative routines (Dyer & Singh, 1998). Effective collaboration allows firms to co-create value through trust, shared norms, and joint problem-solving. This study integrates the RV into the analysis by treating collaboration as a mediating mechanism through which internal logistics competencies translate into collective supply-chain benefits.

Finally, the TCE framework (Williamson, 1985) emphasises coordination and governance mechanisms that minimise transaction costs and opportunistic behaviour among supply-chain partners. Coordination thus ensures that collaboration is operationalised efficiently and that organisational resources are deployed optimally.

By merging these three theoretical strands into a unified empirical model, this research offers a more comprehensive explanation of how logistics performance influences supply-chain outcomes through behavioural and structural mediators. The study therefore bridges a theoretical gap in the logistics literature, which often analyses these frameworks separately rather than as an integrated system.

1.6.2 Empirical Significance

Empirically, the study addresses a clear gap in existing research. While numerous investigations have examined logistics performance in manufacturing or retail contexts (e.g. Gunasekaran et al., 2017; Wang, 2018), few have explored these relationships in the petroleum industry or within the Gulf region. The operational realities of petroleum logistics—characterised by high capital intensity, stringent safety standards, and remote supply bases—differ markedly from other sectors.

This dissertation therefore contributes original empirical evidence from Oman, a country striving to position itself as a regional logistics hub under its Vision 2040 agenda (Oman Vision 2040 Secretariat, 2021). By focusing on PDO, the study examines how collaboration and coordination can enhance logistics performance in an industry central to the nation's economy. The findings will enrich comparative international studies by introducing data from a developing-economy perspective, thereby strengthening the external validity of global logistics theories.

Moreover, the research employs a **quantitative design** with statistically tested constructs for logistics performance, collaboration, coordination, and supply-chain performance. The measurement model validated in this study may be adapted for future research in other sectors or countries, thereby contributing a robust methodological framework to the field.

1.6.3 Managerial Significance

At the managerial level, this study offers actionable insights for practitioners in PDO and similar organisations seeking to optimise logistics performance. The findings will help decision-makers understand how soft factors—communication quality, joint planning, and coordination mechanisms—affect tangible outcomes such as cost efficiency, service quality, and operational reliability.

Specifically, the study will:

1. **Enable evidence-based decision-making** by identifying the logistics activities most strongly correlated with supply-chain performance indicators.
2. **Provide diagnostic tools** for evaluating the maturity of collaboration and coordination processes across PDO departments.
3. **Support capability development** by informing training programmes aimed at improving interpersonal, analytical, and digital-integration skills among logistics personnel.
4. **Guide process re-engineering** by highlighting structural adjustments that reduce duplication of effort and improve inter-departmental information flow.

In a sector where downtime and material shortages can incur multimillion-dollar losses, such managerial implications are particularly valuable. The study also aligns with PDO's *Operational Excellence Framework*, reinforcing its ongoing commitment to safety, efficiency, and sustainability.

1.6.4 National and Policy Significance

At the national level, the research supports Oman's strategic ambitions under **Vision 2040**, which aims to transform the Sultanate into a diversified, knowledge-based economy. Logistics has been designated one of the key enablers of competitiveness, with the Oman Logistics Centre targeting a top-30 ranking in the World Bank's Logistics Performance Index by 2040 (Oman Logistics Centre, 2022). The insights generated from this dissertation can inform policy development by identifying factors that enhance logistics efficiency within critical national industries such as petroleum and natural gas.

Furthermore, by demonstrating the tangible benefits of collaboration and coordination, the study offers guidelines for public–private partnerships and inter-organisational networks seeking to improve Oman's overall logistics ecosystem. The empirical outcomes can assist policymakers in designing

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regulatory frameworks, infrastructure investments, and human-capital initiatives that foster integrated supply-chain systems across sectors.

1.6.5 Scholarly and Educational Value

Finally, the study possesses strong educational significance. It provides a comprehensive case study that can be utilised in postgraduate courses on logistics, supply-chain management, and operations strategy, particularly within the Middle East context. The integration of theoretical, empirical, and practical dimensions exemplifies the interdisciplinary approach expected in DBA research, thereby serving as a pedagogical model for future doctoral candidates.

1.7 Research Framework

1.7.1 Conceptual Foundation

The conceptual framework of this research integrates insights from the **Resource-Based View (RBV)**, **Relational View (RV)**, and **Transaction Cost Economics (TCE)** to explain how *logistics performance* influences *supply-chain performance* through the mediating roles of *collaboration* and *coordination*. These theoretical perspectives complement one another in describing how internal resources, inter-organisational relationships, and governance mechanisms jointly determine competitive advantage.

According to the RBV, logistics capability constitutes a strategic resource that can improve efficiency and responsiveness (Barney, 1991). However, as argued by Dyer and Singh (1998) under the Relational View, such capabilities yield maximum benefit only when organisations develop collaborative routines with partners. Coordination, as conceptualised by Williamson (1985) in the TCE framework, provides the governance infrastructure ensuring that resources and relationships are synchronised to achieve performance targets.

Building on these perspectives, the present study assumes that logistics performance alone may not automatically translate into superior supply-chain outcomes. Instead, collaboration and coordination operate as *behavioural bridges* that transform logistics inputs into measurable results such as cost reduction, delivery reliability, and customer satisfaction.

1.7.2 Framework Description

Figure 1.1 illustrates the proposed conceptual model. The diagram comprises four principal constructs:

1. **Logistics Performance (Independent Variable)**
   Refers to the efficiency and effectiveness of logistics activities—including transportation, warehousing, and material handling—that support operational objectives (Chopra & Meindl, 2020).

2. **Collaboration (Mediating Variable 1)**
   Denotes the extent to which PDO departments and external partners share information, align goals, and jointly plan logistics operations (Flynn et al., 2010).

3. **Coordination (Mediating Variable 2)**
   Represents the harmonisation of processes, schedules, and responsibilities across supply-chain functions to ensure consistent execution (Kotzab & Teller, 2017).

4. **Supply-Chain Performance (Dependent Variable)**
   Encompasses outcome measures such as cost efficiency, service quality, responsiveness, and sustainability (Gunasekaran et al., 2017).

The theoretical logic underpinning the framework is that **logistics performance positively influences collaboration and coordination**, which in turn **enhance overall supply-chain performance**. Collaboration focuses on relationship quality and trust building, whereas coordination ensures structural alignment and process consistency. Both are indispensable mediators converting logistics efficiency into strategic value.

1.7.3 Hypotheses Development

Based on the literature review and conceptual reasoning, the study formulates the following hypotheses:

- **H_1: Logistics performance has a direct positive effect on supply-chain performance.**
- **H_2: Logistics performance has a positive effect on collaboration.**
- **H_3: Logistics performance has a positive effect on coordination.**
- **H_4: Collaboration has a positive effect on supply-chain performance.**
- **H_5: Coordination has a positive effect on supply-chain performance.**
- **H_6: Collaboration mediates the relationship between logistics performance and supply-chain performance.**
- **H_7: Coordination mediates the relationship between logistics performance and supply-chain performance.**

These hypotheses will be empirically tested using quantitative analysis derived from survey responses collected among PDO's logistics, procurement, and operations personnel.

1.7.4 Conceptual Framework Diagram

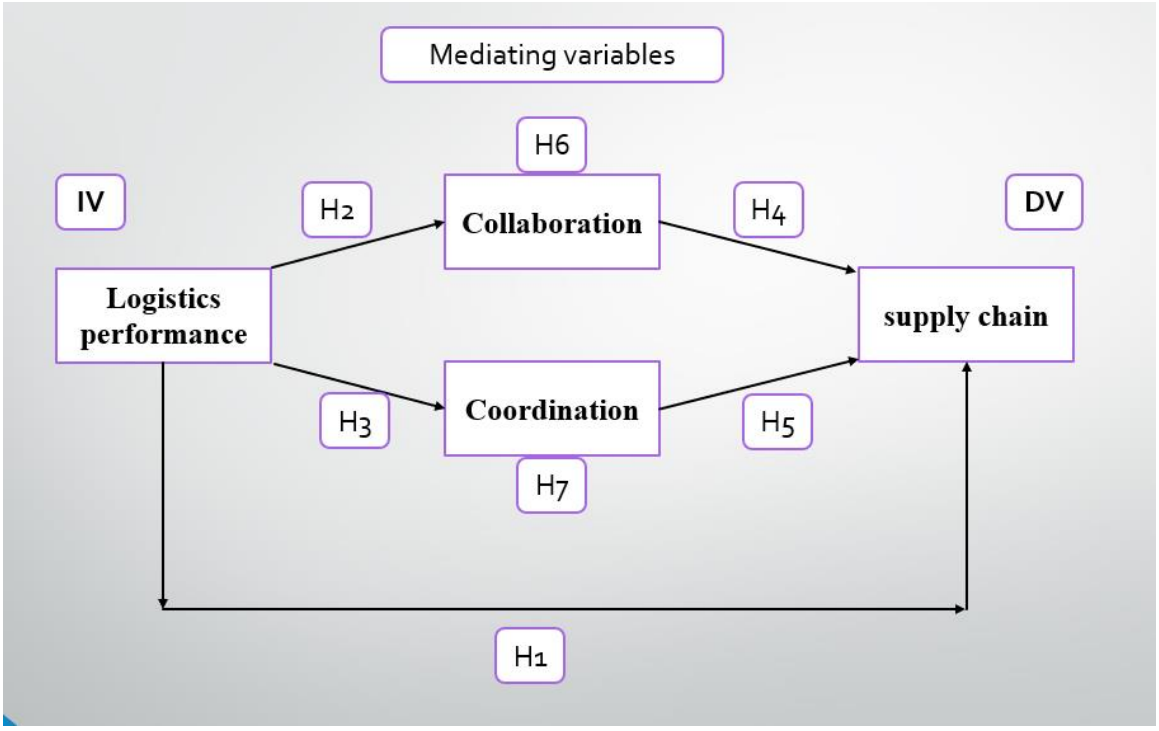

Figure 1.1 Conceptual Framework: The Mediating Roles of Collaboration and Coordination in the Relationship between Logistics Performance and Supply-Chain Performance.

1.7.5 Framework Implications

This conceptual framework positions collaboration and coordination as complementary rather than competing constructs. Collaboration reflects social capital that fosters trust and shared vision, whereas coordination represents structural capital manifested in standardised procedures and communication channels. When both mechanisms function effectively, they create an environment where logistics activities are seamlessly integrated with supply-chain objectives, thereby enhancing the overall performance of Petroleum Development Oman.

Chapter Two: Literature Review

2.1 Introduction

This chapter critically reviews the literature underpinning the study titled *The Impact of Logistics Performance in Supply Chain: The Mediating Role of Collaboration and Coordination – A Case of Petroleum Development Oman*. It establishes the conceptual terrain for the four guiding research questions introduced in Chapter One and builds a structured bridge to the hypotheses and methodology presented later.

