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Human factors influencing knowledge sharing behavior in digital port ecosystems: The mediating role of knowledge sharing intention

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Abstract: The successful implementation of smart port initiatives and digital transformation strategies depends not only on technological infrastructure but also on employees' willingness to exchange knowledge across organizational boundaries. This study investigates the mediating role of knowledge-sharing intention in the relationship between human factors and inter-industry knowledge-sharing behavior among employees in Malaysian container ports. Grounded in the Theory of Planned Behavior, Social Cognitive Theory, and Social Exchange Theory, the study adopts a quantitative, cross-sectional design. Data were collected through structured questionnaires and analyzed using Partial Least Squares Structural Equation Modelling (PLS-SEM). The findings reveal that individual, peer, and organizational factors significantly influence employees' intention to share knowledge, while knowledge-sharing intention significantly predicts inter-industry knowledge-sharing behavior. Mediation analysis confirms that knowledge-sharing intention serves as a significant mechanism through which human factors influence actual knowledge-sharing practices. The study contributes to the literature by extending the understanding of human-centered determinants of knowledge sharing within digital port ecosystems and smart logistics environments. The findings highlight the importance of fostering supportive organizational cultures, collaborative relationships, and employee motivation to strengthen sustainable knowledge exchange, innovation capability, and digital transformation within the maritime industry.

Keywords: *Digital port ecosystems, Human factors, Knowledge sharing behavior, Knowledge sharing intention.*

1. Introduction

International business plays a significant role in driving global economic growth through cross-border trade, foreign investment, and international supply chain integration. Ports function as strategic gateways connecting maritime transportation and inland logistics systems, enabling efficient cargo movement across global supply chains. The competitiveness of ports reflects a country's capability to attract investment, reduce logistics costs, and strengthen national economic performance. Malaysia possesses a strong geostrategic advantage due to its location along the Straits of Malacca, one of the busiest maritime trade routes globally, handling approximately 100,000 vessels annually and facilitating nearly 25% of world trade [1]. This strategic position strengthens Malaysia's role as a regional logistics hub and global distribution center. In this increasingly competitive and technology-driven environment, knowledge sharing has become a critical organizational capability for sustaining operational efficiency, innovation, digital transformation, and long-term competitiveness. As ports increasingly adopt smart port technologies, automation systems, and digital logistics platforms, effective knowledge exchange among employees and industry stakeholders has become essential for maximizing the benefits of technological innovation.

Knowledge sharing refers to the exchange of expertise, information, skills, and experiences

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among individuals, teams, and organizations. Previous studies demonstrated that effective knowledge sharing contributes significantly to organizational productivity, innovation capability, and sustainable organizational performance [2]. In addition, it is also emphasized that knowledge collaboration enhances organizational productivity by supporting best practices, operational continuity, and innovation across organizational boundaries [3]. In increasingly dynamic industrial environments, organizations that successfully encourage knowledge exchange are more capable of responding to market uncertainties, technological transformation, and operational disruptions.

Knowledge sharing also plays an important role in supporting sustainable development initiatives. Effective knowledge sharing practices contribute directly to Sustainable Development Goal (SDG) 8, which focuses on decent work and economic growth, by improving workforce capability, productivity, and sustainable employment opportunities [4]. In addition, knowledge sharing supports SDG 9 concerning industry, innovation, and infrastructure development through continuous information exchange, technological collaboration, and organizational learning. Apart from that, it is also reported that knowledge sharing strengthens sustainable organizational performance and acts as a mediator between environmental management awareness and sustainability outcomes [5]. Similarly, Ahmad et al. [6] found that green human resource management practices become more effective when supported by strong knowledge-sharing cultures. These findings indicate that knowledge sharing is no longer viewed merely as an operational activity but rather as a strategic mechanism supporting sustainability, innovation, and long-term competitiveness. In technology-intensive industries, knowledge sharing also serves as a critical enabler of digital innovation by facilitating the transfer of expertise, operational best practices, and technological know-how across organizational boundaries. Consequently, organizations undergoing digital transformation increasingly depend on effective knowledge sharing to support innovation adoption and sustainable development.

Previous empirical studies consistently confirmed the positive influence of knowledge sharing at individual, team, and organizational levels. At the individual level, knowledge sharing positively influences employee creativity, work performance, and innovative behavior. Lee [7] found that knowledge sharing contributes significantly to individual creativity within higher education institutions. Vandavasi et al. [8] further reported that knowledge sharing positively affects shared leadership development and innovative behavior among hospitality employees. Similarly, Brooke et al. [9] highlighted that self-efficacy significantly mediates employees' knowledge-sharing behavior, emphasizing the importance of psychological and behavioral factors in encouraging knowledge exchange. At the team level, knowledge sharing strengthens collaboration effectiveness, trust, creativity, and team performance. Ahmad and Karim [2] reported that tacit and explicit knowledge sharing mediate the relationship between social capital and team innovation. Organizations that successfully cultivate collaborative knowledge-sharing environments are more likely to achieve continuous innovation and sustainable organizational effectiveness.

At the organizational level, knowledge sharing functions as a strategic driver of organizational learning, innovation, and sustainable competitive advantage. Arsawan et al. [10] reported that knowledge sharing significantly influences innovation culture, business performance, and sustainable competitiveness among organizations. Similarly, Azeem et al. [11] found that organizational culture, innovation orientation, and knowledge sharing positively contribute to long-term organizational competitiveness. Cormican et al. [12] further emphasized that knowledge sharing transforms individual expertise into organizational assets, preventing knowledge loss while strengthening organizational continuity and resilience. These findings demonstrate that organizations capable of effectively managing and sharing knowledge are better positioned to sustain competitive advantage in increasingly dynamic industrial environments.

The importance of knowledge sharing becomes even more critical within inter-organizational and technology-enabled environments such as the port industry. Modern port operations increasingly rely on digital platforms, automated systems, integrated logistics networks, and real-time information exchange to improve operational performance and supply chain visibility. Consequently, effective inter-

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industry knowledge sharing has become an important mechanism supporting both operational integration and technological innovation. Port operations involve collaboration among multiple stakeholders, including shipping companies, terminal operators, customs authorities, freight forwarders, logistics providers, and warehousing organizations. Effective inter-industry knowledge sharing enables better coordination, reduces operational redundancy, improves decision-making quality, and strengthens supply chain efficiency. Ferretti et al. [13] highlighted that knowledge sharing within sea-land logistics networks significantly improves coordination and operational integration among port stakeholders. Similarly, Luo et al. [14] argued that information exchange and knowledge transfer are critical for improving maritime logistics competitiveness and organizational resilience.

The global port industry has experienced substantial recovery and transformation following the COVID-19 pandemic. According to UNCTAD [15], global container shipping activities increased significantly during the post-pandemic recovery period, while Asian ports dominated the Container Port Performance Index rankings. Ridzuan et al. [16] noted that the Malaysian port industry plays an essential role within the national Blue Economy framework by supporting trade activities, logistics development, and maritime sustainability initiatives. In addition, Malaysia's maritime sector contributes significantly to the national economy through international trade, logistics services, and employment generation.

