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Digital transformation and organizational performance in port logistics: The mediating role of supply chain performance in an emerging economy

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Abstract: The purpose of this study is to investigate the effect of digital transformation on organizational performance through the mediating effects of supply chain performance. Specifically, the benefits of IoT adoption, the challenges of IoT adoption, and the capabilities of information systems are considered as factors driving digital transformation. Based on the Resource-Based View (RBV) theory and Supply Chain Network Theory (SCNT), an elaborate model was constructed and tested. A quantitative explanatory approach was used in this research, and data collection involved survey questionnaires administered to 120 managers, IT officers, and logistics practitioners working for multipurpose ports in East Java, Indonesia. PLS-SEM technique was adopted for the statistical analysis of data collected. The study's findings show that the benefits of IoT adoption and capabilities of information systems exert significant and positive influence on supply chain performance and organizational performance. The mediator effect of supply chain performance was confirmed in both relationships. Challenges of IoT adoption do not significantly impact neither supply chain performance nor organizational performance. Digital transformation improves organizational performance via improvement of supply chain performance. It is recommended that port logistics firms invest more in IoT adoption and enhance their supply chains.

Keywords: *Digital transformation, Emerging economy, Information systems, Internet of things (IoT), Organizational performance, Port logistics, Supply chain performance.*

1. Introduction

Digital transformation has become a crucial element for enhancing competitiveness among organizations in the current data-oriented economy. The adoption of advanced technologies such as IoT, big data analytics, and information systems due to digital transformation has revolutionized how businesses function. Prior studies have demonstrated that digital technologies assist organizations in attaining improved decision-making, enhanced data insight accuracy, and boosting their operational efficiency [1, 2]. In the logistics and ports industry, the implementation of IoT is vital as it facilitates traceability, proactive maintenance, and synchronization of all activities within the supply chain. Research evidence shows that organizations that adopt IoT technology significantly improve their performance, cost management, and service delivery [3, 4]. However, despite all the advantages offered by digital transformation, there are certain structural challenges that may pose an impediment to its implementation, such as technology issues, cybersecurity risks, and human resource challenges.

Conceptually, the connection between digital capability and organizational performance is based on RBV, where the premise is that valuable, rare, and inimitable resources, including the Internet of Things and information systems integration, are the basis for competitive advantage [5].

At the same time, SCNT stresses that the level of performance is defined not only by the possession of resources but also by the degree of integration within the supply chain [6]. Consequently, technologies serve as amplifiers that boost supply chain visibility, agility, and reactivity, resulting in improved organizational performance. Nevertheless, most of the available research in this area is devoted to the

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manufacturing and logistics industries, while the port business and developing countries are underrepresented in this context.

Nonetheless, the port industry in Indonesia, especially the multipurpose ports located in East Java, is exceptional in its own ways because it presents a fascinating case study regarding digitalization. Although some ports have attempted to apply digital technologies such as the Internet of Things (IoT) and information systems for effective loading and unloading of ships, this is not consistent with the fact that their development is constrained by costly investments, low levels of digitalization, and the inability of people to use digitalization. This means that there will be a difference between the capability of the technology and organizational performance improvement. This trend applies in emerging countries where the introduction of technology does not necessarily translate into improved performance [7, 8].

An important gap in the existing literature is the lack of emphasis on a holistic empirical model involving three key variables: benefits of IoT implementation, challenges of IoT implementation, and information systems. Most previous studies have focused on the individual effects of these variables or their direct impact on organizational performance [9]. Additionally, there has been insufficient analysis of how information technology influences performance outcomes. Specifically, Supply Chain Performance (SCP) is considered a significant intermediary variable in this process.

In addressing these knowledge gaps, we establish a theoretical model that explores the impact of the potentialities and challenges of IoT adoption, along with information system capability, on organizational effectiveness by considering SCP as a mediator. By using SCP as the central focus of our study, we broaden the scope of our research in terms of investigating the benefits of digital transformation in logistics. Our research conforms to the prevailing trend of conducting research from a mechanistic and comprehensive perspective on digital transformation [10].

