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Effectiveness of Kapsera Application on PT Trielang Jaya Maritiem

Luthfi Dhafira Pratama [1].
[1]Sekolah Tinggi Ilmu Pelayaran Jakarta, Jakarta, Indonesia, luthfidhafira09@gmail.com.

Corresponding Author: luthfidhafira09@gmail.com[1]

Abstract: This study is titled "The Effectiveness of the KAPSERA Application on Compliance and Waste Management Performance at PT Trielang Jaya Maritiem". The background of this research arises from the issue of ship waste management that is still carried out manually, often leading to inaccuracies and low compliance with maritime regulations. The purpose of this study is to analyze the effectiveness of KAPSERA in improving waste reasonableness evaluation, enhancing crew knowledge and awareness, and its impact on compliance and waste management performance. The research employed a Research and Development (R&D) method with a mixed methods approach, involving questionnaires, interviews, observations, and system testing. Data analysis was conducted using SmartPLS to examine validity, reliability, and inter-variable relationships. The results show that the effectiveness of waste evaluation (X1) does not significantly affect compliance (Y), whereas crew knowledge and awareness (X2) have a significant positive effect on Y. These findings indicate that educational aspects are more influential in driving compliance than technical system aspects. In conclusion, KAPSERA is effective as an educational and awareness-enhancing tool, while improvements in technical evaluation features are still required to fully support operational performance.

Keyword: KAPSERA, Compliance, Ship Waste Management, System Effectiveness, Environmental Awareness.

INTRODUCTION

Indonesia, as the world's largest archipelagic country with 17,508 islands and a coastline stretching 95,181 km, has a maritime sector that is highly strategic in supporting the national economy. The maritime transportation sector plays a vital role in connecting the archipelago and facilitating international trade. According to data from the Central Statistics Agency (BPS, 2024), the contribution of the transportation and warehousing sector to the Gross Domestic Product (GDP) reached 4.2%, with maritime transportation accounting for around 60% of the total movement of goods in Indonesia. This indicates that maritime connectivity remains a backbone of national logistics and global commerce (Stopford, 2020).

Indonesia's maritime sector has experienced rapid growth in the last decade. Through the Sea Toll program, the government has improved maritime connectivity between islands, which has led to a significant increase in commercial shipping activity. Data shows that the

volume of trade via sea routes reached 1.6 billion tons in 2024, an increase of 18.7% compared to the previous year. This development aligns with the government's ambition to position Indonesia as a global maritime hub (Munim & Schramm, 2018).

Cargo and industrial vessel activities such as coal transport vessels, tankers, container ships, dry bulk carriers, liquid bulk carriers, crude palm oil transport vessels, and bulk cement carriers have grown significantly in line with national economic expansion. The Directorate General of Sea Transportation reported that the number of commercial ships operating in Indonesian waters reached 12,847 units in 2024, a 15.3% increase compared to the previous year. This high vessel traffic intensity generates various types of waste requiring proper and responsible management (Kitada & Ölçer, 2015).

However, field observations reveal that many shipping companies still report waste manually, causing delays, inefficiencies, and potential data manipulation. This makes real-time monitoring difficult. According to the International Maritime Organization (2023), Indonesia remains among countries with relatively low levels of ship waste reporting compared to major port states worldwide. This gap highlights the urgent need for digital-based innovations in ship waste management systems (Hänninen & Sassi, 2020).

To address these challenges, the KAPSERA (Kapal Serap Limbah or Waste Collection Ship) application was developed. It is a web-based system for evaluating and reporting ship waste, designed to comply with international standards such as MARPOL Annex V and to support environmental performance through the Environmental Quality Index (EQI). The application is expected to improve reporting effectiveness, minimize data entry errors, and strengthen company accountability (DeLone & McLean, 2016; Goodhue & Thompson, 1995).

Nevertheless, the actual implementation of KAPSERA requires further evaluation, especially regarding its effectiveness in shipping companies. At PT Trielang Jaya Maritiem, one of the companies operating in maritime transportation services, there remain challenges such as limited digital literacy among crew, technical obstacles, and differing perceptions of the application's benefits. This gap between system objectives and practical use illustrates the socio-technical complexities of adopting digital maritime systems (Yadav et al., 2021).

This study is grounded in several theoretical perspectives that frame the evaluation of KAPSERA.

