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Digital Innovation in Port Service Governance: Implementation of Indonesia Shipping Agencies Association Policy in Southeast Sulawesi

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ABSTRACT

Digital port governance innovation in archipelagic regions frequently faces challenges of institutional fragmentation and infrastructure gaps, meaning performance evaluations must extend beyond narrow economic metrics. This descriptive qualitative study aims to analyze the implementation of the Indonesia Shipping Agencies Association (ISAA) policy in supporting port service digitalization in Southeast Sulawesi, identify policy implementation challenges, and examine the role of digital governance in improving service performance utilizing a Collaborative Digital Port Governance Framework. Data were gathered through in-depth interviews with eleven informants representing service providers, service users, and socio-ecological stakeholders, alongside field observations and document analyses of performance records from 2022–2024. The findings reveal that Inaportnet integration successfully reduced administrative processing times from hours to minutes and drove a 24.5% transaction volume growth by 2024. Crucially, alongside logistical acceleration, digital transparency enhances governance functions and ecological enforcement by mitigating carbon footprints through minimized vessel idling and enabling trace-backed maritime waste monitoring. However, network instability, physical facility constraints, and uneven digital literacy remain primary obstacles in policy implementation. This study recommends integrating real-time carbon footprint tracking modules into the digital platform, enforcing pre-arrival digital logging for ship-generated waste management, and expanding multi-sectoral coordination to include environmental authorities to secure long-term socio-ecological resilience.

A. INTRODUCTION

The development of digital technology has become a key driver in the transformation of public service governance. Digital innovation is not only interpreted as the adoption of information systems or electronic platforms but also includes fundamental changes in the pattern of interaction between government and society and between government institutions. Digital transformation represents a structural shift in public service delivery that reshapes organizational processes and governance arrangements (Sabarofek et al., 2025). In this context, digital governance has a close relationship with the efficiency of public services, because through data integration, process automation and the reduction of vertical bureaucracy, services can be made faster, more transparent and accountable. However, the success of these innovations is highly dependent on proper policy implementation, so a normative foundation is needed that ensures alignment between the strategic vision of digitalization and operational execution in the field.

In the contemporary maritime sector, digital governance must evolve beyond the traditional paradigm of administrative acceleration and bureaucratic reduction. While process automation significantly lowers transactional friction, modern maritime governance increasingly demands that digital innovation intersects with environmental sustainability. In this regard, port digitalization should be contextualized within the broader framework of the Blue Economy, which emphasizes the sustainable use of ocean resources for economic growth while preserving the health of marine and coastal ecosystems (Bennett et al., 2019; World Bank, 2017). Consequently, the conceptualization of "innovation" in port services can no longer be limited to electronic document processing or automated logistics. Instead, it must be expanded to encompass vital environmental governance functions, such as digital emissions monitoring, real-time marine pollution management, ecological footprint tracking, and the optimization of energy use during sustainable port operations (DEMİR et al., 2022; Emecen Kara, 2022). Integrating these ecological safeguards into digital frameworks ensures that maritime industries achieve long-term socio-ecological resilience alongside economic viability.

In Indonesia, the maritime sector has a strategic role in supporting connectivity and national economic growth, especially in archipelagic regions such as Southeast Sulawesi. The region has limited land accessibility, making the efficiency of port services a critical factor in regional development. It also emphasizes the urgency of digital transformation in the maritime sector, which involves many stakeholders and complex regulations.

As one of the key actors in the port service chain, the Indonesia Shipping Agencies Association (ISAA), a professional organization representing shipping agencies in Indonesia, plays an important role in encouraging the digitalization of ship agency services. As an official association of ship agents established by the Ministry of Law and Human Rights in 2017, ISAA is tasked with bridging port authorities, local governments, and ship operators in the delivery of port services. The focus on ISAA in this study is based on its strategic position in the port service chain, where the efficiency and transparency of the loading and unloading process is greatly influenced by the coordination and digital integration carried out by this association.

A number of studies have highlighted the relevance of digitalization in public governance. Digital governance has been shown to enhance transparency, accountability, and effectiveness (Gil-Garcia et al., 2018). Recent studies further argue that digital ecosystems can strengthen governance capacity and foster greater stakeholder integration and adaptive policymaking processes (Tresiana et al., 2024). Digital innovation in public service governance is also considered to strengthen operational efficiency while fostering citizen participation (Wardana & Prabawati, 2024). Other studies indicate that digitalization improves service efficiency and effectiveness, although it often encounters challenges such as infrastructure gaps and bureaucratic resistance (Afrilia et al., 2024); (Widianto, 2023). The principles of digital public service innovation emphasize transparency, participation, collaboration, and contextual intelligence (Bertot et al., 2016). At the global level, the integration of digital systems with e-government in Europe has been found to significantly improve data accuracy and service accessibility (Criste et al., 2024).

In the port sector, the frameworks of e-governance, smart governance, and interoperability governance have been widely used to analyze the relationship between technology adoption and service performance improvement (Akhter, 2025; Belmoukari et al., 2026). Integrating digital information systems has been shown to reduce vessel waiting times by up to 30% and significantly lower logistics costs (Safuan, 2023). In Spain, the implementation of digital frameworks was found to

streamline logistics and enhance stakeholder integration (Gómez Díaz et al., 2023), while an end-to-end evaluation approach has been emphasized as crucial for overcoming interoperability challenges (González-Cancelas et al., 2024). These findings underline that port digitalization can significantly enhance productivity and responsiveness in the maritime sector.

Although the literature generally supports the positive contribution of digital governance to public service performance, recent studies reveal an ongoing academic debate regarding its actual effectiveness. On one hand, digital transformation is considered capable of increasing efficiency, transparency, and accountability through automation and data integration (Criste et al., 2024; Gil-Garcia et al., 2018; Sain et al., 2025). On the other hand, several scholars argue that digitalization may also generate new governance challenges, including digital inequality, technological dependency, interoperability problems, and institutional resistance (Benga & Elhamma, 2024; Recanati, 2024). In the maritime sector, while digital port systems have been associated with reduced logistics costs and improved service responsiveness, concerns remain regarding uneven infrastructure readiness, organizational adaptation, and stakeholder capacity to fully utilize digital platforms (González-Cancelas et al., 2024; Margaretha et al., 2025). These competing perspectives indicate that the success of digital governance cannot be explained solely by technology adoption but must also consider institutional, organizational, and collaborative dimensions. These divergent findings suggest that the effectiveness of digital governance is highly context-dependent. While technology can facilitate administrative efficiency, its outcomes are often mediated by institutional capacity, stakeholder collaboration, regulatory support, and infrastructure availability. Therefore, understanding the contextual factors that shape digital governance outcomes remains an important area of inquiry.

