



Digital Innovations in Knowledge and Talent Management for Sustainable Maritime Development: The Case of Indonesian Ports

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ABSTRACT

This study examines the creation and execution of a novel digital portal designed to unify learning management, talent management, and knowledge management in Indonesian ports. It analyses the organisational prerequisites, implementation obstacles, and strategy frameworks necessary for attaining successful digital transformation in a geographically distributed entity. Employing a qualitative case study methodology, data were gathered via comprehensive interviews with essential staff from the Human Resources and Information Technology departments, in addition to an examination of internal records. Thematic analysis was utilised to discern principal patterns and correlations. The results indicate that the portal satisfies the essential requirements for operational integration among the divisions and locations of Indonesian Ports. Nonetheless, obstacles like organisational policies, the adoption of digital culture, and technology infrastructure were recognised. The report recommends a strategic framework for successful implementation, encompassing technological investments, digital literacy efforts, revised policies, and improved interdepartmental communication. This research enhances the theoretical comprehension of integrated digital platforms and provides practical insights for enterprises with analogous issues in digital transformation. This pioneering study in Indonesia's port sector offers useful insights into addressing operational challenges within a large-scale, globally distributed organisation.

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1. Introduction.

Digital transformation has emerged as a crucial factor in enhancing organisational efficiency and production in contemporary times (Zhang, Long and von Schaeuwen, 2021; Li, Zhao and Zhao, 2024; Omol, 2024; Qiao, Li and Hong, 2024). Indonesia has a network of ports spread across the archipelago, covering 122 ports in 32 provinces and having 7,106 employees in 2023. In international companies such as Port of Indonesia (Safuan,

2024), which operates from Sabang to Merauke, geographical and operational constraints are the main obstacles to integrating knowledge, talent, and learning management.

Figure 1: Map of the Operational Zones of Indonesian Ports.



Source: Indonesian Ports.

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Consequently, creative technology-driven solutions are necessary, as shown by the "Portaverse" portal (Pelindo, 2024), which has become highly pertinent for fostering across all company divisions.

Numerous studies indicate that digital technology can facilitate integration and collaboration inside huge businesses (Adomako and Nguyen, 2024; Huang and Wang, 2024; Ly, 2024; Sarala et al., 2024). Nonaka and Takeuchi (1995) elucidated that technology-driven knowledge management can foster innovation and organisational learning. In contrast, Alavi and Leidner (2001) examined the significance of knowledge management systems in enhancing organisational efficiency (Nonaka and Takeuchi, 1995; Alavi and Leidner, 2001). Collings and Mellahi (2009) examine talent management solutions, although their research emphasises individual growth while neglecting integrated digital platforms (Collings and Mellahi, 2009).

Eoin Whelan and Marian Carcary (2011) examine how talent management principles can enhance knowledge management initiatives, highlighting the advantages of incorporating these functions within organisations (Whelan and Carcary, 2011). Hantoobi et al. (2021) explore tools and frameworks developed to efficiently integrate knowledge management with learning management systems, facilitating effective knowledge transfer in virtual environments. Nonetheless, this research possesses certain limitations that warrant acknowledgement (Hantoobi et al., 2021). Many concentrate on a singular facet, such as knowledge or talent management, neglecting to emphasise integrating knowledge management, talent management, and learning management within a cohesive digital platform.

Furthermore, studies on implementing this digital platform are predominantly in the technology or education sector (Gorshenin, 2018). However, there is limited discourse over its application inside Indonesia's port sector. Current research frequently occurs in areas with limited geographic scope, which is inconsequential for organisations such as Pelindo, which encounters distinct issues due to the extensive scale of its operations.

This research examines the requirements and obstacles in creating Portaverse, an innovative portal integrating knowledge management, talent management, and learning management inside Pelindo. This gateway is anticipated to facilitate the organisation's comprehensive digital transformation, transcend geographical limitations, and enhance the company's operational efficiency. This research intends to identify the essential factors required for the successful implementation of this portal to furnish Pelindo with strategic insights into the digital transformation process. The research findings are anticipated to offer strategic recommendations for Pelindo to enhance Portaverse as a cohesive digital solution.