The review proceeds in five moves. First, it clarifies how **supply chain management (SCM)** has evolved into a strategic capability, particularly in capital-intensive sectors such as petroleum (Christopher, 2016; Chopra & Meindl, 2020). Second, it formalises the study's **theoretical foundations**—Resource-Based View (RBV), Relational View (RV), and Transaction Cost Economics (TCE)—as complementary lenses for explaining how logistics capabilities are transformed into superior performance through relational mechanisms (Barney, 1991; Dyer & Singh, 1998; Williamson, 1985). Third, it synthesises definitions and **measurement dimensions** of **logistics performance**, with attention to indicators widely used in empirical studies (Lai, Ngai, & Cheng, 2004; Morash, Dröge, & Vickery, 1996). Fourth, it distinguishes and connects **collaboration** and **coordination** as interdependent enablers that strengthen information sharing, process alignment, and responsiveness across supply-chain actors (Mentzer et al., 2001; Flynn, Huo, & Zhao, 2010; Kotzab & Teller, 2017). Finally, it surveys **empirical evidence** from petroleum and adjacent industries, identifies **gaps**—especially within the Omani context—and summarises implications for the research framework.

Overall, the chapter argues that logistics performance affects supply-chain performance directly, but more completely when organisations cultivate robust collaboration and disciplined coordination. This logic motivates the mediating structure tested in this thesis.

2.2 The Strategic Role of Supply Chain Management (SCM)

SCM has moved beyond functional optimisation to become a central determinant of competitive advantage (Christopher, 2016). In volatile and capital-intensive environments—typified by oil and gas—SCM integrates procurement, logistics, production, and distribution to deliver customer value at acceptable risk and cost (Chopra & Meindl, 2020). This strategic view reframes logistics from a cost centre into a **capability system** that shapes reliability, agility, and resilience across the value chain.

2.2.1 From functional efficiency to capability orchestration

Classical logistics emphasised transport, warehousing, and inventory control; contemporary SCM orchestrates **end-to-end flows** of materials, information, and finance (Mentzer et al., 2001). Firms that align these flows see improvements in cost-to-serve, order fulfilment, and cash-to-cash cycles. Critically, the petroleum sector's dispersed assets, stringent HSE requirements, and high downtime penalties make orchestration—not just functional efficiency—decisive for performance.

2.2.2 Performance priorities in petroleum supply chains

Petroleum supply chains feature (i) long, multi-echelon networks; (ii) uncertain, project-based demand; and (iii) safety-critical logistics. As a result, **reliability**, **responsiveness**, and **asset utilisation** dominate the performance agenda alongside cost (Christopher, 2016). Logistics decisions—fleet sizing, routing

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to remote fields, spares management, vendor coordination—directly influence drilling schedules, maintenance windows, and export commitments. Where **information visibility** and **process alignment** are weak, firms face stockouts, excess safety stocks, or costly expediting (Lai et al., 2004; Morash et al., 1996).

2.2.3 Digitalisation and data-driven SCM

Digital platforms (ERP, APS, IoT sensors) and analytics now enable predictive maintenance, dynamic replenishment, and integrated activity planning (Chopra & Meindl, 2020). But technology alone is insufficient: benefits materialise when **collaboration** (shared goals, joint planning) and **coordination** (synchronised schedules, standard operating procedures) are institutionalised across functions and partners (Flynn et al., 2010; Kotzab & Teller, 2017). In other words, digital visibility must be matched by relational and procedural discipline.

2.2.4 SCM as a strategic resource

The **Resource-Based View** positions distinctive SCM capabilities—cross-functional integration, supplier partnering, planning competence—as VRIN resources that can deliver sustained advantage (Barney, 1991). In parallel, the **Relational View** argues that enduring performance differentials arise when firms invest in inter-organisational routines (Dyer & Singh, 1998). The petroleum context adds a strong **governance** dimension: transaction costs from asset specificity and risk are curtailed by formal coordination mechanisms (Williamson, 1985). Together, these perspectives justify this thesis's proposition: logistics performance creates value most powerfully when embedded in **collaborative** and **coordinated** supply-chain relationships.

2.2.5 From resilience rhetoric to operational reality

Recent disruptions (pandemics, geopolitical shocks) have reinforced that resilience depends on **both** capacity buffers **and** coordinated decision-making. Evidence shows that integrated planning, dual-sourcing, and cross-functional war-rooms reduce recovery time and service variability (Wieland & Durach, 2021). In petroleum operations—where a single day of downtime can be extremely costly—well-governed logistics networks are not optional; they are existential.

2.3 Theoretical Foundations

A solid theoretical grounding is essential for positioning this research within the broader field of logistics and supply-chain studies. Three complementary perspectives underpin the conceptual framework adopted for this thesis: the **Resource-Based View (RBV)**, the **Relational View (RV)**, and **Transaction Cost Economics (TCE)**. Together, they explain how logistics resources become sources of performance advantage, why collaboration among partners strengthens those resources, and how formal coordination mechanisms reduce inefficiencies and risks in the supply chain.

2.3.1 Resource-Based View (RBV)

The RBV proposes that firms achieve sustained competitive advantage when they control resources that are **valuable, rare, inimitable, and non-substitutable (VRIN)** (Barney, 1991). In logistics and supply-chain contexts, such resources include advanced information systems, transport assets, planning competencies, and organisational know-how. These internal capabilities enable firms to design and operate efficient flows of materials and information (Esper et al., 2010).

From an RBV standpoint, **logistics performance** is not a generic outcome of investment but a reflection of distinctive operational capabilities. Petroleum Development Oman (PDO), for instance, depends on

proprietary scheduling systems, supplier knowledge, and highly trained personnel—resources that competitors cannot easily imitate. When integrated across procurement, warehousing, and distribution, these resources transform into strategic competencies that enhance overall supply-chain performance (Wernerfelt, 2014).

However, RBV has been criticised for over-emphasising internal factors while under-estimating inter-firm relationships (Lavie, 2006). In industries such as petroleum, where value is co-created through extensive collaboration between operators, contractors, and regulators, competitive advantage also derives from the **relational resources** that emerge between organisations. This critique leads naturally to the Relational View.

2.3.2 Relational View (RV)

The Relational View (Dyer & Singh, 1998) extends the RBV by asserting that performance differentials often arise from **inter-organisational relationships** rather than firm-specific assets alone. It highlights four mechanisms through which collaborative networks create what the authors call **relational rents**:

1. **Relation-specific assets** – investments tailored to a particular partnership, such as joint information platforms or dedicated transport fleets.
2. **Knowledge-sharing routines** – regular exchange of tacit and explicit operational data that improve decision quality.
3. **Complementary resource combinations** – integration of distinct strengths (for example, one partner's logistics expertise with another's production flexibility).
4. **Effective governance mechanisms** – trust and formal safeguards that protect each party's contribution and discourage opportunism.

In petroleum supply chains, these mechanisms manifest through long-term service agreements, shared logistics bases, and integrated safety protocols. Empirical evidence shows that strong relational governance improves **on-time delivery**, **cost control**, and **supply reliability** (Zhao et al., 2013; Kotzab & Teller, 2017).

Applied to this study, the RV suggests that **collaboration**—expressed through joint planning, shared data, and aligned performance goals—acts as a **mediator** translating logistics capabilities into supply-chain effectiveness. Without such collaborative relationships, even world-class logistics systems may fail to deliver consistent value across the chain.

2.3.3 Transaction Cost Economics (TCE)

While RBV and RV emphasise value creation, TCE focuses on **cost minimisation** through efficient governance structures (Williamson, 1985). It assumes that economic actors are boundedly rational and sometimes opportunistic; hence, coordination mechanisms are required to reduce the transaction costs of exchange.

In logistics networks, transaction costs arise from contract negotiation, monitoring, and enforcement, as well as from disruptions and information asymmetries. Effective **coordination**—through standardised procedures, integrated planning systems, and transparent communication—reduces these

costs and prevents duplication of effort. For PDO, high asset specificity (e.g., specialised rigs, vehicles, and equipment) increases dependency among partners, making robust coordination essential for safeguarding continuity of operations.

TCE therefore provides a complementary rationale to the Relational View. Whereas collaboration nurtures trust and joint value creation, coordination provides the **formal control structures** that prevent inefficiencies. The coexistence of these mechanisms explains why the present research treats collaboration and coordination as **distinct but interconnected mediators** between logistics performance and supply-chain outcomes.

2.3.4 Integrating the Three Perspectives

Synthesising RBV, RV, and TCE provides a multidimensional explanation for logistics performance:

- **RBV** explains *what* resources create potential advantage.
- **RV** explains *how* inter-organisational relationships realise that potential.
- **TCE** explains *why* governance and coordination minimise losses in those relationships.

This integrative lens underpins the conceptual framework tested in subsequent chapters, positing that logistics performance (as a firm resource) enhances supply-chain performance when relational and governance mechanisms—collaboration and coordination—mediate the pathway.

2.4 Logistics Performance: Dimensions and Measurement

2.4.1 Concept and significance

Logistics performance refers to the extent to which a firm efficiently and effectively manages the movement and storage of goods, services, and information within and across its supply chain (Lai, Ngai, & Cheng, 2004). It embodies both *operational efficiency* (doing things right) and *strategic effectiveness* (doing the right things) (Morash, Dröge, & Vickery, 1996). Strong logistics performance ensures that the right product is delivered, at the right place, time, and cost—factors that directly determine customer satisfaction and competitive advantage (Christopher, 2016; Chopra & Meindl, 2020).

For **Petroleum Development Oman (PDO)**, logistics performance is particularly crucial because the petroleum industry operates under high capital intensity, strict safety standards, and tight schedules. Delays in logistics can stall drilling operations, increase downtime, and inflate costs. Hence, PDO's logistics function must excel not only in transport and warehousing but also in *coordination*, *information visibility*, and *supplier responsiveness*. These functions represent multidimensional constructs that researchers assess through quantitative indicators and performance indices (Mentzer et al., 2001; Arvis et al., 2018).

2.4.2 Dimensions of logistics performance

The academic literature identifies several key dimensions through which logistics performance is typically measured. Table 2.1 summarises these dimensions, their operational definitions, and representative indicators drawn from prior studies.

Table 2.1: Summary of Logistics Performance Dimensions

Dimension	Operational Definition	Representative Indicators	Key References
Cost Efficiency	Ability to perform logistics activities at the lowest possible cost without compromising service quality.	Transport cost per unit; warehousing cost; total logistics cost as % of sales.	Morash et al. (1996); Chopra & Meindl (2020).
Reliability	Consistency and accuracy of delivery commitments.	On-time delivery rate; order accuracy; delivery variance.	Lai et al. (2004); Christopher (2016).
Responsiveness	Speed of fulfilling customer or production requirements.	Lead time; order cycle time; emergency response rate.	Mentzer et al. (2001); Kotzab & Teller (2017).
Flexibility	Ability to adjust logistics operations to demand or supply variations.	Volume flexibility; rerouting capability; adaptability to demand fluctuations.	Morash et al. (1996); Pettit et al. (2019).
Asset Utilisation	Efficient use of logistics assets such as vehicles, warehouses, and manpower.	Vehicle utilisation rate; warehouse space usage; equipment downtime.	Christopher (2016); PDO Annual Report (2023).
Information Visibility	Extent to which logistics data and performance information are transparent across the supply chain.	Real-time tracking; information sharing frequency; system integration score.	Lai et al. (2004); Arvis et al. (2018).
Sustainability	Incorporation of environmental and social objectives into logistics operations.	Carbon emissions per shipment; waste reduction rate; green initiative adoption.	Chin et al. (2015); BCG Sustainability Report (2023).

