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IMPACT OF INFORMATION AND COMMUNICATION TECHNOLOGY ADOPTION ON THE OPERATIONAL PERFORMANCE OF THIRD-PARTY LOGISTICS COMPANIES

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ABSTRACT
This study investigates the adoption of Information and Communication Technology (ICT) and its impact on the performance of Third-Party Logistics (3PL) companies, with specific reference to firms in the Coimbatore district of Tamil Nadu, India. Using a structured questionnaire administered to 104 respondents across various 3PL firms, the study employs percentage analysis, central tendency and dispersion analysis, ranking analysis, and Pearson correlation to evaluate ICT adoption patterns and their effects on operational and financial outcomes. Findings reveal that ICT adoption significantly enhances productivity, operational efficiency, and managerial decision-making. A strong positive correlation ($r = 0.683$, $p < 0.01$) was established between enabling organizational contexts and ICT adoption levels. The study also identifies key barriers including high implementation costs, integration challenges, user resistance, infrastructure limitations, and cost constraints. The findings provide actionable recommendations for logistics managers, technology vendors, and policymakers seeking to leverage ICT for improved logistics performance.

KEYWORDS: *ICT Adoption, Third-Party Logistics (3PL), Operational Performance, Warehouse Management System (WMS), Transportation Management System (TMS), Supply Chain Technology, Logistics Efficiency*

INTRODUCTION

In the swiftly globalizing market, the efficiency and responsiveness of supply chains are crucial elements for gaining a competitive edge. Third-party logistics (3PL) providers businesses that offer outsourced logistics functions like transportation, storage, inventory control, and additional services play a pivotal role in modern supply chains. With customers seeking quicker delivery, greater transparency, and adaptable services, 3PL providers must continuously evolve their operations to maintain profitability and service excellence.

Information and Communication Technology (ICT) has become a crucial driver of this transformation. By automating tasks, enhancing information visibility, supporting real-time decision-making, and enabling advanced analytics, ICT can transform operational performance across cost, speed, accuracy, and customer satisfaction dimensions.

Although numerous large multinational 3PL providers have made significant investments in ICT, the levels of adoption and resulting performance outcomes differ greatly by company size, region, and service type. Small and medium-sized 3PLs often encounter financial, technical, and human-resource constraints that hinder successful ICT adoption. This research addresses the core question: How significantly does the integration of ICT affect the operational and financial outcomes of third-party logistics firms, and which organizational and environmental elements moderate this relationship?

OBJECTIVES OF THE STUDY

- To assess the impact of Information and Communication Technology (ICT) on organizational and operational performance.
- To identify and analyze barriers to the adoption and integration of ICT in organizations.
- To explore enabling contexts and theoretical frameworks for ICT adoption and performance enhancement.

REVIEW OF LITERATURE

A substantial body of literature underscores the pivotal role of ICT in logistics. Lai, Zhao & Wang (2007) identified three IT strategy types supportive, technological, and aligned demonstrating that alignment of IT strategy with business strategy generates measurable competitive and financial performance advantages for 3PL firms. Zhou et al. (2023) showed that logistics digitization positively affects both financial performance (profitability, cost savings) and service performance (speed, reliability, customer satisfaction), with customer collaboration and government support acting as moderating forces.

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Evangelista & Sweeney (2006) highlighted that ICT usage in small 3PLs, including communication technologies and information integration with clients, directly enhances competitive capabilities such as service customization and supply chain responsiveness. Cortez-Clavo et al. (2025) demonstrated that digital technologies including AI and IoT lower costs and reduce lead times in logistics operations. Matwiejczuk (2020) affirmed that advanced logistics technologies are strategic enablers of service differentiation and market success.

RESEARCH METHODOLOGY

Research Design and Area of Study

This study adopts a descriptive and correlational research design, utilizing a quantitative approach to examine the relationship between ICT adoption and 3PL firm performance. The area of study is Coimbatore district, Tamil Nadu a rapidly developing tier-2 city with a growing logistics ecosystem serving companies like Amazon, Flipkart, Delhivery, and Blue Dart.

Population and Sampling

The study population comprises 104 employees across logistics companies in Coimbatore district, spanning Operations Managers, IT Managers, Supply Chain Executives, Customer Service Representatives, and Top Management. A purposive (judgmental) sampling technique was employed, selecting respondents based on their specific expertise and experience in logistics and ICT-related functions.