Despite these positive developments, the Malaysian port industry continues facing several operational and strategic challenges. These include excessive dependency on road transportation, limited hinterland integration, fragmented maritime governance, digitalization gaps, and increasing competition from regional ports. Furthermore, growing geopolitical uncertainties and supply chain disruptions continue affecting global maritime operations and port competitiveness [17]. Although digital transformation initiatives such as smart ports, automation systems, artificial intelligence applications, and digital logistics platforms have improved operational efficiency, human-centered challenges related to communication, collaboration, trust, and knowledge sharing remain significant concerns within the industry. The effectiveness of technological investments ultimately depends on employees' willingness to exchange knowledge and collaborate across organizational boundaries.

Existing studies on knowledge sharing within the maritime and logistics sectors primarily focus on technological systems, information management platforms, smart port technologies, and digital transformation initiatives [18]. While these studies have contributed significantly to understanding technology-enabled knowledge management, limited attention has been given to the human factors that influence employees' willingness to share knowledge within digitally transforming port environments. Previous studies suggested that organizational climate, peer support, and leadership significantly influence employees' willingness to share knowledge [19]. Nevertheless, empirical evidence examining these relationships within the port industry remains limited, particularly in developing countries such as Malaysia. As ports continue to adopt advanced technologies and smart logistics systems, understanding the human dimensions of knowledge sharing becomes increasingly important for ensuring successful digital transformation and sustainable organizational performance.

Furthermore, limited studies have investigated the mediating role of knowledge sharing intention in explaining how human factors influence actual inter-industry knowledge sharing behavior among port employees. According to the Theory of Planned Behavior, behavioral intention functions as the strongest predictor of actual behavior [20]. Recent studies further confirmed that knowledge sharing intention significantly influences employees' actual knowledge sharing practices across organizational contexts [21, 22]. However, empirical validation within maritime and port industry settings remains insufficient.

Therefore, this study aims to examine the mediating role of knowledge-sharing intention in the relationship between human factors and inter-industry knowledge-sharing behavior among port employees in Malaysia's transhipment port. Specifically, this study investigates the influence of individual factors, peer factors, and organizational factors on employees' intention to share knowledge and actual inter-industry knowledge-sharing behavior. The study focuses on employees working at the

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leading transshipment ports in Southeast Asia. The findings are expected to contribute theoretically by extending the application of the Theory of Planned Behavior, Social Cognitive Theory, and Social Exchange Theory within the maritime industry context. Practically, the findings may provide valuable insights for policymakers, port authorities, and organizational leaders in developing sustainable human-centered strategies that strengthen knowledge-sharing practices, organizational learning, and long-term port competitiveness.

2. Literature Review

2.1. Knowledge

Knowledge is widely recognised as a strategic organisational asset that contributes to innovation, competitiveness, and long-term sustainability. The concept of knowledge has been interpreted from various disciplinary perspectives because it involves cognitive understanding, experience, information, and contextual interpretation. According to Zahedi [23] knowledge is not merely static information but a dynamic human resource that enables individuals to justify beliefs and generate meaningful understanding. Similarly, Garcia-Perez et al. [24] described knowledge as an intangible asset acquired through cognitive processes such as learning, communication, reasoning, and perception. These interpretations indicate that knowledge plays a significant role in shaping organisational capability and decision-making processes.

In organisational contexts, knowledge is regarded as a valuable resource that supports performance improvement and competitive advantage. Kivijärvi [25] explained that knowledge encompasses skills, experiences, concepts, and visions that influence the ability of individuals and organisations to solve problems and make strategic decisions. Effective knowledge management enables organisations to utilise employees' expertise and experiences to improve operational efficiency and organisational learning. Ahmad and Karim [2] further argued that organisations capable of managing and utilising knowledge effectively are more likely to achieve innovation, productivity, and sustainable growth. The growing importance of knowledge has encouraged organisations to invest in systems and cultures that facilitate knowledge creation and dissemination. In modern organisations, knowledge is increasingly viewed as a critical source of intellectual capital that enhances organisational adaptability and innovation capability. Ahmad et al. [6] highlighted that knowledge contributes significantly to employee learning, collaboration, and organisational development. Furthermore, the rapid advancement of digital technologies and globalisation has intensified the need for organisations to continuously acquire, develop, and share knowledge to remain competitive in dynamic business environments.

In contemporary technology-driven industries, knowledge has become increasingly important for supporting digital transformation, innovation adoption, and organizational adaptability. Consequently, effective knowledge management is essential for organizations operating within digitally connected environments.

2.2. Types of Knowledge

Knowledge is commonly categorised into tacit knowledge and explicit knowledge. Tacit knowledge refers to personal knowledge that is difficult to formalise, document, or communicate because it is deeply rooted in individual experiences, intuition, and skills. According to Adesina and Ocholla [26], tacit knowledge is developed through practical experiences and social interactions, making it highly valuable but difficult to transfer within organisations. This type of knowledge often exists in the minds of employees and can only be shared through observation, collaboration, mentoring, and continuous interaction.

In contrast, explicit knowledge refers to knowledge that can be documented, codified, and easily communicated through written materials, manuals, databases, and organisational procedures. Explicit knowledge is structured and systematic, enabling organisations to store and disseminate information efficiently across departments and employees. Ahmad and Karim [2] explained that

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explicit knowledge supports organisational learning because it can be accessed, transferred, and reused with minimal difficulty. The availability of technological systems has further improved organisations' capability to manage and distribute explicit knowledge effectively. Both tacit and explicit knowledge are essential for organisational success because they complement each other in knowledge creation and innovation processes. Organisations that successfully integrate both forms of knowledge are more capable of improving problem-solving, creativity, and decision-making processes. Ahmed et al. [27] emphasised that technological platforms and social interactions facilitate the integration of tacit and explicit knowledge within organisations. Consequently, organisations need to establish supportive environments that encourage employees to share experiences, ideas, and documented information to maximise organisational knowledge resources.

The integration of tacit and explicit knowledge has become increasingly important in digital environments where organizations rely on technology-enabled systems to capture, transfer, and utilize knowledge across organizational boundaries.

2.3. Knowledge Sharing

Knowledge sharing refers to the process through which individuals exchange information, expertise, experiences, and skills with others within or between organisations. It is considered a crucial activity in knowledge management because it facilitates organisational learning, innovation, and performance improvement. Ahmad and Karim [2] defined knowledge sharing as the dissemination of knowledge among individuals to enhance collective understanding and organisational effectiveness. Similarly, Ahmed et al. [27] highlighted that knowledge sharing enables organisations to improve communication, collaboration, and problem-solving capabilities.

