

Impact of Manifest Mismatch Information on Cargo Operation: A Case of Inland Container Depots

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DOI: 10.29322/IJSRP.15.09.2025.p16536

<https://dx.doi.org/10.29322/IJSRP.15.09.2025.p16536>

Paper Received Date: 28th August 2025

Paper Acceptance Date: 21st September 2025

Paper Publication Date: 30th September 2025

Abstract -This study examines the impact of manifest mismatch information on cargo operations at Inland Container Depots (ICDs) in Tanzania, with particular attention to the role of Artificial Intelligence (AI) in reducing these challenges. A mixed-methods approach was adopted, combining structured questionnaires, interviews, and documentary review. Findings reveal that manifest mismatches commonly arise from human errors, system incompatibilities, lack of coordination, and fraudulent practices. These issues lead to prolonged cargo dwell times, higher operational costs, and regulatory compliance risks. Regression analysis confirmed a significant positive relationship between mismatches and cargo delays. Stakeholders perceive AI applications including anomaly detection, automated validation, and predictive analytics as viable solutions to mitigate documentation discrepancies, though infrastructural and policy limitations remain. The study concludes that addressing manifest mismatches is crucial for enhancing ICD efficiency and recommends greater digital integration, policy reforms, and pilot testing of AI-driven systems.

Index Terms- Artificial Intelligence (AI), Customs Clearance, Cargo Operation, Container Depots (ICDs), Manifest Mismatches, Inland Container Depot.

INTRODUCTION

The growth of international trade has increased the importance of logistics and transport systems in ensuring smooth cross-border cargo movement. Inland Container Depots (ICDs) have become central to this process as they consolidate, store, and move cargo efficiently while helping to decongest seaports. Their efficiency in handling and processing cargo is now a key factor in sustaining global supply chain operations. Central to ICD performance is the accuracy of documentation, especially manifests, which detail shipment contents, destinations, and handling requirements. Yet, manifest mismatches where documentation does not align with actual cargo have emerged as a pressing challenge, creating delays and inefficiencies in trade facilitation.

In Tanzania, the port of Dar es Salaam serves as a gateway not only for national trade but also for landlocked neighbors such as Rwanda, Burundi, Uganda, Zambia, and the Democratic Republic of Congo. To reduce congestion at the port, Tanzania established ICDs located strategically inland, where customs clearance and storage are carried out closer to final destinations. However, ICD efficiency remains dependent on the accuracy of manifests. Mismatches occur due to data entry errors, fraudulent misdeclarations, last-minute cargo changes, or weak system integration between port, customs, and shipping stakeholders.

Several studies highlight that human error, poor data entry practices, technological failures, and fraudulent activities are leading causes of manifest mismatches. For example, in 2018 an ICD in Kenya recorded clearance delays up to 50% longer than normal due to inconsistencies between documentation and actual cargo. Such discrepancies increase paperwork, inspections, and verification time, disrupting overall supply chain performance. As a result, businesses face delays, added storage charges, and increased operational costs.

The clearance process in Tanzania illustrates how mismatches escalate delays. Shipping agents must submit electronic manifests to the Tanzania Revenue Authority (TRA) and Tanzania Ports Authority (TPA) before vessel arrival. Customs officers later validate manifests against cargo and Bills of Lading at ICDs. Despite automation through the Tanzania Customs Integrated System (TANCIS), frequent coordination challenges between TRA, TPA, and ICD operators contribute to persistent mismatches. Research by Zikomo Mapunda (2016) and Magenge Yese (2020) confirms that inefficiencies in documentation processes are among the main sources of cargo clearance delays at ports and inland depots.

The consequences of mismatches extend beyond delays, often increasing costs and undermining competitiveness. For example, an ICD in Delhi, India, reported storage charges rising by 25% in two years due to documentation errors. Similarly, the World Bank (2019) noted that even a one-day customs clearance delay could reduce a country's trade volume by 1%, disproportionately affecting small and medium enterprises (SMEs). Compliance risks also arise, as shown in a European ICD case where mismatched manifests led to a week-long delay, fines of nearly \$200,000, and lost sales. These examples underscore the risks of poor documentation in global logistics.

