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Examining the Effectiveness of Supply Chain Strategies on Project Performance in the Mazabuka–Kafue Road Construction Project

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Abstract

Supply chain management has become an important component of construction project delivery because procurement, supplier coordination, inventory, logistics, information and risk processes affect material availability and continuity of works. This study explored the effectiveness of supply chain strategies on performance in the Mazabuka–Kafue Road Construction Project in Zambia. Four objectives guided the study: evaluating strategies adopted; determining their influence on project performance; analyzing factors influencing effectiveness; and ascertaining implementation challenges. A mixed-methods case-study design was used, with quantitative data from 100 respondents and qualitative information from 15 key informants. The findings show widespread recording of conventional strategies, including procurement planning, supplier relationship management, inventory management and logistics planning, while digital technology use was limited. Procurement planning was often changed because of delays, supplier relationships included both performance-management and contractual approaches, and inventory records remained substantially manual. Stakeholder coordination, financial resources, technical capacity, communication, infrastructure and institutional commitment were mostly moderate to weak. Lengthy approval procedures and delayed supplier payments were recurring implementation conditions. The study concludes that the presence of supply-chain strategies does not by itself establish effectiveness; implementation depends on integration, coordination, technical capacity, information flow and institutional conditions.

Keywords: Supply Chain Management, Construction, Procurement, Logistics, Inventory Management, Project Performance, SCOR Model, Mazabuka-Kafue Road, Zambia

1. Introduction

1.1 Background

Construction projects depend on coordinated flows of materials, information, finance and services. Supply chain strategies are therefore connected to procurement planning, supplier selection, logistics, inventory, information sharing and risk management [1, 2]. In road construction, failures in these activities can affect continuity of works and the use of project resources.

Zambian road construction provides a setting in which these relationships can be examined because projects involve public institutions, contractors, consultants, suppliers and other stakeholders. The Mazabuka–Kafue road links economic areas in Southern and Lusaka provinces and supports movement of agricultural products and other goods. The thesis identifies differences between planned and actual project performance and raises questions about alignment between supply-chain practices and project delivery [3].

The study therefore examines not only whether supply-chain practices exist, but how they are implemented, how respondents perceive their influence on project performance, which conditions shape effectiveness and what challenges are encountered.

1.2 Problem Statement

The research problem arises from the difference between the expected contribution of supply-chain management and the reported project conditions. Procurement strategies may exist while schedules continue to change, suppliers may be contracted while relationships remain partly transnational, and inventory may be controlled while records remain manual. These

conditions create uncertainty about the extent to which supply-chain strategies are integrated into project performance management.

1.3 Objectives and Research Questions

The general objective was to explore the effectiveness of supply chain strategies on project performance in the Mazabuka–Kafue Road Construction Project.

The specific objectives were: (1) to evaluate the supply chain strategies adopted; (2) to determine their influence on project performance; (3) to analyse factors influencing their effectiveness; and (4) to ascertain challenges affecting effective implementation.

The research questions followed the same structure, asking which strategies had been adopted, how they influence project performance, which factors influence effectiveness and which challenges affect implementation.

1.4 Scope and Research Gap

The study focused on supply-chain practices within the Mazabuka–Kafue road construction project and included stakeholders involved in project management, procurement, contracting, engineering and related functions. The literature reviewed in the thesis indicates substantial international work on construction supply chains but less project-specific empirical evidence from Zambia.

1.5 Study Context

The project provides a useful case because its supply chain includes public-sector decision processes, contractors, suppliers and transport activities. This combination allows operational strategies to be considered alongside institutional conditions.

2. Literature Review

2.1 Supply Chain Strategies in Construction

Supply chain management in construction involves coordination of organizations and activities that transform inputs into completed infrastructure. Christopher [1] describes supply chain management through the management of relationships and flows across organizational boundaries. Construction applications extend this logic to procurement, material delivery, subcontracting, information and logistics [2].

Procurement planning aligns purchasing activities with project schedules and material requirements. Supplier relationship management can range from transactional contracts to collaborative partnerships. Inventory management balances availability against storage and holding costs, while logistics coordination manages movement and timing. Information sharing provides visibility across organisations, and risk management addresses uncertainty in supply and delivery.

