



## **Трансформація людського капіталу: нові вимоги до навичок у цифровій морській галузі**

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**Прийнято: 02.01.2025 | Опубліковано: 14.01.2025**

***Анотація.** Розвиток технологій і суспільства невпинно вносить значні зміни в сучасний світ. Технологічний прогрес сприяє покращенню якості життя, однак водночас ставить нові виклики, які потребують адаптації та освоєння інноваційних технологій. Четверта промислова революція ініціювала процеси цифровізації, які кардинально трансформують суспільство та економіку.*





*У статті досліджуються виклики, пов'язані з вимогами до кваліфікації людського капіталу, актуальними для судноплавних і морських компаній. Розглядаються наявні компетенції, необхідні для успішної професійної діяльності в галузі, а також аналізуються навички, які будуть потрібні в майбутньому. У статті пропонуються рекомендації для морської індустрії та судноплавних компаній щодо забезпечення кваліфікованого персоналу, здатного ефективно адаптуватися до викликів цифрової трансформації.*

**Мета:** Проаналізувати вплив і масштаб цифровізації в морській індустрії в контексті управління людськими ресурсами (HRM) та розвитку людських ресурсів (HRD). Визначити значення своєчасної підготовки та трансформації морської галузі до викликів цифровізації. Надати визначення цифровізації, а також запропонувати рекомендації для успішного впровадження стратегічних планів цифрової трансформації у компаніях. Розглянути нові вимоги до людського капіталу в умовах цифровізації.

**Методи:** У дослідженні використано теоретичні методи, такі як аналіз, синтез, індукція, дедукція, класифікація та моделювання. Емпіричні методи включали спостереження, аналіз наукових публікацій та звітів міжнародних організацій.

**Результати:** Визначено адаптоване під вимоги морської індустрії поняття цифровізації та ключові характеристики цифрової компанії. Виявлено основні виклики, які постають перед HRM і HRD, а також показано важливість своєчасної адаптації людського капіталу в морській галузі до процесів цифровізації.

**Висновки:** На основі проведеного дослідження запропоновано рекомендації для морських компаній, спрямовані на підвищення їхньої конкурентоспроможності та оптимізацію бізнес-процесів за рахунок цифровізації. Виокремлено ключові навички, необхідні для людського капіталу в умовах четвертої промислової революції, такі як управління даними, адаптація до цифрових систем і стратегічне планування.



**Ключові слова:** судноплавна компанія, морська індустрія, цифровізація, управління людськими ресурсами, розвиток людських ресурсів, м'які (Soft) та жорсткі (Hard) навички.

## **Transforming Human Capital: New Skill Demands in the Digital Maritime Industry**

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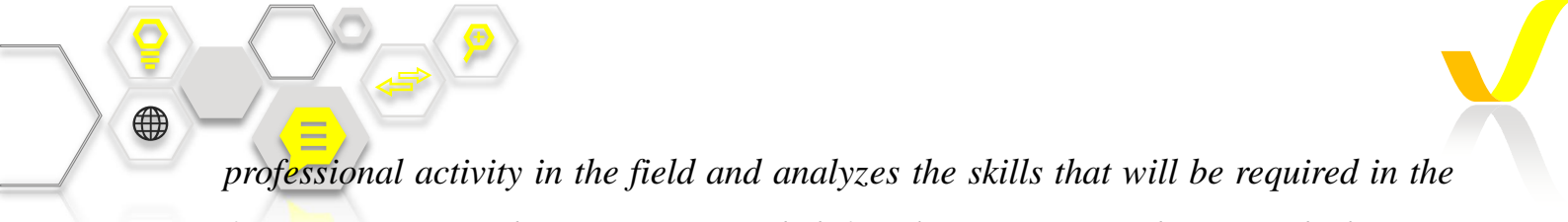
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***Abstract.** The development of technology and society continuously brings significant changes to the modern world. Technological progress improves the quality of life while simultaneously posing new challenges that require adaptation and mastery of innovative technologies. The Fourth Industrial Revolution has initiated digitization processes that are radically transforming society and the economy.*

*This article examines the challenges associated with the qualifications required for human capital, particularly relevant to shipping and maritime companies. The study explores existing competencies necessary for successful*