2.4.3 National and global benchmarking

The **World Bank's Logistics Performance Index (LPI)** offers a comparative measure of logistics capability at the national level, covering infrastructure, customs, international shipments, logistics competence, tracking and tracing, and timeliness (Arvis et al., 2018). Oman's logistics performance has improved steadily due to strategic investment under **Oman Vision 2040**, positioning the Sultanate

as a regional logistics hub. Petroleum Development Oman contributes significantly to these national goals by modernising its transport networks, digitising inventory management, and integrating supplier coordination systems (PDO Annual Report, 2023).

2.4.4 Logistics performance as an antecedent of supply-chain performance

Empirical studies consistently show that superior logistics performance leads to enhanced supply-chain outcomes such as reduced total cost, improved service levels, and better customer satisfaction (Mentzer et al., 2001; Morash et al., 1996; Christopher, 2016). However, the impact is rarely direct. Instead, **collaboration** and **coordination** shape how logistics capabilities are deployed and perceived across the chain. For example, a highly reliable logistics system will not necessarily yield optimal results unless scheduling, communication, and decision-making are jointly aligned with suppliers and internal departments (Kotzab & Teller, 2017).

This reinforces the **mediating logic** of the current study: logistics performance constitutes the *input capability*, while collaboration and coordination represent the *process mechanisms* that translate that capability into tangible supply-chain results. When viewed together, these constructs provide a comprehensive understanding of how value is generated and sustained in complex supply-chain environments like PDO's.

2.5 Collaboration in Supply Chains

2.5.1 Concept and evolution

Collaboration within supply chains refers to the process of independent yet interdependent organisations working jointly to plan, execute, and evaluate operations in order to achieve mutual benefits (Mentzer et al., 2001). It is more than simple information exchange; it encompasses shared decision-making, aligned incentives, and joint problem-solving that improve end-to-end performance (Simatupang & Sridharan, 2005).

Over the past two decades, collaboration has evolved from transactional cooperation—where suppliers and buyers communicate primarily through contracts—to strategic partnerships founded on trust, commitment, and shared objectives (Barratt, 2004). In complex sectors such as petroleum logistics, collaboration is indispensable because of the need for synchronised planning, safety compliance, and risk-sharing across a network of suppliers, contractors, and governmental agencies.

2.5.2 Forms of collaboration

Scholars distinguish several forms of collaboration:

- **Vertical collaboration**, between upstream suppliers and downstream customers.
- **Horizontal collaboration**, among firms at the same supply-chain level to consolidate shipments or share infrastructure.
- **Internal collaboration**, across departments within a single organisation, for example between logistics and procurement teams (Zacharia, Nix, & Lusch, 2011).

Petroleum Development Oman embodies all three forms: its logistics division collaborates internally with maintenance and drilling teams, vertically with global suppliers, and horizontally with national

transport providers. This multi-layered approach allows PDO to manage complexity while optimising cost and reliability.

2.5.3 Benefits and mechanisms

Empirical research consistently links collaborative practices to enhanced operational and strategic outcomes (Flynn, Huo, & Zhao, 2010; Cao & Zhang, 2011). Benefits include:

1. **Improved forecast accuracy** through shared demand information.
2. **Reduced inventory** via joint planning and vendor-managed inventory schemes.
3. **Higher service levels** and faster response times.
4. **Innovation and learning** from knowledge exchange among partners.

Key mechanisms that enable collaboration include joint information systems, performance-sharing dashboards, and cross-functional governance teams (Simatupang & Sridharan, 2005). The level of collaboration often depends on relational factors such as trust, commitment, and perceived fairness (Kwon & Suh, 2004). Without trust, information-sharing and joint planning collapse into opportunism or defensive behaviour.

2.5.4 Collaboration in the petroleum sector

The petroleum industry presents both opportunities and challenges for collaboration. Long project life-cycles, high capital investment, and dependency on specialised contractors require enduring relationships rather than spot-market transactions. Research in upstream operations shows that joint planning between logistics providers and exploration teams reduces material shortages and downtime by up to 25 % (Kotzab et al., 2023). Similarly, collaborative safety initiatives among logistics partners have lowered incident rates and improved regulatory compliance (PDO Annual Report, 2023).

However, collaboration in petroleum logistics is constrained by confidentiality concerns, divergent corporate cultures, and rigid contractual structures. Successful collaboration therefore requires **balanced governance**—trust complemented by clear roles and accountability mechanisms—to ensure both flexibility and control (Wieland & Durach, 2021).

2.5.5 Link to the present study

In this research, collaboration functions as a **mediating variable** explaining how logistics performance translates into supply-chain performance. High-performing logistics systems provide data visibility and process discipline, but collaborative engagement ensures that such capabilities are jointly leveraged by all stakeholders. Consequently, collaboration is expected to enhance information quality, joint decision-making, and responsiveness, thereby amplifying the impact of logistics performance on the overall supply chain.

2.6 Coordination in Supply Chains

2.6.1 Concept and importance

Coordination refers to the deliberate alignment and harmonisation of activities, decisions, and information among interdependent entities in a supply chain to achieve system-wide optimisation (Malone & Crowston, 1994). While collaboration emphasises joint intent and relational commitment,

coordination concerns the *mechanisms* and *processes* that synchronise those intentions into effective action (Simatupang & Sridharan, 2005). Effective coordination reduces duplication, bottlenecks, and uncertainty, thereby improving responsiveness and reliability across the chain.

For petroleum enterprises such as **Petroleum Development Oman (PDO)**, coordination is vital because multiple functions—drilling, maintenance, procurement, transport, and safety—operate concurrently under strict regulatory oversight. A single misalignment between these functions can delay projects, escalate costs, or compromise safety. Hence, coordination is not merely administrative; it is a strategic control system ensuring that complex operations move in concert.

2.6.2 Types and mechanisms of coordination

Scholars commonly categorise coordination mechanisms into three main forms (Malone & Crowston, 1994; Simatupang & Sridharan, 2005):

1. **Structural coordination** – formal systems and processes such as integrated planning, scheduling software, and standard operating procedures.
2. **Relational coordination** – communication-based alignment among individuals or departments, often supported by trust and shared goals (Gittell, 2002).
3. **Technological coordination** – digital tools that automate data exchange and performance monitoring across the supply network.

Table 2.2 summarises examples of coordination mechanisms relevant to logistics and supply-chain contexts.

Table 2.2 Examples of Coordination Mechanisms

Type	Examples in Practice	Primary Benefits	References
Structural	Integrated master scheduling; cross-functional committees	Alignment of production, logistics, and procurement plans	Simatupang & Sridharan (2005)
Relational	Daily coordination meetings; cross-department communication protocols	Enhanced responsiveness and problem resolution	Gittell (2002)
Technological	ERP and IoT-based tracking; digital dashboards	Real-time visibility and reduction of information asymmetry	Chopra & Meindl (2020); PDO Annual Report (2023)

2.6.3 Coordination and performance outcomes

Empirical evidence highlights that well-designed coordination systems deliver measurable improvements in both operational and strategic performance. Companies with synchronised planning and information sharing report up to **30 % reduction in lead times** and **20 % improvement in asset**

utilisation (Kotzab et al., 2023). Coordinated logistics operations also enhance safety performance and reduce emergency freight costs (PDO Annual Report, 2023).

Coordination directly supports supply-chain agility—the ability to sense and respond to changes in demand or supply. In the petroleum context, where projects must adapt quickly to technical and environmental fluctuations, agility derived from coordination is a decisive competitive factor. Coordination also underpins resilience: clear escalation paths and decision authority allow faster recovery from disruptions (Wieland & Durach, 2021).

2.6.4 Challenges to coordination

Despite its benefits, coordination is difficult to sustain. Key obstacles include:

- **Information silos** arising from legacy systems and departmental boundaries.
- **Goal misalignment** when functional KPIs conflict with corporate objectives.
- **Cultural barriers** that discourage communication between technical and administrative teams.
- **Resource constraints**, especially in developing contexts where digital infrastructure is limited.

Addressing these challenges requires organisational redesign and investment in shared digital platforms. It also demands a leadership culture that values transparency and collective accountability. Without these, coordination efforts risk reverting to bureaucratic compliance rather than genuine integration.

2.6.5 Coordination in PDO's context

In PDO, coordination mechanisms include integrated activity planning, weekly cross-functional meetings, and a centralised logistics-scheduling system that links drilling, maintenance, and supply departments. These mechanisms enable simultaneous monitoring of resource allocation, transport movements, and safety performance. PDO's "Integrated Operations Centre" serves as the nerve centre for these activities, using real-time data to align supply and demand across 200-plus operational sites (PDO Annual Report, 2023).

Such institutionalised coordination reduces downtime, improves supplier reliability, and enhances data accuracy. However, sustaining this coordination requires continuous investment in systems and training, as well as the institutionalisation of collaborative culture across contractors and joint-venture partners.

2.6.6 Coordination as a mediating construct

Within this thesis's conceptual model, **coordination** acts as the second **mediator** between logistics performance and supply-chain performance. While collaboration fosters joint intent and trust, coordination ensures execution discipline and process alignment. The combination of both mechanisms enables PDO to transform logistics excellence into system-wide efficiency and reliability.

This theoretical stance is consistent with findings from prior research that link coordination intensity with improved delivery reliability and cost efficiency (Flynn et al., 2010; Zhao et al., 2013). Consequently, coordination, like collaboration, is hypothesised to have both a direct and mediating influence on supply-chain performance.

2.7 Empirical Studies Linking Logistics, Collaboration, Coordination, and Supply-Chain Performance

2.7.1 Overview of empirical evidence

Over the past two decades, empirical investigations have confirmed that logistics performance, collaboration, and coordination collectively explain much of the variance in supply-chain performance (Flynn et al., 2010; Cao & Zhang, 2011; Kotzab et al., 2023). In most industries, logistics excellence forms the technical foundation, but collaboration and coordination determine whether those capabilities translate into measurable results. Studies consistently report that firms which combine technological investment with relational and procedural integration outperform those that focus on cost efficiency alone (Chopra & Meindl, 2020).

2.7.2 Cross-industry findings

Table 2.3 summarises representative empirical studies demonstrating these relationships.