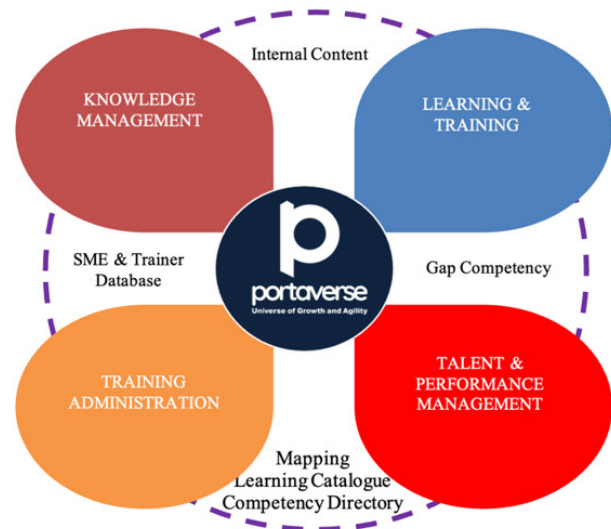
2. Literature Review.

2.1. Portaverse.

Portaverse is a versatile application that is offered as a software - as a - service (SaaS) (Raghavan R., K.R. and Nar Gundkar, 2020). Indonesian Ports, commonly referred to as

Pelindo. This application consolidates three primary systems: Portaverse Learning (LMS), which offers a Home & Explore feature for searching and selecting courses based on employees' interests and requirements, a dashboard for monitoring learning progress, balances, and hours, along with provisions for both online and offline learning activities. A Portaverse Knowledge Management System (KMS) encompasses a Knowledge Map for delineating knowledge, including business processes, strategic initiatives, expert resources, and knowledge documentation; Social Media functionalities for rapid access to essential information; communities for collaboration and knowledge exchange; and repositories for documenting and disseminating information in diverse formats. Portaverse Talent Management System (TMS & PMS) incorporates SMART Plan Key Performance Indicators (KPIs) for reducing and monitoring performance metrics, Personal Assessment tools for evaluating superiors, peers, and subordinates, and Project Management capabilities for overseeing schedules, workflows, and task allocation (Pelindo, 2024). Portaverse implements the A Stop Platform concept as a knowledge repository that Pelindo employees can access flexibly at any time and location, enhancing knowledge management, learning, talent, and career management within a unified system.

Figure 2: Portaverse as People Development Super Apps.



Source: Indonesian Ports.

2.2. Knowledge Management.

Knowledge Management (KM) is a methodical procedure for finding, capturing, organising, and disseminating knowledge ((Girard and Girard, 2015). Knowledge management encompasses the administration of two categories of knowledge: tacit information, which is challenging to articulate, and explicit knowledge, which is readily documented (Smith, 2001; Gamble, 2020; Adesina, 2024). The effective execution of knowledge management can enhance corporate performance, promote innovation, and enable improved decision-making (Abbas et al., 2022). Shujahat et al. (2019) highlighted that the knowledge

management process substantially influences knowledge-based innovation by mediating knowledge worker productivity (Shujahat et al., 2019).

2.3. Talent Management.

Talent Management (TM) is a strategic methodology for overseeing human resources within a business. It encompasses the processes of recruiting, developing, and retaining skilled personnel (Rožman, Tominc and Štrukelj, 2023; Tenakwah, 2024). TM's principal objective is to find, cultivate, and retain individuals with exceptional potential to enhance the organisation's success substantially (Nurung et al., 2023). Research conducted by Abbas et al. (2022) demonstrates that good talent management techniques can improve organisational performance by augmenting decision-making capacities (Abbas et al., 2022).

2.4. Learning Management.

Learning Management (LM) is a methodical framework for overseeing people's learning and development processes inside a business. LM includes the planning, executing, and assessing training and development initiatives (Oliveira, Cunha and Nakayama, 2015). Learning Management-enabled technologies, such as the Learning Management System (LMS), enable the dissemination of educational content, monitoring of progress, and evaluation of learning results. Nurung et al. (2023) highlighted the significance of knowledge application in the correlation between knowledge management techniques and corporate innovation, which is intricately linked to the organisational learning process (Nurung et al., 2023).