*professional activity in the field and analyzes the skills that will be required in the future. Recommendations are provided for the maritime industry and shipping companies to ensure a qualified workforce capable of effectively adapting to the challenges of digital transformation.*

**Objective:** *To analyze the impact and scope of digitization in the maritime industry in the context of Human Resource Management (HRM) and Human Resource Development (HRD). To highlight the importance of timely preparation and transformation of the maritime sector to meet the challenges of digitization. To define digitization and offer recommendations for the successful implementation of strategic digital transformation plans in companies. To examine new requirements for human capital in the context of digitization.*

**Methods:** *The research employs theoretical methods such as analysis, synthesis, induction, deduction, classification, and modeling. Empirical methods include observation, analysis of scientific publications, and reports from international organizations.*

**Results:** *An adapted concept of digitization tailored to the maritime industry and the key characteristics of a digital company were identified. Major challenges facing HRM and HRD were outlined, emphasizing the importance of timely adaptation of human capital in the maritime sector to digitization processes.*

**Conclusions:** *Based on the research, recommendations for maritime companies are proposed to enhance their competitiveness and optimize business processes through digitization. Key skills required for human capital in the context of the Fourth Industrial Revolution are identified, including data management, adaptation to digital systems, and strategic planning.*

**Keywords:** *shipping company, maritime industry, digitization, human resource management, human resource development, soft skills, hard skills.*

**Problem statement.** The implementation of digital technologies is one of the key factors in improving efficiency. To enhance the competitiveness of modern shipping companies, it is essential to develop a strategy for adapting to digitalization



systems. Additionally, it is crucial to consider the skill levels of the current workforce and create conditions where the level of digital literacy aligns with the requirements of the digital transition.

The insufficient level of digital literacy among employees in the maritime sector and shipping companies slows down automation processes, reduces company productivity, and increases operational costs.

If this issue remains unresolved, companies will lose their competitiveness, face increased task completion times, and fail to meet market demands.

Research is necessary to develop strategies for improving digital literacy among employees in maritime companies, which will enhance their adaptability and efficiency in the context of digital transformation.

**Analysis of recent research and publications.** A significant amount of data was analyzed during the course of this work, which can be divided into several groups, as outlined below.

The topic of human capital is widely covered in the literature; however, the authors' primary interest was focused on the specific challenges facing human capital today.

The first group of literature related to the publication topic includes works that address human capital, its definition, evolution, and current state. The works of Goldin C. [1], Rosen S. [2], and Wößmann L. [3] provide a comprehensive understanding of this subject.

The next task was to study the existing challenges of HRD. It should be noted that digitalization is one of the key themes, and the works of Outsadee Y. et al. [4], and Theotokas I. et al. [5] contain important aspects of this issue. In particular, the study by Outsadee Y. et al. [4] provides numerous examples of the application of digital technologies and artificial intelligence in maritime organizations and shipping companies.

On the other hand, it was necessary to examine the current state of HRM. The works of Ahammad T. [6], Ogedengbe D.E. [7], and Theotokas I. et al. [5] (in the



aforementioned study) explore the challenges facing HRM due to the digitalization of the maritime industry, driven by the Fourth Industrial Revolution.

Special attention was also paid to literature focused on digitalization. The work of Strohmeier S. [8] introduces clear definitions of digitalization, company digital transformation, and analyzes the extent to which digitalization concepts are already established and require further expansion.

Reports from international organizations, which provide a general understanding of the demand for digitalization, are also noteworthy. The reports by UNCTAD [9], [10] offer a more comprehensive picture of the importance and state of digitalization on a global scale.

In conclusion, it can be stated that the topics of human capital, HRD, HRM, and digitalization have been sufficiently studied. However, the number of works focused on researching the skills required for human resources remains insufficient. Therefore, we consider this topic relevant and offer recommendations on the necessary skills and their application.

#### **Identification of previously unresolved aspects of the general problem.**

Despite the significant body of research devoted to human capital, Human Resource Management (HRM), Human Resource Development (HRD), and digitalization, there are still aspects that require further investigation.



