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The Impact of Digital Export Systems on Reducing National Logistics Costs

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Abstract

This study aims to analyze the impact of digital export systems on reducing national logistics costs in Indonesia. Although Indonesia's export volume continues to rise, its logistics costs remain relatively high, largely due to inefficient administrative and coordination processes. The implementation of digital systems such as the Indonesia National Single Window (INSW), Electronic Bill of Lading (e-BL), and Terminal Operating System (TOS) is intended to enhance transparency, accelerate service procedures, and minimize reliance on manual documentation. This research employs a qualitative descriptive approach, with data collected through in-depth interviews, on-site observations at the port, and document analysis related to export procedures. The findings indicate that digital export systems contribute to shorter processing times, improved data accuracy, and reduced operational expenses. However, the effectiveness of these systems is still influenced by human resource readiness and inter-agency system integration. Therefore, digital export transformation has the potential to strengthen Indonesia's international trade competitiveness, although it requires further enhancement of user capabilities and cross-sector policy alignment.

Keywords: *Digital Export Systems, Efficiency, INSW, Logistics Costs, Smart Port.*

Abstrak

Penelitian ini bertujuan untuk menganalisis dampak penerapan sistem ekspor digital terhadap penurunan biaya logistik nasional di Indonesia. Meskipun volume ekspor Indonesia terus meningkat, biaya logistik nasional masih relatif tinggi, yang salah satunya disebabkan oleh proses administrasi dan koordinasi yang tidak efisien. Penerapan sistem digital seperti Indonesia National Single Window (INSW), Electronic Bill of Lading (e-BL), serta Terminal Operating System (TOS) pada pelabuhan bertujuan untuk meningkatkan transparansi, mempercepat proses layanan, dan mengurangi ketergantungan pada dokumen manual. Penelitian ini menggunakan pendekatan kualitatif deskriptif dengan teknik pengumpulan data melalui wawancara mendalam, observasi langsung di pelabuhan, dan analisis dokumen terkait proses ekspor. Hasil penelitian menunjukkan bahwa sistem ekspor digital berkontribusi pada pengurangan waktu proses, peningkatan akurasi data, dan efisiensi biaya operasional. Namun, efektivitas penerapannya masih dipengaruhi oleh kesiapan sumber daya manusia dan integrasi sistem antar lembaga. Dengan demikian, digitalisasi ekspor dinilai mampu mendukung peningkatan daya saing perdagangan internasional Indonesia, meskipun masih memerlukan penguatan kapasitas pengguna dan sinkronisasi kebijakan lintas sektor.

Kata Kunci: *Biaya Logistik, Efisiensi, INSW, Sistem Ekspor Digital, Smart Port.*

INTRODUCTION

Global trade has become increasingly competitive, requiring countries to ensure that their export processes are efficient, transparent, and cost-effective (Hiraide, 2022; Turgunpulatovich, 2022; and Salawu & Ghadiri, 2022). For Indonesia, exports play a crucial role in national economic growth (Lee & Fernando, 2021; Stievany & Jalunggono, 2022; Arifah & Kim, 2022; and Nopiana et al., 2022). However, despite increasing export volume, the country continues to face structural challenges in the logistics and export administration sectors.

One of the most critical issues is the relatively high national logistics cost, which hinders Indonesia's ability to compete effectively in international markets.

Indonesia's logistics cost is estimated to reach 23% of the Gross Domestic Product (GDP), which is considerably higher compared to many other trade-oriented countries (Mao et al., 2024; OECD, 2021; and Santoso, 2021). Such a high cost reflects inefficiencies that occur across the export chain from documentation and customs clearance to port management and inter-agency coordination. These inefficiencies directly impact exporters, particularly small and medium enterprises (SMEs), which often operate with limited financial margins (Forgione & Migliardo, 2023). Traditional export processes in Indonesia have long relied on manual and paper-based documentation systems (Norik, 2025; Sharma et al., 2024; and Tyagi & Khan, 2024). These manual procedures increase the risk of errors, document duplication, and inconsistencies (Shahbodaghi et al., 2024; Hammer et al., 2023; and Steinkamp et al., 2022). Moreover, fragmented coordination among government agencies and private stakeholders slows down the decision-making and verification process. As a result, exporters experience delays that lead to increased costs and longer shipment cycles. The lack of transparency is also a persistent issue in traditional systems. Without integrated data management, exporters often face difficulty tracking the progress of documents and shipments. This lack of visibility raises the potential for administrative bottlenecks, overlapping tasks, and opportunities for miscommunication (Adepoju et al., 2022; Igwe-Nmaju, 2024). It also reduces trust among stakeholders, including shipping lines, exporters, freight forwarders, and customs authorities.

