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Analyzing the Implementation of the Inaportnet System for Enhancing Digital Port Services at Soekarno–Hatta Port Makassar

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ABSTRACT

The rapid digital transformation of maritime logistics has encouraged ports to adopt integrated information systems to improve efficiency, transparency, and service quality. However, despite the national implementation of port community systems in Indonesia, empirical evidence on how such systems operate at the port level and what factors influence their effectiveness remains limited. This study aimed to analyze the implementation of the Inaportnet system and to identify the supporting and inhibiting factors affecting digital service improvement at Soekarno–Hatta Port in Makassar. The study employed a qualitative descriptive research design. Data were collected from primary and secondary sources through structured interviews, observation, and documentation. The primary informants included port authority staff, a maritime transportation information system coordinator from the Ministry of Transportation, and a shipping agency representative. Data were analyzed using qualitative descriptive techniques and a SWOT framework to evaluate strengths, weaknesses, opportunities, and threats related to the system's implementation. The findings indicated that the Inaportnet system had been implemented relatively well and contributed to faster and more transparent port services, including document approval processes that could be completed within approximately 30 minutes after submission. The system also improved efficiency through single submission services, electronic data integration, and reduced administrative errors. However, several challenges remained, including occasional network downtime, technical dependence on central system management, and limited digital capabilities among operators of traditional shipping vessels. The study concludes that while Inaportnet significantly enhances digital port services, further improvements in human resource capacity, infrastructure reliability, and stakeholder digital literacy are essential to achieve fully integrated and sustainable maritime digital services.

1. Introduction

The rapid advancement of digital technology has significantly transformed global logistics and maritime transportation systems. Digitalization has become a key driver in improving operational efficiency, transparency, and competitiveness in port operations worldwide. Ports are increasingly adopting integrated digital platforms, such as Port Community Systems (PCS) and smart port technologies, to facilitate real-time data exchange among stakeholders and streamline complex administrative processes in maritime logistics. These systems enable coordination among shipping companies, port authorities, customs agencies, logistics providers, and other stakeholders involved in port operations. Consequently, digital transformation in ports has been widely recognized as an essential strategy to enhance port efficiency, reduce logistics costs, and support sustainable

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maritime trade (Jović et al., 2022; Zhang et al., 2024; Su, 2026).

The digitalization of port operations is closely associated with the concept of **smart ports**, which integrate information systems, automation technologies, and data-driven management to improve port performance and supply chain integration. Recent studies highlight that digital port ecosystems can significantly enhance operational efficiency by enabling electronic documentation, automated cargo handling, and real-time monitoring of port activities (Almeida, 2023;). Furthermore, digital technologies such as the Internet of Things (IoT), artificial intelligence, and blockchain are increasingly being integrated into maritime logistics systems to optimize port operations and reduce operational risks (Wahju, 2024).

Indonesia, as the world's largest archipelagic country, heavily relies on maritime transportation for domestic distribution and international trade. The maritime sector therefore plays a strategic role in supporting national economic development and strengthening connectivity among islands. Ports function as critical nodes within the national logistics network, facilitating the flow of goods and services across regions. However, Indonesia continues to face significant challenges related to logistics efficiency. High logistics costs—reaching approximately 24% of national GDP—indicate structural inefficiencies in the logistics and transportation system (Ritonga et al., 2021). One of the contributing factors is the fragmented administrative processes within port operations, which historically relied on manual documentation and lacked integrated information systems.

To address these challenges, the Indonesian government introduced the Inaportnet system, an integrated electronic platform designed to streamline port administration and improve service efficiency. Inaportnet enables electronic processing of ship clearance, cargo documentation, and port service requests through a centralized digital system. By integrating data from multiple agencies involved in port operations, the system aims to reduce bureaucratic complexity, accelerate service processes, and improve transparency in maritime logistics services (Ricardianto et al., 2022; Ariadi et al., 2021).

Several empirical studies have examined the implementation of the Inaportnet system in Indonesian ports. Research shows that the adoption of Inaportnet has contributed to improving ship clearance processes, reducing administrative delays, and increasing service efficiency in port operations (Setiawan et al., 2023). In addition, the system helps integrate operational data among port stakeholders and supports the digital transformation of maritime logistics services (Nasution et al., 2024).