There is a lack of studies that thoroughly analyze the specific skills critically important for adapting human capital to the conditions of digital transformation.

While the process of digitalization is well-studied, the effective implementation of digital solutions in HRM and HRD to enhance the competitiveness of companies in the maritime sector remains insufficiently explored.

Specific challenges related to the digitalization of maritime companies, particularly in the context of automation, the use of artificial intelligence, and big data, require more detailed analysis.

Comprehensive research on how digitalization affects the productivity and adaptability of employees in various sectors of the maritime industry is lacking.





Although international organizations provide a general picture of the state of digitalization, the adaptation of international experience to local conditions, especially in the maritime sector, requires further analysis.

These aspects highlight the importance of further research to develop strategies that will effectively adapt human capital to the demands of the digital economy and ensure the competitiveness of companies in the future.

**Formulation of the article's goals (Problem statement).** The aim of the article is to analyze the challenges related to adapting human capital to the conditions of digital transformation and to develop recommendations regarding the essential skills for employees in the maritime sector under the Fourth Industrial Revolution.

Key objectives of the article:

- 1) To investigate the impact of digitalization on human capital development in the maritime sector;
- 2) To identify the key skills required for the effective implementation of digital technologies in HRM and HRD;
- 3) To analyze the existing challenges of digitalization for maritime companies, particularly regarding automation, artificial intelligence, and big data utilization;
- 4) To summarize international experience in the implementation of digital technologies and adapt it to local conditions;
- 5) To propose recommendations for enhancing company competitiveness through the development of digital literacy among their employees;

These objectives are aimed at addressing research gaps and providing practical solutions for maritime organizations.

**Presentation of the main research material.** The maritime industry plays a crucial role in global trade by transporting goods and commodities between countries and regions. As noted by Autsadee Y. [11], based on the findings of Liu X. et al. [12], over 80% of global trade by volume and 70% by value is transported by sea. The maritime industry encompasses a wide range of activities, including shipping, ports and terminals, logistics and supply chain management, shipbuilding



and repair, and marine services, as highlighted by Jeevan J. [13]. It is a complex and highly integrated industry involving various players and stakeholders.

The growth of the maritime industry has been closely linked to the expansion of global trade over the past century. As international trade has grown, so has the demand for shipping and other maritime services, as observed by Liu Z. [14]. Additionally, the maritime industry has driven economic development in many countries and regions, as noted by Jeevan J. [15]. Furthermore, it has facilitated globalization, enabling the growth of international trade and contributing to economic prosperity in many countries, as emphasized by Notteboom T. and Rodrigue J.P. [16].

Throughout history, the maritime sector has played a significant role in facilitating global trade and economic activities, acting as a cornerstone of economic and logistical advancement. Recent changes in the sector are largely driven by the continuous advancement of digital technologies, as discussed by Alnıpak S. and Toraman Y. [17].

The emergence of the 4th Industrial Revolution, also referred to as Industry 4.0 (I4.0), has disrupted existing business models, as noted by Coskun-Setirek A. and Tanrikulu Z. [18], and transformed the way businesses operate. Industry 4.0 is characterized by advanced technologies such as the Internet of Things, blockchain, machine learning, big data analytics, robotics, cloud computing, and augmented reality, as highlighted by Gallo T. and Santolamazza A. [19], Zhong R.Y. et al. [20], and Kerin M. and Pham D.T. [21]. Along with the 4th Industrial Revolution, the terms digitization, digitalization, and digital transformation have emerged. In recent years, notable changes in the sector are attributed to the continuous progress of digital technology, as highlighted by Verhoef P.C. [22].

Dynamic changes in digital technology must be closely monitored and systematically analyzed. These changes profoundly impact the maritime industry, particularly in the areas of Human Resource Management (HRM) and Human Resource Development (HRD). According to Armstrong M. [23], HRM is the strategic and coherent approach to managing people effectively and efficiently in a





company or organization, ensuring they contribute to achieving a competitive advantage. It is designed to maximize employee performance in alignment with an employer's strategic objectives.

Human Resource Development (HRD) is defined by Swanson R.A. [24] as a process of developing and unleashing human expertise through organizational development (OD) and training and development (T&D) to improve performance.