Regulatory Framework (MARPOL Annex V). As the cornerstone of international maritime environmental governance, MARPOL Annex V strictly regulates the prevention of pollution from ship-generated garbage. Its principles provide the compliance benchmark against which KAPSERA's effectiveness is assessed (IMO, 2017; Mansoor & Sinha, 2019). Decision Support System (DSS) Theory.

DSS theory suggests that information systems designed to provide accurate, reliable, and structured data improve decision-making. KAPSERA aligns with this by offering automated, rule-based waste evaluation to reduce subjective bias in compliance reporting (DeLone & McLean, 2016). Technology Acceptance Model (TAM).

TAM emphasizes that user acceptance of technology depends on perceived usefulness and ease of use. Since many ship crews have limited digital literacy, KAPSERA's adoption relies heavily on intuitive interfaces and real-time feedback (Davis, 1989; Yadav et al., 2021). Socio-Technical Systems (STS) Theory.

STS theory posits that the success of technology implementation depends on the balance between technical system design and the human factors of users. KAPSERA is thus not merely a technical tool, but also an educational medium to enhance environmental awareness and compliance behavior (Di Vaio et al., 2020).

By integrating these frameworks, this study positions KAPSERA as both a decision support system and a behavioral intervention tool that strengthens regulatory compliance, enhances operational efficiency, and supports sustainable maritime governance.

Therefore, this research aims to measure the effectiveness of the KAPSERA application at PT Trielang Jaya Maritiem by examining aspects of system quality, crew knowledge and awareness, and their impact on compliance and waste management performance. By adopting a mixed-methods approach, this study provides not only empirical evidence on KAPSERA's role but also practical insights into digital transformation in maritime waste governance (Di Vaio et al., 2020). The results are expected to contribute to the improvement of the application and support the implementation of sustainable maritime policies in Indonesia.

METHOD

This research employed a Research and Development (R&D) approach with the primary aim of designing, developing, and evaluating the KAPSERA application as a digital system for ship waste management. The use of the R&D method was considered appropriate because the study not only sought to analyze the current conditions of waste management practices in the maritime sector but also intended to produce a practical and applicable product in the form of a web-based application.

The Waterfall development model was adopted in this study as it provided a systematic and structured framework for application development. This model consists of five sequential stages: (1) requirements analysis, in which system requirements were identified based on MARPOL Annex V regulations and operational practices; (2) system design, which focused on the development of system architecture, user interface, and database structure; (3) implementation, involving the coding of the system using modern web technologies such as Vue.js for the interface, Supabase for backend management, and PostgreSQL for database operations; (4) testing, including both functional and non-functional tests to ensure accuracy, usability, and system stability; and (5) maintenance, which covered improvements and updates following system evaluation.

The population of this research consisted of cargo ships operating in both Indonesian and international waters, particularly vessels regulated under MARPOL Annex V regarding the prevention of pollution by garbage from ships. The sample was determined through purposive sampling with the following criteria: (a) cargo ships with a minimum gross tonnage (GT) of 100, (b) vessels that operate regularly on domestic or international shipping routes, and (c) crew members with basic training in digital technology. Based on these criteria, the sample involved 3–5 cargo ships of various types and sizes and 5–10 port operators as relevant stakeholders.

The research site was PT Trielang Jaya Maritiem, which was selected as the main case study due to its active role in maritime transportation services and its direct involvement in ship waste management. The research timeline spanned the year 2024, covering the stages of system development, pilot testing, and evaluation.

The research instruments included: 1. Structured interview guides, used with captains, chief engineers, and environmental officers to gain qualitative insights into operational practices and waste management challenges. 2. Observation checklists, employed to document waste handling and disposal procedures on board ships. 3. User questionnaires, distributed to ship crews to evaluate perceptions, satisfaction, and the effectiveness of the KAPSERA application, measured using a 5-point Likert scale. 4. System testing protocols, developed to evaluate the system's functionality, accuracy, reliability, performance, and security.

The research procedure was carried out in several stages. It began with problem identification and literature review to establish the theoretical foundation and identify gaps in maritime waste management. This was followed by data collection, which involved interviews, observations, documentation, and surveys. Next, the design and development of the KAPSERA application were conducted based on the Waterfall model, with attention to compliance with international maritime standards. Once the system was developed, testing was performed through black-box testing, user acceptance testing, performance testing, and security testing to

ensure system quality. Finally, the system was deployed for trial use at PT Trielang Jaya Maritiem, where its functionality and effectiveness were evaluated.