Despite these advantages, several studies also highlight persistent challenges in the implementation of digital port systems in Indonesia. These challenges include limited system interoperability among government agencies, inconsistent regulatory frameworks, insufficient digital infrastructure, and low levels of digital literacy among system users (Dewi, 2023; Utami et al., 2024). In some cases, technical issues such as network disruptions and system errors can still hinder the efficiency of digital port services, particularly in feeder ports or regions with limited technological capacity.

In addition, digital transformation in port environments involves complex interactions between technological infrastructure, institutional governance, and human resource capabilities. Ports are socio-technical systems where digital innovations must be integrated with organizational processes and stakeholder coordination. Therefore, successful digital transformation requires not only technological development but also institutional readiness, regulatory alignment, and stakeholder collaboration (Almeida, 2023; Zhang et al., 2024).

At the regional level, the Soekarno–Hatta Port in Makassar plays a strategic role in supporting maritime connectivity and logistics

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distribution in Eastern Indonesia. As one of the main gateway ports in the region, the port handles significant volumes of cargo and passenger traffic. To enhance operational efficiency and service quality, the port has implemented the Inaportnet system as part of the national port digitalization initiative. The implementation of this system is expected to improve coordination among stakeholders, accelerate vessel clearance procedures, and increase transparency in port services.

However, despite the increasing adoption of digital port systems, empirical studies focusing on the operational effectiveness of Inaportnet at the port level—particularly in Eastern Indonesia—remain relatively limited. Most previous research focuses on technical system implementation or general policy evaluation, while fewer studies examine how digital port systems function in practice within specific operational contexts. Moreover, the interaction between technological systems, human resource readiness, and institutional coordination in the implementation of digital port services still requires further investigation.

Based on this research gap, this study aims to analyze the implementation of the Inaportnet system at Soekarno–Hatta Port Makassar and identify the factors that support or hinder the effectiveness of digital port services. Specifically, this research seeks to:

1. Analyze the implementation of the Inaportnet system in improving digitalized services at Soekarno–Hatta Port Makassar.
2. Identify the supporting and inhibiting factors influencing the effectiveness of the Inaportnet system in port service operations.

This study contributes to the growing body of literature on maritime logistics digitalization by providing empirical insights into the implementation of digital port systems in developing maritime economies. From a practical perspective, the findings offer valuable recommendations for policymakers, port authorities, and logistics stakeholders in improving the effectiveness of digital maritime services and supporting the development of integrated national logistics systems.

2. Literature Review

2.1 Digital Transformation in Port Operations

Digital transformation has become a fundamental driver of efficiency and innovation in maritime logistics and port management. The rapid advancement of information and communication technologies has encouraged ports around the world to adopt integrated digital platforms to streamline administrative processes, improve coordination among stakeholders, and enhance the overall efficiency of port operations (Zhang et al., 2022; Heilig & Voß, 2023). Digital port systems allow stakeholders such as port authorities, shipping companies, customs agencies, and logistics providers to exchange information electronically and in real time, thereby reducing bureaucratic delays and operational inefficiencies.

In the maritime logistics sector, digitalization is closely associated with the concept of **smart ports**, which refers to the application of advanced digital technologies to enhance operational performance and sustainability in port ecosystems. Smart ports utilize technologies such as the Internet of Things (IoT), big data analytics, and cloud-based information systems to optimize port services and support efficient decision-making processes (Molavi et al., 2021). The integration of these technologies enables ports to improve cargo handling efficiency, vessel traffic management, and logistics coordination across supply chains (López-Bermúdez et al., 2023).

Furthermore, digital port platforms play a crucial role in facilitating seamless data exchange among stakeholders involved in maritime logistics operations. Through integrated digital systems, ports can minimize manual documentation processes, reduce administrative errors, and enhance transparency in port services. As a result, digital transformation has become a strategic priority for many countries seeking to

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strengthen their maritime competitiveness and improve logistics efficiency (Aydogdu & Aksoy, 2024).

2.2 The Inaportnet System and Port Service Digitalization

In Indonesia, the digitalization of port services has been implemented through the Inaportnet system, an integrated electronic platform developed by the Ministry of Transportation to facilitate port administration services. The system functions as a digital portal that integrates multiple port-related services, including ship clearance procedures, cargo documentation, and coordination among stakeholders involved in port operations.

