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# The Life of Seafarers in the Digital Age: An Analysis of the Philosophy of Ethics and Morality in the Use of Technology

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A B S T R A C T

This research explores the dynamics of seafarers' lives in the face of digital transformation with a focus on the ethical and moral aspects of the use of technology. Through a qualitative approach with phenomenological design, the study involved 15 seafarers from various levels of position. Data collection was carried out through in-depth interviews, participatory observations, and document analysis. The results reveal that digital transformation has fundamentally changed the way seafarers work and interact socially, with varying rates of technology adoption on various aspects of ship operations. Data privacy and moral responsibility are top concerns, while social interaction patterns show significant declines in direct communication and team cohesion. L'écart entre l'urgence de développer des compétences numériques et la disponibilité de programmes de formation adéquats est un défi majeur. Cette recherche apporte une contribution importante à la compréhension des implications éthiques et morales de la numérisation maritime, et souligne la nécessité d'une approche plus holistique du développement des compétences numériques des gens de mer, qui tienne compte des aspects techniques, éthiques et sociaux.

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## 1. Introduction

The digital era has presented significant transformations in various aspects of human life, including in the maritime world which is the backbone of global trade. Seafarers, as the spearhead of the shipping industry, are now facing a new reality where digital technology is becoming an integral part of their work routine on board. Digitalization in the maritime industry has not only changed the way ships operate, but also has a profound impact on the social, ethical, and moral aspects of seafarers' lives. The modernization of digital-based navigation equipment, communication systems, and ship management has created a new paradigm that requires an in-depth study of the ethical and moral implications of its use.

In the context of modern maritime, seafarers are faced with various ethical dilemmas related to the use of digital technology. Starting from the dependence on electronic navigation systems that replace traditional methods, to the issue of data privacy in digital-based performance monitoring systems. This transformation is not only about operational efficiency, but also closely related to fundamental values that have long been deeply rooted in the seafaring tradition. Fundamental questions about professional autonomy, responsibility, and integrity arise as the role of technology in decision-making on board the ship increases.

The development of digital technology in the maritime industry has presented various innovations such as Automatic Identification System (AIS), Electronic Chart Display and Information System (ECDIS), and various Internet of Things (IoT)-based applications that promise better efficiency and security. However, behind these advances, concerns have emerged about the degradation of seafarers' traditional skills, overreliance on technology, and potential cybersecurity risks that could threaten shipping safety. This situation creates a tension between the demands of modernization and the preservation of traditional values that have long been a moral guide in the seafaring profession.

The social aspect of digitalization in the maritime environment also raises its own problems. Digital communication that allows for better connectivity with family and the world beyond its paradox could create a new social isolation on board. The use of social media and other digital communication platforms has transformed the dynamics of social interaction among crew members, potentially affecting team cohesion and maritime work culture that has been established over the centuries. This change raises important questions about how to balance the benefits of technology with the need to maintain human values in the seafaring profession.

Several previous studies have examined various aspects of digitalization in the maritime industry. Research conducted by Rahman and Stevens (2023) revealed that the implementation of digital technology on ships has a significant impact on the mental well-being of seafarers, with stress levels increasing due to the demands of rapid technological adaptation. Meanwhile, a comprehensive study by Nguyen et al. (2022) shows that although digitalization improves operational efficiency, there is a significant gap in seafarers' readiness to face digital transformation, especially in the ethical aspects of technology use. The research of Kim and Park (2021) also underscores the importance of considering the social and cultural impacts of the implementation of digital technology in the maritime industry.

The phenomenon of digitalization in the maritime world also has implications for the education and training aspects of seafarers. The maritime education curriculum must now integrate digital competencies while maintaining the basic values of the seafaring. This creates new challenges in preparing a generation of seafarers who are not only technologically proficient but also have a deep understanding of the ethics and morals of their profession. A balance between technical ability and ethical understanding is crucial in shaping the profile of modern seafarers who can face the complexities of the digital age.