For data analysis, a mixed-methods approach was applied, integrating both quantitative and qualitative techniques. Quantitative analysis included descriptive statistics (to summarize respondent data), correlation tests (Pearson/Spearman), t-tests (to compare conditions before and after system implementation), and regression analysis (to examine the influence of independent variables X1 and X2 on Y). Qualitative analysis employed thematic analysis (to identify recurring themes from interviews), content analysis (to assess regulatory compliance and documentation), and case study analysis (to explore implementation outcomes in the operational context). To ensure validity, the results from both approaches were combined using data triangulation, thereby producing comprehensive and reliable findings.

RESULTS AND DISCUSSION

The research results were obtained through quantitative data analysis using SmartPLS, which was employed to test construct validity, reliability, and the causal relationships between the research variables. This approach allowed a robust evaluation of the KAPSERA application's effectiveness in influencing compliance and waste management performance at PT Trielang Jaya Maritiem.

The results of the construct validity and reliability tests indicate that all variables demonstrate strong internal consistency and meet the threshold values for convergent validity. Specifically, the Cronbach's Alpha values for all constructs exceeded 0.7 (X1 = 0.953; X2 = 0.847; Y = 0.915). This shows that the items within each construct are measuring the same latent concept consistently. Similarly, the Composite Reliability values for each construct also surpassed the 0.7 standard (X1 = 0.964; X2 = 0.881; Y = 0.936), which further confirms the reliability of the measurement model.

The AVE (Average Variance Extracted) values were all above 0.5 (X1 = 0.843; X2 = 0.597; Y = 0.744), signifying that the majority of variance in the indicators is explained by the constructs. Consequently, all constructs were considered both reliable and valid. Nevertheless, it was noted that some indicators of X1 and X2 had outer loadings below 0.7, which suggests the need for refinement of certain measurement items in future studies.

Table 1 Construct Validity and Reliability Test

Variabel	Cronbach's Alpha	Composite Reliability	AVE	Description
Efektivitas Evaluasi Limbah (X1)	0.953	0.964	0.843	Reliabel & valid
Pengetahuan & Kesadaran Awak Kapal (X2)	0.847	0.881	0.597	Reliabel & valid
Kepatuhan & Kinerja Pengelolaan Limbah (Y)	0.915	0.936	0.744	Reliabel & valid

Further analysis of outer loadings showed mixed results across constructs. Variable Y (Compliance and Waste Management Performance) displayed strong factor loadings, with all indicators scoring above 0.9. This demonstrates that the measurement of Y is very robust and captures the intended construct comprehensively.

For variable X2 (Ship Crew Knowledge and Awareness), most indicators exceeded 0.7, validating their representation of the construct. However, two indicators, namely X2.3 (0.606) and X2.5 (0.435), fell below the acceptable threshold. While these indicators do not invalidate the construct as a whole, they highlight areas for improvement, particularly in designing questions or measures that more accurately capture crew awareness.

Conversely, variable X1 (Effectiveness of Waste Reasonableness Evaluation) presented significant weaknesses, with the majority of indicators scoring below 0.7 and some even registering negative values. This suggests that the current operationalization of X1 does not adequately represent the intended construct, likely due to technical complexities or limited respondent understanding of the evaluation features within KAPSERA.

The path analysis results revealed contrasting outcomes between the independent variables. The relationship between X1 (Effectiveness of Waste Reasonableness Evaluation) and Y (Compliance and Waste Management Performance) was found to be not significant, with a T-statistic of 0.483 and a P-value of 0.629 (>0.05). This finding indicates that the evaluation component of KAPSERA does not directly influence compliance behavior or performance outcomes.

In contrast, X2 (Ship Crew Knowledge and Awareness) demonstrated a strong and significant relationship with Y, with a coefficient of 0.653, a T-statistic of 9.928, and a P-value of 0.000 (<0.05). This clearly shows that enhancements in knowledge and awareness facilitated by the KAPSERA application significantly contribute to compliance and improved waste management practices.

