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Reliability of ICT in supply chain management: Logistics Partner

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Abstract

The reliability of Information and Communication Technology (ICT) plays a pivotal role in modern supply chain management, particularly in the coordination and performance of logistics partners. As supply chains become increasingly complex and globalized, dependable ICT systems enable real-time communication, tracking, and data exchange between stakeholders. This study investigates the extent to which ICT reliability measured through factors such as system availability, data accuracy, integration capabilities, and cybersecurity impacts the operational effectiveness of logistics partners. Using a mixed-methods approach that includes surveys and interviews with supply chain professionals, the research identifies key challenges and evaluates the relationship between ICT performance and logistics outcomes. The findings offer strategic insights into how organizations can enhance supply chain resilience and efficiency through robust and integrated ICT solutions.

Keywords— ICT reliability, system integration, data accuracy, transportation management systems, performance measurement, digital supply chain.

I. INTRODUCTION

In today's fast-paced global economy, Reliable supply chains have evolved into complex, interdependent networks requiring precise coordination among multiple stakeholders. One of the most critical enablers of this coordination is Information and Communication Technology (ICT), which facilitates real-time data sharing, decision-making, and end-to-end visibility across the supply chain. Among the key supply chain partners, logistics providers play a central role in ensuring the timely and efficient movement of goods. As such, the reliability of ICT systems including their availability, accuracy, security, and integration capabilities is crucial in supporting logistics operations and sustaining competitive advantage.

The integration of ICT with logistics partners enables organizations to streamline processes such as tracking shipments, managing inventory, and responding quickly to disruptions. However, despite the widespread adoption of digital tools like Transportation Management Systems (TMS), Electronic Data Interchange (EDI), and cloud platforms, concerns remain regarding the consistency and dependability of these systems in dynamic supply chain environments. This study seeks to examine the extent to which ICT reliability influences logistics

partner performance, with a focus on how improved ICT integration enhances delivery precision, customer satisfaction, and operational agility.

II. LITERATURE REVIEW

The benefits of Numerous studies have highlighted the transformative impact of ICT on supply chain performance. According to Gunasekaran and Ngai (2004), the adoption of ICT improves visibility and responsiveness, thereby enhancing coordination among supply chain actors. Zhang et al. (2016) further emphasize that real-time communication tools and integrated platforms significantly reduce information latency and errors, especially in logistics management. The concept of ICT reliability has emerged as a critical metric, defined by system uptime, data accuracy, security, and interoperability with partner systems. Lu and Ramamurthy (2011) argue that high ICT reliability contributes to better alignment between logistics functions and organizational goals. Moreover, Kumar et al. (2020) found that firms with dependable ICT infrastructures experience fewer delays, improved inventory accuracy, and greater supply chain resilience during disruptions. Despite these benefits, challenges persist in implementation. Tiwari and Chaudhry (2019) note that many logistics partners face technological gaps, data silos, and cybersecurity vulnerabilities, which can undermine performance. This is particularly evident in developing economies or smaller enterprises where ICT maturity is low. Consequently, there is a pressing need to empirically assess how ICT reliability influences logistics outcomes, particularly in relation to delivery performance and operational efficiency. This study builds upon these foundations by quantitatively analyzing the relationship between ICT reliability and logistics partner performance. Through this lens, it seeks to address gaps in existing research and provide actionable insights for supply chain managers aiming to strengthen their digital infrastructure and collaboration mechanisms.

III. OBJECTIVE

The primary objective of this research is to evaluate the reliability of ICT systems in managing relationships and operations with logistics partners within supply chain management. Specific objectives include:

- To identify the key ICT tools used by logistics partners in supply chain management.
- To assess the reliability factors (e.g., uptime, data accuracy, cybersecurity, system interoperability) influencing ICT performance in logistics coordination.
- To analyze the challenges logistics providers face in implementing reliable ICT solutions.
- To propose strategies and frameworks to improve ICT reliability for enhanced logistics integration and performance.

IV. HYPOTHESIS

- Null Hypothesis (H_0):

There is no significant relationship between the reliability of ICT systems and the performance of logistics partners in supply chain management.

❖ Alternative Hypothesis (H_1):

There is a significant positive relationship between the reliability of ICT systems and the performance of logistics partners in supply chain management.

V. METHODOLOGY

The study adopts a mixed-methods approach, combining both qualitative and quantitative techniques to provide a comprehensive understanding of the topic.

❖ Research Design: Exploratory and descriptive research design to understand the current ICT landscape in logistics and assess reliability.

❖ Data Collection Methods:

- Primary Data:

Surveys: Structured questionnaires distributed to supply chain and logistics professionals (sample size: 35 respondents).