The effectiveness of knowledge sharing depends heavily on organisational culture, trust, communication, and employee willingness to contribute knowledge. Employees are more likely to share knowledge when organisations establish supportive environments that encourage collaboration and mutual respect. Abbasi et al. [28] argued that social capital elements such as trust, social interaction, and interpersonal relationships significantly influence employees' willingness to engage in knowledge sharing activities. In addition, supportive leadership and organisational commitment play important roles in encouraging employees to exchange valuable information and experiences. Technological advancements have transformed the way knowledge is shared within organisations. Digital communication platforms, social media, and information systems have facilitated faster and more efficient knowledge dissemination across organisational boundaries. The increasing adoption of digital technologies has transformed knowledge sharing from a traditional interpersonal activity into a technology-enabled organizational capability. Digital platforms support real-time collaboration, information exchange, and knowledge integration among geographically dispersed stakeholders. As organizations continue to embrace digital transformation initiatives, effective knowledge sharing becomes increasingly important for supporting innovation and operational performance.

2.4. Knowledge Sharing Behavior

Knowledge sharing behavior refers to the actions and willingness of individuals to disseminate knowledge, expertise, and experiences with others. This behavior is influenced by psychological, social, and organisational factors that determine whether individuals are willing to contribute their knowledge voluntarily. According to Abbasi et al. [28], knowledge sharing behavior is strongly associated with social relationships, trust, and reciprocal interaction among employees. Employees who perceive positive social relationships within organisations are generally more motivated to share knowledge with colleagues.

Knowledge sharing behavior contributes significantly to organisational innovation, learning, and performance enhancement. Organisations that promote positive knowledge-sharing behavior are more capable of improving collaboration, creativity, and problem-solving efficiency. Ahmad et al. [6] found that employees are more likely to engage in knowledge sharing when they perceive personal and

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organisational benefits from such behavior. Moreover, positive organisational culture and supportive management practices strengthen employees' motivation to participate in knowledge-sharing activities. Despite its importance, knowledge-sharing behavior may be hindered by various barriers such as a lack of trust, fear of losing personal value, inadequate rewards, and poor communication systems. Ali Ahmed and Mahboob Khurshid [21] explained that behavioral intention plays an important role in determining employees' willingness to use technological platforms for knowledge-sharing purposes. Organisations must therefore develop strategies that encourage openness, collaboration, and trust to strengthen employees' knowledge-sharing behavior and improve organisational effectiveness. This requirement becomes particularly important in technology-intensive industries where organizational success increasingly depends on employees' ability to exchange knowledge effectively within digital and interconnected working environments.

2.5. Underpinning Theory

The Theory of Planned Behavior (TPB) developed by Ajzen [29] is widely used to explain behavioral intention and human actions in various organisational contexts, including knowledge sharing behavior. According to the TPB, behavioral intention is influenced by three primary factors: attitude toward the behavior, subjective norms, and perceived behavioral control. He explained that individuals are more likely to perform a behavior when they possess positive attitudes toward the behavior, perceive social support, and believe they have the capability to perform it successfully.

The TPB has been extensively applied in studies related to knowledge sharing because it provides a comprehensive explanation of individuals' intentions and behaviors. Ajzen [20] further clarified that behavioral intention serves as the immediate determinant of actual behavior. In the context of knowledge sharing, employees are more likely to share knowledge when they perceive knowledge sharing positively, receive encouragement from colleagues and organisations, and possess confidence in their ability to contribute valuable knowledge. In addition to TPB, Social Exchange Theory is also relevant in explaining knowledge-sharing behavior. Social Exchange Theory suggests that individuals engage in social interactions based on reciprocal benefits and mutual trust. Agbanyo and Shi [30] argued that employees are more willing to share knowledge when they expect positive returns such as recognition, cooperation, and social support. Therefore, both TPB and Social Exchange Theory provide strong theoretical foundations for understanding how non-technological factors influence knowledge sharing intention and behavior. These theoretical perspectives are particularly relevant within digitally transforming organizations, where human behavior, social interaction, and organizational support remain critical determinants of successful knowledge exchange despite increasing technological sophistication.

2.6. *Non-Technological Factors*

Non-technological factors refer to human and organisational elements that influence employees' willingness and ability to engage in knowledge-sharing activities. These factors are often categorised into individual, co-worker, and organisational factors. Unlike technological factors, non-technological factors focus on behavioral, social, and cultural aspects that shape employees' interactions and collaborative practices. Abbasi et al. [28] highlighted that social relationships, organisational culture, and interpersonal trust significantly influence knowledge sharing behavior among employees. Although technological infrastructures facilitate information exchange, the effectiveness of knowledge sharing ultimately depends on employees' willingness to contribute, collaborate, and engage in knowledge exchange activities. Consequently, understanding non-technological factors remains essential for maximizing the benefits of technology-enabled knowledge management systems.

Individual factors include personal attitudes, motivation, self-efficacy, and willingness to share knowledge with others. Employees with positive attitudes and strong confidence in their expertise are generally more willing to contribute knowledge within organisations. Ahmad et al. [6] found that employees' intrinsic motivation and perceived benefits strongly influence their participation in

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knowledge sharing activities. In addition, personal values and commitment toward organisational goals also contribute to positive knowledge-sharing behavior. Co-worker and organisational factors are equally important in encouraging effective knowledge sharing practices. Supportive colleagues, teamwork, trust, leadership support, and organisational culture create environments that facilitate collaboration and information exchange. Abbasi et al. [28] emphasised that employees are more likely to share knowledge when organisations provide supportive environments, recognition systems, and opportunities for collaboration. Therefore, organisations must address non-technological factors comprehensively to strengthen knowledge-sharing practices and organisational performance.

2.7. Intention to Share Knowledge

Knowledge sharing intention refers to an individual's willingness or readiness to share knowledge, experiences, and expertise with others. Behavioral intention is considered a critical predictor of actual knowledge sharing behavior because individuals are unlikely to engage in knowledge sharing activities without prior intention. Based on the Theory of Planned Behavior, intention reflects an individual's motivation and commitment toward performing a specific behavior [29]. Therefore, understanding employees' intention to share knowledge is essential for organisations seeking to improve collaborative practices and organisational learning. In digitally connected organizational environments, behavioral intention also plays a critical role in determining whether employees actively participate in technology-enabled knowledge sharing activities.

Several factors influence employees' intention to share knowledge, including attitude, subjective norms, trust, organisational culture, and perceived behavioral control. Employees who perceive knowledge sharing positively and receive encouragement from colleagues and management are more likely to develop strong intentions to share knowledge. Ali Ahmed and Mahboob Khurshid [21] explained that social influence and perceived usefulness significantly affect behavioral intention toward knowledge sharing activities. Similarly, Ahmad et al. [6] found that supportive organisational environments and employee motivation positively influence knowledge sharing intention. Knowledge sharing intention plays an important mediating role between non-technological factors and actual knowledge sharing behavior. Employees with strong intentions are more likely to participate actively in organisational knowledge exchange activities. Agbanyo and Shi [30] highlighted that reciprocal relationships and social support strengthen employees' intentions to engage in collaborative knowledge sharing. Consequently, organisations should focus on developing positive attitudes, supportive cultures, and trust-based relationships to strengthen employees' intention and willingness to share knowledge effectively.