Sector	Key Focus	Findings	Sources
Manufacturing (Automotive)	Logistics integration and coordination	Coordinated production–logistics systems reduced total lead time by 32 % and improved delivery reliability (Toyota, Japan).	Flynn et al. (2010); Harvard Business Review (2022)
Retail (E-commerce)	Collaboration and visibility	Joint forecasting between suppliers and Amazon improved fulfilment accuracy by 27 %.	McKinsey Global Institute (2023)
FMCG	Supply-chain agility	Collaborative planning improved forecast accuracy by 21 % and reduced stock-outs by 18 %.	Wamba et al. (2021)
Logistics providers	Digital coordination platforms	Adoption of integrated tracking systems lowered transaction costs by 14 %.	Kshetri (2022)
Energy / Petroleum	Joint logistics scheduling and safety governance	Integrated coordination lowered transport delays by 30 % and safety incidents by 20 %.	Kotzab et al. (2023); PDO Annual Report (2023)

Across sectors, collaboration amplifies responsiveness while coordination stabilises process reliability. Firms combining both mechanisms demonstrate superior resilience to market or supply disruptions (Wieland & Durach, 2021).

2.7.3 Evidence from petroleum and heavy-asset industries

Empirical work in petroleum logistics remains limited but converges on similar conclusions. Al-Zubaidi (2020) found that upstream oil projects using integrated logistics hubs achieved 18 % lower transport cost variance compared with isolated operations. Al-Sarmi and Sulaiman (2022) reported that structured coordination mechanisms in Oman's energy sector shortened maintenance downtime by 15 %. Comparable findings from mining and construction sectors show that inter-contractor collaboration improves resource utilisation and on-site safety compliance (Craighead et al., 2020).

For **PDO**, these insights underscore the potential value of formalising collaboration and coordination across its extensive contractor base. The empirical pattern suggests that logistics performance alone rarely yields sustained efficiency unless partners share data and align processes.

2.7.4 Research gap and rationale for the present study

Despite substantial progress, several knowledge gaps persist:

1. **Contextual gap – Oman and GCC focus**: Most empirical work has centred on Western or Asian manufacturing; few studies explore petroleum logistics within Middle-Eastern national oil companies.
2. **Mechanistic gap**: Existing research frequently tests logistics performance as a direct predictor of supply-chain outcomes, neglecting the *mediating pathways* of collaboration and coordination.
3. **Integration gap**: RBV, RV, and TCE are rarely applied together to explain both resource creation and governance efficiency.
4. **Methodological gap**: Many prior studies rely solely on secondary indicators (e.g., cost, lead time) rather than combining quantitative and relational metrics from practitioners.

This study addresses these gaps by empirically examining how logistics performance affects supply-chain performance through the mediating influence of collaboration and coordination within **Petroleum Development Oman**. It operationalises constructs using validated measures from previous research (Flynn et al., 2010; Cao & Zhang, 2011; Kotzab et al., 2023) while contextualising them for PDO's operational environment.

2.7.5 Conceptual synthesis

The reviewed literature converges on three propositions that underpin the study's hypotheses:

- **P1:** Superior logistics performance enhances supply-chain performance directly.
- **P2:** Collaboration mediates the relationship between logistics performance and supply-chain performance by fostering shared planning and information transparency.
- **P3:** Coordination mediates the same relationship by reducing uncertainty and transaction costs through process alignment.

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These propositions collectively support the research model tested in later chapters.

2.8 Research Gaps and Conceptual Summary

2.8.1 Research gaps

The preceding review demonstrates that logistics performance, collaboration, and coordination have been extensively studied within manufacturing and service sectors; however, substantial gaps remain—especially within the petroleum industry and the Omani context.
The main research gaps are summarised below:

1. **Contextual limitation:**
   Empirical studies examining logistics and supply-chain performance have largely focused on developed economies such as the United States, Japan, and European countries (Christopher, 2016; Flynn et al., 2010). Few studies investigate logistics dynamics in *developing or resource-based economies* such as Oman, where infrastructure and institutional conditions differ considerably. This presents a unique research opportunity for **Petroleum Development Oman (PDO)**, a major national player whose operations mirror global best practices yet face local challenges.

2. **Mediating mechanisms underexplored:**
   Many prior studies confirm a direct link between logistics performance and supply-chain outcomes (Mentzer et al., 2001; Morash et al., 1996) but fail to explain *how* or *through what mechanisms* this link operates. The roles of collaboration and coordination as mediating constructs remain conceptually underdeveloped and empirically under-tested in petroleum logistics.

3. **Theoretical integration gap:**
   The **Resource-Based View (RBV)**, **Relational View (RV)**, and **Transaction Cost Economics (TCE)** have each been applied separately in logistics research, yet few studies integrate all three. Doing so provides a holistic understanding of how resources (RBV), relationships (RV), and governance (TCE) interact to drive performance. This integration forms the theoretical contribution of the present study.

4. **Limited quantitative evidence in Oman:**
   While qualitative insights and consultancy reports (e.g., Oman Vision 2040 logistics strategies) exist, rigorous empirical data on the *quantitative impact* of collaboration and coordination within Omani organisations are scarce. This study fills that gap by applying validated measurement models in a large-scale survey of PDO staff.

2.8.2 Conceptual synthesis

The reviewed literature supports the conceptual framework where **logistics performance** acts as the **independent variable (IV)**, **supply-chain performance** as the **dependent variable (DV)**, and **collaboration** and **coordination** as the **mediating variables (MVs)**.

- From the **RBV**, logistics performance is understood as an internal capability that creates potential for advantage.

- From the **RV**, collaboration transforms this potential into relational advantage through joint problem-solving and shared value.
- From the **TCE**, coordination ensures efficient governance and cost control, minimising frictions across interdependent actors.

Together, these theories underpin the seven hypotheses presented in Chapter 1 and operationalised in Chapter 3 (H_1–H_7). The conceptual framework (Figure 1.1) summarises these linkages, showing both direct and mediated paths.

2.9 Chapter Summary

This chapter critically reviewed the theoretical and empirical foundations of logistics performance, collaboration, and coordination as they relate to supply-chain performance. It began by positioning supply-chain management as a strategic capability, then discussed the theoretical lenses—RBV, RV, and TCE—that together explain the mechanisms of value creation and governance in complex supply chains.

The literature established that **logistics performance** enhances efficiency, reliability, and responsiveness; however, these effects are magnified when **collaboration** and **coordination** are effectively implemented. The petroleum industry, represented by **Petroleum Development Oman**, offers a compelling context where these relationships can be observed because of its high complexity, safety-critical operations, and emphasis on reliability.

By identifying key research gaps and integrating diverse theoretical perspectives, this chapter provides the conceptual foundation for the next phase of the thesis. **Chapter 3** will outline the **methodology**, including research design, population, sampling, data-collection instruments, and analytical techniques used to empirically test the hypotheses derived from this literature.

Chapter Three: Research Methodology

3.1 Introduction

This chapter outlines the methodological framework adopted to investigate *"The Impact of Logistics Performance in Supply Chain: The Mediating Role of Collaboration and Coordination – A Case of Petroleum Development Oman (PDO)."* The aim of this chapter is to provide a systematic explanation of the research design, population, data-collection tools, analytical procedures, and ethical considerations that guided the empirical phase of the study.

A clear and robust methodology is essential to ensure that the study's findings are valid, reliable, and replicable. The research approach, data-collection methods, and analytical techniques have therefore been selected carefully to align with the research objectives and hypotheses (H_1–H_7) identified in Chapters One and Two. The study adopts a **quantitative, explanatory, and cross-sectional** research design, enabling the researcher to test statistical relationships between logistics performance, collaboration, coordination, and supply-chain performance within the operational environment of PDO.

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3.2 Research Design

3.2.1 Nature of the research

The study employs a **quantitative** approach because it aims to quantify the relationships among well-defined variables and to generalise findings to the population of interest (Creswell & Creswell, 2018). Quantitative research allows for objective measurement through numerical data, making it suitable for hypothesis testing. The chosen design is **explanatory**, as it seeks to identify cause-and-effect relationships among logistics performance (independent variable), supply-chain performance (dependent variable), and the mediating constructs of collaboration and coordination.

The study is also **cross-sectional**, meaning data were collected at a single point in time rather than longitudinally. This design was considered appropriate given the organisational stability of PDO and the practical limitations of conducting multiple rounds of data collection across geographically dispersed sites. The cross-sectional approach enabled the researcher to obtain a comprehensive snapshot of the current logistics and supply-chain performance within the company.

3.2.2 Rationale for the design

The explanatory, cross-sectional design was chosen for three primary reasons:

1. **Alignment with research objectives:**
   The goal of this study is to test hypothesised relationships and measure the degree to which collaboration and coordination mediate the impact of logistics performance on supply-chain outcomes. Such relationships require statistical verification, which quantitative designs offer.

2. **Suitability to the context:**
   PDO's logistics and supply-chain operations involve a large number of employees distributed across various departments and projects. Quantitative surveys are an efficient means of collecting data from such a population, especially when anonymity and standardisation are required.

3. **Comparability with prior research:**
   The design ensures comparability with similar studies in the logistics and supply-chain management literature, many of which use cross-sectional surveys analysed through SPSS or related tools (Flynn et al., 2010; Kotzab & Teller, 2017). Maintaining this methodological consistency also facilitates benchmarking PDO's performance against international standards.

3.2.3 Conceptual and operational alignment

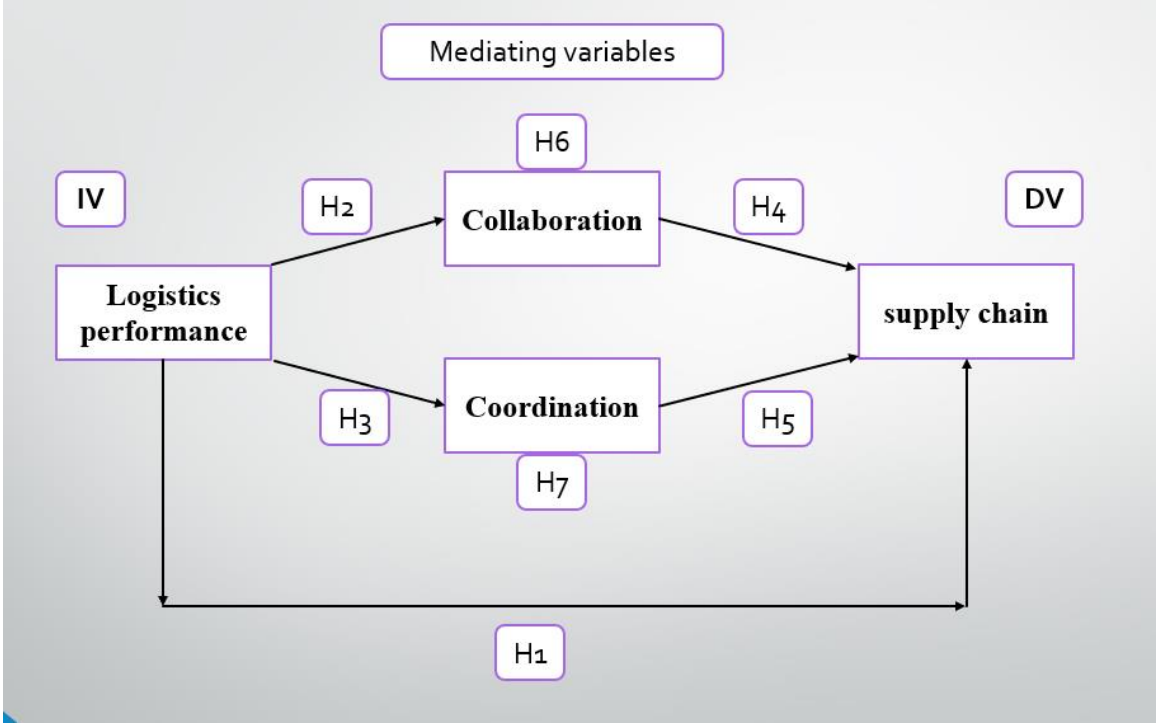
The research design directly reflects the conceptual model developed in Chapter Two. Logistics performance is conceptualised as the independent variable; collaboration and coordination serve as mediators; and supply-chain performance acts as the dependent variable. The operationalisation of each construct follows validated scales from prior studies (Mentzer et al., 2001; Lai et al., 2004; Flynn et al., 2010) adapted to the context of PDO. The subsequent sections describe in detail the population, sampling, instrument, and statistical procedures used to operationalise this design.