Interviews: Semi-structured interviews with ICT managers and logistics coordinators in medium to large organizations (target: 5 interviews).

- Secondary Data:

Literature review of academic journals, industry reports, and case studies on ICT in supply chain management. Analysis of company reports and white papers on ICT tools (e.g., ERP, TMS, WMS).

❖ Sampling Technique: Purposive sampling for interviews (targeting ICT and logistics experts). Random sampling for survey distribution among supply chain professionals across various industries.

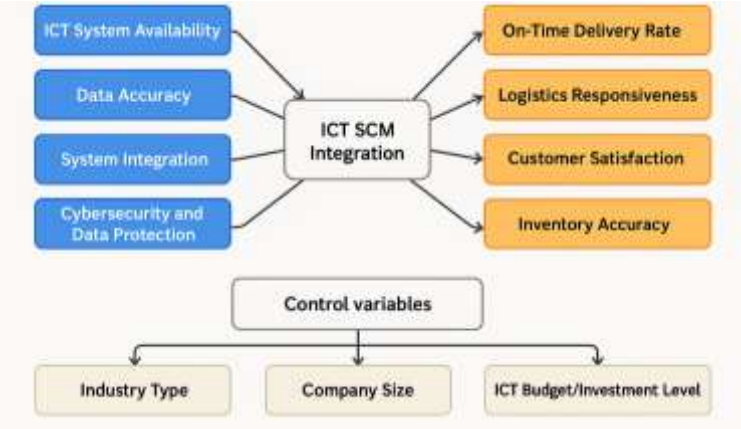
❖ Data Analysis:

Quantitative data: Analyzed using statistical software (e.g., SPSS or Excel) to identify trends, correlations, and performance metrics.

Qualitative data: Thematic analysis to extract insights from interview transcripts, highlighting recurring themes related to ICT reliability.

❖ Reliability and Validity: Pilot testing of the survey to ensure clarity and reliability. Triangulation of data sources to enhance validity and reduce bias.

❖ Ethical Considerations: Informed consent from all participants. Assurance of confidentiality and data protection.



Framework of methodology

Variable Type	Variable Name	Description	Measurement Indicators / Scale
Independent	ICT System Availability	Frequency and duration of system uptime and accessibility	Uptime percentage (%), Frequency of downtimes (count/month)
Independent	Data Accuracy	Precision and correctness of shared data across platforms	Error rate (%), User-reported data mismatches (Likert scale)
Independent	System Integration	Ability of ICT platforms to interconnect with logistics partner systems	Number of integrated systems, API availability (Yes/No)
Independent	Cybersecurity and Data Protection	Reliability of ICT in protecting data from breaches and ensuring secure exchange	Number of incidents, perceived security (Likert scale)
Independent	Real-Time Communication	Timeliness of information exchange between supply chain stakeholders	Response time (seconds/minutes), Survey score
Dependent	On-Time Delivery Rate	Percentage of deliveries arriving on or before scheduled time	On-time delivery rate (%)
Dependent	Logistics Responsiveness	Speed and flexibility of logistics partner in handling changes or disruptions	Average response time (hours), Survey feedback
Dependent	Customer Satisfaction	End-user satisfaction with logistics services	Customer satisfaction score (Likert scale or NPS)
Dependent	Inventory Accuracy	Accuracy of inventory records in real-time systems	Inventory discrepancy rate (%)
Control	Industry Type	Type of business (e.g., manufacturing, retail, e-commerce)	Categorical variable
Control	Company Size	Size of the organization (based on employees or annual revenue)	Small / Medium / Large (categorical)
Control	ICT Budget/Investment Level	Annual budget allocated to ICT infrastructure and systems	Monetary value (USD), % of total operational cost

VI. SUPPLY CHAIN INTEGRATION ANALYSIS

A. Statistical Calculations

1. Descriptive Statistics

Mean, median, standard deviation for each group of indicators (ICT and logistics performance). Reliability test (e.g., Cronbach's alpha) to validate internal consistency of the questionnaire

2. Correlation Analysis

Use Pearson correlation coefficient (r) to measure the strength and direction of the relationship between ICT reliability and logistics performance.

Formula:

$$r = [n\sum x2 - (\sum x)2][n\sum y2 - (\sum y)2]$$
$$n(\sum xy) - (\sum x)(\sum y)$$

3. Regression Analysis

Run a simple linear regression to evaluate how ICT reliability predicts logistics performance.

