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Human Resources
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THE ROLE OF MARITIME EDUCATION IN DIGITALIZATION

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Abstract. As a result of the rapid technological development and the introduction of digitalization, a radical change occurs in the functioning and operation of the maritime industry. Digitalization places new demands on human resources in the sector. As a result, there is a gap between the demand and the supply of knowledge, skills and opportunities. In this context, this paper aims to justify the new role, tasks and instruments for forming a new educational environment of the maritime education in accordance with the current digitalization of maritime universities. The research proves that digitalization is not only a collection of technological solutions and software products, but also comprises design, management and control of the educational process in an innovation environment with the help of management tools – entrepreneurial hubs, active interactions and talent management of the organization. The research uses the multimethod approach. The systems approach, analysis and synthesis are the main research methods.

Keywords: education; digital university; digitalization; maritime innovation hubs; skills gap; qualified staff

Introduction

Contemporary global changes, caused and catalyzed by economic, financial, climate, pandemic and military crises, pose a challenge to the efficient functioning of global supply chains and the facilitation of safe maritime transport operations. Therefore, a new way of thinking is required to help overcome the harmful effects of global changes, in which big data, digitization and the use of exponential technologies become extremely important. Maritime universities, global maritime organizations, ports and all other logistics stakeholders are open to the digital revolution. The reasons for this are that digitalization and new technologies are the key to standardization, enhancing the efficiency in shipping, and fostering economic recovery. At the same time, it is recognized that the transition must ensure economic prosperity, safety, environmental protection and cyber security[1].

In the contemporary world, training and the acquisition of new knowledge determine significantly the future integration and successful realization of people in society. The processes of digitalization in education are closely related to the change in the focus of the search for knowledge, shifted from traditional educational institutions to digitalized electronic resources; to specifically focused and much shorter courses. It is becoming more important for the development of education and science to form innovation hubs, to encourage start-ups with new ideas, to upgrade the role of businesses interested in new technologies, to make universities and in particular maritime universities, the place where students create and implement the latest technologies in a safe and secure manner. These processes are connected with a change in the educational environment, with the need for forming new knowledge and skills, both in the learners and, to an even greater extent, by the trainers (Sivkov 2022, pp. 10 – 11).

In the context of the above, the paper aims to justify the new role, tasks and instruments for forming a new training environment of the maritime education in accordance with the current digitalization of maritime universities. The general methods of research are system approach, analysis and synthesis.

The following issues are discussed in the paper in order to reach the aim mentioned above:

• To examine the relevance and challenges to employment resulting from the development of digitalization.

• To analyze the new role, tasks and trends in the development of maritime universities in the context of digitalization.

• To identify innovative tools for creating a new educational environment for the effective application of the digitalization of maritime universities.

The systems approach, analysis and synthesis are the main research methods.

1. Relevance and contemporary challenges of digitalization

The employment challenges resulting from Industry 4.0 are taken into consideration in the discussion of the first issue of the research.

The widespread introduction of digitalization, artificial intelligence and robotics in economies and societies in recent years is of great concern due to the huge changes in the skill demand[2]. In the study of Cedefop (European Center for the Development of Vocational Training), it is obvious that individuals who meet the skill requirements of future jobs in the conditions of digital economy must possess not only good digital skills, but also a healthy mix of cognitive (problem-solving, creativity, learning skills) and socioemotional (communication, cooperation) skills. Furthermore, a snapshot of the labor market reveals that individuals who come back to the job market after having spent an extended period of time in unemployment have greater skill gaps than those without career interruptions.

The low qualification of some individuals in society is also a significant problem. Cedefop's analysis highlights that skill shortages genuinely arising due to

an absence of job-ready candidates affect Europe's most innovative, internationally competitive and dynamically growing enterprises, posing productivity and growth constraints (Dimitrakiev, Molodchik 2018).