2.8. Previous Studies

Individual factors have consistently been identified as important determinants influencing employees' willingness to participate in knowledge-sharing activities. Prior studies suggested that personal attitudes, intrinsic motivation, self-efficacy, and perceived benefits significantly shape employees' behavioral intention toward knowledge sharing [28]. Employees who perceive knowledge sharing as beneficial to their professional development and organizational contribution are generally more willing to engage in collaborative knowledge exchange activities. From the perspective of the Theory of Planned Behavior (TPB), individual attitude plays a critical role in determining behavioral intention [29]. Employees with positive attitudes toward knowledge sharing are more likely to develop stronger intentions to disseminate knowledge within organizational environments. Similarly, Social Cognitive Theory emphasizes the importance of self-efficacy and individual confidence in influencing behavioral engagement. Previous empirical studies also demonstrated that employees with higher self-confidence and stronger intrinsic motivation tend to exhibit greater intention to share knowledge [31]. Despite extensive research on individual determinants, existing findings remain fragmented across organizational and industrial contexts. Furthermore, limited studies have examined the influence of individual factors on knowledge sharing intention in inter-industry environments.

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Coworker-related factors play a substantial role in facilitating collaborative knowledge-sharing practices within organizations. Existing literature highlights that interpersonal trust, peer support, communication quality, and social interaction positively influence employees' willingness to exchange knowledge [28]. Employees are more likely to share knowledge when they perceive supportive and trustworthy relationships among colleagues. Social Exchange Theory explains that individuals tend to engage in knowledge-sharing activities when reciprocal relationships and mutual benefits are present [30]. Trust-based interactions among coworkers create psychological safety that encourages employees to contribute ideas, experiences, and expertise without fear of exploitation or negative consequences. Previous studies further revealed that collaborative work environments significantly enhance employees' behavioral intention toward knowledge sharing [32, 33]. However, many previous studies primarily focused on intra-organizational settings and technological collaboration platforms. Limited empirical attention has been given to coworker influence within broader inter-industry knowledge-sharing contexts.

Organizational factors are frequently recognised as critical enablers of knowledge sharing practices. Organizational culture, leadership support, reward systems, and organizational climate have been found to significantly influence employees' behavioral intention toward knowledge sharing [34]. Supportive organizational environments encourage employees to participate actively in collaborative learning and knowledge dissemination activities. According to the Theory of Planned Behavior, subjective norms and perceived behavioral control contribute substantially to behavioral intention formation [29]. Organizational support mechanisms such as management encouragement, communication openness, and recognition systems strengthen employees' perceptions regarding the importance and feasibility of knowledge sharing. In addition, organizational climate has been shown to influence employees' confidence and motivation to engage in collaborative knowledge practices [35]. Although previous studies confirmed the importance of organizational support in promoting knowledge sharing, inconsistent findings remain regarding the relative influence of organizational factors across different industrial settings. Furthermore, the majority of prior studies emphasized technological infrastructures rather than behavioral and organizational dimensions.

Collectively, previous studies indicate that both technological and non-technological factors contribute to successful knowledge-sharing practices. While technological infrastructures provide platforms that facilitate information exchange, human-related factors such as motivation, trust, social interaction, and organizational support remain fundamental drivers of knowledge-sharing behavior. As organizations increasingly adopt digital technologies and collaborative platforms, understanding the interaction between human factors and knowledge sharing processes becomes increasingly important for supporting innovation, organizational learning, and digital transformation. Behavioral intention is widely recognised as the immediate antecedent of actual behavior. According to the Theory of Planned Behavior, intention reflects an individual's readiness and motivation to perform a particular behavior [29]. In the context of knowledge sharing, employees with stronger intentions are more likely to engage actively in knowledge dissemination and collaborative learning activities. Previous studies consistently demonstrated that knowledge sharing intention positively influences actual knowledge sharing behavior [21, 36]. Employees who possess a strong willingness and commitment toward knowledge exchange are generally more proactive in contributing expertise, experiences, and information to colleagues and organizational networks. Moreover, intention has been identified as an important psychological mechanism linking organizational and interpersonal determinants with behavioral outcomes. Despite the growing number of studies examining knowledge-sharing behavior, limited research has investigated the mediating role of knowledge-sharing intention within inter-industry contexts.

Within the port industry, knowledge sharing has become increasingly important due to the growing adoption of smart port technologies, automation systems, and digital logistics platforms. The effectiveness of these technological initiatives depends not only on infrastructure investments but also on employees' willingness to exchange knowledge across organizational and industry boundaries.

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Therefore, understanding the human factors that influence knowledge-sharing intention and behavior remains critical for supporting sustainable port innovation and digital transformation.

3. Methodology

This study employed a quantitative research design grounded in the positivist paradigm to examine the influence of non-technological factors on inter-industry knowledge sharing among port employees operating within a digitally transforming port environment at Malaysia's transshipment port. The quantitative approach enables systematic examination of human and organizational factors that support knowledge exchange within technology-enabled logistics and maritime operations. The quantitative approach was selected because the study aimed to measure psychological and organizational constructs systematically and to test the causal relationships among variables using statistical techniques [37]. In line with the deductive approach, hypotheses were developed based on established theories and prior empirical findings before being tested using empirical data [14]. The proposed framework was developed to examine how human-centered factors influence knowledge-sharing practices that support collaboration, innovation, and information exchange within modern port operations. The conceptual framework of the study was developed based on three underpinning theories, namely the Theory of Planned Behavior (TPB), Social Cognitive Theory (SCT), and Social Exchange Theory (SET). TPB explains the relationship between attitude, intention, and behavior in predicting knowledge-sharing practices [38]. SCT emphasizes the role of self-efficacy and social influence in shaping behavioral outcomes [9]. Meanwhile, SET explains knowledge-sharing behavior through reciprocal relationships, trust, and organizational support [39].

The research framework consisted of non-technological factors as independent variables, knowledge-sharing intention as the mediating variable, and inter-industry knowledge-sharing behavior as the dependent variable. The independent variables included individual factors, peer factors, and organizational factors. Individual factors comprised knowledge self-efficacy and image, while peer factors included peer trust, peer involvement, and peer attitude. Organizational factors consisted of organizational culture and organizational structure. The mediating variable was knowledge-sharing intention, whereas inter-industry knowledge-sharing behavior represented the final outcome variable. The framework was tested using Partial Least Squares Structural Equation Modeling (PLS-SEM), which is appropriate for complex predictive models involving mediation relationships [40]. The study adopted a cross-sectional design in which data were collected at a single point in time. This approach was considered appropriate because the respondents consisted of executive-level port employees with demanding work schedules and because the study focused on examining existing relationships rather than long-term behavioral changes [41].

In addition, the cross-sectional approach enabled efficient data collection within the operational environment of a high-intensity port organization. The study utilised a cross-sectional research design, where data were collected at a single point in time through a structured questionnaire survey. The cross-sectional design was considered appropriate because the study aimed to examine the current relationships and causal influences among the constructs rather than changes over time. In addition, the target respondents consisted of executive-level employees working in a highly demanding port environment with limited availability for longitudinal participation. The quantitative approach enabled the researcher to objectively measure psychological and organisational constructs using numerical data and statistical analysis techniques. Furthermore, this design supported the use of advanced statistical procedures such as Structural Equation Modeling (SEM) and mediation analysis to test the hypothesised relationships and indirect effects among variables.