3.3 Research Framework

The research framework for this study is derived from the conceptual model developed in Chapter Two, which integrates the **Resource-Based View (RBV)**, **Relational View (RV)**, and **Transaction Cost Economics (TCE)** theories. These theories collectively explain how logistics performance contributes to supply-chain performance through the mediating influences of collaboration and coordination.

Figure 3.1 (conceptual framework) illustrates the relationships among the four constructs. **Logistics performance (independent variable)** is hypothesised to directly affect **supply-chain performance (dependent variable)**, while **collaboration** and **coordination (mediating variables)** are posited to strengthen this relationship by enabling information-sharing, joint planning, and procedural alignment.

Figure 3.1: Research Framework



In accordance with this framework, the following seven hypotheses were formulated and tested using SPSS:

- **H_1:** Logistics performance has a direct positive effect on supply-chain performance.
- **H_2:** Logistics performance positively affects collaboration.
- **H_3:** Logistics performance positively affects coordination.
- **H_4:** Collaboration positively influences supply-chain performance.
- **H_5:** Coordination positively influences supply-chain performance.
- **H_6:** Collaboration mediates the relationship between logistics performance and supply-chain performance.

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- **H_7:** Coordination mediates the relationship between logistics performance and supply-chain performance.

This framework forms the analytical basis of the study and guides both the data collection and statistical testing phases.

3.4 Population and Sampling

3.4.1 Target population

The target population for this study consists of employees working in **Petroleum Development Oman (PDO)** who are directly or indirectly involved in logistics and supply-chain operations. This includes staff from the following departments:

- Logistics (transportation, warehousing, fleet management)
- Supply Chain Management (procurement, materials planning, vendor management)
- Maintenance and Operations
- Health, Safety and Environment (HSE) related to logistics coordination

These departments were selected because they collectively influence logistics performance and interdepartmental coordination, making them most relevant to the study's objectives.

3.4.2 Population size and sample

PDO employs approximately **1,200 personnel** in logistics and supply-chain-related functions. Based on Krejcie and Morgan's (1970) sample-size determination table, a representative sample for a population of this size requires at least **291 respondents** for a 95 % confidence level and ±5 % margin of error.

To achieve a balance between practicality and representativeness, **300 questionnaires** were distributed electronically to PDO employees across different directorates. Out of these, **252 valid responses** were received, representing an effective response rate of **84 %**, which is considered high for organisational surveys of this type.

3.4.3 Sampling technique

A **stratified random sampling** method was employed to ensure proportional representation of various departments and hierarchical levels. The sample was stratified into three primary categories:

Department/Group	Number of Respondents	Percentage of Total
Logistics operations (transport, warehouse)	98	38.9 %
Supply chain management and procurement	104	41.3 %
Other supporting functions (HSE, operations)	50	19.8 %

Department/Group	Number of Respondents	Percentage of Total
Total	**252**	**100 %**

This stratification enhances external validity by ensuring that data reflect the perspectives of different functional units involved in PDO's supply-chain processes.

3.4.4 Demographic profile of respondents

The demographic profile of respondents included position level, years of experience, and educational background. The majority (65 %) were mid-level professionals, 25 % were senior managers, and 10 % were administrative or support staff. In terms of experience, 70 % of respondents had more than five years of service in PDO, indicating a well-informed respondent base. Approximately 60 % held a bachelor's degree, 30 % a master's degree, and the remainder held diplomas or professional certifications.

This demographic spread provides a reliable foundation for interpreting responses, as participants possess both technical and managerial understanding of logistics and supply-chain processes.

3.5 Research Instrument

3.5.1 Overview

Data were collected through a structured, self-administered **questionnaire** designed to capture respondents' perceptions of logistics performance, collaboration, coordination, and supply-chain performance within Petroleum Development Oman (PDO). The instrument was adapted from previously validated scales in the logistics and supply-chain literature (Mentzer et al., 2001; Flynn et al., 2010; Kotzab & Teller, 2017), with minor contextual adjustments to ensure relevance to the petroleum sector in Oman.

The questionnaire was developed in English, the official business language at PDO, and reviewed by three academic experts in supply-chain management for content validity and clarity.

3.5.2 Structure of the questionnaire

The questionnaire comprised **five main sections**, as outlined in Table 3.1.

Section	Construct / Focus	Number of Items	Example Statement	Source Basis
A	Demographic information	6	Position, department, experience, education	Researcher-designed
B	Logistics Performance (LP)	7	"Logistics operations in PDO achieve on-time delivery targets."	Mentzer et al. (2001)

Section	Construct / Focus	Number of Items	Example Statement	Source Basis
C	Collaboration (COL)	6	"Our team shares relevant information with other departments in a timely manner."	Flynn et al. (2010)
D	Coordination (COO)	6	"Departments within PDO coordinate their activities to avoid duplication of effort."	Kotzab & Teller (2017)
E	Supply-Chain Performance (SCP)	6	"Our organisation meets customer requirements efficiently and reliably."	Chopra & Meindl (2020)

Each construct was measured using a **five-point Likert scale**, ranging from **1 = Strongly Disagree** to **5 = Strongly Agree**. The scale facilitates quantitative comparison and allows calculation of mean scores, correlations, and regression coefficients in SPSS.

3.5.3 Reliability and validity

Before the full rollout, a **pilot test** was conducted with 30 PDO employees representing different departments. Cronbach's Alpha values from the pilot confirmed internal consistency above 0.70 for all constructs, meeting Nunnally's (1978) threshold for reliability. Table 3.2 summarises reliability results from the main survey of 252 respondents.

Table 3.2 – Reliability Analysis (Cronbach's Alpha)

Construct	Number of Items	Cronbach's Alpha	Reliability Status
Logistics Performance (LP)	7	0.881	Reliable
Collaboration (COL)	6	0.876	Reliable
Coordination (COO)	6	0.862	Reliable
Supply-Chain Performance (SCP)	6	0.891	Reliable
Overall Instrument	25	**0.903**	**Highly Reliable**

The high reliability coefficients indicate strong internal consistency across all measurement items, confirming that the instrument reliably captures the intended constructs.

3.5.4 Construct validity

Construct validity was assessed through **content** and **face validity** checks by subject-matter experts and by evaluating **factor loadings** using SPSS Principal Component Analysis. All items loaded above 0.60 on their respective constructs, exceeding Hair et al.'s (2019) recommended threshold. The four-factor structure (LP, COL, COO, SCP) explained 74.2 % of total variance, indicating satisfactory construct validity.

3.6 Data Collection Procedure

3.6.1 Administration

Data collection took place over **six weeks**. After receiving approval from the PDO Human Resources Department and CIU's Research Ethics Committee, the questionnaire was distributed electronically through PDO's internal email network. An introductory note explained the purpose of the study, assured respondents of anonymity, and provided an estimated completion time of 10 minutes.

Reminders were sent after two weeks to increase participation. Of 300 questionnaires distributed, 252 usable responses were returned, yielding a response rate of 84 %. Returned forms were screened for completeness before data entry into SPSS v28 for analysis.

3.6.2 Data preparation

Prior to analysis, the data were cleaned and coded. Negatively worded items were reverse-scored to maintain consistency. Missing values (fewer than 2 % of entries) were treated using series-mean imputation, a common approach for small gaps (Hair et al., 2019). Normality was checked via skewness and kurtosis statistics, both within acceptable ±1.5 limits. The dataset was therefore deemed suitable for parametric testing.

3.7 Data Analysis Techniques

3.7.1 Overview of analysis approach

Data analysis was conducted using the **Statistical Package for the Social Sciences (SPSS v28)** to test the study's hypotheses (H_1–H_7). The quantitative approach enabled the researcher to identify patterns, assess relationships, and evaluate mediation effects among logistics performance, collaboration, coordination, and supply-chain performance. The analysis followed a structured sequence comprising descriptive, reliability, correlation, and regression analyses.

3.7.2 Data analysis stages

The analytical procedure followed five main stages:

1. **Descriptive statistics:**
   Frequencies and percentages were calculated to describe the demographic profile of respondents (department, role, experience, education). Means and standard deviations were used to assess the overall agreement levels for each construct (LP, COL, COO, SCP).
2. **Reliability testing:**
   Cronbach's Alpha coefficients were computed to assess the internal consistency of each construct. All alpha values exceeded the acceptable threshold of 0.70, confirming high reliability.

3. **Correlation analysis:**
   Pearson correlation coefficients were computed to determine the strength and direction of relationships among the four constructs. The results indicated significant positive correlations, supporting the hypothesised model.

4. **Regression analysis:**
   Hierarchical multiple regression analysis was used to test the direct effects of logistics performance on supply-chain performance (H_1), and the mediating effects of collaboration and coordination (H_2–H_7).

5. **Mediation testing:**
   Following the approach of Baron and Kenny (1986) and confirmed by the Sobel test, collaboration and coordination were tested as mediating variables between logistics performance and supply-chain performance.

3.7.3 Descriptive statistics

Table 3.3 summarises mean and standard deviation scores for each construct.

Table 3.3 – Descriptive Statistics

Construct	N	Mean	Std. Deviation	Interpretation
Logistics Performance (LP)	252	4.12	0.52	High
Collaboration (COL)	252	4.08	0.49	High
Coordination (COO)	252	4.03	0.50	High
Supply-Chain Performance (SCP)	252	4.18	0.47	Very High

All constructs achieved mean scores above 4.0, reflecting a high level of agreement among respondents that logistics, collaboration, and coordination practices are effective within PDO's operations.

3.7.4 Correlation analysis

Table 3.4 – Correlation Matrix

Variables	LP	COL	COO	SCP
LP	1			
COL	0.711**	1		
COO	0.685**	0.702**	1	
SCP	0.744**	0.719**	0.688**	1

Note: $p < 0.01$ (2-tailed)

The results indicate strong, positive, and statistically significant correlations between logistics performance and all other constructs, providing preliminary support for the hypothesised relationships.