The incorporation of digitization into various aspects of maritime operations has led to significant transformations in logistics and navigation, while also extending its influence on HRD, as noted by Autsadee Y. et al. [25], creating new demands for human capital. Similar to other industries, the maritime sector faces the challenge of adapting to digital transformation in HRD while maintaining competitiveness in a rapidly changing global environment, as highlighted by Autsadee Y. et al. [26] and Wu A.C., Kao D.D. [27].

Understanding the dynamic nature of digital HRD is crucial for maritime enterprises aiming to stay competitive globally. Moreover, the outcomes of this investigation contribute to the existing knowledge by elucidating the distinct dynamics and challenges associated with digitalization in HRD within the maritime sector, as noted by Autsadee Y. et al. [4].

Digital transformation presents significant challenges and necessitates innovative approaches for effective management. It requires systematic and collaborative efforts from academia, businesses, and HR professionals. In the current landscape, a combination of advanced hard and soft skills is essential to meet the demands of modern technologies and the fast-paced work environment. This study analyzes a real-world maritime company to provide actionable recommendations for addressing emerging HRM requirements and outlines tailored HRD procedures to support maritime companies in adapting to the evolving digital era.

### **Transforming human resource management through digitalization.**

Before discussing Human Resource Management (HRM) and digitalization, it is essential to introduce the relevant terminology to ensure clarity and prevent

misunderstandings. According to Strohmeier S. [8] and as well as showed on Figure 1:

- *The digitization of HRM* refers to the technical process of converting analogue HR information into digital HR information for automated processing.
- *The digitalization of organizations* describes the socio-technical process of exploiting digitization potentials for operational and/or strategic organizational purposes.
- *The digital transformation of organizations* denotes the socio-technical digitalization sub-process aimed at exploiting digitization potentials for strategic organizational purposes.
- *Digital organization* represents the socio-technical result of the digitalization of organizations.

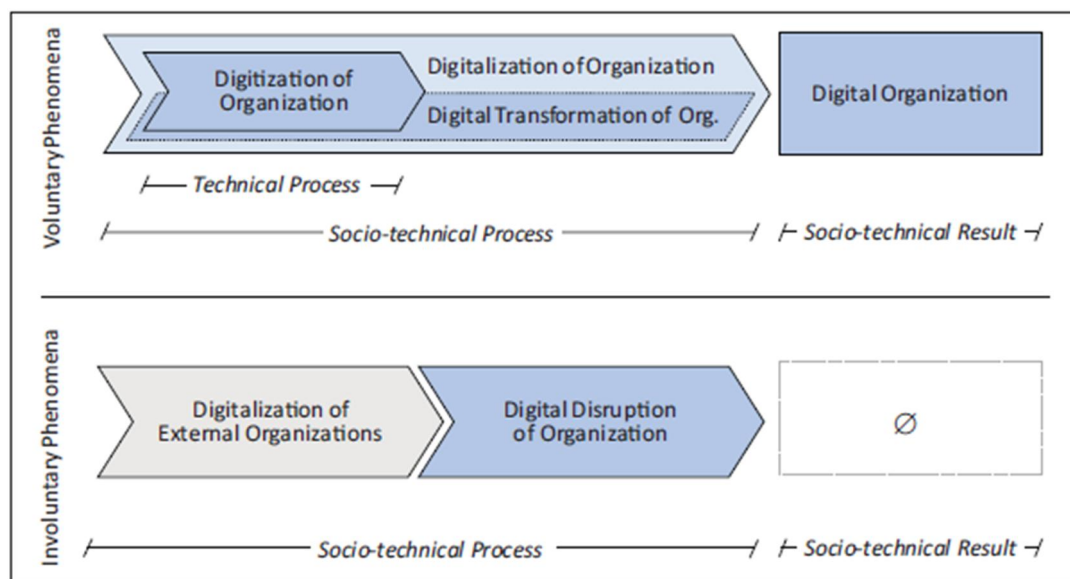


Figure 1. Terminology of digital organizations.

Source: Adapted from Strohmeier S. [8]. Used under CC BY-NC license.

