DOI 10.52260/2304-7216.2024.3(56).20
UDC 334.021
SCSTI 06.91

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DIGITAL TRANSFORMATION OF ECONOMY: THE EXPERIENCE OF ESTONIA AND DENMARK

This article is devoted to the study of best practices of Estonia and Denmark in shaping and developing digital economies. An analysis of the cluster policies of these countries is conducted, examples of the use of digital platforms and digital tools by industrial enterprises and clusters in Estonia and Denmark are considered. Within the framework of this research general scientific research methods have been employed such as analysis and synthesis, case study method in examining practical examples of digital transformation in Estonian and Danish industrial companies, content analysis method of scientific publications, scientometric analysis method to assess the level of interest and activity of the scientific community in the field of digital economy of Denmark and Estonia, and method of graphical construction of frames using VOSviewer software. Drawing on the experiences of Estonia and Denmark, the study identifies key themes and aspects necessary for understanding and successfully managing digitization at the national level. Investments in robust digital infrastructure, fruitful collaboration between government, industry, and the scientific community, as well as contributions of research organizations to the development of digital competencies of the workforce are the key to the formation of innovative ecosystems that foster digital transformation of these countries.

Keywords: *digital economy, e-estonia, e-government, digital platforms, Industry 4.0, scientometric analysis, industrial enterprises and clusters*
Кілт сөздер: *цифрлық экономика, электронды Эстония, электрондық үкімет, цифрлық платформалар, Индустрия 4.0, ғылыми-метрикалық талдау, өнеркәсіптік кәсіпорындар мен кластерлер*
Ключевые слова: *цифровая экономика, электронная Эстония, электронное правительство, цифровые платформы, Индустрия 4.0, наукометрический анализ, промышленные предприятия и кластеры*

Introduction. In the contemporary world, digital transformation has become a key catalyst for economic growth and competitiveness. According to the Euler Hermes experts' report on the Enabling Digitalization Index (EDI), which evaluates countries based on five parameters: regulatory environment for business, knowledge ecosystem, connectivity quality, infrastructure, and market size, the leaders in 2020 were the United States, Germany, and Denmark. The United States ranked first due to its superior knowledge ecosystem, competitive market size, and favorable regulatory environment; Germany possesses a first-class knowledge ecosystem and business infrastructure. Denmark secured the third position for connectivity quality and surpassed China in the number of secured servers. Particularly noteworthy is China's success, which, in the three years preceding the Covid-19 pandemic, rose from 17th to 4th place in the ranking.

Among the pioneers of economic transformation - Estonia and Denmark, which have become synonymous with digital innovation and efficiency. Denmark's performance in the parameters of this ranking is as follows: regulatory environment for business – 97 out of 100 points, knowledge ecosystem – 95, connectivity quality – 100, infrastructure – 90. Estonia ranked 27th in this ranking with the following indicators: regulatory environment for business – 89 points, knowledge ecosystem – 77, connectivity quality – 70 points, infrastructure – 58 points.

It is especially worth noting the first place of Denmark in 2022 in the field of e-Government in the United Nations' e-Government Development Index, which is a composite indicator of three dimensions of e-government: provision of online services, telecommunication connectivity, and human capital.

The TOP-10 countries in the European Commission's Digital Economy and Society Index (DESI) in 2022 were Finland, Denmark, the Netherlands, Sweden, Ireland, Malta, Spain, Luxembourg, Estonia, and Austria. Denmark ranks as follows in four main DESI indicators: availability of broadband - 1st place;

digital technology integration - 2nd place; human capital - 5th place; digital public services - 8th place.

Despite Denmark's lead over other European countries in the ranking, as noted by experts, it is important for the country to continue on the path to achieving the goals set for the Digital Decade, including increasing the percentage of SMEs with at least basic digital intensity to 90% (79% in 2022), increasing the percentage of enterprises using cloud computing services to 75% (62% in 2022), big data (27% in 2022), and artificial intelligence (24% in 2022) by 2030.

According to the DESI ranking for 2022, Estonia is the best country in the sector of digital public services and is recognized as a leader in e-government. Estonia ranks 9th out of 27 EU countries in the overall DESI ranking, including the following indicators: human capital - 8th place, digital technology integration - 15th place, broadband availability - 26th place [1].

Estonia, the developer of Skype software, has successfully utilized digital technologies in the economy and government administration since the 1990s, being the first country to introduce e-government services - e-Estonia - as early as 2001. This comprehensive e-government platform enables citizens to access a wide range of government services online: electronic voting, digital signatures, electronic taxation, healthcare databases, and government digital ecosystem.