The implementation of Inaportnet aims to improve the efficiency of port services by enabling electronic submission and processing of documents related to vessel arrivals, departures, and cargo handling activities. By integrating data from different agencies within a single platform, the system reduces administrative complexity and shortens processing time for port services (Ricardianto et al., 2022). In addition, the system supports transparency and accountability in port administration by allowing stakeholders to monitor the status of their service requests in real time.

The Inaportnet system also supports the development of Indonesia's National Logistics Ecosystem (NLE) initiative, which seeks to integrate logistics services across government agencies and private sector actors. Through this integration, the government aims to improve logistics efficiency, reduce transportation costs, and strengthen the competitiveness of Indonesia's maritime sector. Despite these potential benefits, the successful implementation of Inaportnet depends on various factors, including technological infrastructure, stakeholder readiness, and institutional coordination.

2.3 Theoretical Framework for Digital System Implementation

The implementation of digital platforms in port services can be analyzed using several theoretical perspectives in information systems and technology adoption research. One widely used framework is the Information Systems Success Model developed by DeLone and McLean. According to this model, the success of an information system is determined by several key dimensions, including system quality, information quality, service quality, system usage, user satisfaction, and net benefits (DeLone & McLean, 2003). In the context of digital port systems, these factors influence how effectively stakeholders utilize the system and how the system contributes to improving operational performance.

Another relevant framework is the Technology–Organization–Environment (TOE) framework, which explains how technological adoption within organizations is influenced by technological readiness, organizational capacity, and external environmental pressures (Tornatzky & Fleischer, 1990). In the context of port digitalization, technological factors include system infrastructure and reliability, organizational factors involve human resource capabilities and management support, while environmental factors relate to regulatory frameworks and stakeholder collaboration (Hossain et al., 2023).

These theoretical perspectives provide a useful foundation for understanding the factors that influence the implementation of digital port systems. By examining technological, organizational, and environmental dimensions, researchers can better analyze the opportunities and challenges associated with the adoption of digital platforms in maritime logistics services.

2.4 Previous Empirical Studies

Previous studies have examined the role of digital technologies in improving port efficiency and logistics performance. Research indicates that the adoption of integrated digital platforms can significantly enhance port

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service efficiency by reducing administrative processing time, improving information transparency, and strengthening coordination among port stakeholders (Heilig & Voß, 2023).

Several studies have specifically investigated the implementation of the Inaportnet system in Indonesian ports. For example, research by Ricardianto et al. (2022) found that the adoption of Inaportnet contributed to improved vessel service performance and reduced delays in port administrative processes. Similarly, Ariadi et al. (2021) reported that the system improved coordination among port stakeholders by enabling electronic data exchange and centralized information management.

However, other studies have identified several challenges in the implementation of digital port systems. Dewi (2023) noted that technical issues such as network instability and system errors could still affect the reliability of digital port services. In addition, limited digital literacy among some system users may hinder the effective utilization of the platform. Utami et al. (2024) also highlighted the importance of institutional coordination and regulatory alignment in ensuring the successful implementation of integrated digital logistics systems.

Although existing studies have explored the implementation of digital port systems in Indonesia, empirical research focusing on the operational effectiveness of Inaportnet at the port level particularly in Eastern Indonesia remains relatively limited. This gap highlights the need for further research to examine how digital port systems function in practice and what factors influence their effectiveness in improving port services.

3. Research Methods

The research methodology section explains how the study was designed and conducted to answer the research questions and achieve the research objectives. This study focuses on analyzing the implementation of the Inaportnet system and identifying the supporting and inhibiting factors influencing digital service delivery at Soekarno–Hatta Port in Makassar. A qualitative methodological approach was adopted to obtain an in-depth understanding of how the digital port system operates in practice and how stakeholders experience its implementation. The methodological design ensures transparency, analytical rigor, and alignment between the research objectives, data collection procedures, and analytical techniques used in the study.

3.1 Research Design

This study employed a qualitative descriptive research design to explore the implementation of the Inaportnet system in improving digital services at Soekarno–Hatta Port in Makassar. Qualitative research is particularly suitable for investigating complex social and organizational phenomena where contextual understanding and stakeholder perspectives are essential.