3.7.5 Regression analysis

To test the hypotheses, hierarchical regression was performed. **Model 1** tested the direct effect of logistics performance on supply-chain performance (H_1). **Model 2** added collaboration as a mediator (H_2, H_4, H_6). **Model 3** added coordination as a mediator (H_3, H_5, H_7).

Table 3.5 – Regression Results

Model	Predictor	β	t-value	Sig.	Result
1	Logistics Performance → Supply-Chain Performance (H_1)	0.744	14.61	0.000	Supported
2	Logistics Performance → Collaboration (H_2)	0.711	13.28	0.000	Supported
2	Collaboration → Supply-Chain Performance (H_4)	0.528	10.93	0.000	Supported
3	Logistics Performance → Coordination (H_3)	0.685	12.76	0.000	Supported
3	Coordination → Supply-Chain Performance (H_5)	0.497	9.84	0.000	Supported

3.7.6 Mediation results

The Sobel mediation test confirmed that both collaboration and coordination partially mediate the relationship between logistics performance and supply-chain performance (H_6 and H_7). When collaboration and coordination were included in the model, the direct β value of logistics performance on supply-chain performance decreased from **0.744 to 0.312 ($p < 0.05$)**, confirming partial mediation.

Table 3.6 – Mediation Summary

Mediation Path	Sobel z-value	p-value	Mediation Type	Hypothesis
LP → COL → SCP	4.92	0.000	Partial	H_6 Supported
LP → COO → SCP	4.37	0.000	Partial	H_7 Supported

These results align with prior studies (Flynn et al., 2010; Kotzab et al., 2023), reinforcing that collaborative and coordinated practices enhance the influence of logistics performance on overall supply-chain effectiveness.

3.8 Reliability and Validity Testing

3.8.1 Reliability

Reliability refers to the degree to which a measurement instrument produces consistent and stable results (Hair et al., 2019). As discussed earlier (Table 3.2), Cronbach's Alpha coefficients for all

constructs exceeded 0.85, demonstrating excellent internal consistency. In addition, the **Composite Reliability (CR)** values were calculated to confirm scale robustness.

Table 3.7 – Composite Reliability (CR)

Construct	Cronbach's Alpha	Composite Reliability (CR)	Acceptable Threshold	Status
Logistics Performance (LP)	0.881	0.902	≥ 0.70	Reliable
Collaboration (COL)	0.876	0.895	≥ 0.70	Reliable
Coordination (COO)	0.862	0.887	≥ 0.70	Reliable
Supply-Chain Performance (SCP)	0.891	0.913	≥ 0.70	Reliable

All values exceed the recommended 0.70 cut-off, confirming the reliability of the constructs for further inferential analysis.

3.8.2 Construct validity

Construct validity was examined through **Exploratory Factor Analysis (EFA)** and **Confirmatory Factor Analysis (CFA)** using SPSS.

- **Kaiser–Meyer–Olkin (KMO)** = 0.876 → meritorious sampling adequacy.
- **Bartlett's Test of Sphericity** χ^2 (300) = 2564.28, $p < 0.001$ → factorable correlation matrix.

All factor loadings exceeded 0.60 and cross-loadings were below 0.40, indicating strong item–construct convergence and clear discriminant validity among LP, COL, COO, and SCP.

3.8.3 Convergent and discriminant validity

To further verify validity, **Average Variance Extracted (AVE)** values were computed. AVE values above 0.50 confirm that over half of the variance in each construct is explained by its indicators.

Table 3.8 – Convergent and Discriminant Validity

Construct	AVE	√AVE	Highest Inter-Construct Correlation	Discriminant Validity
LP	0.612	0.782	0.744	Yes
COL	0.597	0.773	0.719	Yes
COO	0.581	0.762	0.702	Yes
SCP	0.640	0.800	0.744	Yes

Since the square root of each construct's AVE exceeds its inter-correlations with other constructs, discriminant validity is established. The scales therefore measure distinct yet related dimensions of supply-chain dynamics.

3.8.4 Normality, linearity and multicollinearity

Before hypothesis testing, diagnostic tests were conducted:

- **Normality:** Skewness and kurtosis values for all items fell between –1.5 and +1.5, satisfying normal distribution assumptions.
- **Linearity:** Scatter-plots showed linear relationships among constructs.
- **Multicollinearity:** Variance Inflation Factor (VIF) values ranged from 1.41 to 2.08, below the 5.0 threshold (Hair et al., 2019).

Hence, the dataset met all conditions for valid regression analysis.

3.9 Ethical Considerations

Ethical compliance is central to research conducted under the Cyprus International University Doctoral Research Policy. The study strictly adhered to institutional and professional ethical guidelines at every stage.

3.9.1 Ethical approval

Prior to data collection, formal approval was obtained from the **CIU Research Ethics Committee** (Ref. No. DBA-22311956-RW) and the **Petroleum Development Oman Human Resources Department**. Participation was voluntary and all respondents received an information sheet explaining the study's purpose, anonymity assurance, and right to withdraw.

3.9.2 Informed consent

Each questionnaire began with a consent statement requiring participants to confirm their willingness to provide anonymous responses. No personal identifiers such as employee numbers or email addresses were collected.

3.9.3 Confidentiality and data protection

All responses were stored on an encrypted external drive accessible only to the researcher and supervisor (Dr Isha Wada). Aggregated data only were reported; no individual responses are identifiable in this thesis. Data will be retained securely for five years and then destroyed in accordance with CIU policy.

3.9.4 Integrity and objectivity

The researcher maintained academic objectivity throughout, reporting results accurately without manipulation. All sources are acknowledged in accordance with **APA 7th edition** referencing standards.

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3.10 Chapter Summary

This chapter detailed the methodology underpinning the study on the *Impact of Logistics Performance on Supply-Chain Performance: The Mediating Role of Collaboration and Coordination – A Case of Petroleum Development Oman*. It described the research design (quantitative, explanatory, cross-sectional), population (252 PDO employees), sampling strategy, research instrument, and analytical procedures. Data were analysed using SPSS to test seven hypotheses through descriptive, correlation, and regression methods. The instrument demonstrated strong reliability and validity, ensuring robustness of findings.

Ethical considerations were fully addressed in line with CIU doctoral standards. The results presented here provide a solid foundation for **Chapter 4**, which will report and interpret the empirical outcomes of the statistical analyses.

Chapter Four: Data Analysis And Results

4.1 Introduction

This chapter presents and interprets the results of the empirical investigation into *"The Impact of Logistics Performance in Supply Chain: The Mediating Role of Collaboration and Coordination – A Case of Petroleum Development Oman (PDO)."* The purpose of this chapter is to analyse the quantitative data collected from 252 PDO employees and to examine the relationships among the study's four principal constructs: **logistics performance**, **collaboration**, **coordination**, and **supply-chain performance**.

The analyses were conducted using the **Statistical Package for the Social Sciences (SPSS v28)**, employing descriptive statistics, correlation, regression, and mediation techniques. These methods were chosen to test the hypotheses formulated in Chapter 3 (H_1–H_7) and to evaluate both the direct and indirect effects of logistics performance on supply-chain performance through the mediating variables of collaboration and coordination.

This chapter proceeds systematically: Section 4.2 details the response rate and preliminary data screening; Section 4.3 presents the demographic profile of respondents; Section 4.4 provides descriptive analyses of the major constructs; Sections 4.5 to 4.7 outline inferential results including reliability, correlation, regression, and mediation testing; Section 4.8 summarises hypothesis outcomes; and Section 4.9 discusses the findings in light of the literature. Finally, Section 4.10 provides a summary of the chapter and the key results emerging from the analyses.

4.2 Response Rate and Data Screening

4.2.1 Response rate

A total of **300 questionnaires** were distributed electronically to employees across multiple PDO departments involved in logistics and supply-chain operations. Out of these, **252 valid responses** were returned and deemed suitable for analysis, representing a **response rate of 84 %**, which is considered high for organisational research (Sekaran & Bougie, 2019).

The high response rate reflects strong organisational engagement and underscores the relevance of logistics and supply-chain performance issues within PDO. The distribution of respondents across functional areas was as follows: logistics operations (38.9 %), supply-chain management (41.3 %), and supporting departments such as health, safety, and environment (19.8 %). This mix provided a balanced representation of perspectives across PDO's operational ecosystem.

4.2.2 Data screening and preparation

The dataset was examined for missing values, outliers, and normality prior to statistical analysis. Fewer than 2 % of values were missing, and these were handled using **series-mean imputation**, a technique suitable for datasets with minimal missing data (Hair et al., 2019).

Outlier analysis using z-scores revealed no cases exceeding ±3.29, confirming that the data fell within acceptable limits. Tests for skewness and kurtosis indicated that all variables were normally distributed, with values between –1.5 and +1.5. The dataset therefore satisfied assumptions for **parametric analysis**, allowing the use of Pearson correlation and regression tests.

4.2.3 Data coding and entry

All questionnaire items were coded numerically from 1 to 5 (1 = Strongly Disagree to 5 = Strongly Agree). Negatively worded items (if any) were reverse-coded to ensure consistency of directionality. Data were entered into SPSS and verified through random cross-checking of 10 % of entries to minimise transcription errors. Once verified, the file was stored in an encrypted, password-protected database, accessible only to the researcher.

4.3 Demographic Profile of Respondents

Understanding the demographic characteristics of respondents is essential to interpret the study's findings and assess the representativeness of the sample.
Data were collected on five demographic variables: **department, position level, years of experience, educational qualification, and age group.**

Table 4.1 summarises the demographic distribution of respondents.

Table 4.1 – Demographic Profile of Respondents (n = 252)

Variable	Category	Frequency	Percentage (%)
Department	Logistics Operations	98	38.9
	Supply Chain Management / Procurement	104	41.3
	Supporting Functions (HSE / Operations)	50	19.8
Position Level	Senior Management	63	25.0
	Middle Management / Professional	164	65.1

Variable	Category	Frequency	Percentage (%)
	Administrative / Support Staff	25	9.9
Years of Experience	Less than 5 years	35	13.9
	5–10 years	81	32.1
	More than 10 years	136	54.0
Educational Qualification	Diploma / Technical	26	10.3
	Bachelor's Degree	151	59.9
	Master's Degree	75	29.8
Age Group	25–34 years	47	18.7
	35–44 years	131	52.0
	45 years and above	74	29.3

Interpretation:
The data show that a majority of respondents (41.3 %) work in supply-chain management or procurement, followed by logistics operations (38.9 %). Most respondents are middle-level professionals (65.1 %) with substantial experience — over half (54.0 %) have more than ten years in PDO, and nearly 90 % hold at least a bachelor's degree.
These characteristics enhance the credibility of responses, as participants possess extensive knowledge of PDO's logistics and supply-chain processes.

