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Digital Transformation in Ferry Shipping – Case Study in the Baltic Sea Region

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ABSTRACT: In every sector of the economy, the use of digital technologies can be observed. In maritime transport, the use of digital technologies is used to operate the infrastructure as well as to reach the customer. The digital transformation in ferry shipping plays a significant role, not only in operations, but also in the way passengers are acquired. The availability and ease of purchasing tickets are important from the point of view of the users' application and the accompanying experience, so-called user experience. However, it is important to ensure the security in cyberspace for both parties of transactions, which is conditioned by the implementation of international, EU and the state legal acts. The aim of the article is to present the legal acts regarding digitalization and cybersecurity in maritime navigation and to identify the digital activities of ferry carriers. The paper uses the exploratory method, the literature review and desk research method. Critical and comparative analysis was also carried out.

1 INTRODUCTION

In the era of technology development, an increasingly important role in reaching customers is played by enabling them to make online transactions. The development of electronic commerce, called e-commerce, is becoming more and more popular. This is due to easy access to electronic devices and the Internet. The societies of European countries are considered highly developed, which influences to a significant share of buying and selling transactions on the Internet. Online sales are also growing in the transport sector. This situation takes place in both passenger and freight transport. In maritime transport, the effects caused by the 4th industrial revolution can be seen. More and more carriers or seaport managers use digital systems in their operations. Shipping carriers promote their services on websites. They try to facilitate contact with customers by using chat bots, applications, the ability to send a form, etc.

Ferry shipping is one of the fastest growing transport segments due to the large number of passengers and cargo carried. It is characterized by high frequency of courses and shuttle traffic between specific seaports. Passengers use ferries for commuting to work, home and short tourist trips. For this purpose, they buy tickets for a cruise. However, in order to make the purchase easier for customers, ferry companies offer sales through dedicated internet portals or their own websites. They also make it possible to reserve places for transporting various types of cargo, e.g. means of road transport.

Despite the unquestionable importance of digitization in the ferry shipping segment, the issues of actions taken by carriers are not sufficiently described in the literature. The aim of the article is to show the legal acts regarding digitalization and

cybersecurity in maritime navigation and to identify the digital activities of ferry carriers.

Since the 19th century, there has been continuous technological progress in the world. This process occurs in every sector of the economy, including maritime transport. From the second decade of the 21st century, the so-called 4. the industrial revolution, otherwise known as industry 4.0. It is distinguished not only by the development of electronic technologies and the Internet (which took place already in the 3rd industrial revolution), but also by more advanced technologies, e.g. such as: Virtual Reality (VR), Internet of Things (IoT), Big Data Analytics, Cloud Computing (CC), 3D printing, online banking, online payment methods or cybersecurity (14). Industry 4.0 is also distinguished by the use of advanced and self-learning forms such as artificial intelligence (AI), machine learning or neural networks.

2 LITERATURE REVIEW

When talking about the 4th industrial revolution, the term digital transformation is also often used. It is "creating new solutions, applications" (45). According to R. Morakanyane et.al. (31) digital transformation in business organizations means „this form of organizational transformation, which is technology-enabled, is concerned with the use of information and digital technologies to impact different aspects of the organization". On the other hand D.R.A. Schallmo and C. A. Williams (40) they define it as „a sustainable, company-level transformation via revised or newly created business operations and business models achieved through value-added digitization initiatives, ultimately resulting in improved profitability". It can be said that digital transformation concerns the organization of the company's work in such a way that it changes its business model, and direct and indirect sales channels are based on the use of the Internet to reach customers. Concluding transactions in a digital way is currently one of the cheapest forms of sale, due to the lack of the need to hire sales representatives or maintain offices. An unquestionable benefit is the availability for consumers from anywhere and at any time, and saving time for both parties to the transaction. Digital transformation is a broader concept than digitalization and digitization, which are its components. This relationship is presented in Fig. 1.