2.5. Integration of KM, TM, and LM in Organizations.

This cohesive strategy facilitates the use of corporate knowledge for more focused talent development, customising learning programs to meet talent requirements and organisational objectives while fostering a learning culture that promotes innovation and sustainable growth. Lee et al. (2013) illustrated that the amalgamation of knowledge management with advanced technologies, including the Internet of Things (IoT), can substantially enhance the capabilities of open innovation and knowledge management within enterprises (Boonswasd and Shirahada, 2022). These findings underscore the necessity of implementing a comprehensive strategy for managing knowledge, talent, and learning.

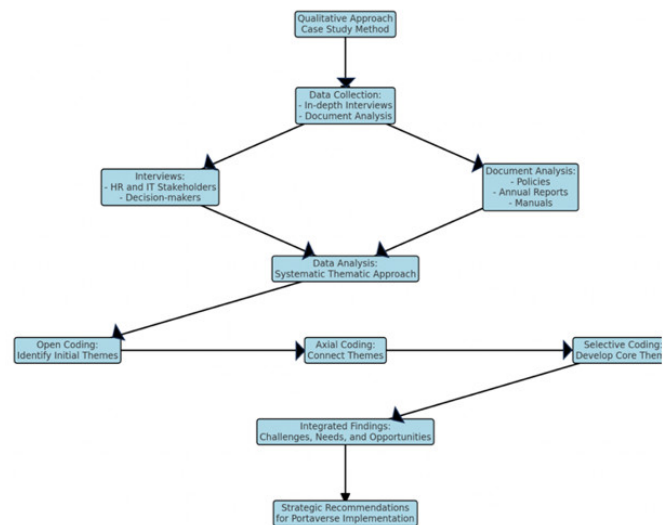
3. Methodology.

This research employs a qualitative methodology utilising a case study approach (Baxter and Jack, 2015; Rashid et al., 2019; Priya, 2021) to examine the evolution and execution of Portaverse comprehensively as a pioneering portal for knowledge, talent, and learning management within Pelindo. This methodology was selected as it enables researchers to explore the experiences and viewpoints of stakeholders within a complex and particular organisational framework. This strategy aims to comprehensively understand the difficulties, needs, and possibilities of implementing Portaverse. The research data was

obtained via comprehensive interviews and an examination of internal records. Interviews were performed with major stakeholders from the HR and IT departments at Pelindo. Participants were chosen according to their involvement in decision-making about knowledge, talent, and learning management. Each conversation aims to elicit comprehensive and detailed insights regarding the Portaverse implementation requirements and the portal's role in facilitating the company's digital transformation. Alongside interviews, internal documents, including . Corporate policies, annual reports, procedure manuals, and other strategic materials are examined to enhance the data acquired from the interviews. This method enhances comprehension and triangulates data, augmenting research findings' validity and reliability.

Data analysis employs a structured thematic methodology to generate complete insights. Data collected from interviews and documentation were evaluated to discern repeating patterns, interrelations across variables, and principal themes pertinent to implementing Portaverse. The analytical approach commences with open coding to identify early themes, progresses to axial coding to link emergent themes, and concludes with selective coding to produce a core theme that encapsulates the phenomenon under investigation. This approach aims to deliver a comprehensive overview of the primary elements affecting the development and execution of Portaverse in Pelindo. The findings of this analysis are anticipated to serve as a strategic framework for enterprises to facilitate the effective integration of Portaverse in advancing the organisation's digital transformation.

Figure 3: Flowchart of the Research Methodology.



Source: Authors.