2.2 Digital Supply Chains

Digital systems can support electronic procurement, enterprise resource planning, GPS delivery tracking, inventory software and supplier portals. Their contribution depends on infrastructure, technical capability and organisational readiness. The thesis evidence suggests that digitalisation in the study project remains limited, making the transition from traditional to integrated supply-chain management an important issue.

2.3 Supply Chain Strategies and Project Performance

Project performance is commonly assessed through time, cost, quality and stakeholder outcomes. Supply-chain strategies may affect these dimensions through material availability, supplier reliability, logistics efficiency and information flow. However, a strategy's presence does not guarantee an outcome. The quality of implementation, coordination and supporting resources also matters.

The literature suggests that collaborative relationships can improve information flow and problem solving, while effective inventory and logistics practices can reduce interruptions. At the same time, excessive inventory can increase costs and weak risk management can leave projects exposed to disruption [4, 5].

2.4 Factors Influencing Effectiveness

The study considers stakeholder coordination, financial resources, technical capacity, communication, infrastructure and institutional commitment as moderating conditions. These factors affect whether strategies can be implemented consistently. Delayed payments can affect supplier participation, weak communication can delay decisions, and limited technical capacity can restrict digital systems.

2.5 Challenges and Research Gap

Construction supply chains can be affected by procurement delays, supplier unreliability, price fluctuations, transportation disruptions, financial constraints, weak information sharing, human-resource limitations and regulatory conditions. These challenges operate at different levels, meaning that not all can be addressed by a project team alone.

2.6 Theoretical Framework: SCOR Model

The study is anchored on the Supply Chain Operations Reference (SCOR) Model. SCOR organizes supply-chain processes around planning, sourcing, making, delivering and returns [6]. In this study, planning was represented by procurement planning and risk management; sourcing by supplier relationship management and supplier arrangements; making by construction continuity and material quality; and delivering by logistics, inventory and information sharing.

Returns management was not measured, which the thesis identifies as a limitation. The framework nevertheless provides a process structure for interpreting the findings. It also highlights a limitation in contexts where digital performance data are not routinely available.

3. Methodology

3.1 Research Design

The study used a mixed-methods case-study design. Quantitative data were collected through structured questionnaires administered to 100 respondents. Qualitative data were collected through semi-structured interviews with 15 key informants. The combination allowed the study to describe recorded practices and examine stakeholder explanations of implementation conditions.

3.2 Sampling and Participants

The respondents represented stakeholders connected to the road project. The quantitative dataset included project managers, procurement officers, RDA officials, contractors,

site engineers and other roles. The quantitative component contained 100 valid cases, while the qualitative component comprised 15 key informants.

3.3 Data Analysis

Quantitative responses were analysed using frequencies, percentages and descriptive summaries. Qualitative interview material was analysed thematically. The revised analysis materials caution against treating coded performance variables as labelled measures where the workbook did not provide a complete value-label dictionary. This article therefore avoids assigning unsupported verbal meanings to those codes.

4. Results and Interpretations

4.1 Respondent Characteristics

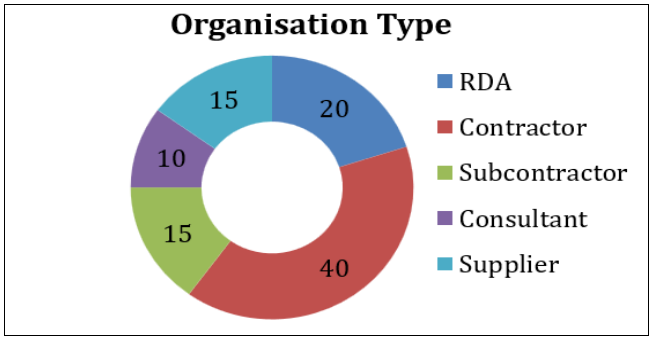


Fig 1: Respondents by organisation type

According to the results, contractors constituted 40% of the 100 respondents, followed by RDA officials at 20%, subcontractors at 15%, suppliers at 15% and consultants at 10%. The distribution captures perspectives from organisations occupying different positions in the construction supply chain.