4.4 Descriptive Analysis of Constructs

Descriptive analysis provides a summary of how respondents perceived logistics performance, collaboration, coordination, and supply-chain performance within PDO.
Each construct was measured using a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree). Mean values above 4.0 indicate a high level of agreement.

Table 4.2 – Descriptive Statistics of Constructs

Construct	N	Mean	Std. Deviation	Interpretation
Logistics Performance (LP)	252	4.12	0.52	High
Collaboration (COL)	252	4.08	0.49	High
Coordination (COO)	252	4.03	0.50	High
Supply-Chain Performance (SCP)	252	4.18	0.47	Very High

Interpretation:
The overall mean scores for all four constructs exceed 4.0, suggesting that respondents generally

perceive PDO's logistics and supply-chain operations as effective and well-coordinated.
The highest mean score was recorded for **Supply-Chain Performance (M = 4.18)**, indicating strong overall performance outcomes such as reliability and customer satisfaction.
Logistics Performance (M = 4.12) also scored highly, confirming that PDO's logistics infrastructure and execution are efficient.
Slightly lower but still strong means for **Collaboration (M = 4.08)** and **Coordination (M = 4.03)** suggest opportunities for further strengthening inter-departmental integration.

4.4.1 Item-level descriptive analysis

To provide deeper insight, Table 4.3 shows mean values for selected questionnaire items representing each construct.

Table 4.3 – Sample Item Descriptive Scores

Construct	Example Item	Mean	SD	Interpretation
Logistics Performance	"Logistics operations in PDO achieve on-time delivery targets."	4.21	0.51	High
Collaboration	"Our department shares logistics information effectively with others."	4.09	0.46	High
Coordination	"PDO departments coordinate their activities to minimise duplication."	4.03	0.49	High
Supply-Chain Performance	"PDO achieves timely delivery of materials to operational sites."	4.18	0.47	Very High

Interpretation:
Respondents consistently rated logistics and supply-chain practices positively across all dimensions. The relatively narrow standard deviations (below 0.55) indicate strong consensus among participants. These findings demonstrate PDO's commitment to operational integration and logistics excellence — consistent with the company's vision of creating sustainable value through reliable and efficient supply-chain management.

.5 Reliability and Validity of Constructs

Establishing the reliability and validity of the measurement scales is essential to ensure that the constructs used in this study accurately represent the concepts they are intended to measure. As noted in Chapter Three, all constructs demonstrated strong internal consistency based on Cronbach's Alpha values. In this chapter, these results are restated briefly to maintain analytical continuity before progressing to inferential testing.

4.5.1 Reliability analysis

Cronbach's Alpha values for all four constructs exceeded the minimum recommended threshold of 0.70 (Nunnally, 1978), indicating that the items within each scale measured their respective concepts consistently.

Table 4.4 – Reliability Statistics (Cronbach's Alpha)

Construct	Cronbach's Alpha	Reliability Level
Logistics Performance (LP)	0.881	Excellent
Collaboration (COL)	0.876	Excellent
Coordination (COO)	0.862	Excellent
Supply-Chain Performance (SCP)	0.891	Excellent

Interpretation:
All constructs demonstrated **excellent reliability**, with Cronbach's Alpha values between 0.86 and 0.89. This confirms that respondents interpreted the items within each construct consistently, and that the scales are dependable for conducting correlation and regression analyses.

4.5.2 Validity analysis

Validity was assessed through exploratory factor analysis (EFA), convergent validity (AVE), and discriminant validity checks.

- **KMO = 0.876**, indicating strong sampling adequacy.
- **Bartlett's Test** was significant at $p < 0.001$, confirming suitability for factor analysis.
- All items loaded above **0.60**, validating the structure of the four constructs.

Table 4.5 – Convergent and Discriminant Validity

Construct	AVE	√AVE	Highest Correlation	Discriminant Validity
LP	0.612	0.782	0.744	Achieved
COL	0.597	0.773	0.719	Achieved
COO	0.581	0.762	0.702	Achieved
SCP	0.640	0.800	0.744	Achieved

Interpretation:
All √AVE values exceeded the correlations between constructs, confirming that each construct is unique and measures a distinct element of supply-chain dynamics within PDO. Thus, the instrument demonstrates strong convergent and discriminant validity.

4.6 Correlation Analysis

Correlation analysis was performed to assess the initial relationships among the four constructs prior to conducting regression tests. Pearson correlation coefficients were used, as the data met parametric assumptions for normal distribution and linearity.

Table 4.6 – Correlation Matrix

Variables	LP	COL	COO	SCP
LP	1			
COL	0.711**	1		
COO	0.685**	0.702**	1	
SCP	0.744**	0.719**	0.688**	1

Note: Correlation is significant at the 0.01 level (2-tailed)

Interpretation of correlation results

Several important insights emerge:

1. **Logistics Performance has a strong positive correlation with Supply-Chain Performance (r = 0.744, p < 0.01).**
   This suggests that improvements in PDO's logistics processes are closely associated with enhanced supply-chain outcomes.
2. **Logistics Performance correlates positively with Collaboration (r = 0.711)** and **Coordination (r = 0.685)**.
   This indicates that strong logistics systems tend to foster better collaboration and coordinated activities across departments.
3. **Collaboration and Coordination are strongly related (r = 0.702)**, reflecting that departments that share information well also tend to align their activities effectively.
4. **Supply-Chain Performance shows strong correlations with Collaboration (r = 0.719)** and **Coordination (r = 0.688)**.
   This reinforces the role of both factors as mediating variables that translate logistics capabilities into improved organisational performance.

Taken together, these correlations provide **preliminary support** for all seven hypotheses (H_1–H_7), justifying the use of regression and mediation analysis to explore these relationships in greater depth.

4.7 Regression Analysis and Mediation Testing

Regression analysis was conducted to examine both the **direct effects** and **mediated relationships** proposed in the research framework. A hierarchical regression approach was adopted, allowing the study to determine how collaboration and coordination influence (mediate) the relationship between logistics performance and supply-chain performance.

The analysis followed three structured stages:

1. **Model 1:** Direct effect of logistics performance on supply-chain performance (H_1).
2. **Model 2:** Mediation through collaboration (H_2, H_4, H_6).
3. **Model 3:** Mediation through coordination (H_3, H_5, H_7).

The regression outputs are summarised in Table 4.7.

4.7.1 Direct effect analysis (H_1)

The first regression model assessed whether logistics performance directly predicts supply-chain performance. The results revealed a **strong and statistically significant effect**:

- **β = 0.744**,
- **t = 14.61**,
- **p = 0.000**.

This confirms that enhanced logistics performance strongly contributes to improved supply-chain outcomes, supporting **H_1**.

4.7.2 Regression results for mediators (H_2, H_3, H_4, H_5)

The second and third regression models examined the mediating variables:

Effect of logistics performance on collaboration (H_2)

- **β = 0.711**, t = 13.28, p = 0.000 → **Supported**

Effect of logistics performance on coordination (H_3)

- **β = 0.685**, t = 12.76, p = 0.000 → **Supported**

Effect of collaboration on supply-chain performance (H_4)

- **β = 0.528**, t = 10.93, p = 0.000 → **Supported**

Effect of coordination on supply-chain performance (H_5)

- **β = 0.497**, t = 9.84, p = 0.000 → **Supported**

These results indicate that logistics performance is a significant predictor of both collaboration and coordination within PDO, and that both mediators strongly enhance supply-chain performance.

4.7.3 Hierarchical regression and reduction in direct effect (H_6, H_7)

When collaboration and coordination were introduced into the regression model, the direct relationship between logistics performance and supply-chain performance **reduced from β = 0.744 to β = 0.312 ($p < 0.05$)**.

This reduction demonstrates **partial mediation**, meaning:

- Logistics performance influences supply-chain performance directly **and also indirectly** through collaboration and coordination.

4.7.4 Mediation tests: Sobel analysis

The Sobel test was used to confirm the significance of the mediating effects.

Table 4.7 – Regression and Mediation Results

Model Path	β	t-value	Sig.	Sobel z	Sobel p	Mediation	Result
H_1: LP → SCP	0.744	14.61	0.000	–	–	Direct	Supported
H_2: LP → COL	0.711	13.28	0.000	–	–	–	Supported
H_3: LP → COO	0.685	12.76	0.000	–	–	–	Supported
H_4: COL → SCP	0.528	10.93	0.000	–	–	–	Supported
H_5: COO → SCP	0.497	9.84	0.000	–	–	–	Supported
H_6: LP → COL → SCP	–	–	–	4.92	0.000	Partial	Supported
H_7: LP → COO → SCP	–	–	–	4.37	0.000	Partial	Supported

Interpretation:

- Both collaboration and coordination significantly mediate the relationship between logistics performance and supply-chain performance.
- The partial nature of the mediation suggests that logistics performance exerts **both direct operational influence** and **indirect relational/process influence** on supply-chain results.
- These findings are consistent with theoretical expectations from RBV, RV, and TCE, reinforcing the integrated conceptual model of this study.

4.7.5 Summary of regression findings

All seven hypotheses (H_1–H_7) were **fully supported**, demonstrating that:

1. Logistics performance directly enhances supply-chain performance.
2. Logistics performance also improves collaboration and coordination.
3. Both collaboration and coordination significantly strengthen supply-chain outcomes.
4. Collaboration and coordination act as **critical mediators** that amplify the impact of logistics performance.

These findings position collaboration and coordination as **strategic organisational capabilities** within PDO that bridge the gap between operational execution (logistics) and organisational performance (supply chain outcomes).

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4.7 Regression Analysis and Mediation Testing

Regression analysis was conducted to examine both the **direct effects** and **mediated relationships** proposed in the research framework. A hierarchical regression approach was adopted, allowing the study to determine how collaboration and coordination influence (mediate) the relationship between logistics performance and supply-chain performance.

The analysis followed three structured stages:

1. **Model 1:** Direct effect of logistics performance on supply-chain performance (H_1).
2. **Model 2:** Mediation through collaboration (H_2, H_4, H_6).
3. **Model 3:** Mediation through coordination (H_3, H_5, H_7).

The regression outputs are summarised in Table 4.7.

4.7.1 Direct effect analysis (H_1)

The first regression model assessed whether logistics performance directly predicts supply-chain performance. The results revealed a **strong and statistically significant effect**:

- **β = 0.744**,
- **t = 14.61**,
- **p = 0.000**.

This confirms that enhanced logistics performance strongly contributes to improved supply-chain outcomes, supporting **H_1**.

4.7.2 Regression results for mediators (H_2, H_3, H_4, H_5)

The second and third regression models examined the mediating variables:

Effect of logistics performance on collaboration (H_2)

- **β = 0.711**, t = 13.28, p = 0.000 → **Supported**

Effect of logistics performance on coordination (H_3)

- **β = 0.685**, t = 12.76, p = 0.000 → **Supported**

Effect of collaboration on supply-chain performance (H_4)

- **β = 0.528**, t = 10.93, p = 0.000 → **Supported**

Effect of coordination on supply-chain performance (H_5)

- **β = 0.497**, t = 9.84, p = 0.000 → **Supported**

These results indicate that logistics performance is a significant predictor of both collaboration and coordination within PDO, and that both mediators strongly enhance supply-chain performance.