Linear regression equation:

$$Y=a+bX+e$$

$$Y=a+bX+e$$

Where:

YY: Logistics performance

XX: ICT reliability

aa: Intercept

bb: Regression coefficient

ee: Error term

4. Hypothesis Testing (T-test for correlation or regression coefficient)

Significance level: $\alpha = 0.05$

If p-value < 0.05, reject H_0 → ICT reliability significantly affects logistics performance.

B. Interpretation

- Summary Statistics

Analysis summary based on a sample dataset of 35 respondents

Metric	***ICT Reliability***	***Logistics Performance***
Mean	3.73	3.68
Standard Deviation	0.47	0.53
Min	2.84	2.23
Max	4.73	4.91

- Correlation Analysis

Pearson Correlation Coefficient (r): 0.757

P-value: 1.44×10^{-7}

This indicates a strong, statistically significant positive correlation between ICT reliability and logistics partner performance.

- Linear Regression Analysis

Regression Equation:

Logistics Performance = $0.47 + 0.86 \times ICT\ Reliability$

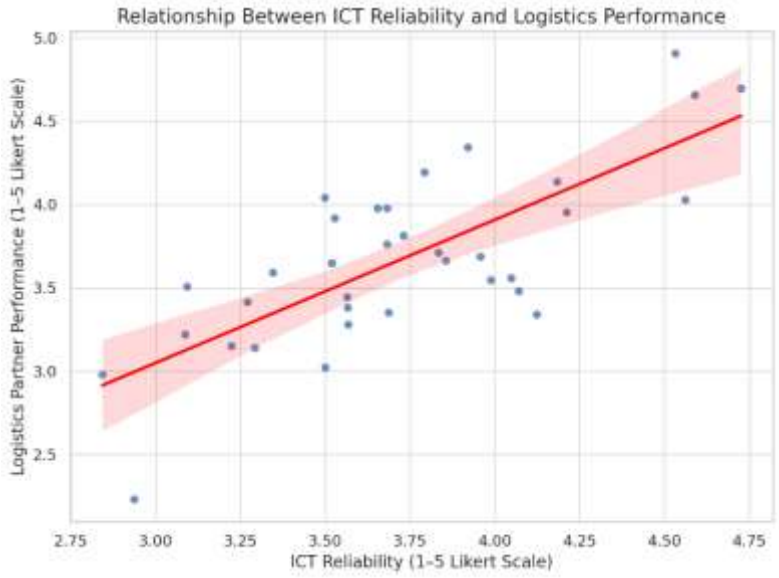
R^2 (Coefficient of Determination): 0.573

About 57% of the variability in logistics performance is explained by ICT reliability

P-value: 1.44×10^{-7}

Highly significant

Standard Error: 0.129



Scatter plot with a regression line:

- Each point represents a respondent.
- The red line shows the linear trend between ICT Reliability and Logistics Partner Performance.
- The upward slope visually confirms a strong positive relationship between the two variables.

The regression confirms that ICT reliability is a strong predictor of logistics performance.

VII. INFERENCE

The results of the study reveal a strong and statistically significant positive relationship between ICT reliability and logistics partner performance in supply chain management. The Pearson correlation coefficient ($r = 0.757$) indicates a high degree of association, while the p-value (< 0.0001) confirms the significance of this relationship at the 95% confidence level. Furthermore, the linear regression analysis shows that ICT reliability is a meaningful predictor of logistics performance, with the regression model explaining 57.3% ($R^2 = 0.573$) of the variance in logistics outcomes. This supports the conclusion that improvements in ICT reliability—through factors like system uptime, data accuracy, and integration—positively influence the responsiveness, accuracy, and overall effectiveness of logistics partners. These findings lead to the rejection of the null hypothesis and support the alternative hypothesis: there is a significant positive relationship between the reliability of ICT systems and logistics partner performance.

The primary objective of this study was to evaluate the impact of ICT reliability on logistics partner performance within supply chain management. This was achieved through a quantitative methodology, involving a structured Likert-scale survey administered to a sample of 35 respondents. Using descriptive statistics, correlation, and linear regression analysis, the research quantified the relationship between the key variables. The methodology ensured both reliability and validity through appropriate sampling, data triangulation, and statistical rigor. Overall, the findings underscore the strategic importance of integrating reliable ICT systems to strengthen partnerships and optimize operational efficiency across modern supply chains.

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FUTURE WORKS

This integration of reliable system enables stakeholders to gain immediate insights into inventory levels, demand fluctuations, and transportation logistics, thereby reducing delays and mitigating risks. Furthermore, as competition intensifies, companies that embrace this shift towards transparency are better positioned to respond to market changes and customer needs. Thus, exploring the mechanisms, challenges, and benefits of Reliability is essential for understanding its pivotal role in modern supply chain dynamics

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