The term *digitalization* refers to a process that organizations must strategically plan and implement. The goals of digitalization should be clearly defined, and its criteria and scope must be structured to align with organizational objectives.

In HRM, certain technical processes can be streamlined by converting analog information into digital formats for more efficient processing. Strohmeier S. [8]



provides a simple example: scanning paper-based application credentials of applicants. This illustrates how digitization concepts can be effectively applied in HRM.

In the maritime industry, digitalization simplifies processes such as monitoring Carbon Intensity Indicator (CII) scores of vessels—a recent priority for the sector. Digital solutions can support operational objectives and, to some extent, strategic goals. For instance, digitization aids in operational tasks like payroll processing and course administration. Strohmeier further highlights efforts to align digital technologies with HR strategies for strategic purposes.

The concept of digital transformation in HRM involves formulating and executing HR strategies based on digitization potentials to create value for an organization. Bharadwaj A. [28] suggests transferring the concept of a digital business strategy to HRM, wherein a digital HR strategy is defined as an HR strategy formulated and executed by leveraging digitization to generate organizational value.

This approach requires rethinking traditional HRM concepts and goals, alongside developing new methodologies. To address these challenges, we propose creating a dedicated position to oversee the business model and identify digital solutions. This professional should possess relevant skills, a deep understanding of the maritime industry, and the ability to implement applications within reasonable timeframes.

Global trends, such as an aging workforce, increased diversity, and technological advancements, continually reshape HRM practices. Stone D.L. [29] highlights the pressures these trends exert, requiring organizations to adopt digitalization holistically—from core HR functions like recruitment and training to more strategic and developmental roles, as noted by Theotokas I. et al. [5].

### **Advancing Human Resource Development in the Era of Digitalization.**

The phenomenon of digitalization in the field of HRD has emerged as a powerful and influential force, garnering considerable interest across diverse sectors. The fundamental concept of digitalization in HRD involves incorporating digital technologies into various aspects of talent management, training, skill enhancement,



and organizational learning, as highlighted by Varshney D. [30]. This shift has been propelled by the extensive integration of advanced technologies such as e-learning platforms, data analytics, artificial intelligence (AI), and virtual reality (VR), among others.

The use of these technologies has not only significantly transformed the way businesses approach HRD but has also played a crucial role in enhancing the competitive advantage of enterprises in the current business environment, as emphasized by Akdere M. et al. [31], Malini T.N. et al. [32], and Otoo-Arthur D. and van Zyl T.L. [33]. HRD plays a crucial strategic role in organizations, emphasizing the improvement of organizational performance by advancing human capital, knowledge, and skillsets. The link between HRD and competitiveness stems from the idea that organizations can gain a competitive edge by fostering a workforce with both expertise and flexibility.

In the broader landscape of digitalization across various sectors, several overarching themes and trends have emerged that extend beyond HRD. One prevailing theme is the transformative power of digital technologies in enhancing operational efficiency and productivity, as noted by Martínez-Caro E. et al. [34] and Papadopoulos T. et al. [35]. Industries across the board are adopting digital tools and automation to streamline processes, reduce costs, and improve overall performance.

Another key focus is the increasing significance of data and analytics. Leveraging data-driven decision-making has become essential for success across various industries, allowing organizations to derive meaningful insights into customer behavior, market dynamics, and operational trends.

To enable the emerging trend of digitalization, companies must employ individuals who possess the necessary skills to work with data and engage in effective data interactions. These skills include the ability to read, analyze, and interpret data accurately, summarize insights, develop data-driven projects, and implement solutions based on data-driven results. Such requirements are complex and necessitate structured methods of Human Resource Development (HRD).



Companies in the maritime industry must choose between two primary strategies: investing in the development of their existing workforce or seeking external human capital that already possesses advanced skills. Both approaches have their respective advantages and challenges.

Promoting internal candidates involves significant investment and depends on the availability of an adequate pool of employees willing to acquire new qualifications. This process requires careful planning, including a structured approach and a well-defined pathway to deliver the necessary training. Conversely, hiring external digital professionals offers immediate access to advanced technical expertise but introduces the challenge of integrating these individuals into the business. External hires may lack an understanding of the organization's structure and may face difficulties in performing tasks that require industry-specific knowledge.