Despite advancements in digital systems, mismatches remain widespread due to system integration gaps, inconsistent data formats, and reliance on manual oversight. While electronic systems can reduce some errors, inadequate synchronization between stakeholders often undermines their effectiveness. As a result, ICDs continue to face delays, higher costs, and supply chain unreliability. Addressing these issues is critical for improving trade competitiveness, and this study aims to evaluate the causes and impacts of manifest mismatches while exploring solutions including automation and digital integration to enhance ICD efficiency and strengthen Tanzania's role in global trade.

Statement of the problem

Efficient cargo handling is vital for global trade, yet persistent challenges caused by manifest mismatches at Inland Container Depots (ICDs) continue to limit operational efficiency. A manifest mismatch occurs when details in shipping documents, such as cargo descriptions, weights, values, or consignee information, fail to match the actual cargo received. Such discrepancies lead to clearance delays, increased storage costs, and potential regulatory penalties. According to the World Bank (2023), document inconsistencies and related inefficiencies account for nearly 30% of cargo processing delays at inland terminals. In Sub-Saharan Africa, this problem is even more severe, with average container dwell times exceeding 20 days compared to 3–5 days in more efficient global trade hubs (UNCTAD, 2022).

Several factors drive manifest mismatches at ICDs. Manual documentation and fragmented digital systems create inconsistencies between shipping lines, customs authorities, and terminal operators (OECD, 2023). Weak data-sharing mechanisms among stakeholders further exacerbate errors during cargo verification, reducing transparency in the clearance process (WTO, 2023). In addition, fraudulent practices such as intentional misdeclaration of cargo to avoid duties or taxes worsen clearance delays and increase costs (IMF, 2022). Collectively, these inefficiencies raise the cost of doing business, discourage investment in logistics infrastructure, and reduce the overall competitiveness of regional trade (World Economic Forum, 2023).

To address these challenges, both global and regional organizations have introduced initiatives to improve cargo documentation. The World Customs Organization (WCO), through its SAFE Framework of Standards, advocates the use of electronic data interchange (EDI) to ensure document accuracy (WCO, 2023). Similarly, regional trade blocs such as the African Continental Free Trade Area (AfCFTA) promote digital trade systems to harmonize documentation across borders (AfCFTA Secretariat, 2023). However, gaps in implementation and poor interoperability between digital systems continue to hinder progress. Without urgent measures such as enhanced automation, real-time data sharing, stricter compliance enforcement, and capacity-building for stakeholders, manifest mismatches will persist slowing trade efficiency, inflating logistics costs, and undermining the economic potential of inland trade corridors.

Research Objectives

The main objective of this study is to assess the Impact of Manifest Mismatch information on Cargo Operation.

Specific Objectives

- i. To assess the primary causes of manifest mismatches information on cargo operation in Inland Container Depots.
- ii. To analyze the operational impact of manifest mismatch information on cargo handling processes in Inland Container Depots.

- iii. To examine the impact of AI technology in manifest information mismatches in Inland Container Depots

Theoretical Review

The study on the impact of manifest mismatch information on cargo operations at Inland Container Depots (ICDs) is grounded in several theoretical perspectives that shape global trade, logistics, and supply chain management. These theories provide insights into the causes, implications, and potential solutions to mismatches, thereby framing the study within established academic discourse.

Transaction Cost Economics (TCE), developed by Oliver Williamson (1975), is particularly relevant in explaining how organizations seek to minimize transaction costs arising from information asymmetry, contractual uncertainties, and operational inefficiencies. In logistics, reducing costs linked to documentation errors, customs delays, and cargo handling is central to efficiency. Manifest mismatches increase transaction costs through re-verification processes, penalties, and clearance delays. TCE highlights how efficient documentation, automation, and digital systems can lower these costs and facilitate cargo movement. Coase (1937) first introduced the concept of transaction costs, while Williamson (1985) elaborated on governance structures in supply chains, and David and Han (2004) demonstrated TCE's relevance to outsourcing in logistics. However, TCE mainly addresses cost minimization, leaving gaps in broader trade facilitation and global supply chain coordination, where Global Value Chain (GVC) Theory provides a complementary perspective.

