The Use of Information and Communication Technologies in International Logistics: A Case Study on the Implementation of Tracking System

TAMIMA ARMANDO MAMEDE CHAZZAOUI

Abstract- ***The growing complexity of global trade has underscored the strategic importance of Information and Communication Technologies (ICTs) in international logistics. This study explores how the implementation of tracking systems—an essential ICT application—can enhance efficiency, visibility, and responsiveness in global supply chains. Drawing on academic literature and real-world case studies, the paper analyzes the role of technologies such as GPS, IoT, and blockchain in improving shipment monitoring, reducing operational risks, and supporting decision-making. The findings indicate that while technological adoption presents challenges related to cost, interoperability, and digital infrastructure, the benefits in terms of transparency, customer satisfaction, and sustainability are substantial. The study concludes that tracking systems represent a critical component for building resilient and competitive international logistics networks***

Indexed Terms- ***Tracking systems; supply chain visibility; global trade; ICT in logistics; blockchain.***

I. INTRODUCTION

The globalization of trade and the expansion of supply chains across borders have significantly increased the complexity of logistics operations. In this context, the use of Information and Communication Technologies (ICTs) has emerged as a critical factor in improving the efficiency, visibility, and reliability of international logistics systems. This paper explores how the implementation of tracking technologies as a subset of ICTs can enhance operational performance and decision-making in global supply chains, focusing on empirical evidence and real-world applications.

ICTs encompass a broad range of technologies, including radio frequency identification (RFID), GPS tracking, real-time data analytics, and cloud-based logistics platforms. These tools facilitate the seamless exchange of information between supply chain partners, enabling synchronized operations across geographically dispersed regions. One of the most impactful ICT applications in international logistics is shipment tracking, which allows stakeholders to monitor the location and condition of goods in transit. This visibility contributes to improved planning, risk mitigation, and customer satisfaction. According to Hofmann and Rüsch (2017), real-time tracking systems reduce uncertainties in global logistics by providing timely information that enables firms to anticipate delays and proactively manage disruptions.

The implementation of tracking systems has been particularly transformative in maritime and air freight. GPS-enabled containers and smart sensors can transmit data on location, temperature, humidity, and potential tampering, allowing for immediate corrective actions if anomalies are detected. In high-value or time-sensitive industries such as pharmaceuticals and electronics, this capability is critical. As noted by Rodrigue and Notteboom (2020), such innovations contribute to supply chain resilience by increasing the transparency and responsiveness of logistics networks. Moreover, integrating these tracking systems with enterprise resource planning (ERP) and transportation management systems (TMS) streamlines operations by automating documentation, customs clearance, and scheduling processes.

A case study conducted by Queiroz, Telles, and Bonilla (2019) highlights the successful adoption of blockchain-integrated tracking systems in international shipping. The study found that blockchain technology, when combined with IoT tracking devices, not only improved visibility but also

enhanced data security and reduced administrative costs. The immutability of blockchain records ensured trustworthy tracking data accessible to all authorized participants, minimizing disputes and enhancing trust among trading partners. This is particularly relevant in international contexts, where multiple actors and regulatory environments can hinder seamless logistics coordination.

Despite the clear benefits, the adoption of ICTs in international logistics faces several barriers, including high implementation costs, lack of standardized protocols, and cybersecurity risks. Smaller firms, especially in developing countries, may struggle to access or deploy advanced tracking technologies due to financial or infrastructural limitations. Furthermore, the effectiveness of ICT systems depends on the interoperability between platforms used by different stakeholders. As emphasized in the World Bank's *Connecting to Compete 2018* report (Arvis et al., 2018), fostering public-private partnerships and investing in digital infrastructure are essential to bridging these gaps and ensuring inclusive technological integration in global logistics.

Environmental considerations also drive the adoption of ICT-based tracking systems. By enabling route optimization and reducing idle time, tracking technologies contribute to lower fuel consumption and emissions. McKinnon (2018) argues that digital logistics solutions are pivotal in achieving sustainability goals in transport-intensive industries. Moreover, automated tracking helps organizations comply with environmental regulations and certification schemes by documenting carbon footprints and energy usage in real time.

The flowchart visually illustrates the integration of Information and Communication Technologies (ICT) in international logistics, focusing on the role of tracking systems. It begins by acknowledging the context of global trade and the resulting complexity in logistics operations. The chart then highlights how ICT—specifically RFID, GPS, and IoT systems—supports logistics by enabling real-time shipment tracking and enhancing visibility. It identifies key technologies such as GPS-enabled containers, smart sensors, and blockchain. The diagram also addresses challenges like high implementation costs, interoperability issues, cybersecurity risks, and unequal access, especially for small firms. To overcome these obstacles, the chart suggests strategic actions like forming public-private partnerships and investing in digital infrastructure, concluding that tracking systems are vital for building more efficient, resilient, and sustainable supply chains.

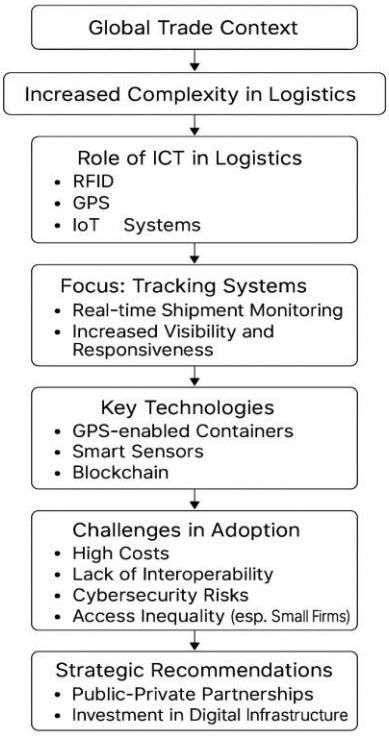

Figure 1. Flowchart summarizing the role of ICT tracking systems in international logistics, including technologies, benefits, challenges, and strategic recommendations.

Source: Created by author.

In conclusion, the use of Information and Communication Technologies—particularly tracking systems—represents a paradigm shift in international logistics. These technologies enhance operational efficiency, provide real-time visibility, and support strategic decision-making across global supply chains. However, to fully leverage their potential, firms must address the challenges related to cost, interoperability, and digital infrastructure. As international trade

continues to evolve in complexity and scale, the integration of ICTs into logistics processes will remain a cornerstone for achieving competitive, resilient, and sustainable supply chains.

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