The research's contributions include three main points. To start, it contributes to the theory of RBV and SCNT by empirically testing the influence of digital assets and networks on performance in port operations. Second, it contributes to balancing the geographical bias in the literature by providing empirical evidence on multipurpose ports from an emerging economy context. Finally, it offers insights useful for port managers and logistics firms.

With these purposes in mind, the current study proposes to: (1) examine the impact of IoT implementation advantages, IoT implementation challenges, and information systems on supply chain performance; (2) assess the influence of supply chain performance on company performance; and (3) evaluate the mediating effect of supply chain performance between digital transformation and organizational performance.

To understand this relationship, a full theory-driven literature review needs to be performed.

2. Literature Review

2.1. Theoretical Foundation

2.1.1. Resource-Based View (RBV)

The Resource-Based View (RBV) suggests that "an organization's competitive edge relies on its capacity to strategically oversee resources that are valuable, rare, inimitable, and non-substitutable [5]. In terms of digital transformation, technologies like IoT and information systems are not only used for operations but also act as strategic digital assets, which could help differentiate the performance of organizations. It has been observed that digital skills combined with the company's operations can improve its effectiveness and agility in the face of rapidly changing markets [5, 10]. Thus, the strategic importance of IoT and information systems lies in the fact that they help turn data into a competitive advantage based on knowledge.

2.1.2. Supply Chain Network Theory (SCNT)

The Supply Chain Network Theory (SCNT) posits that the effectiveness of the supply chain relies on the degree of coordination, cooperation, and integration among organizations in the logistics network can be achieved [6]. In the contemporary era, IoT and information systems have become essential factors for

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making information and materials visible and transparent throughout the logistics process. Practical research suggests that the adoption of digital technology in supply chains leads to enhanced agility, responsiveness, and reliability, thereby affecting organizational performance [4, 8]. Thus, the theoretical framework of SCNT posits that the application of digital technology will only result in optimal outcomes through proper network integration.

2.2. Benefits of IoT Adoption and Supply Chain Performance

The use of IoT technology is beneficial in various ways, such as visibility of assets, time saving, cost saving, and accuracy of data during logistics operations. Through the use of sensors and communication devices, the monitoring of supply chain activities is carried out consistently, hence eliminating any ambiguity and enhancing decision-making processes [3]. From the findings by Ben-Daya et al. [4], it can be noted that the implementation of IoT technology leads to tremendous achievements in the field of logistics.

Furthermore, another facet of the internet of things is regarded as impactful in enhancing visibility in the supply chain, which is a crucial component for boosting efficiency in the supply chain. According to Chen et al. [9], the availability of high levels of information visibility allows businesses to efficiently manage inventory and respond quickly to changes in consumer demand. Nevertheless, a number of studies reveal that the adoption of IoT may not lead to better performance due to insufficient organizational readiness and system integration [7].

2.3. Challenges of IoT Adoption and Organizational Outcomes

Despite all its advantages, there are various challenges associated with IoT technology, which can adversely affect its performance. These challenges mainly relate to high expenses, complexity, a lack of technological infrastructure, and concerns about data security and privacy [3]. Concerning organizations operating in developing countries, these challenges tend to be more severe due to inadequate human resource capacity and resistance to change.

Based on the research conducted by Verhoef et al. [8], it is possible to assert that poor management of digital challenges can lead to low effectiveness in technology adoption and negatively influence overall organizational performance. However, according to other researchers, highly adaptive organizations have the potential to successfully overcome these barriers and lessen their adverse effects [10]. Due to the lack of consistency in the findings, more studies should be conducted on the concerns raised, especially those pertaining to ports.

2.4. Information Systems and Performance Enhancement

The first aspect associated with the incorporation of IoT into organizational infrastructure involves the creation of information systems. For instance, in a virtual environment, information systems play the role of creating a connection between IoT devices and operations within the organization; hence, information is processed in a swift and reliable manner. According to Ben-Daya et al. [4], the use of information systems promotes effective decision-making and reduces mistakes from humans while enhancing information flow through supply chains.