Although the existing body of literature on digitalization in HRD is extensive, there has been relatively little focus on its specific applications within the maritime sector. This industry, marked by distinct challenges such as crew management, safety requirements, and adherence to international regulations, demands a specialized analysis. Few studies have ventured into this specialized domain, but those that have often provide valuable insights into the maritime workforce's readiness to embrace digital HRD practices, technology adoption trends, and the industry's overall digital maturity.

The maritime sector includes a range of industries such as shipping, port operations, logistics, and offshore activities, all of which prioritize efficiency, safety, and adherence to international standards. Today, digitalization in HRD is increasingly essential for improving the competitiveness of the maritime sector. Digital HRD may also play a pivotal role in addressing the unique challenges of the maritime sector. By leveraging digital technologies such as e-learning platforms, data analytics, and AI, maritime companies can enhance their crew's skills, knowledge, and adaptability. This, in turn, leads to improved operational efficiency,



safety measures, and compliance, all of which are critical factors for competitiveness in the global maritime industry.

Furthermore, as the industry evolves, embracing digitalization in HRD may position maritime companies as leaders in innovation and sustainability, aligning them with changing market demands and ensuring long-term competitiveness, as discussed by Autsadee Y. et al. [4].

Digitalization can enhance recruitment and talent acquisition, assist HR with AI-powered systems, improve efficiency in HR operations, increase agility in learning and development, enhance training through VR and AR, improve digital skills gap assessments, enable gamification and microlearning, promote remote onboarding and training, develop digital leadership, ensure efficient performance management, provide continuous performance feedback, visualize employee performance data, and enhance employee experience, as adopted from Autsadee Y. et al. [4].

This comprehensive approach addresses various aspects of digitalization in HRM and HRD, focusing on the skills, knowledge, and practices that modern human capital must possess to remain aligned with the demands of a fast-paced, dynamic environment.

**Human capital in digital transformation.** Based on the information above, it is evident that digitalization is already having a significant impact on Human Resource Development (HRD) and Human Resource Management (HRM). Moreover, in everyday life, the volume of advertisements, news, and information flow has increased substantially. The rapid development of artificial intelligence (AI) is further accelerating changes in the digital landscape, making digital solutions more accessible and attractive for implementation.

As a result, human capital must acquire new skills, experiences, and methods to address current challenges effectively. These skills will become increasingly important as more maritime industries adopt digitalization and transition to automated processes. This shift necessitates a new paradigm in which current practices related to human capital are thoroughly re-evaluated and revised.



To explore this concept further, we focus on a case study of an existing maritime company, referred to here as Company A. Figure 2 presents a simplified organizational chart, illustrating the structure of the company. Each department has its own specific role, and a distinct set of skills required to perform its respective job tasks effectively.