According to the Danish Agency for Digital Government, central, regional, and local governments in Denmark have been strategically collaborating since 2001 to establish a digital public sector, starting with the implementation of digital signatures and emails, followed by bank payments using NemKonto (bank accounts) and electronic invoices in 2004.

Subsequently, in 2007, NemID/EasyID (identification data for public self-service), digital mail, and the national portal for citizens borger.dk were launched to provide online services and information about the public sector, and in 2011 – digital mail for businesses was introduced. Businesses have the capability to conduct all operations electronically: receive statements, pay taxes, and submit reports. Such a system enables annual savings of 10-20% of the budget. In 2016, the exchange of high-level public data began, and by 2022, artificial intelligence (AI), automation, and green transition rules were introduced with the aim of achieving zero emissions by 2050.

The aim of this research article is to analyze the experiences of Estonia and Denmark in the field of digital transformation of the economy, including the formation of digital ecosystems, cluster policy, digitization of industrial production, and the application of digital tools by enterprises and complex integrated industrial structures.

In order to accomplish this aim the following objectives are established: conducting a scientometric analysis of publications to assess the level of interest among researchers in the research questions regarding the main directions and features of the formation and development of digital economies in Denmark and Estonia; analysis of cluster policy in Estonia and Denmark; studying the application of digital platforms and digital tools by industrial enterprises and clusters of the aforementioned countries, as well as identifying the most successful practices of such digital transformation.

During the research, general scientific research methods were used, including analysis and synthesis method, case study method in examining practical examples of digital transformation of Estonian and Danish industrial companies, as well as specialized methods, including content analysis method of scientific publications, scientometric analysis method (using the information array of the Web of Science database), and method of graphical construction of frames in the VOSviewer program.

Literature review. Within the framework of the fourth industrial revolution in manufacturing, progress has been made in the field of data storage and new computational capabilities, as well as developments in artificial intelligence, robotics, additive manufacturing, and human-machine interaction, leading to innovations that transform models, approaches, and concepts in production [2].

Numerous studies emphasize the positive correlation between digital transformation and economic growth. For example, Rosenstand C.'s study shows how digital technologies contribute to increased labor productivity and innovation, leading to overall economic progress [3]. Similarly, studies by Yu F. and Wysokinska Z. [4-5] highlight the role of digitization in stimulating regional economic development and competitiveness. Scupola A. [6] provides a detailed case study of successful digital transformation in Denmark's public administration, emphasizing the importance of policy and stakeholder engagement. Ndou V. [7] discusses the disruptive nature of digital technologies and their role in post-pandemic recovery strategies, while Bednarčíková D. [8] explores the potential of digital technologies for sustainable business, particularly in the context of the European Union. These studies collectively underscore the significance of digital transformation in fostering economic growth and sustainability.

Estonia's focus on integrating digital literacy into curricula and Denmark's initiatives to enhance workforce qualifications reflect efforts to develop the digital competence of the workforce [9]. The development of reliable cyber-secure digital infrastructure is necessary to facilitate the digital transformation of the economy, which is a multifaceted process encompassing technological, institutional, and socio-economic aspects [10-11]. Drawing on the experiences of Estonia and Denmark, this study identifies key themes and aspects necessary for understanding and successfully managing digitization at the national level.

To assess the level of interest of the academic community in the research questions regarding the main directions and peculiarities of the development of digital economies in Denmark and Estonia and to examine existing practical solutions in this area, conducting a scientometric analysis of publications presented in the Clarivate Analytics (WoS) database is considered appropriate. Data collection for the research was conducted by analyzing published works presented in the Web of Science Core Collection scientometric database. The data search formulas were as follows:

1st search = All fields: "digital economy" and "Estonia"; All fields: "e-Estonia";

2nd search = All fields: "digital economy" and "Denmark".

The search query was not limited by date and therefore covered the period from 1975. Due to the relatively recent emergence of the Internet of stationary devices and associated digital technologies, the first scientific articles on the research topic date back to 1995 in the database, therefore, the research results are presented for the period "1995-2024".

Within the framework of conducting the first search query, 45 and 26 publications were obtained respectively, while in the second query, 87 publications were obtained, which were further utilized for conducting a scientometric analysis using the software tool VOSviewer (version 1.6.20) based on the criterion "Co-occurrence: All keywords". It is also noteworthy that the preliminary obtained arrays of publications were analyzed using the capabilities of the webofknowledge.com platform – the "Analyze Results" section.

1) During the 1st search query "digital economy" and "Estonia", the main array consisted of 45 publications, 80% of which belong to the WoS categories: "Economics" - 20 (44.4%) and "Management" - 16 (35.6%), indicating significant interest in digital economy and its management in the context of Estonia.