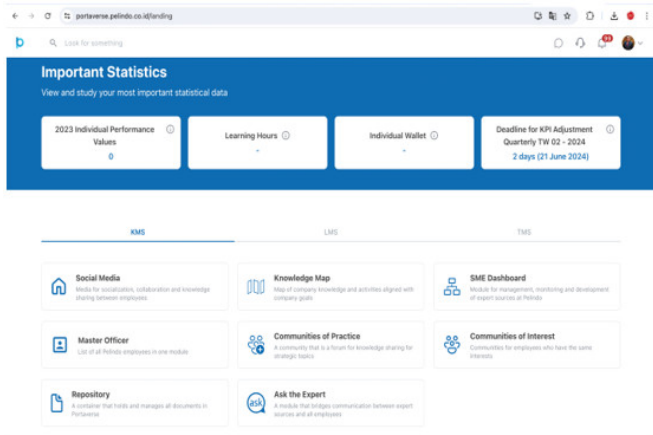
4. Results & Discussion.

4.1. Knowledge Management System in Portaverse.

Portaverse's Knowledge Management System (KMS) has markedly improved access to essential information throughout Pelindo's vast network. Functions like the Knowledge Map

and Repository guarantee that staff can efficiently access, document, and disseminate critical information. By eliminating redundancies and enhancing decision-making efficiency, the system promotes a more cohesive organisational process.

Figure 4: Portaverse Knowledge Management System.



Source: Indonesian Ports.

For example, as of June 2024, Pelindo recorded 376,643 hours of documented learning activities and over 9,737 active users within the system. This data highlights the platform's reach and the substantial adoption rate among employees.

Table 1: User Metrics and Educational Engagement in Portaverse as of Q1 2024.

Users	Trainees	Learning hour	Average learning hour per employee
9,737	93,350	376,643	54.59

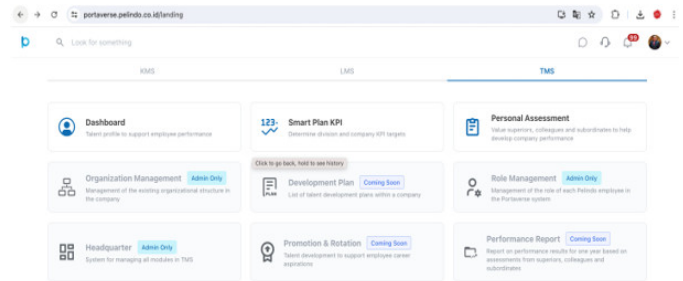
Source: Indonesian Ports.

These metrics align with global trends. Organisations worldwide have seen an increase in average annual learning hours from 35 hours in 2020 to 64 hours in 2023, reflecting a growing emphasis on knowledge and skill development (Bohne, 2024).

4.2. Talent Management System and Performance Enhancement.

The Talent Management System (TMS) in Portaverse serves as a comprehensive tool for managing and evaluating employee performance. By integrating features such as the SMART Plan KPI and Personal Assessment, the platform enables leaders to monitor performance transparently and encourage targeted development. Employees are empowered to self-assess their competencies and track progress against organisational objectives.

Figure 5: Portaverse Talent Management System.



Source: Indonesian Ports.

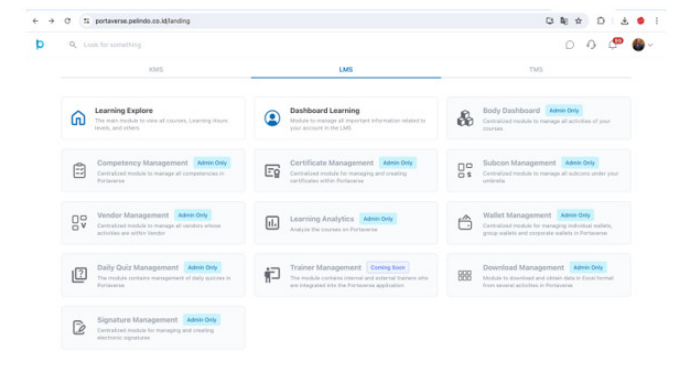
As of Q1 2024, Pelindo reported an increase in performance consistency, with employee engagement metrics improving by 25% compared to the pre-Portaverse era. Such tools have been shown to enhance overall workforce productivity and align individual contributions with broader organisational goals (Abbas et al., 2022).