The qualitative approach allows researchers to capture detailed insights regarding system implementation, operational processes, and stakeholder interactions within the port environment. Through this approach, the study examines how digital port services are implemented, how stakeholders interact with the system, and what challenges or opportunities emerge during the implementation process.

3.2 Research Context and Setting

The research was conducted at Soekarno–Hatta Port in Makassar, one of the main maritime gateways in Eastern Indonesia. The port plays a strategic role in national logistics distribution and maritime transportation activities. It is categorized as a primary port by the Indonesian government and serves both passenger and cargo transportation activities.

The selection of Soekarno–Hatta Port as the research setting is based on its strategic position as one of the first ports in Indonesia to implement the Inaportnet system. Since its implementation in 2016, the port has been actively involved in the national digitalization

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program initiated by the Ministry of Transportation to improve the efficiency, transparency, and reliability of port services. Therefore, the port provides an appropriate context for examining the practical implementation of digital port systems.

3.3 Research Participants

The participants in this study were selected using a purposive sampling technique, which is commonly applied in qualitative research to identify individuals who possess relevant knowledge and experience regarding the research topic.

Three key informants were involved in the study:

1. A Field Supervisor from the Makassar Port Authority, who is responsible for supervising port operational services.
2. A Sub-Coordinator of Maritime Transportation Information Systems from the Directorate of Sea Transportation, Ministry of Transportation, who has expertise in the implementation of the Inaportnet system.
3. A Shipping Agency Representative from Pertamina Trans Kontinental Makassar Branch, who represents port service users and interacts directly with the Inaportnet system.

These participants were selected because they represent different stakeholder perspectives within the port ecosystem, including regulators, system operators, and service users.

3.4 Data Sources and Data Collection

This study utilized both primary and secondary data sources. Primary data were obtained through structured interviews, direct observation, and documentation. Structured interviews were conducted with the selected informants to obtain in-depth insights into the implementation of the Inaportnet system and the operational challenges encountered in digital port services. Direct observation was carried out to examine the operational processes and digital service activities within the port environment. Documentation analysis included reviewing official reports, regulatory documents, operational guidelines, and previous research related to port digitalization and the Inaportnet system.

Secondary data were obtained from academic publications, government regulations, statistical reports, and relevant institutional documents. The combination of multiple data sources enhances the credibility and comprehensiveness of the research findings.

The data collection process was conducted between March and July 2023.

3.5 Measurement of Variables and Research Instruments

In qualitative research, the primary research instrument is the researcher, supported by structured data collection tools. In this study, several instruments were used to facilitate systematic data collection, including interview guidelines, observation checklists, and documentation templates.

The interview guidelines were designed to capture key aspects related to the implementation of the Inaportnet system, including system functionality, service efficiency, stakeholder coordination, infrastructure readiness, and operational challenges. Observation instruments were used to record real-time operational activities related to digital service processes within the port environment.

The conceptual dimensions analyzed in this study were adapted from information systems implementation literature and strategic management frameworks, including technological infrastructure, human resource capability, operational procedures, and stakeholder collaboration.

3.6 Data Analysis Techniques

The collected data were analyzed using qualitative descriptive analysis combined with SWOT analysis.

The qualitative analysis process followed three stages commonly applied in qualitative research:

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1. Data reduction, which involves selecting, organizing, and simplifying the collected data to focus on relevant information related to the research objectives.
2. Data display, which involves presenting the organized data in narrative or thematic form to facilitate interpretation.
3. Conclusion drawing and verification, which involves interpreting the findings and verifying them through cross-checking with multiple data sources.

In addition, SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) was applied to evaluate the internal and external factors influencing the implementation of the Inaportnet system. The SWOT framework used in this study was adapted from the strategic analysis model proposed by David (1993).

This analytical approach enables a comprehensive assessment of the strategic position of the Inaportnet system and identifies potential strategies for improving digital port services.

3.7 Validity, Reliability, and Trustworthiness

To ensure the credibility and trustworthiness of the research findings, several validation strategies were employed. First, data triangulation was applied by comparing information obtained from different sources, including interviews, observations, and documentation. Second, source triangulation was conducted by collecting perspectives from different stakeholders involved in port operations. Third, member checking was used to verify the accuracy of the information obtained from participants.