Moreover, the incorporation of IoT technology along with information systems will enable organizations to adopt data-driven decision-making and enhance performance. Research by Masoud and Basahel [7] shows that companies integrating information systems perform better than those relying on traditional systems. However, the performance of information systems depends on how well they are adapted to new technologies.

2.5. Supply Chain Performance as a Mediating Mechanism

Supply Chain Performance (SCP) signifies an organization's ability to manage the movement of goods, information, and services efficiently. In the SCNT perspective, SCP becomes one of the critical tools that connect technological resources and organizational performance results. As reported by Chen,

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et al. [9], the higher supply chain performance positively affects organizational productivity, client satisfaction, and profit.

Considering the digital transformation process, SCP plays the role not only of an intermediary result but also of a mediator that explains how digital technologies influence organizational performance. The empirical findings demonstrate that digital transformations affect organizational performance indirectly through improving SCP [2]. However, little attention has been paid to the mediating effect of SCP in relation to IoT and information systems in an integrated model, especially in ports.

2.6. Research Gap and Model Development

The literature review highlights significant research gaps, including the fact that many current studies focus solely on the direct impact of IoT or information systems on organizational performance, disregarding mediating factors. Moreover, the research gap pertains to the absence of empirical studies connecting the pros and cons of IoT to organizational performance.

To address these research gaps, this study will suggest a conceptual framework that includes three independent variables: the advantages of IoT adoption, the hurdles of IoT adoption, and information systems, with the mediating factor being supply chain performance and the dependent variable as organizational performance.

Drawing from the theories discussed previously and the gap in earlier empirical research, a research framework has been developed.

In the research model illustrated in Figure 1, we analyse the relationship between the Benefits of IoT Adoption and the Challenges of IoT Adoption, with Information Systems acting as a mediating factor influencing both Organization Performance and Supply Chain Performance. Figure 1 clearly shows both the direct and indirect impacts of this research.

2.7. Hypothesis Development

Utilizing the Resource-Based View (RBV) theory and Supply Chain Network Theory (SCNT), along with prior research outcomes, this paper presents several hypotheses that investigate the connections among IoT adoption, information systems, supply chain performance, and organizational performance.

2.7.1. Benefits of IoT Adoption and Supply Chain Performance

By implementing IoT, companies gain real-time insights and enhance asset tracking and operational efficiency. This helps in better integration and quick decision-making within the supply chain. Some previous research reveals that IoT adoption improves supply chain visibility and efficiency performance [3, 4]. Viewed from RBV theory, IoT adoption is a strategic resource that extends the firm's capabilities.
H1: Benefits of IoT adoption have a positive and significant effect on supply chain performance.

2.7.2. Challenges of IoT Adoption and Supply Chain Performance

Despite the aforementioned benefits, several challenges, such as high initial costs, technological complexity, and lack of infrastructure, can lead to poor system integration and inefficiency during IoT system implementation. It has also been proven that the challenges associated with the implementation of an IoT system adversely affect the supply chain performance [2, 3].
H2: Challenges of IoT Adoption have a negative effect on Supply Chain Performance.

2.7.3. Information Systems and Supply Chain Performance

Information systems are essential in integrating information, communicating, and decision-making within supply chains. Information systems increase effectiveness and coordination, thus increasing responsiveness to meet the needs of an effective and efficient supply chain. Studies have shown that information system capabilities are among the most influential factors in improving supply chain performance [4, 11].

H_3. Information Systems have a positive and significant effect on Supply Chain Performance.

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2.7.4. Benefits of IoT Adoption and Organizational Performance

According to RBV, IoT benefits such as real-time visibility, predictive maintenance, and operational efficiency should be categorized as strategic digital assets to support competitive advantage. IoT implementation transforms operational processes and directly enhances organizational decision-making and output [4, 8].