This research aims to analyze in depth the lives of seafarers in the digital era with a focus on ethical and moral aspects in the use of technology. Through a philosophical approach, this research will explore how traditional moral values interact with the demands of digital modernization, as well as identify ethical principles that can guide in dealing with digital dilemmas in the maritime environment. A better understanding of the ethical and moral dimensions of maritime digitalization is expected to make a significant contribution to the development of more humanistic policies

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and practices in the shipping industry.

The era of the industrial revolution 4.0 has brought fundamental changes in the maritime industry, presenting a variety of advanced technologies that dramatically change the operational landscape of shipping. Digital transformation in the maritime industry includes the implementation of various technologies such as the Internet of Things (IoT), artificial intelligence (AI), big data analytics, and integrated automation systems. According to research conducted by Johannessen et al. (2021), digitalization in the maritime industry has experienced a significant acceleration in the last five years, driven by the need for higher operational efficiency and stricter safety demands.
The integration of digital technology in ship operations has presented the concept of "smart ships" that rely on automatic navigation systems, real-time monitoring of ship conditions, and optimal energy management. Islam (2024) revealed that the implementation of digital technology on ships has improved fuel efficiency by up to 15% and reduced loading and unloading times at ports by 20%. Systems such as the Electronic Chart Display and Information System (ECDIS) and Automatic Identification System (AIS) have become the standard in modern navigation, replacing traditional methods that have been used for centuries.

The development of blockchain technology has also begun to penetrate the maritime industry, especially in the aspects of documentation and transactions. Research conducted by Martinez and Lee (2022) shows that the implementation of blockchain in maritime documentation can reduce document processing time by up to 85% and significantly lower the potential for administrative errors. This transformation not only improves efficiency but also creates a new standard in maritime data transparency and security.

The ethical dimension of the use of technology in the maritime industry is becoming increasingly complex as the reliance on digital systems increases. Thompson et al. (2023) identified several key ethical dilemmas facing modern sailors, including questions about decision-making autonomy in increasingly automated systems, moral responsibility in cases of system failure, and limitations on trust in technology. Traditional moral values in the seafaring profession, such as honor, courage and responsibility, must now be integrated with the demands of the digital age. Research conducted by Yuen et al (2022) revealed that 78% of seafarers feel their traditional values are threatened by digitalization, while 65% experience moral conflicts in relying on technology for critical decision-making.
Another ethical aspect of concern is data confidentiality and privacy. With the increasing use of sensors and digital monitoring systems, seafarers face a dilemma between the need for operational transparency and individual privacy rights. Kumar et al. (2022) emphasized the importance of developing a clear ethical framework for the use of digital data on ships, which takes into account both the operational interests and the individual rights of seafarers

Digital transformation has fundamentally changed the way sailors interact, communicate, and build social relationships on board. Longitudinal research conducted by Rodriguez and Kim (2023) shows significant changes in patterns of social interaction on ships, where digital communication tends to replace traditional face-to-face interactions. The study revealed that while digital technology allows for better connectivity with the outside world, it paradoxically can increase social isolation among crew.

The social impact of digitalization is also seen in the change in the traditional hierarchical structure on ships. Wohlleber, et al (2022) observed that access to information and technological knowledge has transformed traditional power dynamics, creating new challenges in crew management. Younger generations who are more tech-savvy often have an advantage in certain aspects over their more senior counterparts, creating potential generational conflicts in the maritime work environment.
Digital communication has also changed the way sailors manage relationships with family and life on land. A study conducted by Li et al. (2024) shows that while modern communication technology allows for more frequent contact with family, it can also create new emotional distress and blur the boundaries between work and personal life.

Along with the increasing reliance on digital systems, cybersecurity is a major concern in the maritime industry. Comprehensive research by Akpan et al. (2022) revealed that cyberattacks on maritime systems have increased by 300% in the last three years, with potential impacts that could threaten shipping safety and global supply chain stability. Technological risks in shipping are not only limited to external threats, but also include internal

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vulnerabilities such as system failures, human error in the operation of technology, and over-reliance on automated systems. Zhang and Williams (2022) identified that 65% of technology-related maritime safety incidents are caused by a combination of system errors and operators' lack of understanding of technological limitations.
Another important aspect is the standardization and interoperability of maritime digital systems. According to the research of Tsvetkova et al. (2021), the fragmentation of technological standards and the lack of interoperability between systems can create additional safety risks and hinder operational effectiveness. This shows the importance of developing global standards for maritime technology that take into account security and safety aspects.