Despite these competing perspectives, important gaps remain in the literature. Existing studies predominantly focus on digital governance implementation in metropolitan areas, technologically advanced ports, or developed countries. Consequently, limited attention has been paid to how digital governance operates in maritime regions characterized by archipelagic geography, institutional fragmentation, and unequal infrastructure readiness, particularly in eastern Indonesia. Furthermore, the role of professional associations as collaborative intermediary actors in facilitating digital transformation has received little scholarly attention, despite their strategic function in policy advocacy, operational standardization, and multi-stakeholder coordination (Irwan, 2020); (Silambi et al., 2022). This gap leaves unanswered questions regarding how digital innovation interacts with collaborative governance mechanisms under conditions of infrastructural constraints and complex inter-organizational relationships.

The novelty of this study lies in its attempt to formulate a Collaborative Digital Port Governance Framework based on empirical findings from the implementation of ISAA policies in Southeast Sulawesi ports. This study specifically examines how ISAA advances the digitalization of ship agency services through cross-stakeholder coordination, human resource capacity building, and regulatory advocacy in an archipelagic region characterized by geographical constraints and institutional complexity. The proposed framework argues that the effectiveness of digital governance is shaped by the interaction among digital technology integration, stakeholder coordination, institutional capacity, and infrastructure readiness. By emphasizing the role of professional associations as collaborative intermediary actors and the importance of collaborative institutional arrangements, this study extends existing digital governance literature beyond technology-centric explanations of digital transformation while linking digital innovation, collaborative governance, and port operational efficiency in developing maritime regions.

Therefore, this study not only examines the implementation of digital governance in port services but also seeks to explain how the interaction among technological innovation, stakeholder collaboration, institutional capacity, and infrastructure readiness shapes policy implementation outcomes. By integrating these dimensions, this research contributes to expanding the digital governance literature beyond a technology-centric perspective toward a more collaborative and institutional approach.

Accordingly, this study aims to analyze ISAA's policy implementation in promoting the digital transformation of ship agency services in Southeast Sulawesi ports and to examine how digital technology integration, stakeholder coordination, institutional capacity, and infrastructure readiness interact in shaping digital governance outcomes. Based on these findings, the study seeks to formulate a Collaborative Digital Port Governance Framework as a contextual model for digital transformation in developing maritime regions.

THEORETICAL FRAMEWORK

This study is grounded in three complementary theoretical perspectives: Digital Governance Theory, Policy Implementation Theory, and Collaborative Governance Theory. These theoretical foundations are integrated to explain how digital transformation policies are implemented within port governance systems and how institutional, technological, and collaborative factors influence service outcomes.

Digital Governance Theory emphasizes the utilization of information and communication technologies to improve efficiency, transparency, accountability, and accessibility in public administration (Gil-Garcia et al., 2018). Through digital platforms, government organizations can streamline administrative procedures, facilitate information sharing, and enhance service responsiveness. In the context of port governance, digital systems such as Inaportnet enable the integration of administrative processes among port authorities, shipping agencies, terminal operators, and other stakeholders. Consequently, digital governance is expected to reduce bureaucratic complexity and improve the effectiveness of public service delivery.

Policy Implementation Theory provides an analytical perspective for understanding how policies are translated into operational practices. This study adopts the implementation framework developed by Van Meter and Van Horn (1975), which emphasizes the importance of policy standards and objectives, resources, organizational characteristics, inter-organizational communication, implementer disposition, and environmental conditions in determining implementation outcomes. Although originally developed several decades ago, these dimensions remain highly relevant in contemporary studies of public policy implementation, particularly in the context of digital transformation, where institutional capacity, coordination mechanisms, and environmental readiness significantly influence implementation effectiveness.

In addition, Collaborative Governance Theory highlights the importance of cooperation among governmental institutions, private organizations, professional associations, and service users in addressing complex public sector challenges (Ansell & Gash, 2008). Digital transformation initiatives frequently involve multiple actors with diverse interests, resources, and responsibilities, making collaboration an essential requirement for successful policy implementation. Within collaborative governance arrangements, intermediary actors play an important role in facilitating communication, coordination, and collective problem-solving among stakeholders.

In the context of this study, the Indonesia Shipping Agencies Association (ISAA) is conceptualized as a collaborative intermediary actor that bridges government agencies, port operators, shipping companies, and service users. Beyond its operational role as a professional association, ISAA contributes to policy advocacy, knowledge dissemination, stakeholder coordination, and the facilitation of digital transformation initiatives within port service systems. This perspective enables a broader understanding of ISAA's role beyond technology adoption alone and highlights its contribution to collaborative governance processes.

Furthermore, analyzing port digital transformation in developing archipelagic waters requires strong alignment with overarching national policy frameworks and regional sustainability standards. In Indonesia, national maritime directives—such as Presidential Regulation No. 16/2017 on Indonesian Marine Policy—increasingly mandate a transition toward digitized eco-ports, aligning with ASEAN's regional maritime governance strategies that promote low-carbon logistics and sustainable shipping corridors (ASEAN Secretariat, 2025). Given the specific geopolitical and geographical position of Southeast Sulawesi, this study must be situated within the BIMP-EAGA (Brunei Darussalam-Indonesia-Malaysia-Philippines East ASEAN Growth Area) sub-regional context. Within the BIMP-EAGA Vision 2025, maritime connectivity, cross-border logistics efficiency, and sustainable maritime trade are designated as central economic development priorities (BIMP-EAGA, 2019). Port governance in this sub-region faces the dual challenge of accelerating outer-island economic integration while maintaining strict adherence to regional environmental protection agreements (Calado et al., 2024). Therefore, digital mechanisms led by shipping agency associations like ISAA do not operate in an institutional vacuum; they serve as critical infrastructure to fulfill both national green maritime targets and BIMP-EAGA's sub-regional socio-ecological standards.