DATA COLLECTION

Primary data was collected through a structured questionnaire covering demographic information, Likert-scale perceptions of ICT barriers, performance impacts, and enabling contexts. Secondary data was gathered from peer-reviewed journals, industry reports, and published research to support the theoretical framework and identify research gaps.

STATISTICAL TOOLS

Data was analyzed using IBM SPSS Statistics and Microsoft Excel. The following methods were employed: Percentage Analysis for demographic profiling; Central Tendency and Dispersion Analysis (mean, median, mode, standard deviation) for Likert-scale responses; Ranking Analysis to prioritize performance factors; and Pearson Correlation to test hypotheses regarding enabling contexts and ICT adoption levels.

DATA ANALYSIS AND INTERPRETATION

Demographic and Organizational Profile

The sample of 104 respondents represents a cross-section of 3PL professionals. Age-wise, the largest cohort (38.46%) falls in the 25–30 age bracket, reflecting a young and adaptable workforce. Gender distribution reveals 43.27% female respondents, 31.73% male, and 25% preferring not to disclose indicating increasing inclusivity in logistics management. Educationally, 31.73% hold undergraduate degrees while 50% have postgraduate or higher qualifications, signalling high ICT readiness potential.

In terms of job roles, 43.27% are Executives/Directors and 33.65% are in Senior Management, lending strategic credibility to the data. Respondents span multiple sectors: 28.85% from Retail, 27.88% from IT/Software, 18.27% from Transportation & Logistics, and 14.42% from Manufacturing. A majority (43.27%) possess 6–10 years of experience, and 34.62% work in Large Scale 3PL companies with 101–500 employees. Notably, 38.46% represent companies with annual turnover above ₹100 crores.

Table 1: Summary of Demographic and Organizational Profile

Variable	Largest Category	Percentage (%)
Age Group	25–30 years	38.46%
Gender	Female	43.27%
Education	Undergraduate	31.73%
Job Position	Executive/Director	43.27%
Years of Experience	6–10 years	43.27%
Company Scale	Large Scale 3PL	34.62%
Annual Turnover	Above ₹100 Crores	38.46%

Central Tendency and Dispersion Analysis – ICT Barriers

The analysis of ICT-related challenges reveals that respondents moderately agree across all five barrier dimensions. ICT Adoption Barriers recorded the highest mean score of 3.385 (median = mode = 4, SD = 0.948), indicating that general adoption barriers are the most prominently felt challenge. ICT and Infrastructure Limitations showed the highest standard deviation (1.054), reflecting the widest

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divergence in respondents' experiences likely due to variance in organizational maturity. ICT and Cost Constraints displayed the highest variance (1.189), suggesting that cost perceptions differ significantly between small and large-scale firms.

Table 2: Central Tendency and Dispersion Analysis of ICT Barriers (N = 104)

ICT Barrier Factor	Mean	Median	Mode	Std. Deviation
ICT Adoption Barriers	3.385	4	4	0.948
Integration Challenges	3.317	3	3	0.938
User Resistance	3.240	3	3	0.930
Infrastructure Limitations	3.317	3	3	1.054
Cost Constraints	3.231	3	3	1.090

Ranking Analysis – ICT Impact on Organizational Performance

Ranking analysis was applied to evaluate the perceived impact of ICT on key organizational performance dimensions. ICT and Productivity ranked first (mean = 3.50), affirming that respondents strongly associate ICT adoption with enhanced operational output. ICT and Efficiency and ICT and Decision-Making jointly ranked second (mean = 3.471 each), reflecting equal recognition of ICT's role in streamlining operations and supporting data-driven management. ICT and Challenges ranked third (mean = 3.365), acknowledging implementation difficulties, while ICT and Employee Performance ranked last (mean = 3.25), suggesting that non-technological factors like skills and motivation also significantly influence individual performance.

Table 3: Ranking Analysis – ICT Impact on Organizational Performance (N = 100)

Performance Dimension	Mean Score	Rank
ICT and Productivity	3.500	1
ICT and Efficiency	3.471	2
ICT and Decision-Making	3.471	2
ICT and Challenges	3.365	3
ICT and Employee Performance	3.250	4

Correlation Analysis – Enabling Contexts and ICT Adoption

Hypotheses tested: H_0: There is no significant relationship between enabling contexts and performance enhancement. H_1: There is a significant positive relationship between enabling contexts and performance enhancement.