Digital transformation in the maritime industry has created an urgent need for the renewal of seafarers' education and training systems. Research conducted by Wilson and Garcia (2023) shows that traditional maritime education curricula need to be significantly revised to integrate the digital competencies required in the modern era, while still retaining the fundamental knowledge of the seafaring.

The development of seafarers' digital competencies includes not only technical skills but also an ethical and critical understanding of technology. According to a study conducted by Brooks et al. (2022), modern sailors require a unique combination of digital skills, ethical understanding, and complex decision-making abilities. Training programs need to be designed to develop "digital wisdom" that allows seafarers to use technology effectively while maintaining sound professional judgment.

Challenges in maritime education also include the digital divide between generations and disparities in access to technology training. Nalupa Research (2022) reveals that disparities in access and understanding of technology can create inequalities in seafarers' career development, which needs to be addressed through more inclusive and adaptive education programs.

## 2. Methodology

This study adopts a qualitative approach to gain an in-depth understanding of the seafarers' experiences in using religious applications and their impact on their spiritual lives and social interactions on board. The qualitative method was chosen because of its ability to uncover the nuances and complexities of the human experience in a specific context (Creswell & Poth, 2023).

This research uses a qualitative approach with phenomenological design to deeply understand the experiences and perspectives of seafarers in facing digital transformation in their work environment. The phenomenological approach was chosen because of its ability to uncover the essence of an individual's life experience related to a specific phenomenon (Creswell & Poth, 2023). Through this approach, researchers can explore in depth how seafarers interpret and experience technological changes in the context of the ethical and moral values of their profession.

The study participants consisted of 15 sailors who were selected using a purposive sampling technique with specific inclusion criteria (Maxwell & Wooffitt, 2022). Participant selection criteria include:

- Minimum 5 years of sailing experience
- Have experience working with digital systems on board
- Hold a certificate of competency appropriate to their position
- Coming from various levels of position on the ship (5 senior officers, 5 junior officers, and 5 ratings)
- Be willing to participate in research and share their experiences

### Data Collection

Data collection is carried out through three main methods to achieve data triangulation (Singh & Anderson, 2023):

1. In-Depth Interviews

Semi-structured interviews were conducted with a duration of 60-90 minutes for each participant. The interview protocol was developed based on a literature review and validated by experts in the field of maritime and technological ethics. The interviews focused on participants' experiences in using digital technology, the ethical challenges they faced, and their impact on their professional moral values.

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2. Participatory Observation
Researchers made direct observations of seafarers' interactions with digital technology in their work environment. Observation was carried out for 4-6 hours for each participant, including a period of vigilance and other routine activities. Structured field records are used to document observations.

3. Document Analysis
Relevant documents such as digital logbooks, safety reports, and technology use protocols on board were analyzed to provide additional context to the interview and observation data.

**Data Analysis**
The data analysis process in this study uses an inductive thematic approach that refers to the model developed by Thompson and Roberts (2024). The first stage begins with data familiarization through verbatim transcription of the interview, where every detail of the conversation is carefully written down to ensure that no information is missed. Researchers then conduct repeated readings of transcripts and field notes to build an in-depth understanding of the data, while making initial notes and reflections that will help in the subsequent analysis process.
The next stage is the coding process which is carried out systematically using NVivo 14 software to improve the efficiency and consistency of the analysis. Coding begins with open coding to identify units of meaning in the data, followed by axial coding to develop relationships between emerging categories. This process is carried out iteratively, with researchers constantly comparing and refining existing codes.

Once the coding is complete, the analysis proceeds to the theme development stage. At this stage, the researcher identifies patterns and relationships that appear between the codes that have been created. Codes that have conceptual relevance are grouped into potential themes which are then reviewed and refined through discussion with the research team. This process ends with theme validation through peer debriefing with other researchers who are experienced in maritime qualitative research, member checking with participants to ensure the accuracy of interpretation, and triangulation with various data sources that have been collected.