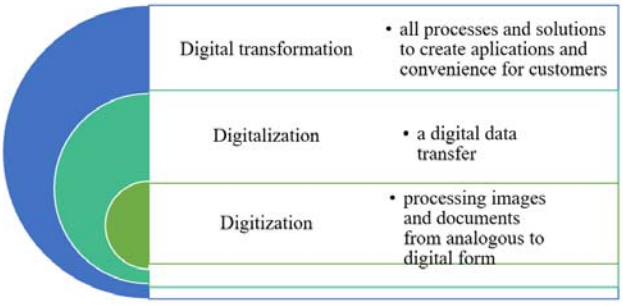

Figure 1. Relations between digital transformation, digitalization and digitization
Source: own elaboration based on (45).

The concept of digitalization is often confused with digitization. According to CISCO (4) digitalization it starts with the relations between people and economic entities and is "using technology to build new business models, processes, software and systems that bring more revenue, provide a competitive advantage and increase efficiency" (4). Its effect is the transformation of business models. D. R. A. Schallmo and C. A. Williams (40) similarly define digitization - as „fundamental changes made to business operations and business models based on newly acquired knowledge gained via value-added digitization initiatives" (40). In the Digital Development Program of Infrastructure and Industry of the European Union (EU), the term was formulated as "the process of implementing achievements in the field of electronics and information technology for general use" (25).

I. Bartusevičienė and E. Valionienė (2) define digitalization as "a continuously changing process in all of those areas, where sensorial systems create a big amount of specialised digital data which together with a billion bits of public data forms huge data sets used for different business and technical purposes. In addition, the need to be able to analyse and use the huge amount of digital data means important changes for important maritime sectors". Moreover, Ch. Legner et. al (26) treat the digitization as "the technical process of converting along signals into a digital form, and ultimately into binary digits, and is the core idea brought forward by computer scientists since the inception of the first computers (43), (12)".

It can be said that digitalization is the process of implementing electronic forms of data recording and transmission, leading to the improvement of their accessibility for all interested parties. This process causes changes in the work of the entire organization, including its business model. Broader access to data is possible through the use of computer and Internet programs as well as applications on electronic devices, including mobile devices.

Digitization is the basic process of converting the content of images, signs, texts, photos and others from traditional to digital form. L. Li et al. (27) define "digital transformation highlights the impact of IT on organizational structure, routines, information flow, and organizational capabilities to accommodate and adapt to IT. In this sense, digital transformation emphasizes more the technological root of IT and the alignment between IT and businesses".

Due to H.C. Burmeister et. al. (3) "digitization and automation will have a great effect on shipping in the future. Hereby, not only navigation or single ship operation is affected, but in most cases, large-scale effects on sea traffic and marine processes are expected. Depending on the concrete digitization and automation project, those are potentially also addressing safety related issues". The Basic difference between digitalization and digitization is that the first term refers to the creation of a digital form of analog objects or data, and the second definition already means the use of acquired digital data - their transmission, processing, sharing (45).

In the literature, it is difficult to find unambiguous definitions of these terms, which would be standardized by international organizations, ministries of individual countries or the European

Commission (EC). However, the basic differences between the concepts are cited by many authors.

When thinking about carrying out digital transformation in enterprises, it is very important to feel the users of computer programs or applications. Organizations are increasingly basing their projects on the so-called User Experience (UX). According to ISO 9241-210: Ergonomics of Human-System Interaction - Part 210: Human-Centered Design of Interactive Systems is „a person's perceptions and responses that result from the use or anticipated use of a product, system or service" (23), (46). After reviewing the literature A. H., Allam et. al. (1) they state that „user experience goes beyond normal usability and functionality aspects of products by incorporating the users' feelings and emotions towards these products before or during interaction". D. Norman et. al. (32) propose their own definition of UX – „the first requirement for an exemplary user experience is to meet the exact needs of the customer, without fuss or bother. Next comes simplicity and elegance that produce products that are a joy to own, a joy to use. True user experience goes far beyond giving customers what they say they want, or providing checklist features. In order to achieve high-quality user experience in a company's offerings there must be a seamless merging of the services of multiple disciplines, including engineering, marketing, graphical and industrial design, and interface design". Comarch company (6) describes UX as "the user experience that accompanies him when using a product (e.g. a controller for operating a drone) or a service. This subjective experience we have can be both positive and negative. It is difficult to talk about an objective user experience, each of us reacts differently. In fact, from the producer's point of view, the most important thing is that the target group for which the product has been designed is satisfied". In the context of the use of computer programs, applications or websites by customers, Comarch (6) also distinguishes the concept Customer Experience (CX). These are the consumer's feelings when contacting the company and getting to know its products or services. For the purposes of this article, the terms UX and CX are used interchangeably.