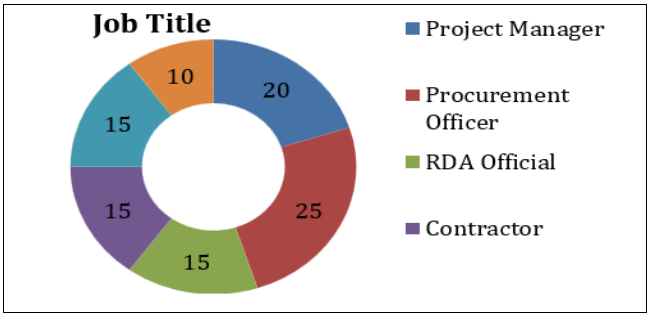


Fig 2: Respondents by job title

According to the results, procurement officers formed the largest job-title group at 25%, followed by project managers at 20%. RDA officials, contractors and site engineers each accounted for 15%, while other roles represented 10%. The distribution includes both management and operational perspectives.

4.2 Experience and Respondent Profile

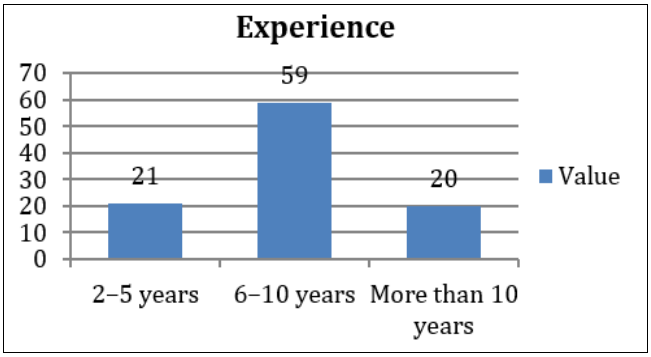


Fig 3: Years of experience in construction supply-chain management

According to the results, 59% of respondents had between six and ten years of experience, 21% had two to five years and 20% had more than ten years. The sample therefore contained substantial practical exposure to construction supply-chain activities.

Table 1: Selected respondent characteristics

Variable	Percentage
Contractors	40%
RDA officials	20%
Procurement officers	25%
6–10 years experience	59%
More than 10 years experience	20%

Interpretation: The respondent profile indicates that the findings were obtained from stakeholders with direct exposure to project procurement and supply-chain activities.

4.3 Objective One: Supply Chain Strategies Adopted

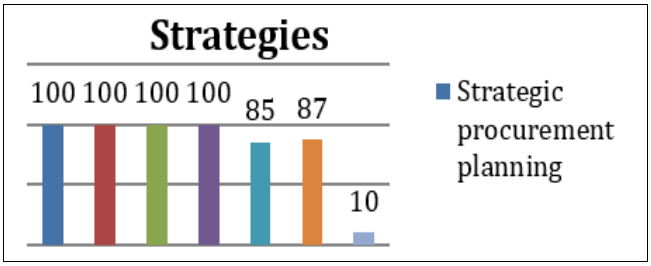


Fig 4: Supply chain strategies adopted on the project

According to the results, strategic procurement planning, supplier relationship management, inventory management and logistics/transportation planning were recorded in all 100 cases. Information-sharing systems were recorded in 85% and risk-management frameworks in 87%. Digital technologies were recorded in only 10% of cases in the revised datasets. The results therefore show broad recording of conventional practices alongside limited digital adoption.

4.4 Procurement Planning Process

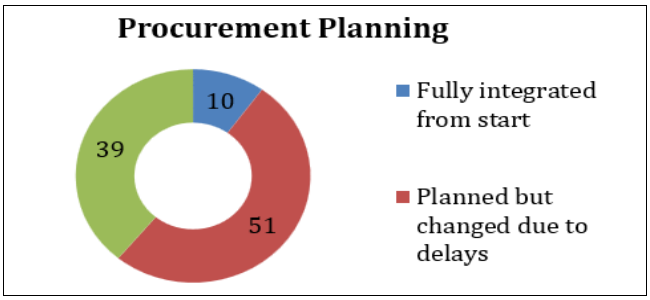


Fig 5: Procurement planning process

According to the results, 51% reported that procurement was planned but often changed because of delays, 39% reported reactive procurement as materials ran out, and only 10% reported full integration with the project schedule from the start. The distribution indicates that the existence of procurement planning did not necessarily mean stable integration with the project programme.