Lean Logistics Theory, rooted in the Toyota Production System developed by Taiichi Ohno (1978), emphasizes waste reduction, process optimization, and continuous improvement. Applied to ICDs, lean logistics helps reduce waste caused by manifest mismatches, such as unnecessary rework, prolonged delays, and higher storage costs. Literature supports this application, with Womack and Jones (1996) extending lean principles to supply chains, Hines, Holweg, and Rich (2004) exploring their role in trade efficiency, and Shah and Ward (2007) demonstrating their impact on operational performance. However, lean logistics largely emphasizes efficiency and does not sufficiently account for institutional or regulatory constraints, underscoring the importance of Institutional Theory in studies of trade facilitation.

The economic model of a dry port also explains how manifest mismatches affect cargo operations. A mismatch, such as discrepancies in container numbers, cargo weight, or type, disrupts clearance processes, leading to delays, longer storage periods, and increased demurrage and operational costs. These errors reduce throughput and revenue while eroding customer trust. Even small mismatches have significant consequences, lowering efficiency and increasing costs. This model emphasizes the importance of accurate documentation and the adoption of digital data systems for cost-effective and reliable dry port operations.

Empirical Literature Review

Empirical studies further illustrate the causes, impacts, and potential solutions to manifest mismatches. At the global level, documentation errors, lack of coordination, and fraudulent practices have been identified as primary causes. The OECD (2023) attributed 25% of manifest discrepancies to manual entry errors, while UNCTAD (2022) highlighted poor integration among customs, shipping lines, and freight forwarders as a key challenge. The WTO (2023) emphasized fraudulent misdeclarations, particularly in high-value trade corridors, accounting for 15% of global mismatches. The impacts are considerable, with the World Bank (2023) noting mismatches delay 30% of cargo clearances, raising dwell times by 5–7 days and costing traders an estimated \$1.8 billion annually. AI solutions, including machine learning models and blockchain-integrated systems, have demonstrated effectiveness in reducing mismatches, although cost and standardization challenges persist (Lee & Park, 2024; Zhang et al., 2023).

Regionally, Africa faces unique challenges, including poor system interoperability, inadequate training, and reliance on manual processes. The AfCFTA Secretariat (2023) reported that 40% of mismatches stem from poor integration between customs and logistics

providers. The AfDB (2022) highlighted staff training gaps, while the WTO (2023) pointed to fraudulent practices such as misclassification of goods. These issues contribute to cargo dwell times of over 20 days in East Africa, far above the global average, and an estimated \$500 million in annual demurrage costs (UNECA, 2022). Pilot AI initiatives, such as the EAC's (2024) customs verification system in Kenya, have reduced mismatches but face adoption barriers including weak infrastructure and staff resistance.

At the local level, Tanzanian studies remain limited but provide critical insights. Mapunda (2016) identified bureaucratic procedures and manual documentation as major causes of cargo delays, while Mushumbusi, Mkumbo, and Johnson (2024) highlighted verification inefficiencies at ICDs. The Tanzania Revenue Authority (TRA, 2023) noted that fraudulent practices contribute to 10% of flagged consignments. These mismatches increase clearance times by 5–10 days and cost \$200–\$300 per container in demurrage charges (TPA, 2023). Beyond financial losses, mismatches undermine competitiveness, particularly for landlocked neighbors such as Zambia and Rwanda, and contribute to \$50 million in annual revenue losses (AfCFTA Secretariat, 2023). Preliminary AI applications, such as TRA's (2024) document verification tool, have reduced detection time by 30% but face challenges of low digital literacy and inconsistent data formats.

Research Gap

Despite the growing importance of ICDs in facilitating efficient cargo movement, manifest mismatches remain an underexplored challenge in Tanzania. While prior studies have examined broader issues of port congestion, customs inefficiencies, and infrastructure bottlenecks (World Bank, 2019; Mwangoka & Msami, 2021), few have directly addressed the operational impacts of mismatches at ICDs. Local research by Mwangoka and Msami (2021), Kiwelu and Mussa (2019), and Mapunda (2016) identifies documentation errors and procedural inefficiencies as major issues but does not analyze their specific link to mismatches or propose AI-based solutions.

