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Project Template

The Role of Technology in Supply Chain Management
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The Role of Technology in Supply Chain Management

Hajer Aldossari

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Chapter 1: Introduction

1.1 Background

Supply chain management links suppliers, manufacturers, logistics providers, and customers through flows of materials, information, and money. Digital tools and information systems now support almost every activity in this chain. Enterprise resource planning (ERP), warehouse management systems

(WMS), transportation management systems (TMS), barcoding and RFID, internet of things (IoT) tracking, and analytics platforms give managers faster and richer information for decisions.

Empirical studies show that information technology supports supply chain integration and improves operational performance. Digital tools help firms share information with suppliers and customers, coordinate planning, and reduce lead times and stockouts.

Saudi Arabia invests heavily in digital transformation under Vision 2030. Logistics and supply chain activities represent a core pillar in this national program, with strong focus on automation, data analytics, and smart logistics platforms.

1.2 Problem Statement

Many firms in Saudi Arabia introduce digital tools in supply chain operations. Yet managers still report gaps in internal coordination, limited information sharing with partners, and mixed performance outcomes. Some studies report strong positive effects of digitalization on integration and performance, while others show that technology improves performance mainly through better integration, not through direct effects alone.

The main problem in this study is the limited empirical evidence from Saudi supply chain intensive sectors regarding how technology adoption supports supply chain integration and performance. More evidence from the local context will support better technology investment decisions.

1.3 Research Questions

Main research question

RQ1: What is the role of technology adoption in improving supply chain performance in supply chain intensive firms in Saudi Arabia?

Sub-questions

RQ1a: How does technology adoption influence internal supply chain integration inside firms?

RQ1b: How does technology adoption influence external integration with key suppliers and key customers?

RQ1c: How does supply chain integration influence supply chain performance?

RQ1d: Does supply chain integration mediate the relationship between technology adoption and supply chain performance?

1.4 Research Objectives

O1: Assess the level of adoption of supply chain related technologies in supply chain intensive firms in Saudi Arabia.

O2: Examine the relationship between technology adoption and internal supply chain integration.

O3: Examine the relationship between technology adoption and external supply chain integration with suppliers and customers.

O4: Analyze the effect of internal and external supply chain integration on supply chain performance.

O5: Test the mediating role of supply chain integration in the relationship between technology adoption and supply chain performance.

O6: Provide recommendations for managers on how to use technology to improve integration and performance.

1.5 Significance of the Study

Theoretical significance

The study extends prior work on IT-enabled supply chain integration and performance by focusing on a Saudi context and on logistics and oil and gas related service sectors.

Practical significance

Results guide managers in Saudi firms on which technologies and integration practices matter most for performance.

Results support policy makers and national programs that promote digital transformation in logistics and supply chain services.

1.6 Definition of Key Terms

Supply chain management

Coordinated management of sourcing, production, warehousing, transportation, and distribution activities from suppliers to final customers.

Technology adoption in supply chain management

Degree of use of digital tools that support planning, execution, monitoring, and coordination of supply chain activities, such as ERP, WMS, TMS, barcoding, RFID, IoT tracking, EDI, and analytics platforms.

Supply chain integration

Extent of strategic and operational coordination among internal functions and external partners in the supply chain through joint planning, information sharing, and aligned processes.

Supply chain performance

Results of supply chain activities in terms of cost, delivery reliability, responsiveness, flexibility, inventory turnover, and customer service.

1.7 Project Outline

The project follows the structure in the university template: introduction, literature review, research methodology, statistical analysis, and discussion with conclusion.

Chapter 1 presents the background, problem, questions, objectives, significance, and definitions.

Chapter 2 reviews the literature and develops the research model and hypotheses.

Chapter 3 describes the methodology, including population, sample, and data collection tools.

Chapter 4 describes the statistical analysis procedures that will test the model.

Chapter 5 presents the expected discussion points, contributions, and conclusion.

Chapter 2: Literature Review

2.1 Overview of Technology in Supply Chain Management

Information technology supports better coordination, smaller inventories, faster response to demand changes, and stronger collaboration along supply chains. Studies report that IT adoption improves data accuracy, visibility across the chain, and information sharing among partners, which supports integration and performance.

2.2 Technology Adoption and Supply Chain Integration

Li et al. (2009) show that IT implementation in manufacturing supply chains strengthens both internal and external integration. Yu et al. (2021) report that supplier and customer IT significantly promote system and process integration with partners.

Recent work on ICT-enabled integration finds strong positive effects on operational and financial performance when firms develop strong integration capabilities based on digital tools.

2.3 Supply Chain Integration and Performance

Supply chain integration supports higher fill rates, better delivery reliability, lower logistics costs, and improved responsiveness. Mediation analysis in several studies shows that digitalization improves performance mainly by enhancing integration and efficiency.

2.4 Digital Transformation and Supply Chains in Saudi Arabia

Saudi logistics and supply chain sectors move towards smart warehouses, automated sorting, AI based planning, and integrated visibility platforms. Vision 2030 gives strong support for logistics digitalization and for supply chain optimization among SMEs.

These changes create a relevant context for studying the role of technology adoption in supply chain integration and performance.

2.5 Research Gaps

Many studies on IT-enabled integration focus on manufacturing sectors in East Asia, Europe, or North America.

Few empirical studies focus on Saudi logistics and supply chain intensive service sectors with a full model that links technology adoption, internal and external integration, and performance.

Evidence on mediation of integration between technology and performance remains limited in this context.

This gap motivates the current research model and hypotheses.