To respond to these challenges, Indonesia has introduced and strengthened several digital export systems. One of the most prominent is the Indonesia National Single Window (INSW), a platform designed to streamline export and import licensing procedures by coordinating multiple ministries and agencies. The system digitally integrates processes that previously required physical document submissions and repeated verification. INSW has demonstrated measurable improvements. Since its implementation, the system has been able to reduce export-import clearance time by approximately 30%, significantly improving procedural efficiency. This reduction is particularly impactful for industries that operate under strict delivery schedules and rely on timely port operations.

In addition to INSW, Indonesia has promoted the use of Electronic Bill of Lading (e-BL) to replace traditional paper-based Bills of Lading. This digitalization ensures that documents are securely issued, transferred, and authenticated (Ren , 2023; Lazaretou, 2022). It reduces processing time and minimizes the risk of document loss or tampering, leading to increased security and reliability in the export supply chain. Meanwhile, ports are undergoing modernization through the development of Smart Port systems. For example, Tanjung Priok Port has implemented Terminal Operating Systems (TOS) and Internet of Things (IoT)-based container tracking, allowing real-time monitoring of container movement and yard management (Breskin & Pandey, 2021; Cil et al., 2022; and Safuan & Syafira, 2024). This technology has resulted in a 20% reduction in vessel idle time, increasing both space utilization and equipment efficiency.

Other countries provide valuable benchmarks. Singapore's PortNet, South Korea's uTradeHub, and the Netherlands' Portbase demonstrate the long-term benefits of fully integrated digital trade systems, such as near-total paperless documentation, predictive analytics, and real-time logistics coordination. These systems prove that digitalization contributes not only to efficiency but also to competitive advantage. Based on these developments, digital export systems are widely recognized as instruments capable of reducing logistics costs by streamlining workflows, minimizing manual labor dependence, and eliminating redundant administrative steps. Furthermore, digitalization enhances data accuracy, which is essential for compliance, risk control, and fast decision-making.

However, technological adoption alone does not guarantee success. The effectiveness of digital export systems is significantly influenced by human resource capability, including digital literacy, operational training, and willingness to adapt to new work environments (Nikou et al., 2022; Zhang & Chen, 2024; and Shatila et al., 2025). The successful implementation of digital export frameworks requires collaboration between government institutions, private logistics firms, port operators, and academic communities. Considering these conditions, it is essential to analyze how digital export systems influence logistics cost reduction at a national scale. Understanding the extent of this impact will help stakeholders particularly policymakers, port authorities, and exporters to maximize the benefits of digitalization. Therefore, this study examines The Impact of Digital Export Systems on Reducing National Logistics Costs, with the aim of providing strategic insights for improving Indonesia's export competitiveness.

Based on these considerations, this study is necessary to provide a deeper understanding of how digitalization contributes to export efficiency and national logistics cost reduction. Therefore, the objectives of this research are to: (1) analyze the role of digital export systems in reducing national logistics costs in Indonesia, (2) identify the key factors that influence the effectiveness of digital export system implementation, and (3) evaluate the challenges that arise in the adoption and operationalization of export digitalization. Accordingly, the findings of this study are expected to offer both conceptual and practical contributions for government institutions, logistics industry actors, and academic stakeholders in strengthening digital transformation within the international trade ecosystem.