3.1. Data Collection and Analysis

Data were collected using a structured questionnaire distributed both online and physically to respondents through official communication channels within the organisation. The questionnaire

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consisted of two main sections. Section A contained demographic questions related to gender, age, ethnicity, educational background, years of service, and current position. Sections B to D measured the main constructs of the study, including inter-industry knowledge sharing behavior, self-efficacy in knowledge sharing, organisational culture, organisational structure, peer trust, peer involvement, peer attitude, image, and intention to share knowledge. All measurement items were adapted from established instruments used in previous empirical studies to ensure theoretical consistency and measurement validity. Minor modifications were made to the wording and contextual relevance to suit the Malaysian port industry environment while preserving the original meaning of the items. The questionnaire utilised a five-point Likert scale ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree") to measure respondents' levels of agreement with each statement.

The use of a Likert scale was appropriate because it enabled the quantification of respondents' perceptions, attitudes, and behavioral intentions in a systematic manner. Prior to the actual data collection, the instrument underwent expert validation and pilot testing to assess content validity, clarity of language, and reliability. The pilot study involved ten respondents selected from the target population to assess questionnaire clarity, content relevance, and instrument comprehensibility before full-scale data collection. Feedback obtained from the pilot participants contributed to improving wording clarity and contextual suitability. Reliability analysis was conducted using Cronbach's Alpha and Composite Reliability, where values exceeding 0.70 were considered acceptable. The validity and reliability of the measurement model were further evaluated using SmartPLS 4.0. Convergent validity was assessed through factor loadings and Average Variance Extracted (AVE), where factor loadings above 0.70 and AVE values above 0.50 indicated satisfactory convergent validity. Discriminant validity was examined using the Fornell-Larcker criterion and the Heterotrait-Monotrait Ratio (HTMT). In addition, Common Method Bias (CMB) was controlled through procedural and statistical approaches.

Procedurally, anonymity and confidentiality were assured to respondents, questionnaire items were arranged randomly, and respondents were informed that there were no right or wrong answers. Statistically, Harman's Single Factor Test was conducted, and the results confirmed that no single factor dominated the total variance, indicating that common method bias was not a significant issue in the study. In addition, procedural remedies were implemented throughout the questionnaire-design process to minimize respondents' evaluation apprehension and reduce the likelihood of systematic response bias.

Data collection was conducted using structured questionnaires distributed both physically and online through Google Forms. Respondents were informed about the objectives of the study, voluntary participation, confidentiality, and their right to withdraw at any stage. Informed consent was obtained before respondents completed the questionnaire. Several procedural remedies were implemented to reduce common method bias (CMB), including anonymity assurance, random arrangement of questionnaire items, and adaptation of validated measurement scales [42]. Harman's Single Factor Test was also conducted to statistically assess the presence of common method bias. The data analysis process involved descriptive and inferential statistical techniques. Descriptive statistics, including frequencies, percentages, means, standard deviations, skewness, and kurtosis, were calculated using SPSS 27.0 to summarize respondent profiles and variable distributions. Mean score interpretation followed three levels: low (1.00–2.33), moderate (2.34–3.67), and high (3.68–5.00).

Inferential analysis was conducted using SmartPLS 4.0 and R software with the lavaan package. The measurement model was first evaluated through reliability and validity assessments, including factor loadings, AVE, Composite Reliability, Cronbach's Alpha, Fornell-Larcker criterion, and HTMT ratio [40]. Subsequently, the structural model was analyzed using PLS-SEM to test the hypothesized relationships among variables. Path coefficients were examined to determine the strength and direction of relationships, while bootstrapping procedures with 5,000 subsamples were conducted to evaluate statistical significance [43]. Mediation analysis was performed to examine the mediating role of knowledge-sharing intention using bias-corrected bootstrapping procedures [44].

The explanatory power of the model was assessed using the coefficient of determination (R^2),

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predictive relevance (Q^2), and effect size (f^2). The use of PLS-SEM was considered appropriate because the study involved multiple latent constructs, mediation effects, predictive modelling objectives, and theory extension within a complex organizational context. Furthermore, PLS-SEM is particularly suitable for exploratory and prediction-oriented studies that examine human and organizational behavior in applied settings [40].

4. Results and Findings

4.1. Structural Model Analysis and Assessments

The main goal of this study was to examine the mediating role of knowledge sharing intention in the relationship between human factors and inter-industry knowledge sharing behavior among transshipment port employees in Malaysia. Specifically, this study investigates the influence of individual factors, peer factors, and organizational factors on employees' intention to share knowledge as a mediating variable towards actual inter-industry knowledge sharing behavior. The structural model analysis using Partial Least Squares Structural Equation Modelling (PLS-SEM) demonstrated highly satisfactory model performance in terms of explanatory power and predictive capability. The findings indicated that the proposed model successfully explained a substantial proportion of variance in the endogenous variables.

Table 1.
Measurement Model Fit Indices (CFA).

Fit Index	Obtained Value	Threshold	Assessment
CFI	0.965	> 0.90	Excellent
TLI	0.962	> 0.90	Excellent
RMSEA	0.039	< 0.06	Excellent
SRMR	0.038	< 0.05	Excellent
χ^2/df	1.85	< 3.00	Excellent

Based on Table 4.16, all model fit indices achieved and exceeded the recommended threshold values. The Comparative Fit Index (CFI) value of 0.965 and Tucker-Lewis Index (TLI) value of 0.962 indicated an excellent level of model fit, both exceeding the recommended minimum threshold of 0.90. In addition, the Root Mean Square Error of Approximation (RMSEA) value of 0.039 was below the acceptable threshold of 0.06, while the Standardized Root Mean Square Residual (SRMR) value of 0.038 was below the recommended threshold of 0.05. Both indices demonstrated excellent model adequacy. Furthermore, the Chi-square to degree of freedom ratio (χ^2/df) of 1.85 fell within the acceptable range below 3.00, confirming that the proposed model adequately fitted the empirical data. The confirmatory factor analysis (CFA) further verified that all major constructs, namely Knowledge Sharing Behavior (DV), Individual Factors (IV_IND), Organizational Factors (IV_ORG), Peer Factors (IV_RAK), and Knowledge Sharing Intention (MEV_A), possessed strong and theoretically consistent measurement structures. This analysis confirmed that the developed measurement model was both valid and reliable for subsequent structural model assessment. The excellent CFA results provided strong justification for proceeding with further analysis using PLS-SEM, thus demonstrating the high methodological quality of the present study.

Table 2 presents the R^2 and Q^2 values, which demonstrate the strength of the model in terms of explanatory and predictive power.

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Table 2.
Assessment of Explanatory and Predictive Power of the Model.