4.5 Supplier Relationship Management

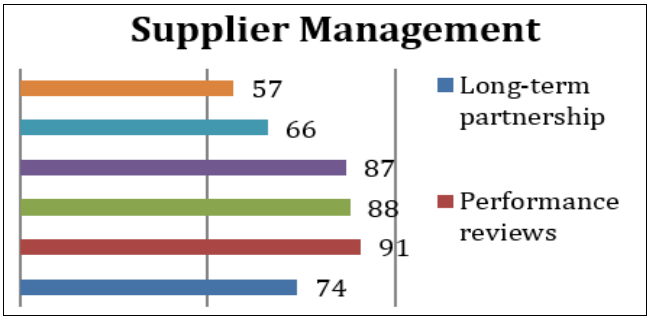


Fig 6: Supplier relationship-management approaches

According to the results, regular supplier performance reviews were recorded in 91% of cases, collaborative planning meetings in 88%, information sharing with suppliers in 87%, long-term partnership agreements in 74%, joint problem-solving in 66% and formal contracts with limited interaction in 57%. Several mechanisms therefore coexisted within supplier relationships.

Interpretation: The evidence should not be reduced to a simple transactional-versus-partnership classification because respondents reported multiple approaches. Performance reviews and collaborative meetings were widespread, while joint problem-solving was less common.

4.6 Logistics and Transportation Coordination

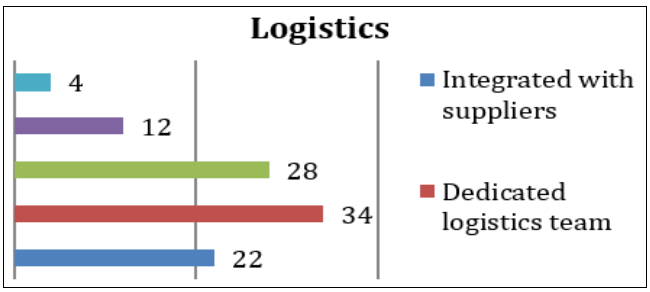


Fig 7: Logistics and transportation coordination

According to the results, 34% used a dedicated logistics team, 28% used hired transport providers with limited coordination, 22% reported integrated planning with suppliers, 12% used an ad-hoc approach and 4% reported poor coordination with frequent disruptions. The largest category was internal logistics management, while supplier-integrated planning accounted for less than one-quarter.

4.7 Inventory Management

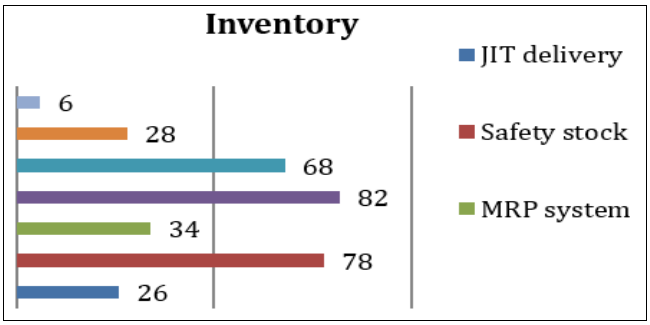


Fig 8: Inventory management practices

According to the results, regular stocktaking and monitoring was recorded in 82%, safety stock in 78%, manual inventory records in 68%, material requirements planning in 34%, digital inventory systems in 28% and JIT delivery in 26%. Six percent reported no formal inventory-management system. The results show active inventory control but substantial dependence on manual records.

4.8 Digital Technology Adoption

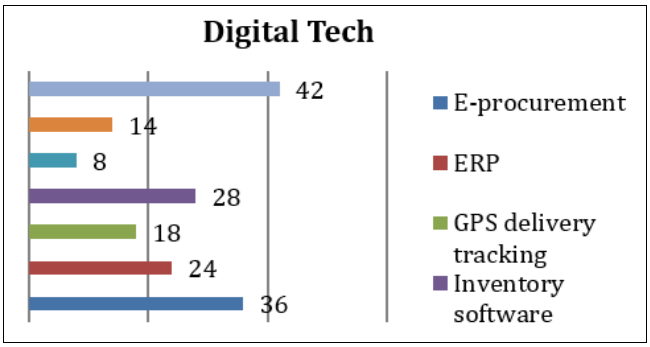


Fig 9: Digital technology adoption

According to the results, 42% reported that no digital technology was used. Electronic procurement was recorded in 36%, inventory software in 28%, ERP in 24%, GPS delivery tracking in 18%, supplier portals in 14% and BIM in 8%. The pattern indicates fragmented rather than integrated digital adoption.