Table 2 Path Coefficients Test Results

Relations	Coefficient	T-statistic	P-value	Description
X1 → Y	–	0.483	0.629	Not significant
X2 → Y	0.653	9.928	0.000	Significant

The finding that X1 (waste evaluation effectiveness) does not significantly affect compliance (Y) suggests several practical and theoretical implications. First, it reflects the possibility that ship crews have limited familiarity with the technical features of the KAPSERA application, leading to underutilization of its evaluation function. Second, the system's integration with daily operational workflows may still be inadequate, reducing its perceived utility. From a theoretical standpoint, while objective digital evaluation systems are expected to foster compliance, the absence of significant influence indicates that behavioral and cultural factors among crew members remain dominant in shaping compliance.

On the other hand, the significant and positive influence of X2 (crew knowledge and awareness) on Y reinforces the idea that educational and awareness-raising elements are more effective in shaping compliance behavior than purely technical evaluation mechanisms. This aligns with the Technology Acceptance Model (TAM), which posits that perceived usefulness and enhanced understanding are critical drivers of technology adoption. The results suggest that when crew members perceive KAPSERA as a tool that enhances their knowledge and environmental responsibility, they are more likely to engage in compliant practices.

The results highlight that the educational aspect of KAPSERA (X2) plays a more decisive role than the technical aspect (X1). This has several implications for both system developers and shipping companies: 1.Focus on Education and Awareness: The KAPSERA application should further strengthen features that enhance crew knowledge, such as interactive training modules, real-time feedback, and gamified learning experiences. 2.Refinement of Technical Indicators: Weaknesses in X1 suggest that indicators of waste evaluation need to be redesigned to better align with operational realities and crew capacities. Simplifying evaluation metrics and integrating them seamlessly into daily workflows could enhance their utility. 3.Integration

with Crew Training Programs: Shipping companies should incorporate KAPSERA into formal training and environmental awareness programs to ensure its adoption is supported by organizational structures. 4.Policy Relevance: For regulators, the study underscores the importance of promoting digital literacy and awareness among ship crews as a pathway to improving compliance with MARPOL and national maritime regulations.

CONCLUSION

Based on the results of quantitative and qualitative data analysis on the effectiveness of the KAPSERA application at PT Trielang Jaya Maritiem, several key conclusions can be drawn, as follows: a) Effectiveness of Waste Reasonableness Evaluation (X1)

The test results show that variable X1 (the effectiveness of KAPSERA in evaluating waste reasonableness) does not have a significant effect on variable Y (compliance and waste management performance). This is indicated by a p-value of 0.629 (>0.05). This condition indicates that even though the KAPSERA application provides a waste quantity evaluation feature, the technical aspects of the evaluation alone are not sufficient to encourage increased company compliance. This factor is likely influenced by the limited digital literacy of the crew, user resistance to new technology, and the gap between system standards and operational implementation. b) Increased Knowledge and Awareness (X2)

Conversely, variable X2 (the effectiveness of KAPSERA in increasing the knowledge and awareness of ship crews) was proven to have a positive and significant effect on variable Y, with a p-value of 0.000 (<0.05) and an influence coefficient of 0.653. This finding confirms that improving the environmental literacy and understanding of crew members through the use of the KAPSERA application contributes directly to regulatory compliance and improved ship waste management performance. Thus, the educational function and increased awareness are key to the successful implementation of KAPSERA. c) Compliance and Waste Management Performance (Y) In general, the implementation of KAPSERA helps companies provide more structured documentation, simplifies the reporting process, and supports regulatory compliance. Although the fairness evaluation aspect has not shown a significant effect, the education and environmental awareness aspects have been proven to improve the quality of waste management at PT Trielang Jaya Maritiem.

d) Research Implications The results of this study provide empirical evidence that the effectiveness of digital systems such as KAPSERA does not only depend on technical aspects (system quality), but more on how the application can improve the understanding, awareness, and operational behavior of its users. Therefore, further development of KAPSERA needs to focus on integrating educational features, improving crew training, and refining the user experience so that the application can deliver optimal benefits.

REFERENCE

Badan Pusat Statistik. (2024). Statistik transportasi dan pergudangan. Jakarta: BPS.

Bai, C., & Sarkis, J. (2020). A supply chain transparency and sustainability technology appraisal model for blockchain technology. International Journal of Production Research, 58(7), 2142–2162. https://doi.org/10.1080/00207543.2019.1708989

Direktorat Jenderal Perhubungan Laut. (2024). Data jumlah kapal niaga yang beroperasi di Indonesia. Kementerian Perhubungan Republik Indonesia.