METHOD

This research uses a qualitative descriptive approach. The purpose of this method is to describe and interpret the implementation of digital export systems and their impact on reducing logistics costs based on actual conditions in the field (Morgenstern et al., 2021; Stanley, 2023). A case study approach is applied to analyze practices occurring within selected export-related institutions such as ports, customs offices, and freight forwarding companies. The qualitative approach is appropriate because the research focuses on understanding processes, experiences, and stakeholder perspectives, rather than testing statistical correlations.

The study focused at Tanjung Priok Port, Jakarta, as one of Indonesia's main international export gateways that has implemented Smart Port systems, Terminal Operating Systems (TOS), and INSW integration. The following are the research subjects:

Table 1. Research subject

Stakeholder Group	Position / Role	Selection Technique
Port Authority	Terminal operations & digital system supervisors	Purposive Sampling
Customs Office	Export clearance officers	Purposive Sampling
Freight Forwarder / Export Company	Export document handlers	Purposive Sampling
Logistics Practitioners	Staff familiar with INSW/e-BL	Snowball Sampling

The data in this study are collected through three primary techniques. First, in-depth interviews are conducted with selected informants to obtain insights into the implementation, benefits, challenges, and perceived cost efficiencies of digital export systems. Second, observations are carried out at the port and export documentation units to examine actual workflow practices, system utilization, and the interactions among stakeholders involved in the export process. Third, document analysis is performed by reviewing export process guidelines,

INSW usage records, operational procedures, relevant digital export regulations, and internal company documents that support export activities.

DISCUSSION

The findings of this study indicate that the implementation of digital export systems has a direct and measurable impact on improving export efficiency and reducing national logistics costs. Indonesia's logistics costs, recorded at approximately 23% of the Gross Domestic Product (GDP), are significantly higher than the global average and reflect systemic inefficiencies in documentation workflows, inter-agency coordination, and port operational management (Antara News, 2023; and PwC Indonesia, 2023). The introduction of digitalization initiatives aims to address these issues by integrating export procedures into unified digital platforms that reduce redundancy and simplify administrative processes.

In line with the first research objective, which focuses on analyzing the role of digital export systems in reducing logistics costs, this study confirms that systems such as the Indonesia National Single Window (INSW), Electronic Bill of Lading (e-BL), and Smart Port digitalization contribute substantially to improving efficiency. The INSW system, which integrates 18 ministries and government agencies, has reduced export–import processing time by an average of 30%, thereby lowering dwelling time and minimizing administrative uncertainty. Likewise, the shift to e-BL has improved document traceability and security, achieving 95% data accuracy, reducing the likelihood of disputes, and accelerating document verification (Pu & Lam, 2021). Furthermore, digitalization at Tanjung Priok Port through Terminal Operating System (TOS) and IoT-based container tracking has resulted in a 20% reduction in vessel idle time, enabling faster turnaround and ultimately lowering operational costs. These findings affirm that digitization drives concrete cost-saving outcomes through time efficiency, transparency, and real-time operational visibility (Albalkhy, 2024; Egbumokei et al., 2024; Feikema, 2025).

Addressing the second research objective, this study identifies several key factors that determine the effectiveness of digital export system implementation. The most influential factor is the level of integration across platforms and institutions. When digital systems used by exporters, customs, and port authorities are seamlessly connected, data exchange becomes faster and more reliable, eliminating duplicated verification steps. Conversely, fragmented integration leads to repeated data entry and procedural delays. Another critical factor is the adaptability and competence of human resources. Skilled and digitally literate personnel are essential to maximizing the benefits of technological tools. Where users understand system functionality, workflows move efficiently; where digital literacy is weak, delays reappear despite advanced system availability. This underlines that technology alone does not produce efficiency its users do.

In alignment with the third research objective, this study also identifies persistent challenges that hinder the optimal adoption of digital export systems. The primary challenge lies in the uneven distribution of digital competence among stakeholders, particularly among small and medium-sized export enterprises that often lack access to training and system operation expertise. Additionally, inconsistencies in policy enforcement and procedural standardization across regions and agencies can reintroduce manual processes, causing gaps in workflow synchronization. For example, some ports may fully adopt digital clearance, while others still require physical verification, resulting in procedural fragmentation. These conditions reveal that regulatory alignment and cross-institutional coordination are just as vital as technological infrastructure.