Interpretation: The digital evidence indicates that the issue is not complete absence of technology but limited coverage and integration. Several isolated tools exist, but a substantial proportion of respondents reported no digital supply-chain technology.

4.9 Objective Two: Influence on Project Performance

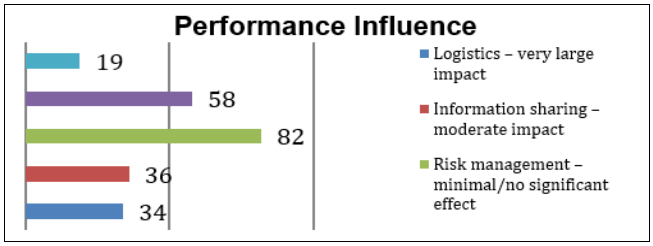


Fig 10: Selected responses concerning supply-chain influence on performance

According to the results, logistics coordination recorded a 34% 'very large impact' response in the reported distribution. Information sharing was mainly associated with moderate influence, while risk management was reported by 52% as having minimal effect and by 30% as having no significant effect on disruptions. Inventory management was associated by 58% with increased costs through overstocking, while 19% associated it with frequent stockouts.

Interpretation: The evidence does not show a uniformly positive influence across all strategies. Logistics appears in the reported responses as an operational mechanism connected with continuity, whereas information sharing and risk management have more modest perceived influence. Inventory responses show that control can coexist with cost or availability problems.

4.10 Evidence Limits

The revised thesis notes that several project-performance variables were coded numerically without a complete value-label dictionary. Some Objective Two items also combine a strategy and a performance dimension in one perception question. The article therefore does not claim a causal strategy-specific effect.

4.11 Objective Three: Factors Influencing Effectiveness

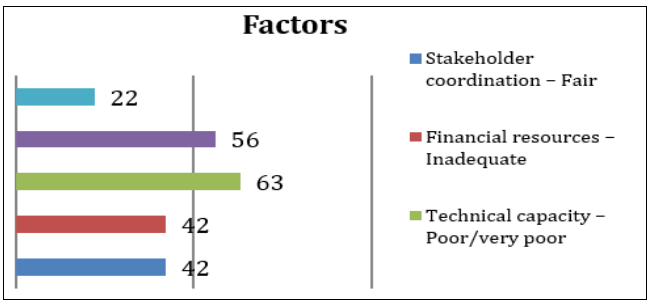


Fig 11: Reported conditions affecting supply-chain effectiveness

According to the results, stakeholder coordination was mainly rated fair, financial resources mainly inadequate, technical capacity mainly poor, communication mainly moderate or ineffective, RDA commitment mainly moderate or low, and infrastructure mainly inadequate or moderate. The revised data record technical capacity as poor for 46% and very poor for 17%.

Interpretation: The results indicate that supply-chain strategies operate within conditions that are not consistently strong. Effectiveness therefore depends on resources, communication, coordination, technical capacity and infrastructure as well as the formal strategy itself.

4.12 Objective Four: Implementation Challenges

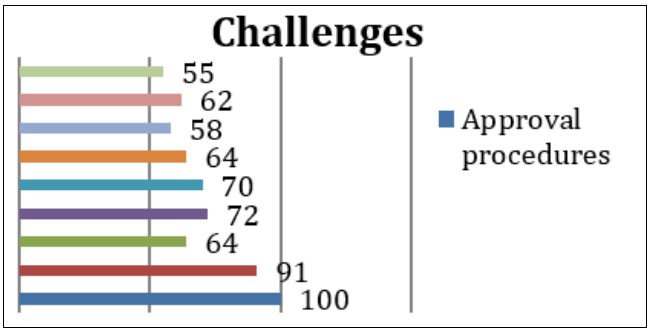


Fig 12: Selected implementation challenges and causes

According to the results, lengthy bureaucratic approval procedures were recorded as a cause of procurement delays in all cases, while delayed supplier payments were reported in 91%. Poor procurement planning was recorded in 64%, material price fluctuations in 72%, procurement delays in 70%, financial constraints in 64% and transport disruptions in 58%. Poor communication between contractors and suppliers was recorded in 62%, while lack of coordination between RDA and contractors was recorded in 55%.