3 LEGAL REGULATIONS OF DIGITALIZATION AND CYBERSECURITY IN MARITIME SHIPPING FOR BALTIC SEA REGION

Changes in society, economy and technology are the main causes of global as well as local development. The fashion for mobility and global trends related to the development of ICT services (Information and Communication Technologies) are one of the most important reasons for the creation of legal regulations. The maritime transport sector lacks regulations regarding the digital transformation process. The impediment to the creation of such legal acts is the high dynamics of changes taking place in the development of information technologies. Currently, the regulations of the IMO - International Maritime Organization, the European Commission, regional organizations and internal legal acts in individual countries are in force. Fig. 2 presents legal acts introduced by individual organizations.

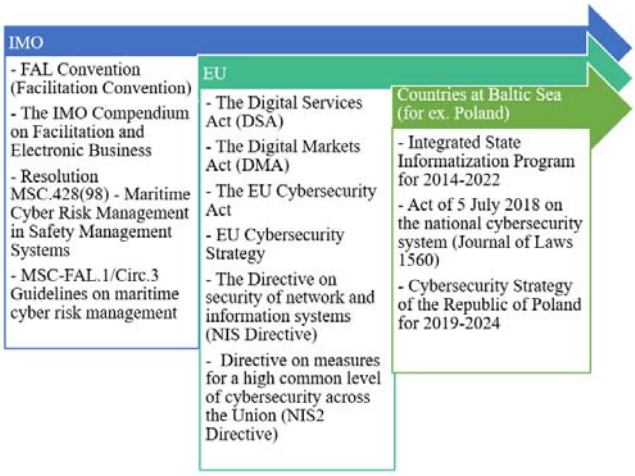

Figure 2. Legislation of digitalization and cybersecurity
Source: own elaboration based on (15); (16); (17); (18); (19); (8); (9); (10); (23).

In 2019, amendments to the FAL Convention - Facilitation Convention entered into force. The Convention was adopted in 1965 and concerned facilitations related to the documentation of ships, their calls at seaports and the circulation of cargo. It has now been extended to include mandatory requirements for national governments to introduce electronic exchange of information between ships and ports (17).

In 2024, further amendments on the mandatory exchange of data in seaports in the world in the so-called SW - Single Window, which will allow to enter data once and reuse them by different entities. Guidance has also been introduced on the "authentication, integrity and confidentiality of information exchanges through maritime single points of contact" (15). IMO ha salso elaborate The IMO Compendium on Facilitation and Electronic Business, which should be used by developers to design systems for electronic data interchange and harmonization of ship and cargo data (16). In addition, IMO has signed a partnership agreement with the World Customs Organization (WCO), the United Nations Economic Commission for Europe and the International Organization for Standardization (ISO), which contributed to the development of amendments to the FAL and the Compendium. Unifying and standardizing the system of data flow through seaports in the world will facilitate the exchange of information and accelerate the process of digital transformation of the entire maritime transport sector.

In recent years, the European Union has been taking actions aimed at digital development of societies and facilitating accessibility in the public and private sectors. The Member States of the European Union ratify legal regulations established by the European Commission and European Parliament. In 2022, two acts related to digital services and markets entered into force: The Digital Services Act (DSA) and The Digital Markets Act (DMA). The EC states that the enactment of these laws has the following objectives (9):

– „to create a safer digital space in which the fundamental rights of all users of digital services are protected";

– „to establish a level playing field to foster innovation, growth, and competitiveness, both in the European Single Market and globally".

Companies operating in the EU, including shipping carriers, are to have better access to markets via online platforms, a wider choice of content providers at lower prices for using their services and the ability to block illegal content or report any violations of unfair competition (10). Smaller companies will have better access to run their own sales platforms, without having to use intermediary portals (10). This situation has so far taken place on the ferry transport market, because the sale of tickets for a cruise was available mainly on dedicated platforms, instead of on the websites of individual carriers.