H_4: Benefits of IoT Adoption positively and significantly influence organizational performance.

2.7.5. Challenges of IoT Adoption and Organizational Performance

High cost of adoption, complex technology, and security risks can impede implementation, but the effect on performance is conditional. In organizations with high dynamic capabilities, challenges to implementing IoT can be overcome [1, 10].

H_5: Challenges of IoT Adoption have a negative effect on Organizational Performance.

2.7.6. Information Systems and Organizational Performance

Information systems serve as a crucial integrator of digital transformation. According to the information systems success model [11], the quality of systems and information enhances organizational performance due to accuracy, processing speed, and improved decision-making.

H_6: The Information Systems has a significant and positive impact on the organizational performance.

2.7.7. Supply Chain Performance and Organizational Performance

Supply Chain Performance (SCP) denotes an organization's capability to manage its flow of products, information, and coordination. Supply Chain network performance is viewed as the direct enabler transferring the value from IT resources to organizational performance (from SCNT perspective). Empirical studies indicate that better supply chain efficiency, flexibility, and responsiveness positively and significantly enhance the productivity and quality of organizational performance [9, 2].

H_7: Supply Chain Performance has a positive and significant impact on Organizational Performance.

2.7.8. Supply Chain Performance as the Mediator

It is improbable that digital transformation enhances organizational performance without linking it with operations. Thus, SCP is the path through which organizational value flows into the organization through capability. A lot of researchers have stated that the impact of digital technology on organizational performance is predominantly an indirect one, and it works by increasing supply chain performance [2, 9].

H_8: The Supply Chain Performance acts as a mediator between the Benefits of IoT Adoption and Organizational Performance.

H_9: The Supply Chain Performance acts as a mediator between Information Systems and Organizational Performance.

H_{10}: The Supply Chain Performance acts as a mediator between the Challenges of IoT Adoption and Organizational Performance.

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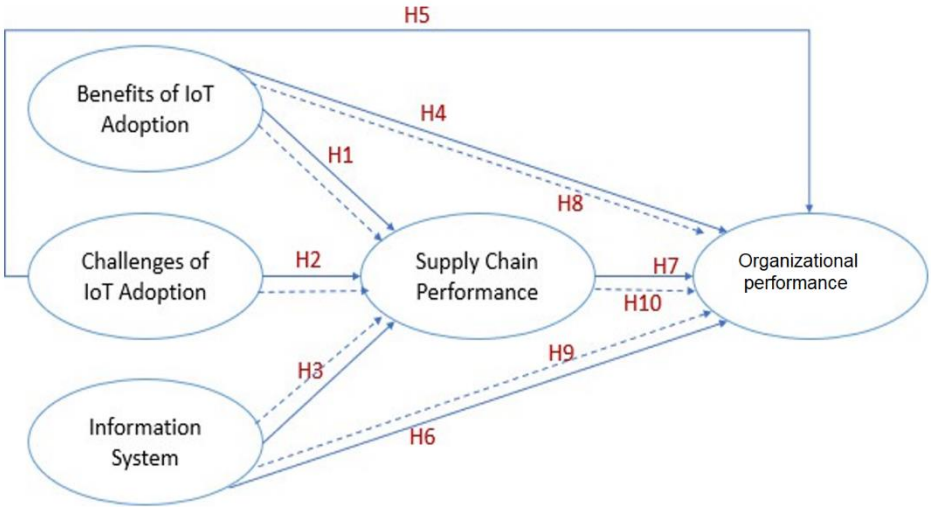

Figure 1.
Conceptual Framework.

According to the model, both direct and indirect effects of digital transformation variables, especially IoT adoption benefits and information system benefits, are predicted to affect organizational performance. Supply Chain Performance has been identified as the pivotal mediating construct. Therefore, the improvement of organizational outcomes is mainly attributed to Supply Chain Performance. On the other hand, considering IoT adoption challenges as an antecedent may represent possible mediating effects on organizational performance. However, their effect varies depending on the organization's readiness and maturity. In summary, digital transformation influences organizational performance neither instantaneously nor directly but through a systematic process mediated by Supply Chain Performance.