Based on these theoretical perspectives, this study proposes a Collaborative Digital Port Governance Framework to explain the factors influencing digital transformation in port services. The framework assumes that the effectiveness of digital governance is shaped by the interaction of four key

dimensions: digital technology integration, stakeholder coordination, institutional capacity, and infrastructure readiness. Although conceptually distinct, these dimensions interact and jointly influence policy implementation effectiveness, which subsequently affects port service performance.

Digital technology integration refers to the adoption and utilization of digital platforms to support administrative processes and service delivery (Gil-Garcia et al., 2018; Kapesa, 2025). Stakeholder coordination reflects the degree of collaboration and communication among actors involved in port governance (Ansell & Gash, 2008; Li et al., 2025). Institutional capacity encompasses human resource competence, organizational readiness, leadership support, and managerial capability required to implement digital policies effectively (Ghilan, 2024; Van Meter & Van Horn, 1975). Infrastructure readiness includes internet connectivity, supporting facilities, and technological resources necessary for sustaining digital governance initiatives (Pratama et al., 2024; Putri & Tjenreng, 2025).

The framework further assumes that the combined influence of these four dimensions determines the effectiveness of policy implementation. Effective implementation subsequently contributes to improved port service performance, particularly in terms of efficiency, transparency, accessibility, and accountability. Therefore, successful digital governance in port services is understood not merely as the result of technology adoption, but as the outcome of interactions among technological, institutional, collaborative, and infrastructural factors.

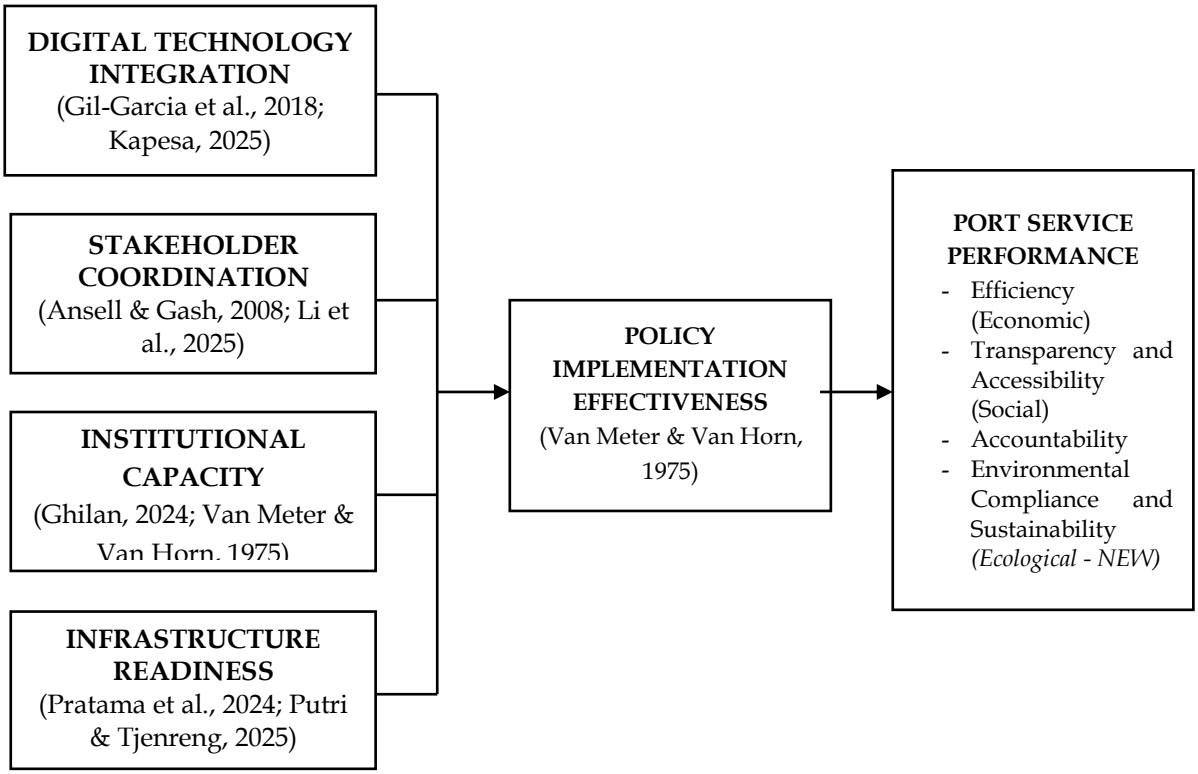

Figure 1. Collaborative Digital Port Governance Framework

Source: Authors' elaboration (2026).

Figure 1 illustrates the conceptual framework employed in this study. The framework integrates Digital Governance Theory, Policy Implementation Theory, and Collaborative Governance Theory to explain the effectiveness of digital transformation in port services. It proposes that digital technology integration, stakeholder coordination, institutional capacity, and infrastructure readiness function as interrelated determinants of policy implementation effectiveness. Effective implementation subsequently contributes to improved port service performance, which is multidimensionally evaluated through economic efficiency, social transparency and accessibility, administrative accountability, as well as ecological compliance and sustainability.

B. METHOD

This study employed a qualitative descriptive approach to analyze the implementation of the Indonesia Shipping Agencies Association (ISAA) policy in optimizing public services at local ports in Southeast Sulawesi. The analysis was guided by four analytical dimensions derived from the proposed Collaborative Digital Port Governance Framework: digital technology integration, stakeholder coordination, institutional capacity, and infrastructure readiness. The qualitative approach was chosen because it is appropriate for understanding the complex and contextual dynamics of digital policy implementation, as well as governance challenges that cannot be adequately captured through quantitative measurements alone. This approach enabled the researchers to explore the perceptions, experiences, and interactions of key actors involved in the digital transformation of port services.

Furthermore, in line with contemporary marine governance requirements, this qualitative design explicitly integrates a socio-ecological lens to evaluate how digital port transformations reverberate beyond commercial boundaries into coastal ecosystems ((Bennett et al., 2019). By capturing non-industrial perspectives alongside structural port actors, the methodology accounts for the interactive dynamics between technological deployment and local environmental governance, ensuring that the critical intersections of the Blue Economy framework are methodologically operationalized.

The research was conducted at the Southeast Sulawesi Regional Executive Board (Dewan Pimpinan Wilayah/DPW) of the Indonesia Shipping Agencies Association (ISAA) in Kendari City. The Regional Executive Board is the provincial-level organizational structure responsible for coordinating ISAA activities in Southeast Sulawesi. This location was selected because it serves as the primary coordination center for shipping agency activities and digital service implementation in the region, providing direct access to relevant stakeholders and operational processes within the port service ecosystem.