Variable	R^2 Value	Interpretation of R^2	Average Q^2 Predict	Interpretation of Q^2
Knowledge Sharing Behavior (DV)	0.638	Moderate–High	0.300	Satisfactory predictive power
Knowledge Sharing Intention (MEV_A)	0.672	Moderate–High	0.423	Good predictive power

The R^2 value for Knowledge Sharing Behavior (DV) was 0.638, indicating that 63.8% of the variance in knowledge sharing behavior was collectively explained by non-technological factors and knowledge sharing intention. Meanwhile, Knowledge Sharing Intention (MEV_A) recorded a higher R^2 value of 0.672, demonstrating that 67.2% of the variance in intention to share knowledge was successfully explained by non-technological factors. According to Cohen [45], R^2 values at this level are categorized as moderate-to-high effects within the context of social science research. From the predictive capability perspective, the positive Q^2 predicted values for all items confirmed that the model possessed relevant predictive ability. A more detailed analysis showed that the MEV_A items recorded higher Q^2 predict values ranging from 0.380 to 0.481 compared to the DV items ranging from 0.263 to 0.348. This finding indicates that the model demonstrated stronger predictive capability for knowledge sharing intention compared to actual knowledge sharing behavior. Furthermore, the comparison between RMSE and MAE values for the PLS-SEM model and traditional linear models revealed that the PLS-SEM model produced more accurate predictions with lower error values. This finding further supports the suitability and superiority of PLS-SEM for the present study.

As a complement to the structural model analysis, effect size (f^2) analysis was conducted to evaluate the magnitude of the effect contributed by each predictor variable toward the endogenous variables. The f^2 effect size measures the relative contribution of each construct in explaining the variance of the dependent variable after controlling for other constructs in the model.

Table 3.
Effect Size (f^2) for Relationships in the Model.

Relationship	Effect Size (f^2)	Interpretation
IV_INDIVIDU → DV	0.022	Small effect
IV_ORGANIZATION → DV	0.069	Small to moderate effect
IV_PEER → DV	0.014	Small effect
MEV_A → DV	0.075	Small to moderate effect
IV_INDIVIDUAL → MEV_A	0.124	Small to moderate effect
IV_ ORGANIZATION → MEV_A	0.298	Moderate to large effect
IV_ PEER → MEV_A	0.083	Small to moderate effect

The effect size analysis revealed variations in the relative importance of each relationship within the structural model. The relationship between Organizational Factors and Knowledge Sharing Intention (IV_ORGANISASI → MEV_A) recorded the largest effect size ($f^2 = 0.298$), which can be categorized as a moderate-to-large effect according to Cohen's [45] criteria. This finding indicates that organizational factors represented the strongest contributor in explaining the variance in knowledge sharing intention among port employees. In contrast, the direct relationships between individual, organizational, and peer factors toward knowledge sharing behavior demonstrated relatively small effect sizes ranging between 0.014 and 0.069. These findings suggest that the influence of these non-technological factors on actual knowledge sharing behavior primarily occurred through the mediating role of knowledge sharing intention.

4.2. Direct Relationship Hypothesis Testing

Based on the direct path analysis conducted using the bootstrapping procedure with 5,000

subsamples, the findings indicated that the majority of the proposed hypotheses were supported by empirical data. Table 4 presents the detailed results of the direct relationship hypothesis testing within the structural model.

Table 4.
Direct Relationship Hypothesis Testing Results.

Relationship	Path Coefficient	T Statistics	P Values	Hypothesis Decision	Interpretation
H1: IV_INDIVIDUAL → DV	0.149	2.437	0.015	Supported	Moderate positive effect
H2: IV_PEER → DV	0.121	1.929	0.054	Not Supported	Not significant
H3: IV_ORGANIZATIONAL → DV	0.245	4.470	0.000	Supported	Strong positive effect
H4: IV_ INDIVIDUAL → MEV_A	0.296	4.955	0.000	Supported	Moderate-to-high positive effect
H5: IV_ PEER → MEV_A	0.248	4.456	0.000	Supported	Moderate positive effect
H6: IV_ ORGANIZATIONAL → MEV_A	0.399	8.897	0.000	Supported	Strong positive effect
H7: MEV_A → DV	0.307	4.298	0.000	Supported	Strong positive effect

Based on Table 4, the relationship between Individual Factors and Knowledge Sharing Behavior (H1) was significant with a moderate positive effect ($\beta = 0.149$). The relationship between Organizational Factors and Knowledge Sharing Behavior (H3) demonstrated a stronger positive effect ($\beta = 0.245$). However, the relationship between Peer Factors and Knowledge Sharing Behavior (H2) did not achieve the required significance level ($p = 0.054$), H2 was not supported. For the relationships involving Knowledge Sharing Intention as the dependent variable, all three non-technological factors demonstrated significant relationships. Organizational Factors (H6) exerted the strongest influence on Knowledge Sharing Intention ($\beta = 0.399$), followed by Individual Factors (H4: $\beta = 0.296$) and Peer Factors (H5: $\beta = 0.248$). Furthermore, the relationship between Knowledge Sharing Intention and Knowledge Sharing Behavior (H7) was also significant, with a strong positive effect ($\beta = 0.307$).

4.3. Mediation Effect Testing

Table 5 presents the results of the mediation effect testing, which confirmed the significant role of Knowledge Sharing Intention as a mediating variable within the structural model.

Table 5.
Mediation Effect Testing Results.

Indirect Effect	Path Coefficient	T Statistics	P Values	Hypothesis Decision	Interpretation
H8a: IV_ INDIVIDUAL → MEV_A → DV	0.091	3.423	0.001	Supported	Partial mediation
H8b: IV_ ORGANIZATIONAL → MEV_A → DV	0.123	3.858	0.000	Supported	Partial mediation
H8c: IV_ PEER → MEV_A → DV	0.076	2.880	0.004	Supported	Full mediation

To determine the type of mediation, whether full mediation or partial mediation, this study adopted the approach recommended in PLS-SEM analysis based on the comparison between direct effects and indirect effects. Full mediation occurs when the indirect effect is significant while the direct effect becomes insignificant after the mediator variable is introduced into the model. In contrast, partial mediation occurs when both direct and indirect effects remain significant simultaneously [40]. This approach ensures accurate interpretation regarding the role of the mediator variable within the proposed research model.

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Based on the analysis conducted, the findings demonstrated that the relationships between Individual Factors and Organizational Factors with Knowledge Sharing Behavior were classified as partial mediation because both the direct and indirect effects remained significant. This indicates that Knowledge Sharing Intention partially explained the relationships, while significant direct effects between the independent and dependent variables still existed. In contrast, the relationship between Peer Factors and Knowledge Sharing Behavior was categorized as full mediation because the direct effect became insignificant after the mediator variable was introduced into the model, whereas the indirect effect remained significant. This finding indicates that the influence of Peer Factors on Knowledge Sharing Behavior was fully transmitted through Knowledge Sharing Intention.