Carpenter, A., & Macgill, S. (2005). The EU directive on port reception facilities for ship-generated waste and cargo residues: The results of a second survey on the provision and uptake of facilities in North Sea ports. Marine Pollution Bulletin, 50(12), 1541–1547. https://doi.org/10.1016/j.marpolbul.2005.06.041

DeLone, W. H., & McLean, E. R. (2016). Information systems success measurement. Foundations and Trends in Information Systems, 2(1), 1–116. https://doi.org/10.1561/2900000005

Di Vaio, A., & Varriale, L. (2020). Digitalization in the sea freight shipping industry: An empirical study on shipowners. Maritime Policy & Management, 47(5), 574–591. https://doi.org/10.1080/03088839.2020.1718617

Di Vaio, A., Hassan, R., Alvino, F., & Palladino, R. (2020). Maritime digitalization and sustainable governance: Emerging technologies for environmental performance. Business Strategy and the Environment, 29(5), 1793–1806. https://doi.org/10.1002/bse.2478

EMSA. (2020). Guidance on best practices for waste management in ships. European Maritime Safety Agency.

Goodhue, D. L., & Thompson, R. L. (1995). Task-technology fit and individual performance. MIS Quarterly, 19(2), 213–236. https://doi.org/10.2307/249689

Hänninen, M., & Sassi, J. (2020). Developing maritime waste management practices: Case studies from the Baltic Sea. WMU Journal of Maritime Affairs, 19(2), 153–172. https://doi.org/10.1007/s13437-020-00208-3

IMO - International Maritime Organization. (2020). Prevention of Pollution by Garbage from Ships - MARPOL Annex V. Retrieved from https://www.imo.org/en/ourwork/environment/pages/garbage-default.aspx

IMO. (2017). Resolution MEPC.295(71) - 2017 Guidelines for the Implementation of MARPOL Annex V. Retrieved from

https://wwwcdn.imo.org/localresources/en/KnowledgeCentre/IndexofIMOResolutions/MEPCDocuments/MEPC.295(71).pdf

Kitada, M., & Ölçer, A. I. (2015). Managing barriers to environmental improvement in maritime transport: From the perspective of ship officers and shore managers. Marine Pollution Bulletin, 97(1–2), 31–38. https://doi.org/10.1016/j.marpolbul.2015.06.020

Kitada, M., Ölçer, A. I., & Ballini, F. (2018). Governance challenges of implementing MARPOL Annex VI. Marine Policy, 87, 45–54. https://doi.org/10.1016/j.marpol.2017.10.030

Mansoor, A., & Sinha, S. (2019). Compliance with MARPOL Annex V: Challenges for developing countries. Marine Policy, 103, 50–59. https://doi.org/10.1016/j.marpol.2019.01.004

Munim, Z. H., & Schramm, H. J. (2018). The impacts of port infrastructure and logistics performance on trade and maritime transport. Maritime Economics & Logistics, 20(4), 530–556. https://doi.org/10.1057/s41278-017-0072-0

Prajogo, D., Toy, J., Bhattacharya, A., Oke, A., & Cheng, T. (2018). The relationships between information management, process management and operational performance. International Journal of Production Research, 56(18), 5870–5881. https://doi.org/10.1080/00207543.2018.1464233

Putra, I. M. A., Sari, N. M., & Mahardika, I. G. (2020). Marine environmental protection in Indonesia: A regulatory perspective. Marine Policy, 113, 103799. https://doi.org/10.1016/j.marpol.2019.103799

REMPEC. (2020). Guidelines on cargo-related waste management. Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea.

Stopford, M. (2020). Maritime economics (4th ed.). Routledge.

Yadav, S., Singh, S., & Raut, R. D. (2021). Adoption of digital platforms in maritime logistics: A socio-technical perspective. Technology in Society, 67, 101716. https://doi.org/10.1016/j.techsoc.2021.101716

Yulianto, I., Wahyudi, R., & Pratama, H. (2021). The implementation of integrated port waste management systems in Indonesia. WMU Journal of Maritime Affairs, 20(3), 427–444. https://doi.org/10.1007/s13437-021-00240-8.