Informants were selected using purposive sampling based on their institutional roles, experience with digital port services, and active involvement in port governance and service utilization. To address the multi-stakeholder nature of port governance, this study involved both service providers and service users. The service provider group consisted of the Chairman of the Southeast Sulawesi Regional Executive Board of ISAA, the Head of the Kendari Harbourmaster and Port Authority Office (KSOP), and the Manager of PT Pelabuhan Indonesia (Pelindo) Kendari Branch. Meanwhile, the service user group included two shipping agents who are members of ISAA, one shipping operator, one logistics service user, and one representative of port service users.

To mitigate institutional bias toward purely economic and administrative actors, the informant pool was deliberately expanded to encapsulate socio-ecological and sustainability dimensions. This expansion involved conducting targeted discussions and retrieving programmatic insights from regional environmental authorities (Dinas Lingkungan Hidup), civil society organizations focused on coastal preservation, and local fishers operating near the Kendari port waters. Incorporating these ecological stakeholders ensures a comprehensive multi-sectoral baseline, crucial for capturing how maritime digitalization interfaces with local waste management, emission monitoring, and coastal community livelihoods (Emecen Kara, 2022). The inclusion of both groups allowed the study to capture perspectives from policy implementers as well as end-users of digital services, thereby providing a more comprehensive understanding of digital governance implementation.

Table 1. Distribution of Informants by Category and Role

No.	Informant Category	Position/Role	Number
1	Service Provider	Chairman of the Southeast Sulawesi Regional Executive Board of the Indonesia Shipping Agencies Association (ISAA)	1
2	Service Provider	Head of Kendari Harbourmaster and Port Authority Office (KSOP)	1
3	Service Provider	Manager of PT Pelabuhan Indonesia (Pelindo) Kendari Branch	1
4	Service User	Shipping Agents (ISAA Members)	2
5	Service User	Shipping Operator	1
6	Service User	Logistics Service User	1

No.	Informant Category	Position/Role	Number
7	Service User	Representative of Port Service Users	1
8	Socio-Ecological Stakeholder	Representative of Regional Environmental Authority (Dinas Lingkungan Hidup)	1
9	Socio-Ecological Stakeholder	Civil Society Organization (CSO) Leader for Coastal Preservation	1
10	Socio-Ecological Stakeholder	Local Fishermen Representative (Kendari Port Waters)	1
		Total	**11**

Source: Primary data processed by the researcher (2024).

Data collection was conducted through four techniques: in-depth interviews, direct observation, documentation study, and literature review. Semi-structured interviews were carried out with all eleven informants to obtain detailed information regarding policy implementation, institutional coordination, service effectiveness, and the socio-ecological dimensions of digital transformation. Service providers were interviewed to explore policy implementation, institutional coordination, and operational issues, while service users provided insights into service accessibility, efficiency, transparency, satisfaction, and obstacles encountered during the utilization of digital port services.

Direct observation was conducted to examine the actual implementation of digital services and interactions among stakeholders within the port environment. Documentation studies involved the review of regulations, institutional reports, policy archives, and administrative records related to port governance and digital service implementation. In addition, a literature review was undertaken to strengthen the theoretical foundation and provide broader contextual understanding of digital governance and public service innovation.

In addition to primary data obtained through interviews and observations, this study utilized secondary data derived from institutional documents, performance reports, port statistics, and administrative records related to the implementation of Inaportnet services. The secondary data included transaction volumes, service processing times, utilization rates of digital services, and annual performance indicators covering the period 2022–2024. The integration of primary and secondary data was intended to strengthen empirical evidence and facilitate triangulation of findings concerning the implementation of digital governance in port services.

Data analysis was conducted using the interactive model developed by Miles, Huberman, and Saldaña (2014), consisting of data reduction, data display, and conclusion drawing with verification (Miles et al., 2014). During the coding and categorization process, the four dimensions of the Collaborative Digital Port Governance Framework, digital technology integration, stakeholder coordination, institutional capacity, and infrastructure readiness were used as analytical categories to organize and interpret the empirical findings. Additional themes emerging from the data were incorporated inductively to capture contextual factors influencing policy implementation.

To ensure the credibility and trustworthiness of the findings, source triangulation and technique triangulation were employed. Source triangulation was conducted by comparing information obtained from service providers, service users, and supporting institutional documents. Technique triangulation involved cross-checking data collected through interviews, observations, and document analysis to verify consistency and enhance the validity of the findings.

In qualitative research, the researcher serves as the primary research instrument. Therefore, theoretical competence, communication skills, and sensitivity to social contexts were essential to ensure objective interpretation and comprehensive analysis of the data. Overall, this methodological design was developed to generate credible findings and provide practical recommendations for strengthening adaptive and inclusive digital governance strategies in island regions such as Southeast Sulawesi.

C. RESEARCH FINDING AND DISCUSSION

Implementation of ISAA Policy in Port Service Digitalization

The implementation of ISAA policies at ports in Southeast Sulawesi forms an important component of digital-based public service transformation. The primary objective is to improve service efficiency, administrative transparency, and stakeholder coordination through the utilization of integrated digital systems. As a professional association representing shipping agencies, ISAA plays a strategic role in facilitating collaboration among shipping agents, the Harbourmaster and Port Authority Office (KSOP), Port Operator Units (UPP), terminal operators, and port service users. Field

observations further indicate that digital platforms have become increasingly integrated into daily administrative operations, particularly in vessel documentation, service coordination, and operational monitoring activities.

1. Digital Technology Integration

The findings indicate that digital technology integration has become a key driver of administrative transformation within port services in Southeast Sulawesi. The implementation of Inaportnet has enabled the digitalization of vessel administration, document processing, service requests, and operational monitoring. Both service providers and service users acknowledged that digital platforms have simplified administrative procedures, accelerated service delivery, and improved access to information.

A shipping agent explained:

"*Previously, administrative submissions often required repeated visits to different offices. Since the implementation of Inaportnet, most processes can be completed online, reducing processing time and improving service predictability.*" (Interview, October 2024)

Similarly, a logistics service user stated:

"*The digital system makes service information easier to access and allows us to monitor document processing more transparently than before.*" (Interview, October 2024)

Field observations confirmed that administrative processes previously conducted manually are now largely performed through digital platforms, particularly for vessel arrival notifications, document verification, service requests, and operational monitoring. These changes have reduced dependence on paper-based administration and facilitated more efficient information management.