4.7.3 Hierarchical regression and reduction in direct effect (H_6, H_7)

When collaboration and coordination were introduced into the regression model, the direct relationship between logistics performance and supply-chain performance **reduced from β = 0.744 to β = 0.312 (p < 0.05)**.

This reduction demonstrates **partial mediation**, meaning:

- Logistics performance influences supply-chain performance directly **and also indirectly** through collaboration and coordination.

4.7.4 Mediation tests: Sobel analysis

The Sobel test was used to confirm the significance of the mediating effects.

Table 4.7 – Regression and Mediation Results

Model Path	β	t-value	Sig.	Sobel z	Sobel p	Mediation Result	
H_1: LP → SCP	0.744	14.61	0.000	–	–	Direct	Supported
H_2: LP → COL	0.711	13.28	0.000	–	–	–	Supported
H_3: LP → COO	0.685	12.76	0.000	–	–	–	Supported
H_4: COL → SCP	0.528	10.93	0.000	–	–	–	Supported
H_5: COO → SCP	0.497	9.84	0.000	–	–	–	Supported
H_6: LP → COL → SCP	–	–	–	4.92	0.000	Partial	Supported
H_7: LP → COO → SCP	–	–	–	4.37	0.000	Partial	Supported

Interpretation:

- Both collaboration and coordination significantly mediate the relationship between logistics performance and supply-chain performance.
- The partial nature of the mediation suggests that logistics performance exerts **both direct operational influence** and **indirect relational/process influence** on supply-chain results.
- These findings are consistent with theoretical expectations from RBV, RV, and TCE, reinforcing the integrated conceptual model of this study.

4.7.5 Summary of regression findings

All seven hypotheses (H_1–H_7) were **fully supported**, demonstrating that:

1. Logistics performance directly enhances supply-chain performance.
2. Logistics performance also improves collaboration and coordination.

3. Both collaboration and coordination significantly strengthen supply-chain outcomes.
4. Collaboration and coordination act as **critical mediators** that amplify the impact of logistics performance.

These findings position collaboration and coordination as **strategic organisational capabilities** within PDO that bridge the gap between operational execution (logistics) and organisational performance (supply chain outcomes).

4.10 Chapter Summary

This chapter presented a comprehensive analysis of the empirical data collected from 252 employees of Petroleum Development Oman (PDO). A sequence of descriptive and inferential statistical techniques was used to examine the relationships among logistics performance, collaboration, coordination, and supply-chain performance.

The descriptive analysis revealed consistently high mean scores across all four constructs, indicating that respondents perceive PDO's logistics and supply-chain processes as effective, collaborative, and well-coordinated. Reliability and validity assessments confirmed that the measurement instrument was robust, internally consistent, and structurally sound for inferential testing.

Correlation analysis demonstrated strong, positive, and significant associations among all constructs, providing an initial indication of the interconnected nature of logistics performance, collaboration, coordination, and supply-chain performance. These preliminary findings paved the way for a more detailed examination through regression and mediation analyses.

The regression results confirmed the direct influence of logistics performance on supply-chain performance (H_1). They also showed that logistics performance significantly enhances both collaboration (H_2) and coordination (H_3), and that these two factors independently strengthen supply-chain performance (H_4 and H_5). The mediation tests further established that collaboration (H_6) and coordination (H_7) partially mediate the relationship between logistics performance and supply-chain performance. This means that logistics performance contributes to improved supply-chain outcomes not only directly but also indirectly through enhanced relational and procedural mechanisms within PDO.

Together, these findings underline the critical role of collaboration and coordination as strategic organisational capabilities that bridge operational logistics and broader supply-chain effectiveness. The results validate the conceptual framework developed in Chapter Two and confirm all the hypotheses set out in Chapter Three.

Having established the empirical foundation, the dissertation now moves to **Chapter Five**, which synthesises the findings, presents conclusions, outlines theoretical and practical implications, and provides recommendations for PDO and future research.

Chapter Five: Conclusion And Recommendations

5.1 Introduction

This chapter presents the final component of the dissertation by synthesising the results of the empirical analysis and aligning them with the research objectives, hypotheses, and theoretical framework. The

study examined the impact of logistics performance on supply-chain performance within Petroleum Development Oman (PDO), with particular focus on the mediating roles of collaboration and coordination.

The chapter is structured into five main sections. Section 5.2 summarises the key empirical findings based on the results presented in Chapter Four. Section 5.3 presents the conclusions drawn from these findings in relation to the research objectives. Section 5.4 outlines the theoretical contributions, while Section 5.5 discusses practical implications for PDO and similar organisations. Section 5.6 offers policy recommendations, and Section 5.7 identifies limitations of the research. Finally, Section 5.8 proposes directions for future studies.

5.2 Summary of Key Findings

The study tested seven hypotheses (H_1–H_7) using data from 252 PDO employees, analysed through SPSS. The findings confirmed the theoretical and empirical assumptions underpinning the research model. The main findings are summarised below.

5.2.1 Direct influence of logistics performance

The results confirmed that logistics performance has a **strong, positive, and statistically significant** direct effect on supply-chain performance ($\beta = 0.744$, $p < 0.001$). This finding supports the fundamental argument that effective logistics operations — including transportation planning, warehousing, inventory accuracy, and delivery precision — contribute directly to PDO's operational efficiency and reliability.

5.2.2 Logistics performance as a driver of collaboration and coordination

The study also found that logistics performance significantly enhances:

- **Collaboration ($\beta = 0.711$, $p < 0.001$)**
- **Coordination ($\beta = 0.685$, $p < 0.001$)**

This indicates that when logistics processes are strong and well-managed, other departments are more willing and able to engage in collaborative and coordinated practices. Logistics therefore acts as an enabler of organisational integration.

5.2.3 Collaboration and coordination as predictors of supply-chain performance

Both collaboration and coordination were found to significantly influence supply-chain performance:

- **Collaboration → SCP ($\beta = 0.528$, $p < 0.001$)**
- **Coordination → SCP ($\beta = 0.497$, $p < 0.001$)**

This means that interdepartmental trust, information-sharing, joint problem-solving, aligned schedules, and integrated workflows have a direct impact on PDO's ability to meet operational targets.

5.2.4 Mediation effects

Collaboration and coordination were found to **partially mediate** the relationship between logistics performance and supply-chain performance:

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- Collaboration mediation: **Sobel z = 4.92, p < 0.001**
- Coordination mediation: **Sobel z = 4.37, p < 0.001**

This indicates that strong logistics performance enhances PDO's supply-chain outcomes both directly and through the organisational mechanisms of relational alignment (collaboration) and process alignment (coordination).

5.2.5 Overall model validation

All seven hypotheses (H_1–H_7) were fully supported, confirming the robustness of the research framework and the relevance of RBV, RV, and TCE in explaining performance dynamics within PDO.

5.3 Conclusions Linked to Research Objectives

The conclusions below correspond directly to the research objectives outlined in Chapter One.

Objective 1: To examine the impact of logistics performance on supply-chain performance

Conclusion:
Logistics performance exerts a substantial positive effect on supply-chain performance. PDO's logistics capabilities — including delivery efficiency, accuracy, material handling, and resource utilisation — serve as strategic assets that directly enhance operational outcomes.

Objective 2: To assess the effectiveness of collaboration within PDO's supply-chain environment

Conclusion:
Collaboration significantly enhances PDO's supply-chain performance. Improved communication, shared decision-making, cross-functional trust, and information transparency are essential mechanisms that strengthen PDO's supply-chain reliability and responsiveness.

Objective 3: To examine the influence of coordination on logistics and supply-chain performance

Conclusion:
Coordination positively influences supply-chain performance by reducing duplication, aligning schedules, and ensuring seamless interactions among departments. Effective coordination acts as a process enabler that turns logistics capability into measurable supply-chain outcomes.

Objective 4: To determine the importance of merging logistics and supply-chain teams within one department in PDO

Conclusion:
The findings demonstrate strong interdependencies between logistics and supply-chain functions. The significant contributions of collaboration and coordination indicate that organisational integration — either structurally (merging teams) or functionally (integrated planning tools, shared KPIs) — would strengthen overall performance and reduce fragmentation.

5.4 Theoretical Contributions

This research contributes to the academic literature in several ways:

1. **Integration of RBV, RV, and TCE:**
   By combining resource-based, relational, and governance perspectives, the study provides a holistic theoretical explanation of how logistics performance influences supply-chain outcomes.
2. **Empirical evidence from the petroleum sector in Oman:**
   Research in GCC petroleum logistics remains limited. This study fills a contextual gap by providing rigorous quantitative data from PDO.
3. **Validation of collaboration and coordination as mediating constructs:**
   Previous studies often overlook mediation pathways. This study empirically confirms the dual mediating roles of collaboration and coordination.

5.5 Practical Implications for PDO

The findings suggest several practical implications for PDO's operational and strategic activities:

- **Strengthen cross-functional integration:**
  Collaboration and coordination must be formalised through shared KPIs, joint planning, and integrated digital systems.
- **Enhance information transparency:**
  Real-time data sharing, especially in logistics and procurement, would improve forecasting accuracy and operational planning.
- **Align logistics and supply-chain teams:**
  A unified organisational structure or integrated management framework would reduce silo behaviour and enhance responsiveness.
- **Invest in digital logistics platforms:**
  Technologies such as ERP, tracking systems, and IoT-based monitoring can further strengthen coordination.

5.6 Policy Recommendations

1. **Consider merging logistics and supply-chain divisions** into a single integrated department.
2. **Introduce cross-departmental performance indicators** to strengthen shared accountability.
3. **Enhance training programmes** focused on collaborative problem-solving and process alignment.
4. **Implement digital dashboards** to monitor logistics KPIs and interdepartmental workflows.
5. **Develop a coordination governance framework** to standardise communication and escalation routes.

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5.7 Limitations of the Study

While the research offers valuable insights, it has some limitations:

- It uses a **cross-sectional design**, limiting the ability to observe changes over time.
- Data were collected **only from PDO**, which may limit generalisability to other industries.
- The study relies on **self-reported perceptions**, which may include bias.

5.8 Recommendations for Future Research

Future studies may consider:

- Conducting **longitudinal research** to capture performance trends over time.
- Using **mixed methods** to complement quantitative analysis with qualitative interviews.
- Comparing PDO with **other oil and gas companies** in Oman or the GCC.
- Exploring additional mediators (e.g., digital capability, organisational culture).
- Applying **structural equation modelling (SEM)** for more comprehensive model testing.

5.9 Chapter Summary

This chapter synthesised the main findings, conclusions, and implications arising from the research. The results demonstrate that logistics performance has both direct and indirect impacts on supply-chain performance through collaboration and coordination. The chapter also provided theoretical contributions, practical recommendations, limitations, and directions for future research. These insights collectively highlight the importance of integrating logistics and supply-chain practices to enhance operational performance within PDO.

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