2.6 Research Model and Hypotheses

2.6.1 Research Model

The conceptual model includes three main constructs:

Technology adoption (independent variable)

Internal and external supply chain integration (mediating variables)

Supply chain performance (dependent variable)

Relationships in the model

Technology adoption → Internal integration

Technology adoption → External integration

Internal integration → Supply chain performance

External integration → Supply chain performance

Technology adoption → Supply chain performance

Internal and external integration also serve as mediators between technology adoption and supply chain performance. This structure follows evidence from Li et al. (2009) and recent studies on digitalization and performance.

2.6.2 Research Hypotheses

H1: Technology adoption has a positive effect on internal supply chain integration.

H2: Technology adoption has a positive effect on external supply chain integration with key suppliers and key customers.

H3: Internal supply chain integration has a positive effect on supply chain performance.

H4: External supply chain integration has a positive effect on supply chain performance.

H5: Technology adoption has a positive direct effect on supply chain performance.

H6: Internal and external supply chain integration jointly mediate the relationship between technology adoption and supply chain performance.

Chapter 3: Research Methodology

3.1 Research Design

The study will follow a quantitative, cross-sectional survey design. A structured questionnaire with multi-item Likert scales will collect data from managers in supply chain intensive firms. Similar designs appear in many studies on IT-enabled supply chain integration and performance.

3.2 Proposed Field of Application

The field of study covers supply chain intensive firms in Saudi Arabia, with focus on logistics providers and oil and gas related service firms in the Eastern Province. These firms operate in a region with strong investments in ports, industrial zones, and logistics corridors, and they face pressure to digitalize operations.

3.3 Population and Sampling Frame

Population

All logistics and supply chain intensive service firms registered in Saudi Arabia, including:

Third-party logistics providers

Freight forwarding and transportation firms

Oil and gas field service providers with strong logistics activities

Unit of analysis

The firm. Key informants will be supply chain, logistics, or procurement managers.

Sampling frame

Lists from national business registries, logistics associations, and major industrial zones.

3.4 Sample Design

Sampling technique

Stratified random sampling. Sector and firm size define the main strata.

Sample size

Target sample size ranges from 250 to 350 usable firm responses, which suits multivariate techniques and structural equation modelling used in similar research.

3.5 Data Collection Tools

Main tool: self-administered questionnaire delivered online.

Sections

Section A: firm profile (sector, size, years of operation, international activity).

Section B: technology adoption scale. Items cover use of ERP, WMS, TMS, barcoding, RFID, IoT tracking, EDI, and analytics in procurement, warehousing, transportation, forecasting, and order management.

Section C: internal and external integration scale. Items cover information sharing, joint planning, and process coordination inside the firm and with suppliers and customers.

Section D: supply chain performance scale. Items assess cost, delivery reliability, flexibility, responsiveness, inventory turnover, and customer satisfaction.

All scales will use a five-point agreement or frequency format. Items will be adapted from validated studies with minor wording changes for the Saudi context.

3.6 Data Collection Procedure

Contact target firms through email and professional networks.

Send survey link with cover letter that explains purpose, voluntary nature, and confidentiality.

Send reminders after one and two weeks to raise the response rate.

3.7 Planned Data Analysis

Data screening, treatment of missing values, and outlier checks.

Descriptive statistics for all variables.

Reliability tests using Cronbach's alpha and composite reliability.

Confirmatory factor analysis to assess convergent and discriminant validity.

Structural equation modelling or multiple regression to test hypotheses and mediation effects.

3.8 Ethical Considerations

Respondents receive full information about the study and provide informed consent.

Responses remain confidential and anonymous.

Data will be used only for academic purposes.

Chapter 4: Statistical Analysis Plan

As this document presents a proposal, this chapter describes the future analysis steps that will be applied after data collection.

4.1 Preparation of Data

Code responses and import data into statistical software such as SPSS and AMOS or similar tools.

Check reliability and validity of all scales through Cronbach's alpha and confirmatory factor analysis.

4.2 Measurement Model Evaluation

Assess item loadings, average variance extracted (AVE), and composite reliability for each construct.

Check discriminant validity by comparing AVE with squared correlations among constructs.

4.3 Structural Model Evaluation

Estimate the structural model that links technology adoption, internal integration, external integration, and supply chain performance.

Examine path coefficients and significance levels for H1 to H5.

Test mediation for H6 using bootstrapping methods and indirect effect estimates.

4.4 Additional Analysis

Compare results across sectors or firm sizes through multi-group analysis if sample size allows.

Explore possible control effects of firm size, age, and international activity on performance.

4.5 Presentation of Results

The final thesis will present tables for descriptive statistics, reliability and validity results, model fit indices, and hypothesis testing results. Graphical representation of the final structural model will summarize the path coefficients and significance.

Chapter 5: Discussion and Conclusion (Expected Plan)

5.1 Discussion of Expected Findings

Based on prior literature, the study expects positive relationships between technology adoption, integration, and performance. A strong mediation effect of supply chain integration between technology and performance also appears likely.

5.2 Theoretical Contribution

Provide empirical evidence from Saudi supply chain intensive service sectors regarding digitalization, integration, and performance.

Extend IT-enabled integration theory by focusing on both internal and external integration in one structural model.

5.3 Practical Implications

Help managers prioritize investments in technologies that support information sharing and joint planning with partners.

Guide firms on how to link digital tools, process integration, and performance metrics.

Support national programs that promote digital logistics solutions under Vision 2030.

5.4 Limitations and Future Research

Cross-sectional design limits strong conclusions about causality.

Survey data rely on managers' perceptions rather than objective performance figures.

Future research could use longitudinal data, multi-respondent designs, and case studies.

5.5 Conclusion

Technology plays a central role in modern supply chains. When firms adopt appropriate digital tools and integrate processes internally and externally, performance tends to improve. This project will provide evidence from Saudi supply chain intensive sectors and will support better strategic decisions about technology and integration.

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