2. Secondary Evidence of Port Service Digitalization Performance

Secondary data obtained from institutional reports and field observations demonstrate substantial improvements in port administrative services following the implementation of Inaportnet. The integration of digital systems has transformed conventional paper-based procedures into electronic services that support real-time document submission, monitoring, and verification.

The implementation of Single Billing and the integration of Inaportnet with other digital applications have strengthened transparency and facilitated the administration of vessel services and Non-Tax State Revenue (Penerimaan Negara Bukan Pajak/PNBP). Furthermore, digital monitoring systems have enhanced supervision of shipping activities and improved the verification of operational documents and service transactions.

Table 2. Comparison of Port Administrative Services Before and After Inaportnet Implementation

Service Indicator	Before Digitalization	After Inaportnet Implementation
Service operation	Limited to office hours	Available 24 hours and 7 days a week
Vessel Arrival Notification (Pemberitahuan Kedatangan Kapal/PKK)	Approximately 2–4 hours	Approximately 1 minute
Sailing Approval Letter (Surat Persetujuan Berlayar/Surat Persetujuan Masuk – SPB/SPM)	Approximately 1–2 hours	Less than 1 minute
Vessel Berthing Notification (Pemberitahuan Penempatan Kapal/PPK)	Approximately 1–3 hours	Approximately 5 minutes
Document submission	Manual and paper-based	Electronic and paperless
Interaction between officers and users	Face-to-face procedures	Digital and zero-contact services
Service monitoring	Limited	Real-time monitoring

Source: Processed from KSOP Class II Kendari institutional reports and field observations (2024).

The comparison presented in Table 2 demonstrates substantial improvements in administrative efficiency following the implementation of Inaportnet. Several service procedures that previously required between one and four hours can now be completed within minutes. The transition from manual administration to electronic processing has enabled continuous service availability, reduced

direct physical interactions, and strengthened monitoring capabilities through real-time information systems.

Beyond structural and administrative acceleration, field observations and institutional records indicate that the implementation of digital innovations via the ISAA policy framework yields critical environmental implications for sustainable port management. Previously, manual clearancing processes and administrative bottlenecks led to prolonged anchorage times, causing vessels to idle excessively in Southeast Sulawesi waters. The transition to integrated electronic systems substantially shortens vessel processing times, which directly correlates with a reduction in maritime fuel combustion. An official from the Harbourmaster and Port Authority Office (KSOP) explained this ecological byproduct of digitalization:

> "*When ships wait for days due to manual paperwork, they keep their auxiliary engines running, which continuously releases exhaust gases into our coastal air. By cutting the approval process down to minutes through Inaportnet, we significantly reduce vessel idling times at the anchorage area, directly lowering fuel burning and localized carbon emissions in the port zone.*" (Interview, October 2024).

Furthermore, field observations revealed that digital transparency allows port authorities to enforce environmental compliance more rigorously. Ships arriving at the port are now systematically screened through the electronic system for mandatory international ecological certificates and ballast water discharge regulations before clearances are granted, effectively utilizing a digital administrative tool as an environmental governance gatekeeper.

These improvements were also acknowledged by service providers and service users, who reported shorter processing times, more predictable administrative procedures, and easier access to service information. Field observations further confirmed that digital systems are actively utilized in routine administrative operations, particularly in vessel arrival notifications, document verification, and service monitoring activities.

Table 3. Operational Performance Indicators of KSOP Class II Kendari in 2024

Performance Indicator	Achievement
Box Crane per Hour (BCH)	23–26 boxes/hour
KSOP minimum standard for BCH	18 boxes/hour
Box Ship per Hour (BSH)	26–29 boxes/hour
KSOP minimum standard for BSH	21 boxes/hour
Non-Tax State Revenue (Penerimaan Negara Bukan Pajak/PNBP) realization	IDR 10.8 billion
Service system	Integrated through Inaportnet and Single Billing
Monitoring of mineral shipment quotas	Conducted through Mineral Transport Monitoring System (SSM Pengangkut) integrated with Inaportnet

Source: KSOP Class II Kendari Performance Report (2024).

The operational performance indicators presented in Table 3 demonstrate positive outcomes associated with digital transformation in port administration. Container handling productivity exceeded the minimum operational standards established by KSOP, while the realization of non-tax state revenue reached IDR 10.8 billion in 2024. In addition, the integration of Inaportnet, Single Billing, and the Mineral Transport Monitoring System (SSM Pengangkut) has strengthened monitoring mechanisms and improved administrative accountability within port operations.

Table 4. Inaportnet Service Transaction Volume at Kendari Port (2022–2024)

Year	Number of Inaportnet Transactions	Annual Growth (%)
2022	3,842	-
2023	4,765	24.0
2024	5,931	24.5

Source: Processed from KSOP Class II Kendari administrative records (2024).

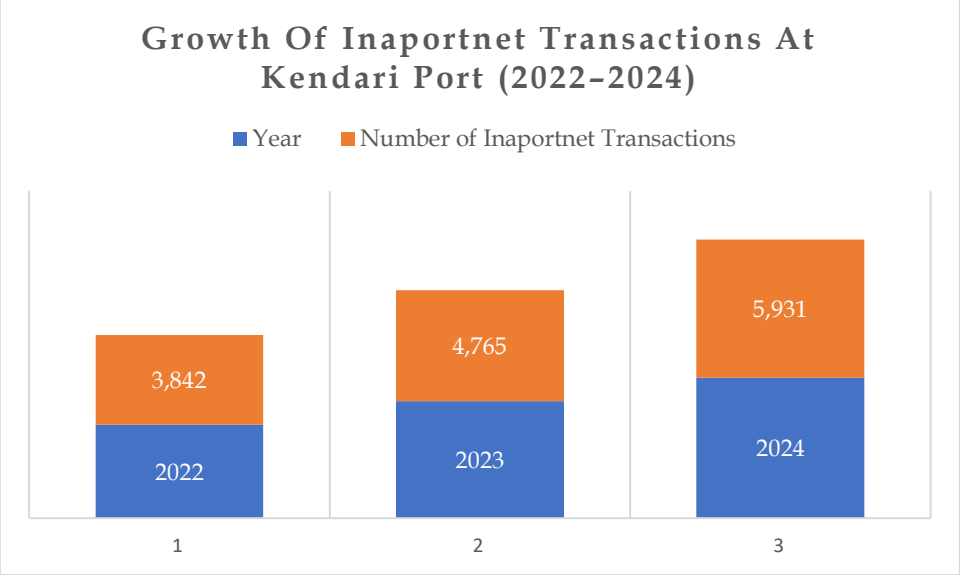

Figure 2. Growth of Inaportnet Transactions at Kendari Port (2022–2024)
Source: Processed from KSOP Class II Kendari administrative records (2024).