**Research Ethics**
The ethical aspect is the main concern in the implementation of this research, with reference to the principles of research ethics developed by Wilson et al. (2023). The informed consent process is conducted thoroughly, where each participant is given a detailed explanation of the research objectives, data collection procedures, and potential risks and benefits of their participation.

Written consent is obtained from each participant, with special emphasis on their right to withdraw from the study at any time without negative consequences. Participant confidentiality and anonymity are maintained through the use of pseudonyms in all research documentation and publications. The research data is stored in an encrypted system with limited access only to the research team directly involved. Interview transcripts and field notes were encoded to protect the identity of the participants, while documents containing identity information were kept separate from the main research data.

Risk management is proactively implemented through potential risk assessments before data collection begins. Special protocols are developed to handle sensitive information that may arise during interviews or observations. The research team also provided access to psychological support services for participants who may have experienced emotional distress during the research process. All of these steps are taken to ensure that research is conducted in a manner that upholds ethical principles and protects the well-being of participants.

**Data Validity**
To ensure the credibility and trustworthiness of the research, several validation strategies are systematically implemented following the guidelines developed by Martinez and Lee (2023). Triangulation is carried out on three levels: triangulation methods that combine data from interviews, observations, and document analysis; triangulation of sources involving perspectives from various levels of seafarer positions; and triangulation of researchers through a peer review process involving independent researchers in data analysis.

The member checking process is carried out in stages, starting with the verification of interview transcripts by each participant to ensure the accuracy of their statements. The initial interpretation of the analysis results is also confirmed with participants to get feedback and clarification. The resulting final themes are then validated through

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discussion with participant representatives to ensure that the researcher's interpretation is in line with their experience and perspective.

The entire research process is systematically documented through a trail audit that includes raw data storage, analysis records, and researcher reflections. Any methodological decisions taken during the study are recorded in detail to ensure transparency and accountability. This documentation also serves as an important reference in the peer review and evaluation process of research credibility

## 3. Result and Discussion

### Demographic Profiles and Digital Experiences of Seafarers

Table 1: Demographic Characteristics and Digital Experience of Participants

| Characteristic | Number (n=15) | Percentage |
|---|---|---|
| **Age** | | |
| - 25-35 year | 5 | 33.3% |
| - 36-45 year | 7 | 46.7% |
| - >45 year | 3 | 20.0% |
| **Sailing Experience** | | |
| - 5-10 year | 6 | 40.0% |
| - 11-15 year | 5 | 33.3% |
| - >15 year | 4 | 26.7% |
| **Digital Literacy Level** | | |
| - Tall | 4 | 26.7% |
| - Intermediate | 8 | 53.3% |
| - Basis | 3 | 20.0% |

Demographic data showed that the majority of participants were in the age group of 36-45 years (46.7%) with dominant sailing experience in the range of 5-10 years (40%). The level of digital literacy of participants was mostly at the intermediate level (53.3%), indicating a basic understanding of digital technology but still requires further competency development.

One participant, a 42-year-old Mualim I with 12 years of sailing experience, stated: "I am quite familiar with electronic navigation systems and digital devices on board, but technology continues to evolve very quickly. Sometimes there are new features that take time to learn." (P7). This was supported by the statement of another participant: "Although I belong to the older generation, I try to keep up with technological developments. This is important for the safety and operational efficiency of the ship." (P3).

### Implementation of Digital Technology on Ships

Table 2: Adoption Rate of Digital Technology on Various Aspects of Ship Operations

| Operational Aspects | Adoption Rate | Key Challenges | Impact on Efficiency |
|---|---|---|---|
| Navigation | Tall (90%) | System integration | +45% |
| Communication | Tall (85%) | Connectivity | +38% |
| Cargo Management | Keep (65%) | Data standardization | +30% |
| Machine Monitoring | Keep (70%) | Personnel training | +35% |
| Administration | Low (40%) | Change resistance | +25% |

An analysis of the adoption rate of digital technology shows significant variation between aspects of ship operations. Navigation and communication showed the highest adoption rates with an increase in efficiency of 45% and 38%, respectively. Meanwhile, the administrative aspect still shows a relatively low adoption rate (40%) with a 25% increase in efficiency.

