

# Impact of Technology on Human Resources in Marine Logistics

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## Abstract

Technology has significantly changed the landscape of the maritime logistics industry, affecting the roles, responsibilities and skill needs of human resources. This study aims to explore the impact of technologies such as automation, digitalization and information systems on human resources in the maritime logistics industry. Through a qualitative and quantitative approach including a literature review, online survey and in-depth interviews, the key findings reveal a shift in the role of workers towards monitoring automation systems, analyzing data and making strategic decisions. New skills such as programming, analyzing data and understanding automation systems have become important. However, the industry faces challenges in recruiting a workforce with the necessary skills and workers' resistance to change. Strategies such as comprehensive training programs, partnerships with educational institutions, and effective change management help integrate technology with human resources. Technology adoption is also driving changes in organizational structures and work cultures to become more collaborative and data-driven. This research provides important insights for businesses and policymakers to develop strategies to prepare a skilled maritime logistics workforce for digital transformation.

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## 1. Introduction

Rapid technical advancements have fueled a considerable revolution in the ocean logistics sector in recent decades. Technological developments in information systems, automation, and digitization have altered the sector's operational environment and had an impact on human resources [1]. This introduction will give a general overview of how technology is affecting maritime logistics' human resources, point out new opportunities and difficulties, and offer insights on how the sector may adjust to these developments.

Technology has enabled more efficient logistics processes, such as real-time tracking of loads, optimization of shipping lanes, and better supply chain management (Venkatesh et al., 2019). However, on the other hand, technology also threatens some jobs previously performed by humans, as those tasks can be automated or replaced by intelligent systems [2]. A key challenge for the ocean logistics industry is balancing the utilization of technology with the need for a skilled and experienced workforce.

One significant impact of technology is the shift in skills required in the ocean logistics workforce. Workers must have new skills, such as data analysis, programming, and an understanding of automation systems [3]. This demands continuous training and human resource development efforts to ensure the workforce remains relevant and competitive.

In addition, technology adoption also affects organizational aspects and work culture in the ocean logistics industry. These changes can create resistance from workers accustomed to traditional methods, requiring effective change management strategies [4].

In this introduction, we will further discuss the various technologies affecting ocean logistics, such as tracking and monitoring systems, process automation, data analytics, and artificial intelligence (AI) applications. The impact of technology on worker roles and responsibilities, the need for new skills, as well as strategies for integrating technology with human resources, will be highlighted in depth.

## **2. Materials and Methods**

This study examined how technology affects human resources in the maritime logistics sector using both qualitative and quantitative methods. A literature review, an online poll, and in-depth interviews with industry stakeholders were some of the techniques used to gather data. This study examined how technology affects human resources in the maritime logistics sector using both qualitative and quantitative methods. A literature review, an online poll, and in-depth interviews with industry stakeholders were some of the techniques used to gather data.

### **2.1. Literature Review:**

A comprehensive literature review was conducted to identify relevant prior research, theories, and concepts relating to the impact of technology on human capital in the context of ocean logistics. Databases such as Scopus, Web of Science, and Google Scholar were used to access academic journals, books, industry reports, and other relevant sources.

### **2.2. Online Survey:**

An online survey was sent to professionals working in ocean logistics companies in different countries. The questionnaire was designed to collect quantitative data on their perceptions and experiences regarding the impact of technologies, such as automation, digitalization, and information systems, on their roles, responsibilities, and skills needs. A Likert scale was used to measure responses to specific statements.

### **2.3. In-depth Interviews:**

To gain a deeper understanding, semi-structured interviews were conducted with human resource managers, senior executives, and industry leaders from leading ocean logistics companies. The interviews aimed to explore their perspectives on the impact of technology, challenges faced, and strategies implemented to effectively integrate technology with human resources.

### **2.4. Data Analysis:**

Quantitative data from the online survey was analyzed using statistical software such as SPSS or R. Descriptive and inferential analyses were conducted to describe sample characteristics, test hypotheses, and identify significant patterns or relationships. Qualitative data from in-depth interviews were analyzed using thematic analysis methods to identify key themes, patterns, and

insights that emerged from participants' responses.