The study by Tri Wikaningrum and Lisa Kartikasari (2023) examines the interplay between talent management, knowledge creation, social capital, ICT support, and innovation performance within private Islamic universities in Semarang. The results indicate that the integration of talent and knowledge management enhances innovation performance (Wikaningrum and Lisa Kartikasari, 2023).

4.3. Learning Management System and Employee Development.

Portaverse's Learning Management System (LMS) Facilitates ongoing education by providing customised training programs that are available both online and offline. This approach has proven especially beneficial in rural regions, enabling personnel to sustain professional development despite geographic obstacles.

Figure 6: Portaverse Learning Management System.



Source: Indonesian Ports.

The average learning hours per employee had surpassed the aim of 50 hours annually, attaining 54.59 hours by mid-2024. These results highlight the significance of LMS tools in promoting a culture of lifelong learning inside enterprises (Suharsono, 2021). Furthermore, Pelindo's data indicates that more

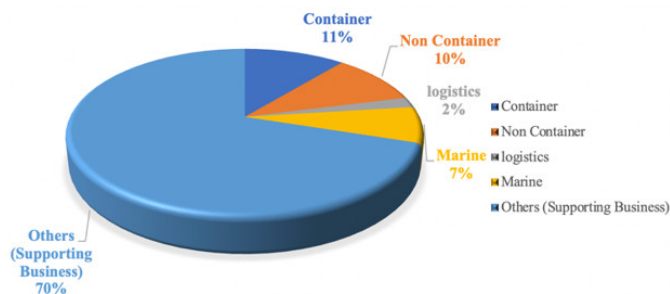
than 93,350 training sessions have been executed through Portaverse, underscoring the platform's significance in talent development and information sharing (see Table 1).

According to data from Statista, the average number of learning hours per employee in organisations worldwide increased from 35 hours in 2020 to approximately 64 hours in 2021, indicating a growing emphasis on learning and development (Bohne, 2024). A report by the Association for Talent Development (ATD) highlights that large companies, leveraging economies of scale, provided more than 50 hours of learning per employee in 2018 (Ho, 2019). Instilling a learning culture within a company is crucial for promoting adaptation and innovation. McKinsey & Company asserts that enterprises can achieve success by fostering a learning culture and investing in competencies that enable individuals and groups to flourish (Smith and McNally, 2021).

4.4. Subject Matter Expert (SME).

This analysis identified that the principal requirement for the Portaverse implementation is enhanced integration among departments and operational sectors within Pelindo. Coordinating between work units presents a considerable problem because of the extensive geographical span from Sabang to Merauke. Employees from several departments indicate that information and data are frequently held in isolation, resulting in redundancy and delays in decision-making. Moreover, mid-level managers underscored the significance of digital platforms that facilitate cross-functional communication to enhance operational efficiency. Portaverse is anticipated to serve as a solution for integrating disparate information systems and providing centralised access to knowledge, training, and talent management.

Figure 7: Composition of SME PELINDO during Q1 2024.



Source: Indonesian Ports.

As of June 2024, Pelindo is augmenting the number of Subject Matter Experts (SMEs) and their respective communities. Small and medium - sized enterprises engaged in human resources, health, safety, security, engineering, risk management, auditing, legal affairs, finance, and commerce consistently expand. This community actively participates in numerous forums and disseminates knowledge to assist the growth of Portaverse. Furthermore, there are 63 active Communities of Practice (CoPs) each quarter, which enhances interactions among SMEs and fosters productivity and ongoing innovation.

Table 2: Composition of SME PELINDO during Q1 2024.

Container	Non-Container	Logistic	Marine	Others*
50 SME	45 SME	7 SME	28 SME	330 SME

*HR, HSSE, Engineering, Risk, Audit, Law, Finance, Commercial and other supporting

Source: Indonesian Ports.