3. Methods

3.1. Research Design

This study employs quantitative research techniques within an explanatory framework to examine the relationship between the adoption of IoT, information systems, supply chain effectiveness, and organizational performance. A cross-sectional survey method was employed to collect primary data from participants working in port logistics service management. This research methodology is suitable for examining theories that relate to two or more latent variables to confirm the structural model.

The scope of the study will be limited to loading and unloading companies operating in multipurpose ports located in East Java, Indonesia. The selected environment is highly applicable as the use of modern technology, such as the Internet of Things, increases in ports.

3.2. Population and Sample

In the current study, the population will include workers engaged in loading and unloading at seven multipurpose ports in East Java. Specifically, respondents are those responsible for management operations, IT staff, and logistics specialists who perform their functions as part of the supply chain and implement digitalization.

The sample size of the participants was chosen at 120 respondents since they had sufficient expertise related to IoT implementation and information systems. As in previous cases where SEM was used to analyse collected data, purposive sampling could be used for this research as well.

According to the guidelines for PLS-SEM sample size criteria, the number of respondents should be between 54 and 200 [12]. Additionally, PLS-SEM can be used with small and medium-sized samples and complex models.

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3.3. Measurement of Variables and Instrument Development

The data collection instrument adopted in this study was a well-structured questionnaire designed according to scales used in earlier works. All the constructs were measured using a Likert-type scale from 1 (strongly disagree) to 5 (strongly agree).

The variables in this research include:

1. IoT Adoption Benefits
   Indicators related to the benefits of IoT adoption included operational efficiency, cost savings, real-time monitoring, and increased asset visibility. Such parameters indicated the potential of IoT to boost operations management and aid decision-making in supply chain management [3, 4, 13].
2. IoT Adoption Challenges
   IoT adoption challenges were assessed using indicators such as high implementation costs, technological complexity, lack of required infrastructure, and data security issues. They were important constraints that could prevent successful IoT implementation [2, 3].
3. Information Systems
   Evaluation of information systems was carried out regarding system integration, data accuracy, processing speed, and decision support. These measures highlight the efficiency of information systems in enabling coordination, improving data quality, and assisting managerial decision-making [11, 14].
4. Supply Chain Performance
   Evaluation of supply chain performance involved measures such as efficiency, responsiveness, flexibility, and coordination. The chosen measures are often employed in measuring supply chain performance [9, 15, 16].
5. Organizational Performance
   Organizational performance was determined based on factors such as productivity, service quality, effectiveness, and performance outcomes. These factors encompass both financial and nonfinancial aspects of organizational performance [17-19].

3.4. Data Collection Procedure

PLS-SEM is used for analysing data with Smart PLS 4.0 software. The reason for applying this type of SEM analysis is its suitability for predictive studies and complex models when using small samples [12].

The analysis was performed in two main phases as follows:

1. Measurement Model Evaluation

Outer model assessment was performed to check the reliability and validity of the proposed constructs. These included:

- Convergent validity (Factor loading > 0.70; AVE > 0.50)
- Reliability through internal consistency (Composite Reliability > 0.70; Cronbach's Alpha > 0.70).

2. Structural Model Evaluation

Inner model assessment was conducted to test the hypotheses using:

- Path coefficients (β)
- t-statistics and p-values (Bootstrap technique)
- Coefficient of determination (R^2)

Such an approach is effective in evaluating the measurement and relationship aspects of the proposed model.

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4. Results

4.1. Respondent Profile and Data Overview

In the current study, 120 participants served as operational managers, IT employees, and logistics supervisors from loading and unloading companies at multi-purpose ports in East Java. Most respondents have worked for more than five years and play a significant role in implementing IoT in logistics and information systems in business processes.

4.2. Measurement Model Results

Table 1.
Measurement Model Evaluation.