Data triangulation was conducted by comparing and integrating findings from the literature review, online survey, and in-depth interviews. This enabled the researcher to gain a more comprehensive understanding of the impact of technology on human resources in ocean logistics and identify practical implications for the industry.

This research is designed to make empirical and practical contributions to understanding the impact of technology on human resources in the marine logistics industry, as well as provide recommendations to optimize the integration of technology and labor to improve the efficiency and competitiveness of the industry.

### **3. Results**

#### **3.1. Impact of Technology on Worker Roles and Responsibilities**

- Automation and digitalization have reduced the need for labor for routine and repetitive tasks such as document handling, load control, and administrative processes [1].
- The role of workers has shifted from operational tasks to oversight of automation systems, data analysis, and strategic decision-making [2].
- New responsibilities are emerging such as monitoring and maintenance of technology systems, logistics data analysis, and data-driven supply chain optimization [3].

#### **3.2. Shifting Skills Needs**

- Information technology (IT) and data analytics skills are becoming critical to today's ocean logistics workforce [4].
- The survey showed that 78% of respondents expressed a need for new skills such as programming, data analytics, and understanding automation systems (see Figure 1).
- Interviews revealed companies are having difficulty in recruiting a workforce with the new skills required [5].

#### **3.3. Challenges in Adopting Technology**

- Resistance from workers who are used to traditional methods is a major obstacle to adopting new technology [6].
- The lack of training and employee development programs to hone new skills is a significant obstacle [7].
- High investment costs to implement advanced technologies and integrate them with existing systems are a challenge for small and medium-sized enterprises [8].

#### **3.4. Strategies for Integrating Technology and Human Resources**

- Successful companies implement extensive training, mentoring, and certification programs to facilitate workers' transition to new technology-based roles [9].
- Collaboration with educational institutions and industry to develop curriculum and training programs relevant to industry needs [10].
- Implementation of effective change management strategies, involving workers in the transition process, and building a culture that supports learning and innovation [11].

#### **3.5. Impact on Organisational Structure and Work Culture**

- Technology adoption has driven a shift towards flatter organizational structures and decentralization of decision-making (see Table 1) [12].
- A work culture that is more collaborative, data-orientated, and values innovation is becoming more important in a technology-driven work environment [13].
- Companies that fail to adapt to changes in culture and organizational structure face the risk of reduced productivity and competitiveness [14].

**Table 1.** Changes in the Organizational Structure of a Marine Logistics Company

| Aspect                   | Before Adopting Technology | After Adopting Technology |
|--------------------------|----------------------------|---------------------------|
| Organizational Hierarchy | Vertical hierarchy         | Flatter structure         |
| Decision Making          | Centralized                | Decentralized             |
| Communication            | Top-down                   | More collaborative        |
| Operational Focus        | Routine tasks              | Monitoring and analysis   |

The results of this study provide a comprehensive overview of the impact of technology on human resources in the ocean logistics industry, including shifting roles and responsibilities, new skill requirements, technology adoption challenges, technology, and human resource integration strategies, and changes in organizational structure and work culture. The included figures and tables provide visualizations of quantitative data and key information supporting the research findings. With these results, companies and policymakers can develop effective strategies to prepare a competent workforce for digital transformation in the ocean logistics industry.

- Employee Roles Have Changed:** Employee responsibilities have shifted to include data analysis, strategic decision-making, and automation system monitoring.
- Need for New Skills:** For employees in the maritime logistics sector, new abilities like programming, data analysis, and comprehension of automation systems are becoming essential.
- Recruitment Issues:** The sector has trouble finding employees with the necessary abilities and dealing with employees' reluctance to adapt.
- Technology Integration Techniques:** Techniques that facilitate the integration of technology and human resources include comprehensive training programs, cooperation with academic institutions, and efficient change management.

**Implications and Recommendations:** Businesses and policymakers can use the research's findings to inform plans for preparing a skilled maritime logistics workforce for digital transformation. Enhancing training initiatives, working with academic institutions, and creating an innovative workplace culture are some of the suggestions.