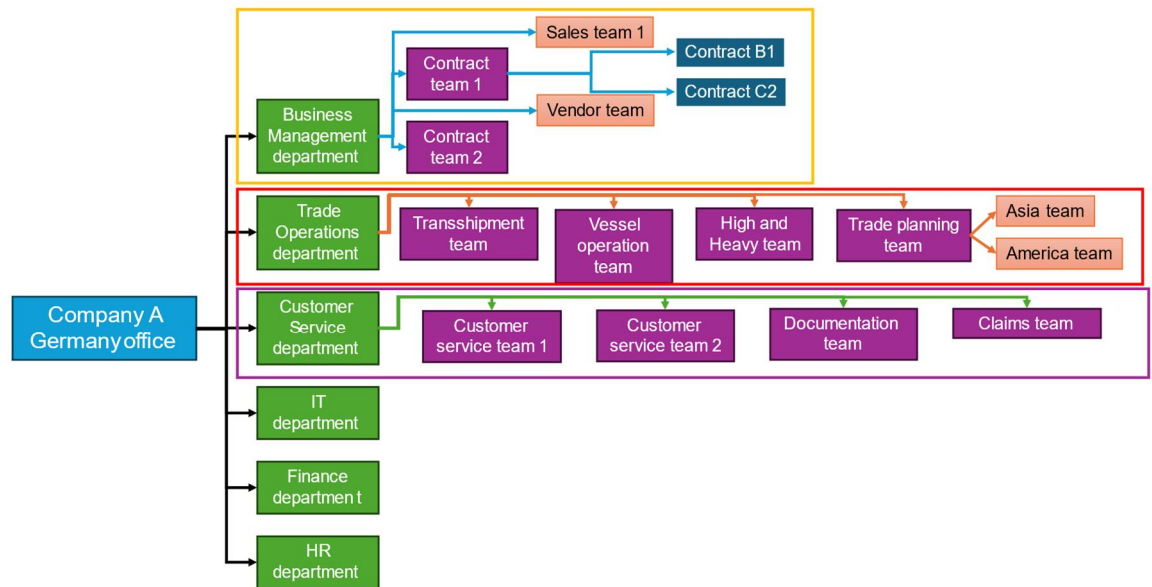


Figure 2. Simplified Organizational Structure of a Maritime Shipping Company

Source: Created by the authors

A more detailed organizational structure reveals that even within the same department, the required skill sets for specific roles may vary significantly. For example, the Sales Team 1 and the Vendor Team within the Business Management Department focus on entirely different tasks and fields of responsibility, yet they operate under the same departmental framework. Another instance is the Trade Planning Team, which is divided into two divisions: the Asia Team and the America Team. While both divisions handle similar responsibilities, their approaches may differ due to cultural nuances and time zone differences when interacting with external stakeholders.

This highlights the critical importance of both hard and soft skills, emphasizing their variation not only across departments but also within teams. While

it is possible to quantify and analyze various criteria, this discussion will focus on identifying the key skills required for each department. Furthermore, we will analyze the relative importance of digitalization skills and explore how they should be integrated to meet the evolving demands of the industry.

Firstly, as shown in Table 1, a summary is provided of the most essential skills required across three departments:

**Table 1.**

**Overview of Essential Hard and Soft Skills by Department**

Customer Service department			Business Management department			Trade Operations department		
Soft skills		Hard skills	Soft skills		Hard skills	Soft skills		Hard skills
1	Communication Skills	CRM System Proficiency	1	Leadership	Strategic Planning and Execution	1	Communication Skills	Import/Export Regulations Knowledge
2	Empathy	Multichannel Communication	2	Communication Skills	Financial Management	2	Attention to Detail	Proficiency in Trade Management Software
3	Problem-Solving	Product or Service Knowledge	3	Decision-Making	Data Analysis and Interpretation	3	Problem-Solving	Understanding of Customs and Compliance Rules
4	Working Under Pressure	Language Proficiency	4	Problem-Solving	Proficiency in Business Tools	4	Organizational Skills	Supply Chain Management
5	Customer-Centric Approach	Data Analytics	5	Emotional Intelligence	Project Management (e.g., Agile, Scrum)	5	Teamwork and Collaboration	International Trade Documentation Handling
6	Flexibility and Adaptability	Technical Tool Expertise	6	Adaptability	Budgeting and Forecasting	6	Adaptability	Logistics and Freight Management
7	Time Management Skills	Sales and Persuasion Skills	7	Conflict Resolution	Business Process Optimization	7	Time Management	Currency Exchange and Risk Management
8	Teamwork Skills	Legal Awareness	8	Teamwork and Collaboration	Market Analysis	8	Stress Tolerance	Inventory and Stock Control
9	Positive Attitude	Payment and Financial Operations Handling	9	Time Management	Regulatory and Compliance Knowledge	9	Negotiation Skills	Trade Finance and Payment Methods Expertise

Source: Created by the authors

Depending on the department, specific skills play a crucial role. However, there appears to be a noticeable trend across all departments: none are explicitly required to possess skills related to implementing digital technologies or generating innovative ideas for improvement through such approaches. At the same time, modern companies increasingly demand knowledge of digital systems. These systems are used internally for various purposes, including generating bills of lading, vessel tracking, monitoring vessel consumption, facilitating internal communication, and managing data exchange.

In our view, employees who not only understand the importance of digital transformation but also possess the skills to utilize these systems effectively—and,



at a minimum, define tasks that such systems can optimize—are essential for driving organizational progress.