Construct	Loading Factor	AVE	Composite Reliability	Cronbach's Alpha
Benefits of IoT Adoption	> 0.70	0.58	0.87	0.83
Challenges of IoT Adoption	> 0.70	0.55	0.85	0.81
Information Systems	> 0.70	0.61	0.89	0.86
Supply Chain Performance	> 0.70	0.60	0.88	0.85
Organizational Performance	> 0.70	0.63	0.90	0.87

The results indicate that all constructs demonstrate convergent validity, as the factor loading values surpass 0.70 and the Average Variance Extracted is above 0.50. Consequently, each construct may be viewed as one that accounts for a significant amount of variability in its indicator variables.

Simultaneously, the Composite Reliability and Cronbach's Alpha values exceed the acceptable threshold of 0.70. Consequently, the assessment tools are very dependable and stable, validating their authenticity as well.

4.3. Structural Model Results

Table 2.
Structural Model (Path Coefficients).

Relationship	Path Coefficient (β)	T-Statistics	P-Value	Result
Benefits of IoT → Supply Chain Performance	0.356	4.21	0.000	Significant
Challenges of IoT → Supply Chain Performance	-0.097	1.32	0.187	Not Significant
Information Systems → Supply Chain Performance	0.402	5.06	0.000	Significant
Supply Chain Performance → Organizational Performance	0.468	6.19	0.000	Significant
Benefits of IoT → Organizational Performance	0.229	2.78	0.006	Significant
Challenges of IoT → Organizational Performance	-0.075	1.11	0.268	Not Significant
Information Systems → Organizational Performance	0.272	3.59	0.000	Significant

From the structural model results, we can learn several significant lessons about the interconnection between digital transformation variables and performance results.

Initially, the benefits of the Internet of Things application have a positive and significant effect on supply chain performance ($\beta = 0.356$, $p < 0.000$) and organizational performance ($\beta = 0.229$, $p < 0.06$). It implies that IoT enhances efficiency in these areas.

Secondly, information systems significantly affect the performance of the supply chain ($\beta = 0.402$, $p < 0.000$). It highlights the importance of information systems for integrating data and processes. Moreover, information systems affect organizational performance ($\beta = 0.272$, $p < 0.000$). These results highlight the significance of information systems for digital transformation.

Third, the performance of the supply chain significantly influences organizational performance ($\beta = 0.468$, $p < 0.000$). The efficiency and effectiveness of an organization's supply chain greatly influence its overall performance.

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Issues associated with the implementation of the Internet of Things do not adversely affect the efficiency of supply chains and organizations. Additionally, these barriers are not statistically significant.

4.4. Coefficient of Determination (R^2)

Table 3.
R-Square Values.

Variable	R^2 Value
Supply Chain Performance	0.622
Organizational Performance	0.658

The coefficient of determination for Supply Chain Performance (R^2) is 0.622, meaning that 62.2% of variance can be explained by Benefits of IoT Adoption, Challenges of IoT Adoption, and Information Systems. For Organizational Performance, R^2 is 0.658, and 65.8% of variance can be explained by independent variables and Supply Chain Performance.

In this regard, it may be noted that both coefficients suggest that a substantial amount of variability can be explained through the proposed regression model.

4.5. Mediation Analysis

Table 4.
Indirect Effects (Mediation Test).

Relationship	Indirect Effect	P-Value	Result
IoT Benefits → SCP → Organizational Performance	0.166	0.000	Significant
Information Systems → SCP → Organizational Performance	0.188	0.000	Significant
IoT Challenges → SCP → Organizational Performance	-0.045	0.210	Not Significant

In the mediation analysis, it is revealed that supply chain performance mediates the effects of IoT benefits on organizational performance, as well as the effects of information systems on organizational performance. This indicates that the influence of digital technologies on organizational performance will primarily occur through enhanced supply chain performance.

Conversely, supply chain performance does not act as a mediator for the effect of IoT drawbacks on organizational performance. The inference that can be made from this is that the drawbacks of IoT do not significantly affect organizational performance through the supply chain channel.