A number of recent studies have identified the differences between the readiness of the academia and the economy to implement Industry 4.0. Thus, for example, (Zeidan, Bishnoi 2020) emphasizes the need to create a new educational ecosystem characterized by: evaluation of current curricula in line with technological development; participation in projects and conducting mandatory internships, coordinated and institutionally planned industrial partnerships; creation of soft skills development programs (Lutzkanova, Mednikarov, Chesnokova 2022). As a result of the industrial revolution, the academia and the economy must be ready for a peculiar technological renaissance denying isolated existence and requiring connectivity to place the human capital in the potentially developing new educational environment.

In support of the above, a number of authors report the radical transformation of industry that has resulted from the integration of emerging technologies (Hernandez-de-Menendez, Morales-Menendez, Escobar, McGovern 2020). However, in order to reach intelligent production through greener and more efficient processes, some barriers must be overcome, such as the lack of qualified personnel to develop and manage various high-tech systems. It is concluded that Industry 4.0 demands a change in the labor market requiring trained professionals who have the competencies and skills to effectively manage technology, the large amount of information, as well as to analyze it.

A study by the ILO[3] on changes in the skill demand in digital economies and societies, from another research angle, draws attention to the emergence of new jobs which will increasingly require conceptually new vocational training and higher education. Artificial intelligence (AI) and machine training specialists, process automation experts, information security analysts, user experience and human-machine interaction designers, software engineering and data science, as well as robotics engineers will be increasingly in demand, since the technologies they work on develop and become more mainstream. However, since digitalization rapidly enters various fields and technological changes accelerate, the existing formal training programs cannot keep up with the demand for new skills. As a result, digital skill gaps are prevalent and can hinder the effective innovation and implementation of new technologies (Stefanova, Kanev 2022, pp. 155 – 161).

Depending on the changes in occupations and tasks, some strategies for developing new skills are suggested, such as[3]:

– On-the-job training to gain access to new tasks or responsibilities;

– Reskilling or upskilling to new occupations through initial or continuing vocational training courses;

– Non-formal and informal digital skills acquisition, including massive open online courses;

– Technical and vocational education and training (TVET) or university degree in cross-specializations;

– University education.

One of the greatest challenges the marine and offshore industries will face in the coming decades is transition to digitalized operations on a trajectory to net zero carbon[4]. Digitalization encompasses several technologies ready to revolutionize the maritime sector, namely:

– visual technologies (with tools: remote inspection and dashboards; enhanced visualization tools; virtual immersion ship models);

– artificial intelligence (with tools: observation through machine learning (ML); enhanced visualization tools; self-aware and cognitive systems);

– virtual assets (with tools: Realtime Vessel Monitoring; Self Learning Digital Twins; Fleet level control via interconnected digital twins);

– autonomous operations (with tools: Ship Connectivity Infrastructure; Enhanced Ship Connectivity; Connected Unmanned Autonomous Ships).

By 2050, digitalization in the maritime industry is expected to achieve:

• control over connected ships in a fleet by means of digital twins;
• data management;
• virtual/real joining (visualization technologies);
• self-correcting systems with artificial intelligence;
• immersion in virtual ship models.

In summary, the development of digitalization is a complex and constantly changing process over time. This requires governments, companies and educational institutions to offer different options for the growth and development of digital talents. It would be incorrect to assume that it is about training more engineers or programmers. A more holistic approach should be taken to create an environment for the implementation and development of people's digital processes and skills.

2. Role, tasks and trends of contemporary education in the context of digitalization

The role, tasks and trends of contemporary education in the context of digitalization are taken into consideration in the discussion of the second issue of the research.

In today's world, universities, particularly maritime universities, and industry are becoming "natural partners" in the process of overcoming skills shortages, sparking innovation and productivity[5]. In an environment of digitalization and rapidly developing technologies, it is more than ever necessary for the teaching, learning and research to be more closely linked with industry needs. In this regard, the aim of universities is to prepare highly skilled personnel for the industry, to bridge the skills gap, to support/participate in innovation and productivity. At the same time, university graduates must handle high technology, thrive in their

careers and strive for lifelong learning. University-business partnership can only be effective and achieve its goals when there is clarity and a shared understanding of what needs to come out on the other side.