Table 4 and Figure 2 show a consistent increase in Inaportnet transaction volumes between 2022 and 2024. The number of transactions increased from 3,842 transactions in 2022 to 5,931 transactions in 2024, indicating growing utilization of digital services among port stakeholders.

The increasing transaction volume corresponds with interview findings, in which both service providers and service users reported growing reliance on digital platforms for vessel administration, service coordination, and information management. The increase in transaction volume reflects the growing acceptance of digital platforms as the primary mechanism for port service delivery.

Overall, the secondary data, interview results, and field observations consistently indicate that digitalization has contributed to improved administrative efficiency, stronger operational performance, increased service utilization, and enhanced accountability within port governance.

To comprehensively evaluate port service performance through a triple-bottom-line perspective, sustainability indicators such as waste management and environmental footprints must be critically integrated alongside economic metrics. Informant insights from environmental authorities and coastal stakeholders reveal that the digitization of shipping agency operations under ISAA significantly enhances the traceability of marine pollution. Through integrated data sharing, the coordination of ship waste disposal (such as oil sludge and domestic solid waste) can be digitally logged and scheduled before the vessel arrives at the terminal. This integration prevents illicit offshore dumping and ensures that maritime waste is transferred securely to regional terrestrial disposal sites in compliance with Green Port principles. Consequently, while traditional indicators heavily prioritize revenue generation and minimal processing times, the socio-ecological dimension of this digital transformation establishes that a digitized port architecture is fundamental to maintaining the ecological equilibrium of coastal communities and local fisheries in Southeast Sulawesi.

3. Inter-Stakeholder Coordination

The findings reveal that stakeholder coordination plays a central role in supporting the implementation of digital governance within port services. Interviews with service providers and service users indicate that coordination among the Southeast Sulawesi Regional Executive Board (DPW) of the Indonesia Shipping Agencies Association (ISAA), the Harbourmaster and Port Authority Office (KSOP), PT Pelabuhan Indonesia (Pelindo), shipping agents, shipping operators, logistics service users, and other stakeholders has become more structured following the adoption of digital systems.

Representatives from KSOP, Pelindo, shipping agents, and port service users generally acknowledged that digital platforms have facilitated information exchange, document verification, and operational coordination among institutions. The availability of integrated service systems has enabled faster responses to administrative requirements and improved communication among stakeholders involved in vessel services.

The Daily Chairman of the Southeast Sulawesi Regional Executive Board (DPW) of the Indonesia

Shipping Agencies Association (ISAA) stated:

"*ISAA as a ship agency association in Southeast Sulawesi Province puts forward a proactive communication system to all stakeholders at the port to optimize coordination and realize maximum service.*" (Interview, October 2024)

From the perspective of service users, coordination among institutions has generally improved compared to previous manual procedures. However, several informants noted that differences in operational procedures, institutional priorities, and response times occasionally create challenges during service implementation.

A shipping operator explained:

"*The online system has improved service efficiency, but differences in procedures and response times among agencies occasionally create delays in operational activities.*" (Interview, October 2024)

Field observations conducted at Kendari Port further revealed that most administrative communication and document verification activities are now conducted through integrated digital platforms. Observations also showed that coordination among agencies has become more systematic because service information can be accessed simultaneously by multiple stakeholders through digital systems.

Overall, the findings indicate that digitalization has strengthened communication and collaboration among stakeholders. Nevertheless, differences in procedural implementation among institutions continue to require attention in order to achieve more integrated and consistent service delivery.

4. Institutional Capacity and Policy Implementation Effectiveness

The findings demonstrate that institutional capacity plays an important role in determining the effectiveness of digital policy implementation within port services. Interviews with representatives from ISAA, KSOP, Pelindo, shipping agents, shipping operators, logistics service users, and port service users indicate that the successful utilization of digital platforms depends not only on technological availability but also on the competencies, readiness, and adaptive capabilities of stakeholders involved in service delivery.

Informants consistently emphasized the importance of technology education, training programs, and continuous capacity-building initiatives in supporting digital transformation. These efforts have enhanced stakeholders' understanding of digital systems and improved their ability to utilize Inaportnet and other supporting applications effectively.

The Daily Chairman of the Southeast Sulawesi Regional Executive Board (DPW) of the Indonesia Shipping Agencies Association (ISAA) emphasized:

"*Technology education for members is part of our time efficiency strategy. With information technology education, it greatly speeds up service processes.*" (Interview, October 2024)

Another informant from ISAA explained:

"*The role of technological advances has many uses such as shortening, providing efficiency, and providing information online.*" (Interview, October 2024)

Several service users also acknowledged that digital literacy and familiarity with electronic systems significantly influence service accessibility and operational efficiency. Stakeholders with greater digital competence generally experience fewer administrative difficulties and are able to utilize digital services more effectively.

Field observations further confirmed that digital systems are actively integrated into daily administrative activities. However, variations in digital literacy and technical capabilities among stakeholders continue to affect the consistency of policy implementation and service utilization.

Overall, the findings indicate that institutional capacity, particularly human resource competence, organizational readiness, and continuous capacity development, constitutes an essential factor supporting the effectiveness of digital policy implementation. Consequently, strengthening institutional capacity remains necessary to ensure the sustainability of digital governance initiatives within port services.

5. Infrastructure Challenges and Service Disruptions

The findings indicate that infrastructure readiness remains an important factor influencing the implementation of digital governance within port services. Although digitalization has improved service efficiency and transparency, several infrastructure-related challenges continue to affect

operational performance.