State governments and internal territorial authorities will have to adapt their activities to the legal acts and strategies introduced by the EU. They also implement their own strategies, laws and regulations to which public and private entities must adapt their activities. This also applies to ferry operators. For example, Poland has the Integrated State Informatization Program for 2014-2022. Poland is also a partner of Digital Single Market EU (41).

To function in the digital space, it is necessary to ensure an appropriate level of cybersecurity. The IMO, the EU and national governments are trying to achieve this goal by introducing regulations that tighten the rules for using the Internet and software. Cybersecurity is the protection of privacy, access to data and ensuring integrity in the digital space (39). The ISO/IEC 27032:2012 standard defines the term "cyber security" as "preservation of confidentiality, integrity and availability of information in the Cyberspace (34). Many international organizations cite their own definitions of cybersecurity. One of them is the International Telecommunication Union, which describes this concept as "the protection of data and systems in networks that are connected to the Internet" (24). Individual countries also create their own terminologies. In Poland, the Act on the National Cybersecurity System (NCS) is in force, which states that it is "resistance of information systems to actions that violate the confidentiality, integrity, availability and authenticity of processed data or related services offered by these systems" (44).

IBM claims that cybersecurity is "practice of protecting critical systems and sensitive information from digital attacks" (13). According to the leader in specialized software - CISCO, the term defines "the practice of protecting systems, networks and programs from digital attacks" (5). However, despite so many definitions of cybersecurity, ENISA - The European Union Agency for Cybersecurity has prepared a Report - Definition of Cybersecurity Gaps and overlaps in standardization, in which it indicated gaps and recommendations of a standardized term on the international arena.

International and state institutions give more and more attention to security in the digital space, which results in the implementation of legal regulations. IMO has introduced guidelines on maritime cyber risk management (MSC-FAL.1/Circ.3 - Guidelines on maritime cyber risk management) (18) and Resolution MSC.428(98) - Maritime Cyber Risk Management in Safety Management Systems (18). The EU has adopted The EU Cybersecurity Act and the EU Cybersecurity Strategy, which aims to raise awareness among Internet and software users. The EU has also introduced The Directive on Security of Network and Information Systems - NIS Directive. In subsequent years, the EU introduced the Directive on Measures for a High Common Level of Cybersecurity Across the Union – NIS 2 Directive, which entered into force on January 16th, 2023, and Member States have 21 months to adopt it (8).

Individual countries follow the example of international institutions and also implement laws and strategies regarding security in cyberspace. An example is the Polish Act of 5 July 2018 on the National Cybersecurity System (44) and the Cybersecurity Strategy of the Republic of Poland for 2019-2024 (42).

Implementation in Poland was also important for the development of the information society the State Informatization Strategy by Ministry of Digitalization (42). Cybersecurity is extremely important for the functioning of the entire country, as well as individual institutions, companies, employees and clients.

Organisation for Economic Cooperation and Development (OECD) it also guides digital security policy and prepares recommendations for Member States whose governments need to adjust their internal laws (36) and the OECD Digital Government Policy Framework (35).

Another initiative is the Guidelines on Cyber Security on board Ships introduced as part of a collaboration by International Chamber of Shipping, International Union of Marine Insurance, BIMCO, Oil Companies International Marine Forum, International Association of Independent Tanker Owners, International Association of Dry Cargo Shipowners, InterManager, World Shipping Council, Superyacht Builders Association, Digital Container Shipping Association and and Chamber of Shipping of America (20).

The level of security in cyberspace can be increased by implementing the ISO/EIC 27001 standard: Information security management systems. Information security management systems. Requirements (21) was elaborated in collaboration between ISO and International Electrotechnical Commission (22).

Recommendation on cyber resilience - Rec. 166 was introduced by International Association of Classification Societies (20).

The analysis of normative acts shows that cruise companies must comply with a number of regulations and guidelines that are introduced on the one hand by international institutions and, on the other hand, by major maritime organizations. The main goal of all these solutions is to increase the safety of both ships at sea and the crew onboard, but most of all the passengers.