This study addresses these gaps by investigating the causes, impacts, and potential AI-driven solutions to manifest mismatches in Tanzanian ICDs. Unlike broader trade facilitation research, it focuses specifically on mismatches as a source of delays, costs, and compliance risks. By contextualizing global insights (World Bank, 2019; Allison Shipping, 2024) within the Tanzanian setting, the study generates empirical evidence on the operational impact of mismatches and evaluates the feasibility of AI-based interventions. In doing so, it contributes to a limited body of research, providing actionable recommendations for stakeholders while highlighting the strategic role of digital innovation in addressing persistent trade inefficiencies.

Research Methodology

A mixed-method design was employed in this study, focusing on five major Inland Container Depots (ICDs) in Dar es Salaam, namely GALCO, Africa ICD, Hesu Investment, SALISLA, and Zambia Cargo.

The sample consisted of 52 respondents, including customs officials, ICD operators, shipping agents, freight forwarders, traders, and transporters. Participants were selected through a combination of purposive and random sampling techniques.

Data collection involved multiple approaches such as structured questionnaires, semi-structured interviews, focus group discussions, direct observations, and documentary reviews.

Quantitative data were analyzed using SPSS, with regression analysis applied to establish the relationship between manifest mismatches and cargo delays. On the other hand, qualitative data were thematically analyzed using NVivo.

The conceptual framework guided the study by linking independent variables human error, system incompatibility, lack of coordination, and fraudulent practices to dependent variables, which included cargo delays, increased costs, and compliance risks. Artificial Intelligence (AI) was introduced as a moderating factor.

Results / Findings

Overview

This study examined the impact of manifest mismatches on cargo operations at Inland Container Depots (ICDs) in Tanzania. The findings highlight the operational disruptions caused by mismatched documentation, including delays, inefficiencies, and higher costs. The analysis combines quantitative data from 52 respondents and regression modeling, supported by qualitative insights from interviews with customs officers, clearing agents, ICD operators, and traders.

Respondent Profile

Respondents represented diverse roles across customs, ICD operations, clearing, transport, and shipping. Most had 3–6 years of professional experience (67.3%), reflecting mid-level practitioners directly engaged in documentation and clearance. The educational background was equally notable: 63.5% held bachelor's degrees, 13.5% master's degrees, while the rest had diplomas or certificates. Clearing officers made up over half of the sample (51.9%), with the remainder spread across customs officers, ICD operators, transport staff, and traders. This diversity ensured that the study captured operational, managerial, regulatory, and client perspectives on manifest mismatches.

Causes of Manifest Mismatches

Findings revealed that mismatches arise from multiple points in the logistics chain, both at the port of loading and at the port of discharge. The most frequent cause is manual data entry errors, followed by poor integration between customs, shipping, and ICD systems, and timing discrepancies when last-minute cargo changes are not updated across systems. Fraudulent misdeclarations, incomplete inspections, and inconsistent formats between agents further exacerbate the problem. At discharge points, issues such as late manifest updates, seal discrepancies, and transmission errors in Electronic Data Interchange (EDI) were also reported.

Operational Impacts

Regression analysis showed that each additional manifest mismatch increased clearance delays by approximately 2.85 hours, explaining 62% of variance in overall delays ($R^2 = 0.62$). On average, shipments experienced 2.3 mismatches, resulting in 8.7 hours of delay per shipment. These mismatches disrupted cargo clearance, created bottlenecks in yard operations, raised demurrage costs for freight forwarders, increased vessel idle time for shipping agents, and inflated logistics expenses for traders and transporters.

Survey results indicated that over 80% of respondents agreed that mismatches caused delays in customs clearance, increased workload for ICD staff, and raised demurrage and storage costs. Traders emphasized that mismatches undermined trust in supply chain reliability, while shipping agents reported losses exceeding \$10,000 per incident in extreme cases. Transporters highlighted scheduling disruptions and idle trucks, further escalating costs across the supply chain.