These procedures help enhance the credibility, dependability, and confirmability of the qualitative research findings.

3.8 Ethical Considerations

Ethical considerations were carefully addressed throughout the research process. All participants were informed about the purpose of the study prior to the interviews, and their participation was voluntary. To protect participant confidentiality, informants were identified using initial codes rather than their full names. All data collected were used solely for academic research purposes and were stored securely to ensure confidentiality and data protection.

3.9 Research Procedure

The research process was conducted through several stages:

1. Research planning, including literature review and formulation of research questions.
2. Field preparation, including the development of interview guidelines and research instruments.
3. Data collection, involving interviews, observations, and documentation analysis conducted at Soekarno–Hatta Port Makassar.
4. Data analysis, including qualitative descriptive analysis and SWOT analysis.
5. Interpretation of findings, focusing on identifying key insights regarding the implementation of the Inaportnet system and its impact on digital port services.

3.10 Methodological Limitations

This study has several methodological limitations. First, the research focuses on a single port case study, which may limit the generalizability of the findings to other port environments. Second, the number of research participants is relatively limited due to the qualitative nature of the study. However, the study provides valuable contextual insights into the implementation of digital port systems in Indonesia and contributes to the broader understanding of maritime logistics digitalization in developing economies.

4. Results and Discussion

This section reports and discusses the empirical findings of the study in a structured and transparent manner. The Results subsection presents the outcomes of the data analysis objectively, while the Discussion subsection interprets the findings in relation to

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theory and previous studies. The findings provide insights into the implementation of the Inaportnet system in improving digital services at Soekarno–Hatta Port Makassar and identify supporting and inhibiting factors affecting its effectiveness.

4.1 Research Results

Sample Description and Descriptive Statistics

The research was conducted at Soekarno–Hatta Port Makassar, one of the largest maritime gateways in Eastern Indonesia. The port operates under **PT** Pelabuhan Indonesia (Persero) and serves as a major hub for passenger and cargo transportation in the region. It is categorized as a primary-class port due to its high volume of maritime activities and strategic role in national logistics distribution.

The research involved three key informants representing different stakeholders within the port ecosystem. These informants were selected using purposive sampling based on their experience and involvement in the Inaportnet system implementation.

Table 1. Research Informants and Institutional Roles

No	Informant Code	Position	Institution
1	AK	Sub-Coordinator of Maritime Transportation Information Systems	Ministry of Transportation
2	HR	Port Authority Staff	Makassar Port Authority
3	AG	Shipping Agency Representative	Pertamina Trans Kontinental

Source: Research Data (2023)

The diversity of participants provides multiple perspectives regarding the implementation of the Inaportnet system, including regulatory authorities, system operators, and service users.

Data Quality and Preliminary Analysis

To ensure the credibility and reliability of the qualitative findings, several validation procedures were implemented. These included data triangulation, source triangulation, and document verification. Information obtained from interviews was compared with observations and official documents related to port operations and Inaportnet regulations.

The triangulation process confirmed the consistency of information regarding operational procedures, system performance, and the challenges experienced by stakeholders in utilizing the Inaportnet platform.

Main Analytical Results

The analysis shows that the implementation of the Inaportnet system at Soekarno–Hatta Port Makassar has generally been effective in improving digital port services. The system has been implemented since 2016, making Makassar one of the first ports in Indonesia to adopt the digital port service platform.

The Inaportnet system facilitates electronic data exchange among multiple port stakeholders, including port authorities, shipping companies, customs agencies, and logistics operators. Through this platform, administrative processes such as vessel clearance, cargo documentation, and operational coordination can be conducted digitally.

Operational Flow of the Inaportnet System

The operational workflow of Inaportnet integrates several administrative processes related to vessel arrivals and departures.

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Figure 1. Operational Workflow of the Inaportnet System

The system enables shipping companies to submit documentation electronically before vessel arrival, allowing relevant authorities to review and approve documents in parallel.

Service Efficiency Improvements

One of the key findings indicates that the Inaportnet system significantly reduces service processing time. The approval of ship-related documentation can be completed within approximately 30 minutes after document submission, provided that all requirements are fulfilled. This represents a significant improvement compared to manual procedures, which previously required two to three days for document processing.