4 RESEARCH METHODOLOGY

The presentation of applicable legal acts in maritime shipping and digital activities used by ferry carriers required the use of research methods from existing sources. For this purpose, a literature review of basic definitions, legal regulations and current information about ferry operators (7). Scientific publications were searched in the following databases: Scopus, Web of Science and Science Direct.

A critical analysis of the literature was carried out to indicate the differences in definitions: digital transformation, digitalization, digitization, user experience and customer experience. Legal acts were reviewed mainly on the websites of international organizations, such as IMO, European Parliament, European Commission, International Organization for Standardization, and dedicated portals for searching legal acts in Poland, such as ISAP or Service of the Republic of Poland. The desk research method was also used in the selection of legal acts. The use of this method was necessary to obtain data and information on selected ferry carriers, which were then subjected to a comparative analysis.

When showing examples of digitalization activities implemented by selected carriers, the case study method was used. However, it was necessary to narrow down the spatial scope of the research in order to select the organizations in question. Fig. 3 presents the selection criteria for the surveyed entities.

Figure 3. Selection criteria of the examined entities
Source: own elaboration.

Narrowing the spatial scope of the research led to a situation where the research subjects were deliberately selected. Only four ferry operators operate in Poland: Stena Line, Polferries, Unity Line and TT-Line. A comparative analysis was carried out on the example of these carriers.

5 EXAMPLES OF ACTIVITIES IN THE FIELD OF DIGITALIZATION OF FERRY CARRIERS

In the Baltic Sea Region, ferry shipping is very developed. There are several dozen routes between the Baltic countries, six of which are between Poland and Sweden. There are four ferry carriers operating in Poland, offering individual connections:

- Stena Lina on the route Gdynia - Karlskrona with the frequency of two crossings a day,
- Polferries on the Gdańsk - Nynäshamn route with the frequency of five trips a week and Świnoujście - Ystad with two trips a day,
- Unity Line on the Świnoujście - Ystad route with a frequency of one crossing per day,
- TT-Line on the route Świnoujście – Trelleborg with the frequency of one crossing per day (47).

Due to the high frequency of ferry crossings and the volume of demand, carriers should provide customers with the security of data sent during the transaction when purchasing tickets and convenient access to information. Ferry companies must adapt to the applicable legal acts in the field of digitalization and cybersecurity implemented by the IMO and EU authorities and state regulations where they operate. In addition, they can also use standards according to ISO 27001 or guidelines from other organizations.

Ferry carriers operating in Poland must meet the requirements of the Act on the National Cybersecurity System (NCS). From 2022, they also had to adapt their digital activities to EU DSA and DMA laws. These enterprises also face the requirements related to the implementation of the EU NIS 2 directive, depending on whether they are recognized as Operators of Key Services by the countries in which they operate. The example of the Polferries carrier shows that ferry companies in Poland have not been approved as such operators, therefore the use of NIS 2 is not obligatory for them (11).

Shipping companies in the EU must also comply with Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of individuals with regard to the processing of personal data and on the free movement of such data, the so-called GDPR. By complying with this regulation, shipping companies can securely process their customers' personal data only with their consent.

Maintaining security standards in cyberspace is not the only activity of shipping companies. It is very important to reach the widest possible group of customers and favor the use of websites, messengers and social media. Ensuring the highest possible level of user experience can translate into acquiring new customers, especially those traveling for tourist purposes, and the acceptance of the company's offer by them.

Table 1. Digital activities of ferry carriers

	Stena Line	Polfer-ries	Unity Line	TT-Line
Ticket sales via the website	Yes	Yes	Yes	Yes
Chat bot on the website	Yes	No	Yes	No
Chat with a consultanton the website	No	No	Yes	No
Chat by Messenger	Yes	Yes	Yes (only chat bot)	Yes
Mobile application	No (only freight customer)	No	No	No
Talking by Internet	No	No	Yes (only redirect to another app)	No
Contact by e-mail	Yes	Yes	Yes	Yes
Facebook	Yes	Yes	Yes	Yes
Instagram	Yes	Yes	Yes	Yes
Linked In	Yes	Yes	Yes	Yes
Twitter	Yes	Yes	Yes	Yes
You Tube	Yes	Yes	Yes	Yes

Source: own elaboration based on websites of ferry carriers in Poland.