Interviews with service providers and service users revealed that infrastructure development has not always progressed at the same pace as digital transformation initiatives. Informants from KSOP, Pelindo, shipping agents, shipping operators, logistics service users, and representatives of port service users acknowledged that several supporting facilities still require improvement to accommodate increasing operational demands and expanding digital service requirements.

The Chairman of the Supervisory Board of the Southeast Sulawesi Regional Executive Board (DPW) of the Indonesia Shipping Agencies Association (ISAA) highlighted this issue by stating:

"*The existing terminals are mostly makeshift and are used for personal interests.*" (Interview, October 2024)

Similarly, the Head of the Harbourmaster and Port Authority Office (KSOP) Kendari explained:

"*It's quite good and good, it's just that it still needs development, it needs additional facilities, docks, and human resources.*" (Interview, October 2024)

Several informants also reported that service disruptions occasionally occur due to network instability and limitations in supporting facilities. These conditions may affect the speed and consistency of service delivery, particularly during periods of high operational activity.

Field observations further revealed that although digital service systems are operational and widely utilized, several supporting facilities and infrastructure components still require upgrading to ensure optimal performance. Observations also indicated that stable internet connectivity remains essential for maintaining uninterrupted digital service operations.

Overall, the findings suggest that infrastructure development remains a critical supporting factor for sustaining digital transformation within port services. Improvements in port facilities, network stability, supporting equipment, and human resource capacity are necessary to maintain service quality and ensure the continuity of digital governance initiatives.

Discussion

The findings of this study demonstrate that the implementation of ISAA policies has contributed significantly to the advancement of digital governance within port services in Southeast Sulawesi. The observed improvements in service efficiency, transaction growth, administrative transparency, and stakeholder coordination indicate that digital transformation has become an important mechanism for modernizing port governance. This finding supports previous studies that conceptualize digital transformation as a structural process capable of improving public service performance and creating more responsive governance systems (Meijer & Thaens, 2021; Sabarofek et al., 2025).

The findings regarding service efficiency support Digital Governance Theory, which argues that the integration of digital technologies can improve efficiency, transparency, accountability, and accessibility within public service delivery systems (Gil-Garcia et al., 2018). The implementation of Inaportnet has transformed conventional administrative procedures into integrated digital services, enabling faster document processing, real-time monitoring, and wider accessibility of service information. The substantial reduction in processing times and the continuous increase in Inaportnet transaction volumes indicate that digital governance has become increasingly institutionalized within port administration. These results are consistent with previous studies emphasizing that digital governance contributes to improved public service performance through administrative simplification and enhanced service responsiveness (Eduardo Junio Andaya et al., 2025; Kapesa, 2025; Reynilda et al., 2025).

Crucially, however, the expansion of our findings into a triple-bottom-line perspective indicates that digital port governance cannot be evaluated solely on economic and administrative merits. By incorporating sustainability metrics, this study shows that digital processes intersect deeply with regional ecological preservation. For instance, the drastic reduction in shipping clearance times directly minimizes vessel idling in anchorage zones, mitigating maritime fuel combustion and associated carbon emissions. This eco-efficiency transforms digital automation from a mere business optimization tool into an active driver of environmental governance functions (DEMİR et al., 2022). Furthermore, the digitization of coordination protocols via ISAA creates a transparent tracking mechanism for ship-generated waste management, ensuring systematic compliance with eco-port protocols and preventing pollution in the fragile coastal waters of Southeast Sulawesi (Emecen Kara, 2022). This expansion redefines "innovation" beyond administrative speed, positioning digital frameworks as essential tools

for local socio-ecological resilience and long-term marine resource sustainability.

The findings further indicate that successful digital transformation depends not only on technological innovation but also on institutional capacity. ISAA has strengthened member competencies through technology education, training programs, and capacity-building activities, thereby improving organizational readiness and stakeholders' ability to adapt to digital service systems. The combination of technological innovation and human resource development has contributed to increased service effectiveness, operational efficiency, and administrative accountability. This finding reinforces the view that successful digital transformation requires both technological readiness and organizational capacity (Ghilan, 2024; Mergel et al., 2021; Nuryadin et al., 2023; Podungge & Monoarfa, 2025).

Furthermore, the findings highlight the importance of stakeholder coordination in determining policy implementation outcomes. This finding is consistent with Collaborative Governance Theory, which emphasizes the importance of cooperation among multiple stakeholders in addressing complex public sector challenges (Ansell & Gash, 2008; Li et al., 2025). The improved coordination among ISAA, the Harbourmaster and Port Authority Office (KSOP), PT Pelabuhan Indonesia (Pelindo), shipping agents, shipping operators, and service users demonstrates the growing importance of network-based governance in managing increasingly complex port operations. This finding is consistent with the digital bureaucracy ecosystem perspective, which emphasizes that digital technologies can improve governance performance by integrating stakeholders and strengthening collaborative capacities across institutions (Tresiana et al., 2024). Digital communication platforms have facilitated information exchange and administrative coordination, contributing to more integrated service delivery across institutions.

The findings also support policy implementation theory, particularly regarding the importance of interorganizational communication in achieving policy objectives (Van Meter & Van Horn, 1975). Although digitalization has improved communication channels and operational coordination, differences in institutional procedures and response times remain challenges that may affect implementation effectiveness. These findings indicate that technological innovation alone cannot guarantee successful policy implementation unless accompanied by effective communication, procedural harmonization, and institutional alignment among implementing organizations.

The findings further reveal a causal relationship between the role of ISAA and improvements in port service performance. ISAA functions not only as a representative organization of shipping agencies but also as an intermediary institution that facilitates communication, disseminates digital service standards, provides technological training, and coordinates problem-solving among stakeholders. From the perspective of Collaborative Governance Theory, these functions strengthen trust, facilitate consensus building, and enhance inter-organizational coordination among port stakeholders (Ansell & Gash, 2008; Li et al., 2025). Furthermore, Policy Implementation Theory emphasizes that effective communication, organizational resources, and inter-agency coordination are critical determinants of successful policy implementation (Van Meter & Van Horn, 1975). Through its coordinating and capacity-building roles, ISAA reduces information asymmetry, improves organizational readiness, and accelerates adaptation to digital systems. Consequently, service procedures become more standardized, transaction processing times decrease, and information accessibility improves. This finding also supports Digital Governance Theory, which argues that improvements in public service performance emerge not merely from technology adoption itself but from the institutional arrangements and collaborative capacities that enable digital technologies to function effectively (Gil-Garcia et al., 2018). Therefore, improvements in port service performance can be understood as the outcome of collaborative institutional mechanisms promoted by ISAA rather than merely the direct consequence of technological innovation.