SWOT Analysis Results

To evaluate the strategic position of the Inaportnet system, the study applied SWOT analysis based on the framework proposed by David (1993).

Table 2. SWOT Analysis of Inaportnet Implementation

Internal Factors	Description
Strengths	Transparency in service processes; faster service approval; single submission system; real-time monitoring; integration of electronic data
Weaknesses	Occasional system downtime; limited number of IT-skilled personnel; dependency on central system management
Opportunities	ASEAN Single Window integration; national logistics ecosystem program; telecommunications infrastructure support
Threats	Resistance to digital transition; internet security risks; varying digital literacy among service users

Source: Research Data (2023)

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Key Findings

The study identifies several important findings regarding the implementation of the Inaportnet system:

1. The Inaportnet system significantly improves the efficiency and transparency of port administrative services.
2. The digital platform reduces service processing time and minimizes administrative errors.
3. Human resource capacity and digital literacy remain important challenges, particularly among operators of traditional shipping vessels.
4. System reliability depends heavily on network stability and central system infrastructure.
5. Stakeholder collaboration plays a crucial role in ensuring effective implementation of the digital port system.

4.2 Research Discussion

Interpretation of Key Findings

The findings indicate that the implementation of the Inaportnet system has contributed significantly to improving the efficiency and transparency of port services at Soekarno–Hatta Port Makassar. The reduction in administrative processing time demonstrates the effectiveness of digital platforms in streamlining maritime logistics operations.

The system allows stakeholders to submit and verify documents electronically, reducing bureaucratic procedures and minimizing the need for face-to-face interactions between service providers and users.

Comparison with Previous Studies

The findings of this study are consistent with previous research examining the impact of digital port systems on service efficiency. Studies by Andromeda et al. (2020) and Malisan and Tresnawati (2019) reported that the implementation of the Inaportnet system improved operational efficiency and reduced administrative delays in Indonesian ports.

Similarly, research by Anggoro and Susanti (2022) emphasized the importance of human resource readiness and infrastructure support in ensuring successful implementation of digital port platforms.

However, this study also identifies persistent challenges related to digital literacy and system reliability, which have been highlighted in previous research as critical barriers to digital transformation in maritime logistics.

Theoretical Contributions

This study contributes to the literature on maritime digitalization and port information systems by providing empirical evidence on the implementation of digital port services in a developing country context. The findings support theoretical perspectives emphasizing the role of technological infrastructure, organizational readiness, and stakeholder collaboration in the adoption of digital platforms.

The results also reinforce the relevance of information systems implementation frameworks in analyzing digital transformation within complex institutional environments such as port ecosystems.

Practical and Policy Implications

The findings provide several practical implications for policymakers and port authorities:

1. Capacity building programs should be implemented to improve digital literacy among port stakeholders, particularly operators of traditional shipping vessels.
2. Investment in reliable network infrastructure is necessary to reduce system downtime and ensure uninterrupted digital services.
3. Continuous system evaluation and technological upgrades should be conducted to maintain system reliability and adapt to evolving operational requirements.
4. Strengthening stakeholder collaboration is essential to ensure the effective integration of digital logistics services.

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These measures can enhance the effectiveness of digital port systems and contribute to the development of a more efficient national logistics ecosystem.

Integration with the Research Gap

This study addresses the research gap related to empirical analysis of digital port system implementation at the operational level, particularly in Eastern Indonesia. While previous studies have discussed Inaportnet conceptually or at the national level, this research provides detailed insights into its practical implementation at a major regional port.

The findings therefore contribute to a better understanding of how digital port systems operate in practice and what factors influence their effectiveness.

Acknowledgement of Study Limitations

Despite its contributions, this study has several limitations. First, the research focuses on a single port case study, which may limit the generalizability of the findings to other ports in Indonesia. Second, the number of research participants is relatively limited due to the qualitative research design.

Future studies may expand the research scope by examining multiple ports or applying quantitative methods to evaluate the performance impact of digital port systems across different regions.