The findings further demonstrated that the mediating role of Knowledge Sharing Intention differed according to the type of non-technological factors. Partial mediation for Individual Factors and Organizational Factors suggests that these variables exert both direct and indirect influences on Knowledge Sharing Behavior. Meanwhile, the full mediation effect for Peer Factors indicates that the influence of peer-related factors was entirely channeled through Knowledge Sharing Intention. Based on Table 5, Knowledge Sharing Intention significantly mediated all relationships between non-technological factors and Knowledge Sharing Behavior. The strongest mediation effect was observed for the relationship between Organizational Factors and Knowledge Sharing Behavior through Knowledge Sharing Intention ($\beta = 0.123$), followed by Individual Factors ($\beta = 0.091$) and Peer Factors ($\beta = 0.076$).

Overall, these findings fully supported Hypothesis H8, confirming that Knowledge Sharing Intention functions as a significant mediator in the relationship between non-technological factors and Knowledge Sharing Behavior.

4.4. Relative Influence Analysis of Main Factors

To identify the most influential factor affecting Knowledge Sharing Intention, an analysis equivalent to multiple regression was conducted using path coefficients within the PLS-SEM framework. The analysis results presented in Table 2 showed that all three contextual factors significantly contributed to Knowledge Sharing Intention, although with different magnitudes of influence. Organizational Factors emerged as the strongest predictor with a standardized coefficient (β) of 0.399 ($p < 0.001$), indicating that every one-unit increase in employees' perception of organizational factors was associated with a 0.399-unit increase in Knowledge Sharing Intention after controlling for the influence of other factors. Individual Factors ($\beta = 0.296$, $p < 0.001$) and Peer Factors ($\beta = 0.248$, $p < 0.001$) also demonstrated significant positive influences, although with relatively smaller magnitudes compared to Organizational Factors.

In terms of relative contribution measured through effect size (f^2) as presented in Table 3, Organizational Factors recorded the highest value ($f^2 = 0.298$), which can be categorized as a "moderate-to-large" effect according to Cohen's (1988) criteria. This finding indicates that Organizational Factors contributed the most in explaining the variance in Knowledge Sharing Intention compared to the other factors within the structural model.

5. Discussion

This study examined the influence of non-technological factors, namely individual factors, peer factors, and organizational factors, on inter-industry knowledge-sharing behavior among port employees, with Knowledge Sharing Intention functioning as a mediating variable. Overall, the findings demonstrated that non-technological factors significantly contributed to both Knowledge Sharing Intention and Knowledge Sharing Behavior among port employees. The results further confirmed the importance of psychological, social, and organizational mechanisms in encouraging knowledge-sharing practices within the port industry. These findings suggest that human-centered factors remain critical

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for supporting effective knowledge exchange in increasingly digitalized and technology-enabled port environments.

The descriptive findings revealed that Individual Factors were at a moderate-to-high level among port employees. Respondents perceived knowledge sharing as a mechanism capable of enhancing their professional image and organizational status. Items related to social image and professional recognition, such as being viewed as "high profile" or possessing "high status," recorded relatively high mean values. However, items associated with the uniqueness of expertise and exclusive knowledge contribution remained at moderate levels. This suggests that port employees acknowledged the professional value of sharing knowledge, although confidence regarding the uniqueness of their expertise could still be strengthened.

These findings are consistent with previous studies emphasizing that knowledge self-efficacy and self-value perception are important antecedents of knowledge sharing behavior. Nursyirwan et al. [46] argued that individuals with stronger confidence in their knowledge and skills are more likely to engage in knowledge-sharing activities. Similarly, Memon [47] highlighted that self-efficacy, organizational commitment, and helping tendencies shape employees' willingness to share knowledge. The present findings, therefore, indicate that the moderate-to-high level of self-confidence among port employees provides a strong psychological foundation for inter-industry knowledge sharing practices. Such psychological readiness is particularly important in modern port environments where employees are increasingly required to exchange operational knowledge across digital platforms, integrated logistics systems, and technology-enabled networks.

Peer Factors, meanwhile, were reported at a moderate level. Employees demonstrated moderate trust toward colleagues and moderate perceptions regarding the absence of negative experiences resulting from knowledge sharing. These findings suggest that although the social environment within the port organization was relatively comfortable, it was not sufficiently strong to fully encourage active and consistent knowledge-sharing behavior. Professional interaction and information exchange with external parties also remained moderate, indicating that social interaction channels existed but had not been optimally utilized to support inter-industry knowledge sharing.

The findings support [48], who argued that group norms and peer practices significantly shape knowledge-sharing behavior because employees are more likely to share knowledge when they observe colleagues engaging in similar practices. Similarly, Rauf [49] emphasized that peer/group domains, including trust, peer support, and social interaction, are critical determinants of knowledge sharing readiness. Therefore, the moderate level of peer influence identified in this study indicates that stronger collaborative norms and interpersonal trust are still required within the port industry.

From a practical perspective, these findings suggest that port management should strengthen trust and peer support through cross-department teamwork, communities of practice, mentoring programmes, and group-based recognition systems. Such initiatives may help establish stronger social norms that encourage proactive knowledge sharing while simultaneously reducing employees' perception of risk associated with sharing operational information. These collaborative practices may also improve employees' willingness to participate in technology-enabled knowledge sharing initiatives, including digital collaboration platforms and smart port information systems.

Organizational factors demonstrated clear differences between structural and cultural dimensions. Items related to organizational structure, facilitating interaction, and document sharing recorded high mean values, whereas items related to management support and positive organizational attitudes toward knowledge sharing remained at moderate levels. This finding suggests that the port organization already possesses relatively supportive structural mechanisms for facilitating interaction and knowledge flow, although stronger leadership commitment and cultural support are still needed. This is particularly important because the successful implementation of smart port technologies and digital transformation initiatives depends not only on technological infrastructure but also on organizational cultures that encourage knowledge exchange and continuous learning.

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These findings are aligned with Raziq et al. [50] and Raziq et al. [51], who emphasized that leadership style and supportive organizational culture directly influence knowledge sharing behavior and organizational performance. When leadership support and organizational culture do not clearly prioritize knowledge sharing, employees may fail to perceive it as an important strategic agenda despite having adequate structural facilities.

Similarly, Awada and Haj Youssef [52] found that organizational structure and tie strength significantly influence tacit knowledge sharing because flexible structures and close interpersonal relationships facilitate knowledge flow between organizational units. Within the port industry context, the positive perception toward organizational structure identified in this study may therefore serve as a strong foundation for further strengthening inter-industry collaboration and knowledge exchange among logistics stakeholders, terminal operators, shipping companies, and port authorities.

The findings also demonstrated that Knowledge Sharing Intention among port employees was at a high level. Respondents expressed a strong willingness to share reports, manuals, methodologies, work experiences, and professional expertise with individuals outside their own organizations and industries. This result is important because intention is commonly recognized as the strongest predictor of actual behavior, consistent with the Theory of Planned Behavior proposed by Ajzen [29].

Nguyen et al. [53] similarly found that employees with a strong intention to share knowledge actively contribute to organizational learning and internal knowledge marketing. In the present study, the high level of intention despite only moderate peer and organizational support suggests that Knowledge Sharing Intention may function as a critical psychological mechanism translating non-technological factors into actual knowledge sharing behavior. Within technology-enabled organizational environments, behavioral intention may also influence employees' willingness to participate in digital knowledge exchange, collaborative information systems, and innovation-oriented work practices.