Taken together, the findings clearly demonstrate that while digital export systems significantly contribute to logistics cost reduction, the magnitude of their effectiveness depends on three interconnected conditions: (1) the degree of system integration among institutions, (2)

the adaptability and capability of human resources operating the systems, and (3) the consistency of policy enforcement and standardization across agencies. Therefore, digitalization must be accompanied by capacity building, institutional alignment, and continuous policy refinement to ensure that the benefits of efficiency can be realized uniformly across the national export ecosystem.

Table 2. Summary of Research Findings

Nr.	Research Objective	Key Findings	Supporting Evidence	Implications
1	To analyze the role of digital export systems in reducing national logistics costs.	Digital export systems significantly enhance efficiency and reduce logistics costs.	a) INSW reduces clearance time by ~30%. b) e-BL improves document accuracy to ~95%. c) Smart Port (TOS + IoT) reduces vessel idle time by ~20%.	Time efficiency, transparency, and automation directly decrease handling, storage, and operational logistics expenses.
2	To identify key factors influencing the effectiveness of digital export systems.	System effectiveness depends on system integration, human resource readiness, and procedure standardization.	a) Inter-agency integration determines the smoothness of data flow. b) Digital literacy varies greatly among industry actors. c) Operational procedures are not yet fully standardized across ports.	Technology delivers optimal benefits only when supported by human capabilities and institutional alignment.
3	To evaluate challenges in the implementation of digital export systems.	Main challenges involve digital skill gaps, incomplete system integration, and inconsistent policy enforcement.	a) Many SMEs lack skilled personnel to operate digital platforms. b) Some process steps still rely on manual verification. c) Policy interpretation differs among regions and agencies.	Capacity building, platform integration improvement, and regulatory harmonization are required to achieve full efficiency benefits.

Generally, the findings of this study confirm that the digitalization of export systems contributes significantly to improving efficiency and reducing national logistics costs by accelerating administrative procedures, enhancing data accuracy, and optimizing port operational performance. However, as summarized in the table above, the effectiveness of these

systems is not uniform and depends on three interrelated conditions: the level of system integration across institutions, the preparedness and competence of human resources, and the consistency of policy enforcement and procedural standardization. When these elements operate in alignment, digital export systems are able to deliver substantial efficiency gains and cost reductions; conversely, when one or more of these elements are lacking, the benefits of digitalization tend to diminish and, in some cases, may even introduce new workflow bottlenecks. Thus, the implementation of digital export systems should not be viewed merely as a technological upgrade, but as a broader process of institutional transformation and capacity development that requires sustained coordination, commitment, and multi-stakeholder collaboration.

CONCLUSION

This study concludes that digital export systems play a significant role in reducing national logistics costs in Indonesia. The implementation of platforms such as the Indonesia National Single Window (INSW), Electronic Bill of Lading (e-BL), and Smart Port technologies has successfully shortened processing times, improved document accuracy, and enhanced port operational efficiency. These improvements directly contribute to cost reductions in handling, storage, and administrative processes, demonstrating that digitalization is a key driver of export efficiency and global trade competitiveness.

However, the effectiveness of these digital systems is not solely determined by the technology itself. The findings highlight that the degree of system integration across government agencies, port authorities, and private stakeholders is essential for ensuring seamless data exchange and eliminating redundant procedures. Additionally, the adaptability and competence of human resources significantly influence system performance, particularly in relation to digital literacy and operational proficiency. Inconsistent policy enforcement and procedural standardization across regions also pose challenges that can limit the full realization of digitalization benefits.

Based on these findings, three recommendations are proposed: first, efforts to strengthen cross-institutional integration should be prioritized to ensure interoperability and reduce administrative fragmentation; second, targeted capacity-building programs are needed to enhance digital skills among export practitioners, especially small and medium-sized enterprises; and third, the government should harmonize regulations and align operational standards across ports and customs offices to ensure consistent and sustainable digital export practices. By addressing these factors collectively, the benefits of digital export systems can be maximized, supporting Indonesia's long-term goal of enhancing its international trade performance and reducing national logistics costs.

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