5. Discussion

This paper presents evidence regarding the impact of digitalization, IoT implementation, and information systems on the performance of organizations within the port logistics sector. The findings indicate that the effect of digital technology on organizational performance is indirect and mediated by supply chain performance.

The significant positive effect of IoT advantages on supply chain efficiency and organizational effectiveness means that digital technology contributes to greater visibility, coordination, and efficiency. The research confirms the RBV theory, according to which technological capabilities are resources that help gain a competitive advantage [5]. IoT helps turn real-time data into useful knowledge, thus ensuring better response times and avoiding inefficiencies. The finding in this research is consistent with previous research about the effect of IoT on the integration and performance of supply chains [3, 4].

5.1. Relationship between the Technology Dimension and Job Performance

Unlike the findings on challenges associated with IoT adoption, there were no significant effects of challenges related to IoT adoption on supply chain performance and organizational performance. The results imply that organizations in the port sector possess adequate adaptive capabilities that help them

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overcome technological barriers, including cost, complexity, and infrastructure barriers. From a theoretical perspective, these findings support the dynamic capability perspective, which considers an organization's ability to reconfigure resources in response to environmental changes [1] and suggest that after a certain stage of digital maturity, negative impacts associated with barriers lose significant roles [2].

Information systems appear to significantly influence this relationship, demonstrating a strong positive connection between information systems and both supply chain performance and organizational performance. The Information Systems Success Model can clarify these results [11], which suggests that system and information quality play key roles in organizational performance. For port operations, information systems act as "the" driver that enables digital integration, thus linking data from IoT devices to their operations. It further supports the Supply Chain Network Theory (SCNT), which posits that good information flow is vital to coordination and performance in a supply chain network [6].

One of the most significant findings in this research is the identification of supply chain performance as a mediating variable. The analysis results clearly show that increases in organizational performance mainly result from improved supply chain performance, including supply chain efficiency, responsiveness, and coordination. The study, therefore, suggests that technology, e.g., digital technologies, does not inherently trigger performance improvements without proper embedment into supply chain operations. It confirms the proposition that supply chain performance serves as the mechanism to transmit the value of digital capability to organizational performance [9].

In summary, we find that digital transformation in the port logistics context is about how to integrate technologies into operations rather than the adoption of technology itself. Port logistics firms with strong alignment of IT/IoT to supply chain activities can realize organizational performance improvements.

5.2. Theoretical Implications

Several points of contribution of the present study to the existing literature can be outlined. First, it has further evolved the RBV by suggesting that digital technologies such as information systems and the IoT act as strategic resources to improve firm performance via supply chain capabilities. Second, it further adds to SCNT by providing empirical evidence on the information integration and coordination benefits toward firm performance improvement.

Third, it provides a mechanism-based perspective, indicating how digital transformation impacts organizational performance via the mediating role of supply chain performance. Previous literature has not considered the mechanism of such an impact but mainly focused on the direct relationship, thus highlighting the research gap addressed by this study.

5.3. Practical Implications

The results, therefore, suggest from a management viewpoint that authorities and logistics firms should attempt to invest more in IoT and integrated information systems in their supply chains to achieve efficiency improvements. However, technology alone will not be able to improve supply chain efficiency, and there should be more investment in coordination, process integration, and data application. Furthermore, the negligible influence of IoT challenges means organizations should not be so inhibited by challenges when implementing technologies, but should endeavour to invest more in digital capabilities and organizational readiness.

6. Conclusions

The findings of the present research indicate that the advantages gained from implementing IoT and IS have a positive influence on an organization's performance, both directly and indirectly through supply chain performance. Supply chain performance acts as an essential intermediary; thus, it is the primary avenue through which digital technologies drive performance development.

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Simultaneously, the obstacles to implementing IoT do not significantly affect performance outcomes, indicating that organizations can navigate these issues, and both points highlight the necessity of integrating digital technologies with supply chain operations in port logistics.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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