One of the findings of an international study[6] on the issues of cooperation between higher education institutions, business and public institutions points out three key challenges hindering the effective implementation of Industry 4.0 and digitalization processes, namely:

- lack of vision on technology;
- lack of skilled workforce;
- lack of understanding of how to prepare for future work.

The research proves that the lack of understanding of how to prepare for future work makes it difficult to allocate resources to train people to acquire the necessary knowledge and skills, which is one of the reasons for the lack of skilled workforce. This slows down innovation and entrepreneurial approaches that can improve human life and the state of the environment. It also notes the training of personnel in fields characterized by high levels of unemployment, instead of training in occupations facing shortage of workforce. This is another possible reason for lack of skilled workforce. The lack of skilled workforce manifests in three ways: lack of understanding technology; lack of knowledge of strategic use of information; lack of ability to create new business models.

Due to the increasing complexity of the technological environment and the lack of understanding of technologies, at the annual meeting of the World Economic Forum[7], representatives of various stakeholders shared a common view on several guidelines for improving digital skills to achieve effective digitalization:

1. Make learning and development a central part of long-term planning and strategy

The rise of the digital workplace and an era of rapid innovation mean existing skills are becoming obsolete faster than ever, making upskilling and reskilling of the workforce an imperative for every business. Learning and development programs must become part of the businesses' investment strategy and be designed with a view to long-term strategic goals. Anticipating the skills that will be critical to organizational success in 3–10 years is a key point. Therefore, the organizations that can create strong digital talent growth engines will be the ones that realize new competitive advantages and long-term sustainable growth.

2. Not to overlook the importance of soft skills

In today's world, where work is done anytime and anywhere (and predominantly over digital channels), soft skills and neurodiversity are increasingly relevant. Empathy, emotional intelligence, and the ability to connect with diverse colleagues across various parts of the world are just as important to success as technical skills. Organizations expect teams to collaborate and co-design to find complex solutions in a fast-changing world. Organizations, despite their size, would benefit from taking

a broader view on upskilling and rounding out technical training with programs that focus on leadership, business management, and cross-functional competencies.

3. Offer/deliver learning across different channels

Hybrid and remote workforces require/expect to meet them on their preferred channels. An agile approach that delivers training through a combination of synchronous and asynchronous channels will help drive deeper engagement, better collaboration, and real-time feedback.

4. Customize approach for different functions and sectors

New technologies, including automation, artificial Intelligence, and machine learning, are reshaping work. Customized technology training curricula are essential in helping build professionals' analytical and technical skills.

5. Support the next generation of talents

More coordinated actions and more systematic public-private partnerships are needed for the training and education. Continuous cooperation should be sought to improve education programs, to develop STEM education, and to build the infrastructure needed to develop digital skills evenly.

In summary, the relationship: "modern education – digital transformation" includes a transition to a new way of presenting resources – skills, tools, support, tailored to the environment, and not a mechanical transfer of classical approaches to the new environment. The transition of universities to digital transformation is not a random process, but a continuous, systematic, planned and entrepreneurial activity of improvement at the technological, administrative and educational level. To optimize the digitalization in universities, the applied management tools, analyzed in the next part of the paper, are also of key importance.

3. Role, tasks and trends of contemporary education in the context of digitalization

Innovation tools that are essential for the implementation of digitalization in maritime universities are taken into consideration in the discussion of the third issue of the research.

Digitalization of maritime universities is not only a set of technological solutions and software products. Digitalization is primarily the design, implementation and control of an educational environment that is innovative in terms of content and functions with the help of certain resources, i.e. tools. The goal of any transformation, including the digital one, is to optimize the educational process in terms of indicators such as time, costs, profitability and contributions. Contributions should be explored in at least three trends – contributions to learners, to universities and to society in general. In accordance with the indicators in the field of maritime education, digitalization should be linked to the following tools:

1) Establishing maritime innovation hubs based on cooperation between maritime educational institutions and industrial partners.