The Pearson correlation analysis yielded a coefficient of $r = 0.683$ between enabling contexts (organizational support, infrastructure, policies, and technological readiness) and ICT adoption level. This represents a strong positive relationship. The significance value ($p = 0.000 < 0.01$) confirms statistical significance, leading to rejection of the null hypothesis. The alternate hypothesis is accepted: favorable enabling contexts including management support, digital infrastructure, skilled workforce, and regulatory frameworks significantly increase the likelihood and depth of ICT adoption in 3PL firms.

Table 4: Pearson Correlation – Enabling Contexts and ICT Adoption Level (N = 104)

Variable	Pearson r	Sig. (2-tailed)
Enabling Contexts ↔ ICT Adoption Level	0.683	0.000

FINDINGS

The study produced the following principal findings:

- The 3PL workforce in Coimbatore is predominantly young (25–30 age group), well-educated, and increasingly diverse characteristics that bode well for future ICT adoption readiness.
- ICT adoption barriers represent the most perceived challenge (mean = 3.385), followed by integration challenges and infrastructure limitations indicating that the journey from ICT investment to performance realization is not straightforward.
- Productivity is the performance dimension most positively impacted by ICT adoption (rank 1, mean = 3.50), followed equally by efficiency and decision-making quality (rank 2, mean = 3.471).
- A strong positive correlation ($r = 0.683$, $p < 0.01$) between enabling organizational contexts and ICT adoption levels confirms that organizational readiness is a prerequisite for ICT-driven performance gains.
- Most respondents operate in large-scale, high-turnover 3PL companies (38.46% with turnover above ₹100 crores), yet barriers persist even in resource-rich environments highlighting the complexity of ICT integration.

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SUGGESTIONS AND RECOMMENDATIONS

Overcoming Adoption Barriers

3PL companies should develop a structured ICT adoption roadmap aligned with long-term business strategies, treating ICT not as a standalone initiative but as an integral component of organizational growth. Management should conduct readiness assessments before deploying new ICT systems, evaluating existing infrastructure, financial capacity, human resource capabilities, and process maturity. A phased implementation strategy beginning with high-impact, low-cost digital tools and gradually scaling to AI-driven analytics, IoT platforms, and blockchain-based tracking reduces risk and ensures sustainable adoption.

Addressing Integration Challenges

Firms should invest in interoperable platforms and open-standard APIs to ensure seamless integration between WMS, TMS, ERP, and client-side systems. Before deploying ICT tools, organizations should map existing workflows and redesign business processes to align with digital systems, avoiding the common pitfall of automating inherently inefficient processes. Cloud-based SaaS solutions are particularly recommended for smaller firms, minimizing integration complexity and upfront investment while providing scalability.

CONCLUSION

This study set out to investigate the adoption of Information and Communication Technology and its impact on the performance of Third-Party Logistics companies in the Coimbatore district. Through a structured empirical investigation involving 104 respondents, significant insights have been generated that contribute to the literature on ICT-driven logistics transformation in developing economies. The findings confirm that ICT adoption plays a central role in enhancing organizational and operational performance in the 3PL sector, with productivity emerging as the most significantly impacted dimension, followed closely by efficiency and decision-making quality. However, effective ICT adoption is not without obstacles: adoption barriers, system integration challenges, user resistance, infrastructure limitations, and financial cost constraints collectively moderate the degree to which technology investments translate into measurable performance gains.

In conclusion, ICT adoption is not merely a technological upgrade it is a strategic transformation that, when executed with the right enabling conditions and organizational commitment, can significantly improve productivity, efficiency, decision-making, customer satisfaction, and competitive positioning. The logistics industry stands at a critical juncture where embracing digital transformation is no longer optional but essential for survival and growth in an increasingly dynamic marketplace.

Future research should examine the longitudinal impact of ICT adoption on 3PL performance, extend the geographic scope to pan-India or cross-national comparisons, and explore the emerging roles of Artificial Intelligence, Blockchain, and Autonomous Systems in shaping the next generation of logistics performance.

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