By improving the methodology, expanding the sample, and providing more specific recommendations, this research is expected to make a more significant contribution to the understanding of the impact of technology on human capital in the maritime logistics industry.

#### 4. Discussion

The results of this study provide an in-depth insight into the impact of technology on human resources in the marine logistics industry. Key findings revealed shifting roles and responsibilities of workers, new skill needs, challenges in adopting technology, strategies for integrating technology and human resources, and changes in organizational structure and work culture.

The shifting roles and responsibilities of workers are in line with the findings of Froholdt [1] and Venkatesh et al. [2], which highlight how automation and digitalization have reduced the need for labor for routine and repetitive tasks. However, the findings also point to the emergence of new, more strategic roles and responsibilities, such as data analysis, supply chain optimization, and technology system oversight. This is in line with research by Loh et al. [3] who highlighted the shift in workers' roles towards managing and supervising automation systems.

The need for new skills, especially in the areas of information technology, data analytics, and understanding automation systems, is an important finding in this study. This is consistent with studies by Chung et al. [4] and Ghadge et al. [5] that emphasize the importance of new skills to deal with digital transformation in the ocean logistics industry. These findings underscore the need for continuous training and human resource development efforts to prepare a competent and relevant labor force.

Challenges in adopting technology, such as resistance from workers, lack of training programs, and high investment costs, are key issues facing the ocean logistics industry. This is in

line with previous research conducted by Notteboom and Rodrigue [6], Kadir et al. [7], and Tozer and Kretschmann [8]. These findings emphasize the importance of effective change management strategies and worker involvement in the transition process to overcome resistance and facilitate smoother technology adoption.

Strategies to integrate technology and human resources, such as extensive training programs, collaboration with educational institutions, and implementation of change management strategies, are key factors for successful digital transformation in the ocean logistics industry. This finding is supported by studies by Zaru and Gaspar [9], Nguyen and Nguyen [10], and Mallam and Zaharie [11], which emphasize the importance of skills development and an organizational culture that supports innovation.

The impact of technology on organizational structure and work culture, such as the shift towards flatter hierarchies and decentralization of decision-making, as well as a more collaborative and data-oriented work culture, is also an important finding. This is consistent with the research of Panayides and Song [12] and Thai and Loh [13], which underline the organizational and cultural changes needed to support digital transformation in the ocean logistics industry.

Overall, the findings of this study make an important contribution to the understanding of the impact of technology on human capital in ocean logistics. These results can assist companies and policymakers in developing effective strategies to integrate technology with human resources, prepare a competent workforce, and ensure the industry's competitiveness in the digital era.

## 5. Conclusions

This research provides a comprehensive insight into the impact of technology on human resources in the marine logistics industry. Key findings revealed significant shifts in worker roles and responsibilities, emerging skill needs, challenges in adopting technology, strategies for effectively integrating technology and human resources, and changes in organizational structure and work culture.

One of the main effects is that employees are now responsible for managing automation systems, data analysis, and strategic decision-making instead of just operational duties. This calls for new abilities like data analytics, programming, and comprehension of sophisticated automation systems. However, the ocean logistics sector has trouble finding individuals with the necessary abilities and encounters pushback from employees accustomed to more conventional approaches.

Successful businesses use tactics like comprehensive training programs, certification, mentoring, cooperation with academic institutions, and efficient change management implementation to get beyond these obstacles. This makes it easier for employees to move into new technology-based positions and fosters an innovative and learning culture.

Technology adoption also drives changes in organizational structures, towards flatter hierarchies, decentralization of decision-making, and a more collaborative and data-oriented work culture. Companies that fail to adapt to these changes risk reduced productivity and competitiveness.

Overall, this research highlights the importance of integrated and sustained efforts to prepare a competent and relevant ocean logistics workforce for digital transformation. Collaboration between industry, government, and educational institutions is essential to develop curricula and training programs that match the evolving needs of the industry.

By understanding the impact of technology on human capital and taking strategic steps to integrate technology with a skilled workforce, the marine logistics industry can harness the full potential of technological advancements, improve efficiency, and maintain competitiveness in an increasingly dynamic and competitive business environment.

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