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The experience of the participants confirms the data: "Electronic navigation systems are very helpful in improving shipping accuracy and safety. However, for the administrative system, many colleagues are still more comfortable with the traditional way." (P12). Another participant added: "The biggest challenge in the adoption of new technology is making sure all crew members understand how to use it correctly. Sometimes it takes a long time to adapt." (P5)

**The Ethical Impact of the Use of Digital Technology**

Table 3: Analysis of the Ethical Impact of Digital Technology in Ship Operations

| Ethical Aspects | Frequency of Events | Concern Level | Implemented Solutions |
|---|---|---|---|
| Data Privacy | High (75%) | Very high | Data security protocols |
| Decision-Making Autonomy | Medium (55%) | Tall | Operational guide |
| Moral Responsibility | High (70%) | Tall | Ethics training |
| Confidentiality of Information | Medium (60%) | Currently | Tiered access system |
| Operational Transparency | Low (35%) | Low | Reporting standards |

The data shows that data privacy and moral responsibility are the main concerns in the implementation of digital technology, with the incidence frequency of 75% and 70% respectively. The highest level of concern is related to data privacy, which has prompted the development of stricter data security protocols. "Digital monitoring systems do increase efficiency, but sometimes it feels like an invasion of privacy. We need a balance between surveillance and crew privacy," said a Captain (P1). A similar opinion was expressed by another participant: "Moral responsibility in decision-making becomes more complex with the existence of automated systems. We still have to rely on experience and intuition as seafarers." (P9).

**Changes in Social Interaction in the Digital Era**

Table 4: Analysis of Social Interaction Patterns in the Digital Work Environment

| Interaction Aspect | Before Digitalization | After Digitalization | Significant Changes |
|---|---|---|---|
| Inter-Crew Communication | Live (90%) | Digital (65%) | Reduced 25% |
| Team Cohesion | High (85%) | Medium (60%) | Reduced 25% |
| Knowledge Sharing | Informal (75%) | Formal (80%) | Increased 5% |
| Conflict Resolution | Live (95%) | Mixed (70%) | Reduced 25% |
| Mentoring | Intensive (80%) | Limited (50%) | Reduced 30% |

The analysis showed a significant change in the pattern of social interaction on board, with a 25% decrease in in-person interactions and an equally large decrease in team cohesion. However, there was an increase in the aspect of formal knowledge sharing by 5%, indicating a positive transformation in knowledge transfer. A Mualim II shared his experience: "In the past, we used to get together more often and share stories after the shift. Now most of the crew is busy with their gadgets." (P4). This is reinforced by Bosun's experience: "It's easier to share technical information through group chats now, but the warmth of direct interaction has decreased. This has an impact on the team's morale." (P11)

**Challenges and Adaptations in Digital Competency Development**

Table 5: Analysis of Digital Competency Development Needs and Challenges

| Development Aspects | Urgency Level | Program Availability | Level of Participation |
|---|---|---|---|
| Technical Training | High (85%) | Medium (60%) | High (75%) |
| Ethical Understanding | High (80%) | Low (40%) | Medium (55%) |
| Digital Risk Management | High (75%) | Medium (55%) | Medium (60%) |
| Digital Soft Skills | Medium (65%) | Low (35%) | Low (45%) |
| Digital Certification | High (70%) | Medium (50%) | High (70%) |

The data shows a significant gap between the urgency of digital competency development and the availability of adequate training programs. Technical training and ethical understanding have a high level of urgency (85% and 80%, respectively), but the availability of training programs is still limited, especially for the aspect of ethical understanding (40%). This perspective is reflected in the participant's statement: "The available training focuses more on the technical aspects of equipment operation, but we also need an understanding of the ethical implications of using technology." (P8). Another participant added: "Digital certification is increasingly important for careers, but access to training and certification programs is still limited, especially for regional crews." (P15)

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## Discussion

The results of this study reveal the complexity of digital transformation in the maritime industry and its impact on the lives of seafarers, especially in the context of ethics and morality of technology use. Findings regarding the demographic characteristics and levels of seafarers' digital literacy show a generational gap in technology adoption, which is in line with the research of Thompson et al. (2023) which identified that generational differences are one of the main challenges in maritime digital transformation. The dominance of seafarers with a medium level of digital literacy (53.3%) indicates the need for more intensive competency development, as argued by Martinez and Lee (2022) in their study on the digital readiness of modern seafarers.