To summarize, Table 2 presents an overview of the most shared soft and hard skills across all involved departments.

**Table 2.**

**Key Shared Hard and Soft Skills Across Department**

Combined departments	
Soft skills	Hard skills
1 Communication Skills	CRM System Proficiency
2 Problem-Solving	Data Analysis and Interpretation
3 Teamwork and Collaboration	Project Management
4 Adaptability	Supply Chain and Operations Management
5 Working Under Pressure	Regulatory and Compliance Knowledge
6 Time Management Skills	Proficiency in Business Tools

Source: Created by the authors

In addition to hard skills, CRM (Customer Relationship Management) proficiency and Data Analysis and Interpretation are key competencies that can be significantly enhanced through digitalization. Strengthening human capital's knowledge and skills in creating, using, and interacting with digital systems is essential for achieving this improvement.

To address this need, companies should develop strategies aimed at enhancing the current skill set of their workforce. These strategies could include creating learning environments where employees can gain the necessary knowledge through seminars, courses, or self-directed learning. Alternatively, organizations could assign new roles to individuals who already possess expertise in digitalization to specifically focus on driving digital transformation initiatives. Roles such as Chief Digital Officer (CDO), Digital Transformation Specialist, and Business Process



Analysts are becoming increasingly common, particularly among medium- and large-sized organizations, as the demand for such expertise grows.

It is also crucial to involve all employees in the processes of creating and working with digital systems. Experienced employees, in particular, are better equipped to identify challenges quickly and propose effective solutions, which offers significant benefits for organizations.

In summary, upgrading the skills of existing human resources is critical. Digitalization represents the future of successful and competitive maritime organizations, and companies must develop innovative strategies to stay ahead in the competitive landscape.

Examples of future hard skills that employees need to acquire to adapt to digitalization processes include:

- Strategic planning for digital transformation
- Proficiency with automation tools
- Advanced Excel skills
- Data analysis and decision-making based on analytics

These skills will be instrumental in enabling organizations to navigate the challenges and opportunities of digital transformation effectively.

**Conclusion.** The maritime industry, as a critical driver of global trade, is undergoing profound transformations due to the rapid advancement of digital technologies and the emergence of Industry 4.0. This digital revolution presents significant opportunities and challenges for Human Resource Development (HRD) and Human Resource Management (HRM) within the sector. Our study highlights the need for maritime companies to strategically address the evolving demands of digitalization by focusing on enhancing their human capital.

The research demonstrates that digitalization is not merely an operational enhancement but a strategic imperative for the maritime industry. By leveraging digital tools such as e-learning platforms, data analytics, artificial intelligence, and virtual reality, companies can improve efficiency, ensure compliance with international standards, and maintain competitiveness in a dynamic global



environment. However, achieving these goals requires a workforce equipped with both advanced technical (hard) skills and interpersonal (soft) skills, enabling them to adapt to and effectively implement digital solutions.

Key findings emphasize the importance of:

1. Cultivating digital literacy across all organizational levels to foster a culture of innovation and adaptability.
2. Developing tailored HRD strategies to address the unique challenges of the maritime sector, such as automation, artificial intelligence, and big data utilization.
3. Establishing dedicated roles, such as Chief Digital Officers or Digital Transformation Specialists, to drive digitalization initiatives and align them with organizational objectives.

The study also underscores the importance of integrating digital HR strategies that align with broader business goals, as well as the necessity of involving all employees—particularly experienced personnel—in the co-creation and implementation of digital systems. This collaborative approach enhances the relevance and effectiveness of digital solutions while promoting organizational efficiency.

To remain competitive, maritime organizations must prioritize upgrading their existing workforce's skills through structured training programs, seminars, and self-directed learning opportunities. The acquisition of future-oriented skills such as strategic planning for digital transformation, proficiency with automation tools, and advanced data analysis is essential for navigating the challenges and opportunities of digitalization.



In conclusion, the maritime industry's ability to harness the potential of digitalization in HRM and HRD will be a decisive factor in shaping its future competitiveness and sustainability. Companies that proactively embrace digital transformation, invest in their human capital, and develop innovative strategies will be better positioned to thrive in an increasingly interconnected and technologically advanced global market.



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