Maritime universities are uniquely positioned in a space where participation is not mandatory, but on the other hand opportunities for joint development, cooperation and collaboration are offered. Therefore, the maritime university should develop as a bridge, hub[8] or platform, uniting students and professionals from various companies, NGOs, governments, public institutions, start-ups and other stakeholders. In this way, maritime universities could promote open innovation and the creation of ecosystems to support the mobility of professionals between companies and higher education institutions. The resulting cooperation clusters offer flexible training opportunities, create new career opportunities, actively participate in the development of new technological solutions. They also enable a more efficient sharing of information and are crucial for the joint finding of innovative solutions for port infrastructure and logistics (Dimitrakieva, Gunes, Dimitrakiev, Atanasova 2022, pp. 176 – 182).

2) Applying new technologies and using simulators in maritime education for the training of highly qualified personnel.

The use of simulators in maritime education and training is an essential component for developing seafarer competencies. Emerging multimedia technologies, such as virtual reality (VR), augmented reality (AR) and mixed reality (MR) create new possibilities for simulations and simulators. Using them in training makes it possible to perform operations, which are relatively cheaper, more immersive, and accessible in comparison to traditional configurations. The concept of utilizing VR, AR, and MR is not new, but recent developments and proliferation allow for practical implementation and real-world application. They support operators and operations both on land and at sea (Mallam, Nazir, Renganayagalu 2019).

3) "Maritime University – Maritime Industry" sustainable cooperation.

University-industry cooperation (Borges 2022) is the key tool for regional economic development, stimulating the creation of human capital, the transfer of knowledge and technology, and strengthening the importance of sustainability in higher maritime education. The tools for university-industry cooperation may include consortia, alliances, research and development projects, staff exchanges, and one-on-one interaction between academia and industry professionals[2]. In order to achieve a successful partnership business model, efforts are needed to overcome the main challenges for the academia and industry, mainly related to access to funding, dealing with opposing views, overcoming organizational and cultural differences (Michel-Schneider 2021). In designing and developing maritime universities as innovation hubs, the support of public institutions is essential for academic research, skills development, upskilling or reskilling of personnel, as well as attracting new talents to the maritime sector[9].

4) Upgrading the skills and abilities of the human resource.

Human resource is a key factor in any transformation process. It is one of the most complex resources in digital transformation processes and is related to

providing the human factor, i.e. training and number of people responsible for the implementation of the relevant activities, their training, motivation, improvement and control. Trained personnel are crucial in the development of any field, but this is especially true for the transformation process. The digital transformation could help to optimize the human factor of any university, Nikola Vaptsarov Naval Academy in particular, as with the same number of employees, thanks to the automation of processes, it will be possible to carry out process optimization and help increase efficiency. This, in turn, will affect both the possible number of trainees and the management's ability to create incentives for employees. Moreover, it will affect the lecturers, thus indirectly increasing the quality and number of trainees. The enhancement of efficiency will result from mandatory upgrading of the skills of all participants in the process, including continuous upskilling of the trainer.

Conclusions and summary

In conclusion, we can confirm that the digitalization of universities is not only a set of technological solutions and software products, but also a transfer of the educational process to a new environment with the help of management tools. Human resource is the key factor in any transformation process. It is one of the most complex resources in digital transformation processes and is related to the provision, training, development and entrepreneurial management of the human factor. Digital transformation could help optimize the motivation and time efficiency of the human factor of each university.

Maritime universities are uniquely positioned in a space that offers opportunities for joint development, cooperation and collaboration. In designing and developing maritime universities as innovation hubs, the support of public institutions is essential both for academic research and for the development of innovative knowledge and skills.

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