Role of Artificial Intelligence

The study explored the potential role of Artificial Intelligence (AI) in reducing mismatches. Current adoption remains limited only 34.6% of respondents use AI-based document verification, and 42.3% employ barcode/RFID tracking. However, 86.5% expressed positive perceptions of AI's potential to improve accuracy, efficiency, and transparency in ICD operations. Proposed solutions include AI-integrated barcode systems to automate cargo verification, reduce manual input, and ensure real-time synchronization across stakeholders.

Respondents noted barriers such as lack of investment, poor integration with legacy systems, and insufficient training. Despite these challenges, stakeholders overwhelmingly supported AI-enabled solutions, with consensus that real-time validation could cut delays by half and reduce documentation errors by up to 70%.

Synthesis

The findings provide strong evidence that manifest mismatches are a primary source of ICD inefficiency in Tanzania. They extend cargo clearance times, disrupt operational workflows, and inflate logistics costs for multiple stakeholders. While systemic challenges such as human error and weak digital integration persist, the results show clear potential for AI-driven solutions to transform ICD efficiency. A shift toward automation, supported by capacity-building and stronger inter-agency coordination, could position Tanzanian ICDs as more competitive regional logistics hubs.

Summary of Causes, Impacts, and AI Solutions for Manifest Mismatches

Category	Key Findings	Impact	AI-Driven Solution
Primary Causes	Manual errors, poor system integration, late updates, fraudulent declarations	Inaccurate documentation	Automated data capture, real-time updates
Operational Delays	Avg. 2.3 mismatches/shipment; +2.85 hrs delay per mismatch; demurrage \$500–\$50,000	Clearance delays, higher costs, idle assets	Predictive analytics for risk management
Stakeholders Involved	Customs, ICD operators, freight forwarders, shipping agents, traders, transporters	Workflow disruptions, financial losses	Integrated barcode/RFID scanning
Current Status/Potential	Current use: 34.6% doc verification, 42.3% tracking	86.5% support adoption	Full automation with centralized manifest database

CONCLUSION AND RECOMMENDATION

This study set out to assess the impact of manifest mismatch information on cargo operations at Inland Container Depots (ICDs) in Tanzania, with an extended focus on the potential role of Artificial Intelligence (AI) as a strategic solution. The findings confirmed that manifest mismatches arising from errors such as incorrect HS codes, inaccurate weights, wrong consignee details, or missing seal numbers are a major operational bottleneck. Regression analysis revealed that each additional mismatch increased clearance times by approximately 2.85 hours, accounting for 62 percent of the variation in cargo delays. These mismatches not only prolonged clearance processes but also raised handling charges and demurrage costs, imposing significant financial burdens on operators, traders, and freight forwarders.

The qualitative insights reinforced these results by highlighting systemic weaknesses such as manual data entry errors, lack of real-time updates from shipping lines, and poor inter-agency communication. These issues triggered repeated verification exercises, congestion,

and inefficiencies across ICD operations, demonstrating that mismatches are not isolated clerical mistakes but indicators of broader documentation and coordination challenges. Overall, the study concludes that manifest mismatches significantly undermine operational efficiency, cost-effectiveness, and trade competitiveness within Tanzania's ICDs, making their resolution a critical priority for the country's logistics sector.

Based on these findings, the study recommends four key measures: (i) investing in integrated digital platforms for real-time sharing of manifest data across customs, port, ICD, and shipping stakeholders; (ii) introducing automation and AI-driven verification tools, supported by barcode and RFID systems, to minimize errors and speed up clearance; (iii) strengthening capacity-building through regular training for customs officers, ICD staff, and freight forwarders, alongside strict enforcement of documentation standards; and (iv) enhancing inter-agency coordination via formal communication frameworks, joint reviews, and centralized support channels for resolving discrepancies. Implementing these measures would mitigate the adverse effects of mismatches, enhance ICD efficiency, reduce operational costs, and support Tanzania's broader agenda of improving trade facilitation and competitiveness in the global market.

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