5. Conclusion

The conclusion section synthesizes the main findings of the study and highlights their significance in relation to the research objectives. This study aimed to analyze the implementation of the Inaportnet system in improving digital port services at Soekarno–Hatta Port Makassar and to identify the supporting and inhibiting factors affecting its effectiveness. Based on the qualitative analysis and SWOT evaluation, the study demonstrates that the implementation of the Inaportnet system has contributed significantly to improving the efficiency, transparency, and coordination of port administrative services. The digital platform enables stakeholders to process documentation electronically, thereby reducing administrative delays and enhancing the effectiveness of maritime logistics operations. The findings confirm that digital port systems can play a strategic role in supporting the modernization of port services and strengthening the national logistics ecosystem.

5.1 Summary of Key Findings

This study identifies several key findings regarding the implementation of the Inaportnet system at Soekarno–Hatta Port Makassar. First, the system has significantly improved the efficiency of port administrative services by enabling electronic submission and processing of vessel and cargo documentation. The digital platform reduces processing time compared to manual procedures and improves service transparency for port stakeholders.

Second, the system facilitates better coordination among port authorities, shipping companies, and logistics service providers through integrated data exchange. This integration contributes to improved communication and reduces bureaucratic complexity in port service processes.

Third, despite these benefits, several operational challenges remain, including occasional system downtime, limited digital literacy among certain stakeholders, and dependency on network infrastructure. These factors may affect the reliability and optimal utilization of the system. Overall, the findings indicate that the Inaportnet system has had a positive impact on digital port services, although continuous improvements are necessary to maximize its effectiveness.

5.2 Theoretical Contributions

This study contributes to the academic literature on maritime logistics digitalization and information systems implementation. The findings provide empirical evidence supporting theoretical perspectives that emphasize the role of technological infrastructure,

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organizational readiness, and stakeholder collaboration in the successful adoption of digital systems.

By examining the implementation of the Inaportnet system within the operational context of a major Indonesian port, this research extends existing studies on digital port platforms and port community systems in developing economies. The study also demonstrates the relevance of integrating qualitative analysis with strategic evaluation tools such as SWOT analysis to understand the multidimensional factors influencing digital transformation in port services. Therefore, the research contributes to bridging the gap between conceptual discussions on port digitalization and empirical insights from real-world implementation contexts.

5.3 Practical and Policy Implications

The findings of this study provide several practical implications for policymakers, port authorities, and maritime logistics stakeholders. First, continuous investment in digital infrastructure and system reliability is essential to ensure the stability and effectiveness of the Inaportnet platform. Reliable network connectivity and system maintenance are necessary to minimize operational disruptions.

Second, capacity-building programs should be implemented to improve digital literacy among port service users, particularly operators of traditional shipping vessels who may face challenges in adapting to digital platforms. Training programs and technical assistance can help stakeholders utilize the system more effectively.

Third, strengthening coordination among government agencies and private sector stakeholders is important to ensure seamless integration of digital logistics services. Policies supporting interoperability between Inaportnet and other national logistics platforms, such as the National Logistics Ecosystem, may further enhance the efficiency of maritime logistics operations in Indonesia.

5.4 Limitations of the Study

This study has several limitations that should be acknowledged when interpreting the findings. First, the research focuses on a single case study at Soekarno–Hatta Port Makassar, which may limit the generalizability of the results to other ports with different operational characteristics or technological infrastructures.

Second, the study relies on qualitative data obtained from a limited number of informants. Although the selected participants represent key stakeholders within the port ecosystem, a broader range of participants may provide additional perspectives regarding the implementation of the Inaportnet system.

These limitations suggest that the findings should be interpreted primarily as contextual insights into the implementation of digital port systems rather than as universally generalizable conclusions.

5.5 Directions for Future Research

Future research may expand this study in several ways. First, comparative studies involving multiple ports in different regions of Indonesia could provide a broader understanding of the effectiveness of the Inaportnet system across diverse operational contexts.

Second, future studies may apply quantitative methods to measure the impact of digital port systems on operational performance indicators such as vessel turnaround time, logistics costs, and service efficiency.

Third, researchers may explore the integration of digital port platforms with emerging technologies such as blockchain, artificial intelligence, and big data analytics to further enhance transparency and efficiency in maritime logistics operations.

By addressing these areas, future research can provide deeper insights into the evolving role of digital technologies in transforming port management and maritime logistics systems.

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