The findings further revealed that Knowledge Sharing Behavior among port employees was already at a high level. Employees actively shared work experiences, expertise, ideas, and operational guidelines with external parties, particularly when requested. Nevertheless, the nature of the responses suggests that knowledge-sharing behavior may still be relatively reactive rather than fully proactive. In digitally transforming port environments, proactive knowledge sharing becomes increasingly important because timely information exchange supports operational coordination, technological adaptation, and innovation across organizational boundaries.

These findings support [46], who argued that individuals possessing high knowledge self-efficacy and appropriate rewards are more likely to transform intention into actual knowledge-sharing behavior. Nguyen et al. [53] further described active knowledge contributors as important "knowledge nodes" facilitating organizational learning and innovation. In the context of the port industry, employees who frequently share expertise with external stakeholders may therefore function as key connectors linking ports with shipping companies, logistics providers, regulators, and terminal operators.

The structural model findings further confirmed that Individual Factors significantly influenced Knowledge Sharing Behavior ($\beta = 0.149$, $p = 0.015$). This result supports previous studies emphasizing the importance of intrinsic motivation, self-confidence, and helping behavior in encouraging knowledge-sharing practices. Mustika et al. [54] demonstrated that knowledge self-efficacy and enjoyment in helping others significantly influence both knowledge sharing intention and behavior. Brooke et al. [9] similarly found that self-efficacy mediates the relationship between experience, trust, and knowledge sharing behavior. These findings suggest that employees' confidence in their expertise remains an important prerequisite for contributing knowledge within increasingly digital and interconnected maritime operations.

However, Peer Factors did not demonstrate a direct significant relationship with Knowledge

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Sharing Behavior (β = 0.121, p = 0.054). Nevertheless, Peer Factors significantly influenced Knowledge Sharing Intention and indirectly affected behavior through full mediation. These findings are consistent with Tang et al. [55], who argued that peer influence often operates indirectly through interpersonal recognition and psychological mechanisms rather than through direct behavioral influence. Similarly, Liang and Yin [56] emphasized that trust among team members acts as an important mechanism linking social relationships and knowledge sharing practices. This finding indicates that social relationships continue to play an important role even in environments where technology facilitates communication and information exchange.

Organizational Factors emerged as the strongest predictor within the model. Organizational Factors significantly influenced both Knowledge Sharing Intention (β = 0.399) and Knowledge Sharing Behavior (β = 0.245). This finding is consistent with Arsawan et al. [10], who found that organizational culture and leadership significantly strengthen knowledge sharing and innovation capabilities. Kim and Park [57] further emphasized that supportive organizational climates and learning cultures increase employees' willingness to share knowledge voluntarily. The finding further suggests that investments in technological infrastructure alone may be insufficient unless accompanied by supportive organizational cultures that encourage knowledge exchange and collaborative learning.

The mediation analysis confirmed that Knowledge Sharing Intention significantly mediated all relationships between non-technological factors and Knowledge Sharing Behavior. Partial mediation was observed for Individual Factors and Organizational Factors, whereas full mediation was identified for Peer Factors. These findings strongly support the Theory of Planned Behavior [29], which posits that intention functions as the immediate antecedent of actual behavior. The findings further demonstrate that behavioral intention functions as a critical mechanism linking organizational and interpersonal influences to actual knowledge-sharing practices within technology-enabled work environments.

Overall, the findings demonstrate that inter-industry knowledge sharing among port employees is influenced by a combination of psychological confidence, social interaction, and organizational support. The findings further suggest that human-centered factors remain essential for maximizing the benefits of digital transformation initiatives, smart port development, and technology-enabled collaboration within the maritime industry. While knowledge-sharing practices already exist at relatively high levels, improvements in peer trust, organizational culture, and leadership support remain necessary to encourage more proactive, systematic, and sustainable knowledge-sharing practices that contribute to innovation, operational resilience, and long-term port competitiveness.

6. Conclusion

This study was conducted to examine the role of non-technological factors, namely individual, peer, and organizational factors, in influencing knowledge-sharing intention and knowledge-sharing behavior within the port industry. As ports increasingly adopt digital technologies, smart-port initiatives, and integrated logistics systems, understanding the human factors that support effective knowledge exchange has become increasingly important. The findings revealed that non-technological factors, knowledge-sharing intention, and knowledge-sharing behavior were all at a high level, indicating that port employees generally possess positive attitudes toward knowledge-sharing practices.

The study also confirmed that knowledge-sharing intention acts as a full mediator between non-technological factors and knowledge-sharing behavior. This suggests that effective knowledge-sharing behavior is not solely dependent on organizational structures, technological infrastructure, or social relationships, but also requires individuals' willingness and intention to engage in such behavior. These findings support the Theory of Planned Behavior (TPB), which emphasizes intention as a key determinant of actual behavior. The results further demonstrate that human-centered factors remain essential for translating organizational support into effective knowledge-sharing practices.

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From a theoretical perspective, this study contributes to the knowledge management literature by highlighting the importance of non-technological factors in promoting knowledge sharing. Unlike many previous studies that focused heavily on technological aspects, this study demonstrates that social, cultural, and organizational elements play a critical role in shaping employees' knowledge-sharing behavior within technology-enabled organizational environments. In particular, the strong influence of organizational factors further reinforces the importance of institutional support, organizational culture, and management practices in fostering knowledge-sharing environments that support innovation, organizational learning, and digital transformation.

Practically, the findings provide valuable guidance for port management and industry practitioners. Organizations should establish supportive policies and cultures that encourage knowledge sharing through recognition programs, reward systems, and continuous training initiatives. Strengthening social interaction among employees through teamwork and cross-functional collaboration is also essential. Additionally, organizations should focus on enhancing employees' motivation, confidence, and awareness regarding the importance of knowledge sharing to improve operational effectiveness, innovation capability, and competitiveness. Such initiatives are particularly important for supporting smart port development, technology-enabled collaboration, and sustainable digital transformation within the maritime industry.

Despite its significant contributions, this study has several limitations. The use of self-reported questionnaire data may introduce social desirability bias, while the cross-sectional design limits the ability to establish causal relationships. In addition, the study was conducted only within the Malaysian port industry, limiting the generalizability of the findings to other industries or international contexts. Future studies are, therefore, recommended to employ longitudinal and mixed-method approaches, expand the research scope to other countries or industries, and include additional variables such as leadership, technology adoption, and environmental factors to gain a deeper understanding of knowledge-sharing dynamics.

Overall, this study concludes that effective management of human and organizational factors is essential for enhancing knowledge-sharing practices in the port industry. The findings demonstrate that although technological systems and digital-transformation initiatives can facilitate information exchange, sustainable knowledge sharing ultimately depends on employees' willingness, organizational support, and collaborative workplace environments. By fostering supportive organizational cultures and strengthening employees' intention to share knowledge, organizations can improve collaboration, innovation, organizational learning, and long-term performance. These efforts are increasingly important for supporting smart-port development, technology-enabled operations, and sustainable competitiveness within the maritime logistics sector.

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The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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