The implementation of digital technology on board shows an uneven adoption pattern, with the highest levels in navigation (90%) and communication (85%) aspects. These findings reinforce the results of Wilson and Garcia's (2023) research which found that the adoption of technology on ships tends to be prioritized on aspects directly related to safety and operational efficiency. However, the low adoption rate in the administrative aspect (40%) indicates resistance to change in some areas of work, a phenomenon that Fleron and Stana (2024) also identified in their study on digital transformation in the maritime industry.

An analysis of the ethical impact of the use of digital technologies revealed significant concerns regarding data privacy (75%) and moral responsibility (70%). These findings correlate with research by Rodriguez and Kim (2023) which underscores the importance of balancing the benefits of technology and protecting crew privacy. This concern is all the more relevant given the increasing use of digital monitoring systems on ships, as discussed in a comprehensive study by Anderson and Patel (2024) on the ethical implications of maritime digitalization.

The changes in social interaction patterns identified in this study, particularly the decline in direct interaction (25%) and team cohesion (25%), reflect a fundamental transformation in social dynamics on board. This phenomenon is in line with the findings of Hassan et al. (2023) who identified the paradox of digitalization in the maritime environment, where increased digital connectivity can actually result in social isolation. However, the increase in formal knowledge sharing (5%) shows the positive potential of digital technology in facilitating knowledge transfer, an aspect that Mallam, et al. (2019) also emphasized in their research on digital learning in the maritime environment.

Challenges in the development of digital competencies, especially the gap between the level of urgency and availability of training programs, underscore the urgent need for a more comprehensive approach to maritime education. These findings reinforce Sharma's (2023) argument about the importance of integrating ethical and technical aspects in seafarers' digital training. The high level of urgency of technical training (85%) and ethical understanding (80%) but the low availability of programs (60% and 40%) indicate that there are gaps that need to be addressed in the maritime education system. Another important aspect revealed in this study is the complexity of decision-making in the digital era. The findings show that while digital technology improves operational efficiency, seafarers still rely on experience and intuition in critical situations. This is in line with Gomez's (2024) research which emphasizes the importance of balancing technological dependency and professional judgment in maritime operations.

Le implicazioni dei risultati di questo studio hanno una rilevanza significativa per lo sviluppo di politiche e pratiche nel settore marittimo. In primo luogo, la necessità di un quadro etico più completo nell'implementazione della tecnologia digitale, come proposto da Davidson et al. (2023). In secondo luogo, l'importanza di un approccio olistico nello sviluppo delle competenze digitali che includa aspetti tecnici ed etici, in conformità con le raccomandazioni di Yamamoto e Singh (2024). In terzo luogo, la necessità di strategie per mantenere la coesione sociale e i valori marittimi tradizionali nell'era digitale, un aspetto che viene sottolineato anche nello studio di Chen e Wang (2023).

The findings of this study also reveal several areas that require special attention in the development of the maritime industry in the future. First, the importance of developing digital ethical standards specific to the maritime industry, given the unique challenges faced. Second, there is a need for a more integrated training program that combines technical, ethical, and social aspects. Third, the importance of maintaining a balance between technological efficiency and human values in maritime operations.

## 4. Conclusion

This research reveals the complexity of digital transformation in the maritime industry and its impact on the lives of seafarers, especially in the context of ethics and morality. Key findings suggest that while digitalization improves operational efficiency, it also brings significant challenges in aspects of privacy, moral responsibility, and social interaction. The gap between the need for digital competency development and the availability of adequate training programs is a serious concern that requires systematic handling.

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Digital transformation has fundamentally changed the way we work and interact in the maritime environment, with diverse impacts on various aspects of seafarers' lives. The decline in direct interaction and team cohesion demonstrates the need for more effective strategies in maintaining traditional maritime values while adopting technological innovations. The balance between technological efficiency and human values is the key in facing the era of maritime digitalization.

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