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ANALYZING THE IMPACT OF TECHNOLOGY ADOPTION ON LOGISTICS EFFICIENCY IN THE SUPPLY CHAIN SECTOR

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Keywords	***Abstract***
Logistics Efficiency, Technology Adoption, Operational Performance, Inventory Control, Route Optimization, Cost Reduction, System Integration	In an era dominated by technological innovation and global competition, logistics has emerged as the cornerstone of business success. Technology adoption in logistics operations enhances visibility, accuracy, and speed, transforming traditional supply chain models into agile, data-driven systems. This study, conducted at Safexpress — India's leading supply chain and logistics company — examines how technologies such as the Warehouse Management System (WMS), Transportation Management System (TMS), Global Positioning System (GPS), and the proprietary software Propel influence logistics efficiency. Using both primary and secondary data, the study explores the relationship between technology adoption, operational performance, and employee adaptability. Findings indicate that technology has significantly reduced paperwork, improved route planning, and enhanced inventory management while saving substantial operational time. However, challenges such as system downtime, lack of training, and complex interfaces persist.

1. INTRODUCTION

Technology has become an indispensable force in shaping the logistics and supply chain sector. As businesses strive to achieve higher operational efficiency and customer satisfaction, the adoption of digital tools and automation has become a competitive necessity rather than a choice. The global logistics environment is undergoing a profound transformation, characterized by the integration of Artificial Intelligence (AI), the Internet of Things (IoT), data analytics, and automation into every aspect of operations. In India, this transformation is being spearheaded by leading companies like Saf

express, which has consistently leveraged technology to improve delivery timelines, enhance transparency, and reduce operational costs. Founded in 1997 and headquartered in Gurugram, Saf express operates across 31,000 incudes with over 750 branches and 12,500 GPS-enabled vehicles. Its commitment to digital transformation has made it one of India's most trusted logistics brands. However, while technology adoption has been extensive, understanding its measurable impact on logistics efficiency is crucial to identifying strengths, gaps, and future opportunities.

This research investigates how the implementation of WMS, TMS, GPS, and Propel systems has influenced operational efficiency, cost reduction, accuracy, and employee performance at Saf express. It also explores challenges encountered during the integration of these technologies and the extent to which employees have adapted to digital systems.

2. OBJECTIVES OF THE STUDY

1. To assess the impact of Warehouse Management Systems (WMS) on warehouse operations and inventory control.
2. To determine the overall improvements in logistics performance post-technology adoption.

3. LIMITATIONS OF THE STUDY

1. The study was conducted on a limited sample of 60 employees, which may not represent the entire Safexpress workforce.
2. The research period (July–September 2025) was short, restricting long-term performance analysis.
3. The study focused only on Safexpress, limiting the general applicability of results to other logistics companies.
4. Data collected were based on employee perceptions, which may involve response bias.

4. SCOPE FOR FUTURE STUDY

1. Comparative studies can be conducted across multiple logistics firms to understand industry-wide technology impacts.
2. Future research can include emerging technologies like AI, IoT, robotics, and blockchain in logistics operations.
3. Long-term (longitudinal) studies can track changes in efficiency and cost savings over time.
4. Further studies can analyse how employee training and skill development influence technology adoption success.

5. REVIEW OF LITERATURE

Grover & Ashraf (2024) highlighted how IoT-driven intralogistics enable automation and real-time monitoring, ensuring better warehouse utilization.

Abhishek Tiwari (2020) noted that ICT has revolutionized e-commerce logistics in India, fostering faster communication and service scalability.

Ankita Shukla et al. (2022) emphasized how technologies like AI and Big Data ensured supply chain resilience during COVID-19 disruptions.

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Asad Ullah et al. (2024) discussed global benchmarks for Industry 4.0 technologies such as robotics and automation, noting improved accuracy and reduced lead time.
Chauhan et al. (2023) integrated sustainability with technology adoption, suggesting that digital tools not only improve performance but also minimize environmental impact.
Deepika Joshi et al. (2024) found that IoT adoption in agrifood logistics is hindered by poor connectivity and unclear implementation roadmaps, a lesson for developing economies.
Dutt & Roy (2023) analyzed multimodal logistics systems in India, highlighting infrastructure and policy gaps.
Peter Jacob Hinneh Jr. & Atul Sangal (2025) studied SMEs in India, confirming that technology reduces cost and increases visibility but is limited by employee resistance.
Ruthramathi & Sivakumar (2024) emphasized that regional logistics firms in Tamil Nadu have improved coordination and competitiveness through IT adoption.
Abhay K. Grover & Muhammad Hasan Ashraf (2024):
Identified key success factors for autonomous and IoT-driven intralogistics adoption, emphasizing phased implementation and workforce readiness. Useful for understanding warehouse digital transformation stages.

6. RESEARCH METHODOLOGY

Research Design

The study employed a descriptive research design, suitable for assessing current practices and their outcomes. It focuses on understanding how employees perceive and utilize technology in their daily operations. Data collection are primary and secondary and in Primary Data are collected through structured questionnaires distributed to 60 employees of Safexpress. Secondary Data Gathered from company reports, academic journals, and credible online sources.

DATA ANALYSIS AND INTREPRETATION

RELATIONSHIP BETWEEN DOES TECHNOLOGY HELP IN FASTER ORDER PROCESSING * HAS GPS TRACKING IMPROVED DELIVERY VISIBILITY

H_0 (Null Hypothesis): There is no significant relationship between whether technology helps in faster order processing
H_1 (Alternative Hypothesis): There is a significant relationship between whether technology helps in faster order processing

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	36.200[a]	8	.000
Likelihood Ratio	24.767	8	.002
Linear-by-Linear Association	.023	1	.881
N of Valid Cases	60		
a. 10 cells (66.7%) have expected count less than 5. The minimum expected count is .05.			