Another important finding concerns the role of technology integration in strengthening policy effectiveness. The implementation of Inaportnet, Single Billing, and the Mineral Transport Monitoring System (SSM Pengangkut) demonstrates how integrated digital platforms can enhance transparency, accountability, and operational control within port governance. These findings are consistent with previous studies showing that digital technologies improve administrative accountability, information accessibility, and service responsiveness when supported by appropriate governance arrangements (Syamsiar, 2023). The increasing utilization of digital platforms among stakeholders further reflects the growing acceptance of technology-based governance within port administration.

However, the study also reveals that infrastructure readiness remains a critical determinant of

digital transformation success. The persistence of network instability, infrastructure limitations, and disparities in digital literacy indicates that technological adoption alone is insufficient to achieve optimal outcomes. These findings support previous studies showing that infrastructure gaps and limited human resource capacity continue to be major barriers to technology integration within public sector organizations (Pratama et al., 2024; Putri & Tjenreng, 2025). Consequently, sustainable digital governance requires not only technological innovation but also continuous investment in infrastructure development and human capital enhancement.

The findings demonstrate that the effectiveness of digital governance in port services cannot be explained by a single factor. Digital technology integration improves administrative processes and service accessibility; however, its effectiveness depends on the presence of stakeholder coordination, institutional capacity, and infrastructure readiness. These four dimensions operate interactively rather than independently. Effective coordination facilitates information exchange among stakeholders, institutional capacity supports adaptation to digital systems, and infrastructure readiness ensures the continuity of digital service operations. Consequently, the interaction among these dimensions determines policy implementation effectiveness, which subsequently influences port service performance. This finding empirically supports the Collaborative Digital Port Governance Framework proposed in this study.

Theoretical Contribution

This study advances the digital governance literature by proposing the Collaborative Digital Port Governance Framework, which shifts the academic focus from isolated technological adoption (Criste et al., 2024; Gil-Garcia et al., 2018) toward a multi-dimensional, interactive model. By conceptualizing digital transformation as a co-dependent outcome of digital technology integration, stakeholder coordination, institutional capacity, and infrastructure readiness, this framework offers a more robust analytical tool for evaluating policy implementation in complex, multi-stakeholder public service environments.

Significantly, this study extends the contemporary maritime literature by infusing a Triple-Bottom-Line and Blue Economy perspective into digital port architecture. While traditional paradigms evaluate port digitalization primarily through economic and logistical metrics, this study establishes that automated workflows inherently function as environmental governance mechanisms. By demonstrating how electronic clearancing directly mitigates coastal carbon emissions through minimized vessel idling and safeguards marine ecosystems via trace-backed waste management, this research redefines "digital innovation" as a core driver of eco-port sustainability and local socio-ecological resilience.

Finally, this framework introduces the strategic conceptualization of professional associations as collaborative intermediary enablers in digital ecosystems. Rather than viewing non-state associations merely as passive service users, this study positions them as active institutional bridges that reduce information asymmetry, mobilize organizational resources, and accelerate digital literacy. Consequently, this model expands existing digital bureaucracy and collaborative governance theories, offering scalable insights for developing regions characterized by geographical fragmentation, institutional complexity, and uneven infrastructural capacities.

D. CONCLUSION AND RECOMMENDATION

Conclusion

This study concludes that the implementation of ISAA policies through the adoption of the Inaportnet system has contributed to improving service efficiency, administrative transparency, stakeholder coordination, and the effectiveness of digital governance in Southeast Sulawesi ports. The findings indicate that successful digital transformation is influenced not only by technology adoption but also by stakeholder coordination, institutional capacity, and infrastructure readiness. Although digital systems have enhanced service delivery and operational performance, challenges related to infrastructure limitations, network stability, digital literacy, and procedural harmonization remain significant obstacles. Crucially, this study demonstrates that evaluating digital effectiveness must expand beyond administrative speed to internalize a triple-bottom-line perspective, where digital acceleration simultaneously reduces anchorage idling times, fuel combustion, and localized carbon emissions.

The study further reveals that ISAA plays a strategic role not only as a professional association but

also as a collaborative intermediary actor that facilitates communication, coordination, capacity building, and policy advocacy among stakeholders involved in port governance. Consequently, improvements in port service performance can be understood as the result of collaborative institutional arrangements rather than merely technological innovation. By strengthening this collaborative network, digital governance expands the institutional capacity to monitor environmental compliance and systematically track ship-generated waste.

From a theoretical perspective, this study proposes the Collaborative Digital Port Governance Framework, which explains digital transformation as the outcome of interactions among digital technology integration, stakeholder coordination, institutional capacity, and infrastructure readiness. The findings extend digital governance literature by emphasizing the importance of collaborative and institutional factors in shaping policy implementation effectiveness and public service performance in maritime governance, while establishing that digital architectures must concurrently foster ecological resilience and sustainable marine resource management.

Recommendation

Based on the findings of this study, the following recommendations are proposed to enhance both logistical efficiency and socio-ecological sustainability:

1. Strengthen stakeholder coordination through regular communication and collaborative mechanisms involving ISAA, the Harbourmaster and Port Authority Office (KSOP), Port Operator Units (UPP), port operators, and service users, while expanding coordination to include environmental authorities to institutionalize Green Port principles into daily digital interactions.
2. Increase investment in digital and physical port infrastructure, including internet connectivity, supporting facilities, and operational infrastructure, to ensure reliable, uninterrupted service delivery and support upcoming modules for real-time tracking of vessel carbon footprints and environmental compliance screening.
3. Expand capacity-building programs and digital literacy training for port officials, shipping agents, and other stakeholders to improve the effective utilization of digital service platforms, incorporating technical modules regarding green maritime standards and eco-port protocols.
4. Develop integrated monitoring and evaluation mechanisms to continuously assess the performance of digital governance initiatives, including specialized digital logging system under ISAA to declare, track, and schedule ship-generated waste disposal to prevent offshore dumping.
5. Promote greater harmonization of administrative procedures and operational standards among institutions involved in port services to support more efficient, integrated, and environmentally responsible service delivery across Southeast Sulawesi waters.

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