Table 1 presents the composition of Pelindo's Subject Matter Expert (SME) as of the first quarter of 2024. The SME distribution illustrates the company's primary emphasis on servicing diverse operational sectors. The container category comprises over 50 SMEs, underscoring the significance of container services as a fundamental aspect of Pelindo's operations. The non-container sector shall consist of 45 SMEs offering Diverse services unrelated to containers, including managing multipurpose terminals and bulk freight. Seven SMEs are tasked with supply chain management. Moreover, other logistics operations within the logistics sector constitute a fundamental pillar of port operating Efficiency. The number of SMEs in the maritime industry which emphasise ship services has reached 28, highlighting the crucial importance of marine services such as ship navigation and scheduling delays. The other category, encompassing supporting topics such as Human Resources, Health, Safety, Security, Environment, Engineering, Risk Management, Auditing, Legal Affairs, Finance, and Commercial Operations, contains the highest number of 330 Subject Matter Experts. These underscore the need for cross-functional support to guarantee the sustainability of Pelindo's operations and strategic advancement. The distribution of SMEs across various sectors illustrates Pelindo's commitment to enhancing the company's internal competencies through specialised expertise in each domain, which serves as the basis for deploying Portaverse as a comprehensive portal for knowledge, talent, and learning management across Pelindo's operational regions.

The research, Subject Matter Experts: The Key to Knowledge Transfer, underscores the essential role of SMEs in the generation and dissemination of knowledge inside businesses. The research indicates that SMEs have specialised expertise, which renders them essential for knowledge dissemination with several channels (Savdharia, 2019).

4.5. Advantages of Portaverse Implementation.

The integration of Portaverse has yielded substantial operational benefits for Pelindo. Enhanced access to critical information has mitigated process impediments, and interdepartmental cooperation has been refined. Post-operational transformation, Pelindo has executed substantial enhancements to optimise productivity and minimise dwelling time at its ports. A significant accomplishment was recorded at Sorong Port, where the average duration of vessel stay was reduced from 72 hours to a maximum of 24 hours. From January to September 2023, the average port stay enhanced to roughly 10.84 hours, in contrast to 24.37 hours over the corresponding period in the prior year. The

decrease in port stay period has resulted in enhanced productivity and more efficient cargo handling operations. The transition also facilitated the stabilisation and reduction of Dwelling Time at various significant ports operated by Pelindo (Pelindo, 2023). Data from the Indonesia National Single Window (INSW) reveals that the average dwell time at major ports, including Tanjung Priok, Tanjung Emas, Tanjung Perak, and Makassar, consistently maintained under three days. In November 2021, the average duration of stay was documented at 2.51 days. Notwithstanding minor increases during busy periods, the overarching trend indicates enhanced efficiency in the freight processing Times (Mabrori, 2022).

The deployment of apps like Portaverse facilitates enterprises' digital transformation by embracing paperless practices and electronic offices. This enables other organisations to glean insights from Pelindo's experience in leveraging technology for their digital transformation.

Table 3: Company Performance Analysis and Employee Training (2021-2023).

Description	Unit	2023	2022	2021
Total Operating Revenues	Thousands of Rupiah	31.018.217.702	29.700.604.135	28.814.806.337
Profit for the Year	Thousands of Rupiah	4.012.581.263	3.908.469.857	3.176.145.276
Employee education and training hours	Hours/Employee/ Year	376.643	329.624	240.556

Source: Indonesian Ports.

Between 2021 and 2023, the corporation exhibited a favourable development trajectory in its performance. Total operating income rose steadily from 28,814,806,337 thousand Rupiah in 2021 to 31,018,217,702 thousand Rupiah in 2023, indicating an annual growth of 3.08% and 4.44% in the subsequent year. Net profit rose from 3,176,145,276 thousand Rupiah in 2021 to 4,012,581,263 thousand Rupiah in 2023, reflecting a substantial growth of 23.07% in 2022 and 2.67% in 2023. The corporation augmented its investment in employee education and training, evidenced by the rise in training hours from 240,556 Hours per employee year in 2021 to 376,643 hours in 2023. This augmentation underscores the company's dedication to human resource development, which can Enhance overall efficiency and performance.