Table 1 presents the activities of ferry operators in the field of digitalization. Each of them provides information on their own websites and allows to buy tickets for the cruise. It is one of the most basic forms

of communication and company promotion. However, only Stena Line and Unity Line allow to ask questions by their customers via the chat bot available on their websites.

More advanced and more convenient for the client is the possibility of exchanging messages with a consultant. This form of contact is possible only with Unity Line, but only after turning it on in more advanced settings. Each of the analyzed carriers uses social media, such as Facebook, Instagram, Linked In or Twitter. Ferry companies have official profiles (also dedicated to Polish passengers) on Facebook, where they make it possible to establish contact via chat in the Messenger application. However, the use of this application is not the same to exchanging messages with a company employee. Unity Line sends automatic messages informing that it is a contact with a chat bot that can only answer standard questions. Messengers can be operated through the use of artificial intelligence. The Unity Line carrier is the only one of the analyzed carriers that has the option to connect via the Internet or by phone with a consultant on its website, but only by redirecting to another application that supports such connections. Each of the carriers offers e-mail contact with customer service departments. Ferry companies also provide telephone contact, but this is not an activity related to digital progress. Stena Line, Polferries, Unite Line and TT-Line have their own YouTube channels, where they present their offer for passengers.

Ferry carriers operating cruises from Poland do not have their own dedicated mobile applications for passengers. It is possible to use the application of an intermediary selling tickets. There are several portals on the web dedicated to the subject of the ferry and enabling the purchase of tickets. However, it should be up to the enterprise to increase the comfort and usability for the customer, which would satisfy their needs at a higher level.

6 CONCLUSIONS

Over the years, the effects of digital transformation in maritime shipping have been visible in the legislative and business spheres. Along with technological progress and changes introduced by companies from the maritime transport sector, legal regulations are being elaborated specifying the rules for moving around in the digital space. However, access to new technologies is increasing at a much faster pace than legal standards, which results from the specificity of the activities of these fields. IMO, the EU and national governments are implementing more and more laws and directives regarding the process of digitalization and cybersecurity. However, the obligation to adapt activities to these legal acts is not the same for all entities in the maritime transport sector. Ferry carriers must adapt their activities in cyberspace to the regulations applicable to the entire maritime transport sector or business entities, as no dedicated recommendations have been established for this group. They can increase the level of security on the network by applying ISO or other organizations standards. Taking care of the security of your clients' data is not only a necessary action from a legislative and ethical point of view, but also a marketing one, similar to increasing your activity on the Internet.

Shipping carriers take various digital activities according to trends and possibilities of gaining customers. Providing information in a manner convenient for the customer is intended to rise his user experience, which is to increase his ability to use the company's services. Most ferry carriers in Poland offer cruises on different routes (with the exception of the Świnoujście - Ystad route, where services are provided by Polferries and Unity Line), which means that they compete mainly for tourist passengers who are not obligated of the need to travel on a given route and can freely choose.

Ferry companies operating in the entire Baltic Sea Region can undertake more digital activities that have an impact on shaping the user experience due to intensified competition on the same routes. Ferry carriers, despite the use of digital forms of contact and the use of modern technologies, use older methods of communication in client-consultant relations, which means that these forms are considered the most effective.

7 LIMITATIONS AND RECOMMENDATIONS

The authors of the article are aware of the limitations of the results of the research presented above. The above analyses are spared mainly about exploratory research and observation. It would certainly be worthwhile to conduct a survey among representatives of ferry shipping companies in order to learn about their attitude to the above-described issues of digitalization or digital transformation. Their point of view on the challenges that they are faced, would have a great cognitive and application value. We should realize that adaptation to the customers' needs and new trends in the information technologies takes time and is capital intensive. Nevertheless, it is obvious that those companies that can quickly adapt to new technological solutions will be competitive on the market.

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