Interpretation: The challenge evidence needs to be read by dimension. The revised thesis distinguishes challenge-rating questions from multiple-response questions about causes of procurement delays. They should therefore not be treated as contradictory. The results identify institutional processes, particularly approvals and payments, as recurring implementation conditions.

5. Discussion

5.1 Strategies Adopted

The widespread recording of procurement planning, supplier management, inventory and logistics is consistent with construction supply-chain literature, which identifies these processes as mechanisms through which material and information flows are coordinated [1, 2]. The lower level of digital adoption is consistent with research showing that digital transformation requires organizational capability, skills and supporting infrastructure rather than technology alone [7].

The procurement findings are important because 90% reported either changing plans because of delays or procuring reactively. This suggests that planning exists but is not consistently protected by stable approval, supplier and project-schedule conditions. The supplier results show multiple relationship mechanisms rather than a single model of supplier engagement.

5.2 Performance Influence

The performance evidence is mixed. Logistics is connected with continuity of construction activity, while information sharing and risk management have weaker reported influence. Inventory management produces both control practices and reported cost or stockout consequences. This aligns with the principle that supply-chain practices can create benefits or costs depending on implementation conditions [4, 5].

The article does not treat these responses as proof of causal impact. The instrument design and coding limitations described in the revised thesis do not support a separate causal estimate for each strategy.

5.3 Moderating Conditions and SCOR Interpretation

The findings on stakeholder coordination, financial resources, technical capacity, communication, infrastructure and institutional commitment support a contextual interpretation of supply-chain effectiveness. Supply-chain practices require resources and coordination to function as intended. Delayed payments can affect supplier participation, slow approvals can change procurement plans, and limited technical capacity can constrain digital systems.

The SCOR framework helps organise the evidence across planning, sourcing, making and delivering [6]. Procurement planning and risk management correspond with planning; supplier relationships with sourcing; construction continuity and material quality with making; and logistics, inventory and information sharing with delivering. The study did not measure returns management.

5.4 Digitalisation

The digital evidence shows that e-procurement, inventory software, ERP, GPS and supplier portals are present in portions of the project environment, but 42% reported no digital technology. The result indicates fragmented digitalisation rather than an integrated digital supply chain. This has implications for visibility and data sharing across organisations.

5.5 Conclusion

The study found widespread conventional supply-chain practices, but implementation was uneven. Procurement planning was often changed or conducted reactively, supplier relationships used multiple mechanisms, logistics were frequently managed internally or through providers with limited coordination, and inventory records remained substantially manual.

6. Conclusion and Recommendations

6.1 Overall Conclusion

The evidence concerning performance influence was mixed. Logistics was associated with continuity, while information sharing and risk management had more modest reported influence. Inventory management was associated with both control practices and adverse cost or stock out outcomes. The available instrument does not support a causal claim for strategy-specific effects.

Effectiveness was shaped by stakeholder coordination, financial resources, technical capacity, communication, infrastructure and institutional commitment. Challenges included approval procedures, supplier-payment delays, price fluctuations, procurement delays, financial constraints, transport disruption and communication problems.

6.2 Recommendations

Procurement schedules should be integrated with the master project programme and updated through formal early-warning procedures. Practical digital systems should be introduced in stages, beginning with e-procurement, delivery tracking and inventory monitoring. Supplier performance should be monitored using indicators for quality, delivery reliability, responsiveness and compliance.

Minimum and maximum stock levels should be established for critical materials and supported by accurate records. A regular supply-chain coordination forum should link contractors, suppliers and RDA representatives. Targeted training should address procurement planning, inventory, digital systems, supplier monitoring and risk management.

Approval and supplier-payment workflows should be reviewed to identify avoidable delays. Project-level risk registers should connect supply risks to procurement, logistics, inventory and supplier decisions. Future studies should combine survey data with project records and clearly labeled performance measures.

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