These operational improvements demonstrate Pelindo's Dedication to optimising port services and logistics. Through process optimisation and the implementation of Integrated digital technologies, Pelindo effectively diminished logistical expenses and enhanced the Competitiveness of Indonesia's maritime industry. Furthermore, the system's focus on skill development Has strengthened the workforce, aligning individual competencies with organisational needs. These findings highlight Portaverse's ability to serve as a benchmark for digital transformation across the maritime sector.

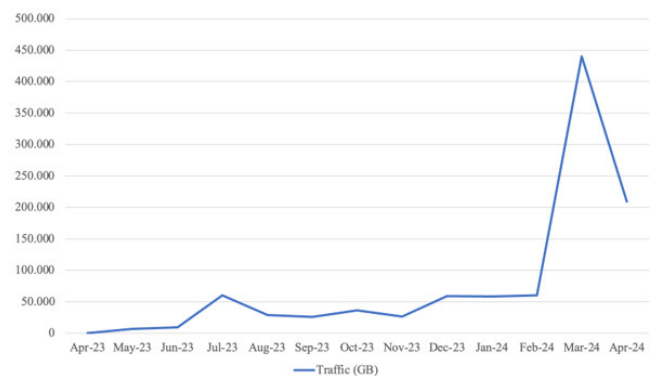
4.6. Challenges in Implementing Portaverse.

Despite its successes, the implementation of Portaverse has encountered significant challenges. The uneven technological infrastructure across Pelindo's network, particularly in remote ports, limits the platform's seamless utilisation. Additionally, cultural resistance remains a key obstacle, as many employees are hesitant to adopt digital tools due to a lack of familiarity or confidence. Organisational policies have also been identified as insufficiently aligned with the goals of digital transformation, necessitating revisions to support a more robust implementation framework. These challenges underscore the need for targeted infrastructure investments and digital literacy programs, as well as more precise policy directives to ensure sustainable adoption (Lee and Lee, 2023).

4.7. Strategic Implications and Future Directions.

The traffic data for Portaverse, illustrated in Figure 6, indicates a substantial rise in user interaction. Traffic remained consistently low throughout 2023 before undergoing a significant increase in March 2024, coinciding with faster system-wide deployment. This peak coincided with Pelindo's strategic deployment of Portaverse across its divisions and the execution of specialised training programs. Although traffic had a minor decrease in April 2024, it indicates the platform's stabilisation during the initial adoption phase. The rise in traffic corresponds with enhancements in staff involvement and knowledge-sharing initiatives, hence affirming the platform's efficacy. Addressing infrastructural constraints and enhancing digital preparedness will be essential for maintaining user engagement and maximising the platform's long-term advantages.

Figure 8: Portaverse Application Traffic.



Source: Indonesian Ports.

Portaverse's success demonstrates the transformative potential of integrating knowledge, talent, and learning management into a single digital solution. For Pelindo, the platform has not only enhanced operational efficiency but also positioned the organisation as a leader in leveraging technology for workforce development. Moving forward, investments in technological infrastructure, particularly in under-connected regions, will be essential. Furthermore, fostering a digital culture through comprehensive training and revising organisational policies will en-

sure long-term success. Comparative studies with similar platforms in industries such as logistics and education could offer additional insights into optimising digital transformation strategies (Nonaka and Takeuchi, 1995).

Conclusions.

This study's findings underscore the importance of Portaverse as a novel platform for integrating knowledge management, talent management, and learning management within Pelindo. The study highlights the essential requirement for operational and departmental integration across geographically diverse areas, which Portaverse seeks to handle proficiently. The implementation process faces hurdles, such as inadequate technology infrastructure, reluctance to embrace a digital culture, and insufficient organisational policies that facilitate digital transformation. The report suggests a strategy framework comprising infrastructure expenditures, extensive digital literacy training programs, policy revisions, and interdepartmental collaboration to address these difficulties. This strategy guarantees that Portaverse can improve operational efficiency, promote collaboration, and aid Pelindo's extensive digital transformation initiative. The research enhances theoretical and practical knowledge by elucidating unified digital platforms in the port industry and offering pragmatic insights for analogous businesses encountering operational challenges. The effective execution of Portaverse could provide a standard for other port operators in utilising digital technology for sustainable development and international competitiveness.

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