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Key Analysis:

- Pearson Chi-Square: Value = 36.200, degrees of freedom = 8, significance (p-value) < 0.001. Likelihood Ratio: Value = 24.767, significance (p-value) = 0.002, also statistically significant.
- Linear-by-Linear Association: Value = 0.023, p-value = 0.881, indicating no significant linear trend between the variables.
- Note on Assumptions: 66.7% of cells have expected counts less than 5, which may affect the validity of the chi-square results (this means some results should be interpreted with caution due to small sample sizes in some categories).

Interpretation:

- Statistical Significance: The variables tested in the crosstabulation are associated at a statistically significant level ($p < 0.05$), meaning it is very unlikely this relationship is due to chance.
- Caution: Because many cells have low expected counts, these chi-square results should be interpreted carefully, and it may be helpful to collapse categories or increase sample size in future analyses for more robust findings.

RELATIONSHIP BETWEEN TRAINING QUALITY AND THE OVERALL IMPACT OF TECHNOLOGY ON LOGISTICS EFFICIENCY.

Null Hypothesis (H_0): There is no significant correlation between training quality and the overall impact of technology on logistics efficiency.

Alternate Hypothesis (H_1): There is a significant correlation between training quality and the overall impact of technology on logistics efficiency.

Correlations			How would you rate the training provided?	Overall, how would you rate the impact of technology on logistics efficiency
Spearman's rho	How would you rate the training provided?	Correlation Coefficient	1.000	-.261*
		Sig. (2-tailed)	.	.044
		N	60	60
	Overall, how would you rate the impact of technology on logistics efficiency	Correlation Coefficient	-.261*	1.000
		Sig. (2-tailed)	.044	.
		N	60	60
*. Correlation is significant at the 0.05 level (2-tailed).				

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Interpretation

The Spearman's rho = –0.261 indicates a weak negative correlation between the two variables.This means that as the rating for training quality increases, the rating for overall impact of technology on logistics efficiency tends to slightly decrease, and vice versa.

The p-value = 0.044, which is less than 0.05, indicates that the relationship is statistically significant.Therefore, you reject the null hypothesis (H_0) and accept the alternate hypothesis (H_1).This suggests that employees who rated training as higher tended to give a slightly lower rating to the overall impact of technology, possibly indicating that while training is good, the technology's efficiency impact may not fully meet expectations — or that those who received more intensive training are more aware of system limitations.

There is a weak but statistically significant negative correlation ($\rho = -0.261$, $p = 0.044$) between employees' rating of the training provided and their overall rating of the impact of technology on logistics efficiency.

7. FINDINGS & SUGGESTIONS

The survey responses revealed that 95% of respondents were male and 68.3% worked in the operations department. Most employees (over 70%) had less than three years of experience, indicating a young and adaptive workforce.The most frequently used technologies were WMS and Propel, followed by combinations including TMS and GPS. This confirms Safexpress's dependence on integrated digital systems for warehouse and route management.Approximately 82% of employees felt comfortable or very comfortable using these technologies, reflecting high adaptability. However, 20% reported receiving no training, indicating a need for structured learning modules.Over 70% of respondents stated that technology saves them 1–2+ hours daily, primarily due to automation of documentation, route planning, and real-time tracking.Chi-square tests showed a significant association ($p < 0.05$) between training and comfort level, suggesting that adequate training enhances system usability.The most reported issues were system downtime (45%), complex interfaces (40%), and slow internet (25%). These challenges highlight the importance of consistent IT infrastructure upgrades and user support.Employees agreed that WMS reduced inventory errors, TMS improved route optimization, and GPS increased delivery visibility. Moreover, 70% believed that technology adoption has drastically reduced paperwork, reflecting environmental and operational benefits.

8. SUGGESTIONS

1. **Enhance Training Programs:** Regular workshops should be organized to improve employee proficiency in using WMS, TMS, and GPS.
2. **Upgrade IT Infrastructure:** Address issues related to downtime and connectivity by investing in high-speed networks and backup servers.
3. **Simplify User Interfaces:** Collaborate with technology vendors to design more intuitive system dashboards.
4. **Introduce Continuous Feedback Mechanisms:** Establish an employee feedback system to report system issues promptly.

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9. CONCLUSION

The study concludes that technology adoption has significantly improved logistics efficiency at Safexpress. Tools such as WMS, TMS, GPS, and Propel have streamlined operations, improved visibility, reduced paperwork, and enhanced overall productivity. Employee perceptions reflect satisfaction with these systems, though gaps in training and infrastructure maintenance persist.

The findings highlight that technology not only reduces human effort and error but also contributes to sustainability and customer satisfaction. However, to fully leverage these benefits, Safexpress must continuously invest in system optimization, employee development, and AI-driven innovations. As logistics continues to evolve, the company's proactive approach to digital transformation positions it strongly in an increasingly competitive and technologically dynamic market.

10. AUTHOR(S) CONTRIBUTION

The writers affirm that they have no connections to, or engagement with, any group or body That provides financial or non-financial assistance for the topics or resources covered in this Manuscript.

11. CONFLICTS OF INTEREST

The authors declared no potential conflicts of interest with respect to the research, authorship, And/or publication of this article.

12. PLAGIARISM POLICY

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