The distribution of publications by countries is as follows: Estonia - 24 articles (53.3%), Latvia - 6 articles (13.3%), Australia, Netherlands, and Ukraine - 5 each (11.1%). The key period of publications for this search query is 2013-2024, with the majority of works published in 2017-2024 (75%).

The TOP-5 educational institutions that published the highest number of articles on scientific topics considered in this context are: Tallinn University of Technology - 12 (26.7%), University of Tartu - 10 (22.2%), Ministry of Education Science of Ukraine - 5 (11.1%), P2P Foundation, and Queensland University of Technology with 4 articles each (8.9%).

It is important to note regarding scientific publications that they are presented in the form of articles in such scientific journals as "Access Press Publishing House" - 6 articles (13.3%), "Elsevier" - 5 (11.1%), "University Latvia" - 5 (11.1%), "Sage" - 4 (8.9%), "Springer Nature" - 3 (6.7%), which serve as significant platforms for presenting and exchanging research achievements in the field of digital economy.

The completed scientometric analysis identifies three clusters. In the "Digital Economy" cluster (highlighted in red), studies on the impact of digitization on economic growth, innovation, competitiveness, and other aspects of economic activity are concentrated (figure 1).

In the "Information and Communication Technologies" cluster (green), various aspects of technologies underlying the digital economy are thoroughly examined. The "Models of Digital Transformation" cluster (blue) focuses on research related to specific models and practices of implementing digital technologies in various sectors of the economy and society.

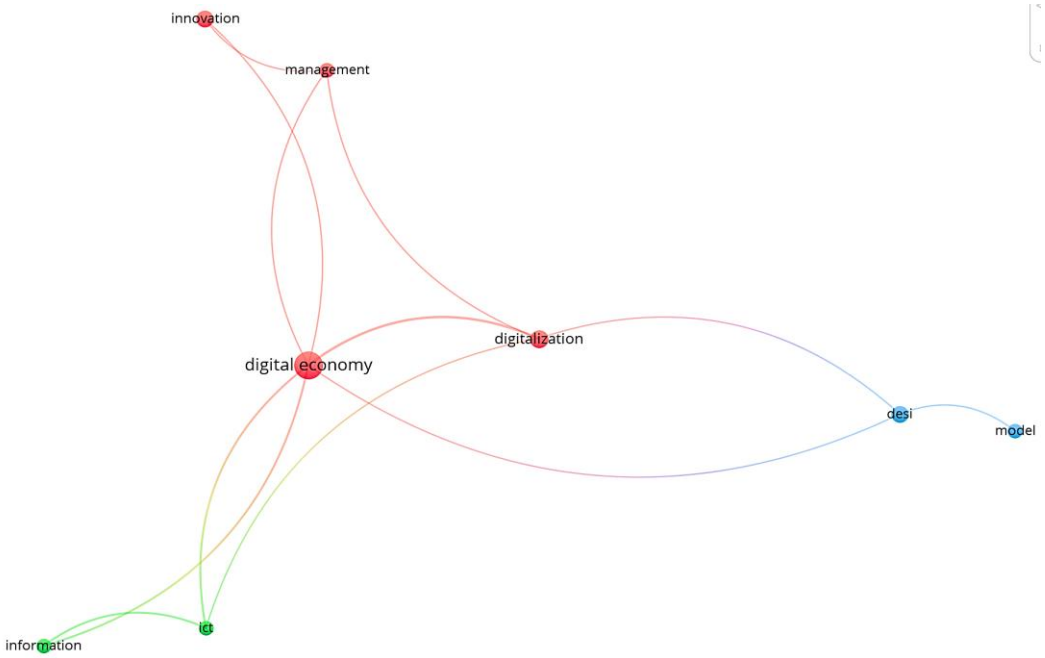

Figure 1. **Results of scientometric analysis by "Co-occurrence:keywords" criterion**
** Compiled by the authors*

Upon the request of "e-Estonia", the primary dataset comprised 26 publications, which were distributed among countries as follows: Estonia - 15 articles (57.7%), USA - 4 articles (15.4%), Germany, Russia - 3 articles each (11.5%). The key period of publications for this search query spans from 1995 to 2024, with the majority of works published between 2017 and 2024 (72.2%).

2) According to the second search query "digital economy" and "Denmark" 87 publications were retrieved, 40% of which belong to the following WoS categories: "Business" - 19 (21.8%), "Economics" - 9 (10.3%), and "Management" - 7 (8%), confirming the relevance and importance of researching the development and management of the digital economy in the context of Denmark.

The TOP-5 educational institutions that published the highest number of articles on the topic under consideration include: Aalborg University and Copenhagen Business School with 14 articles each (16.1%), Aarhus University - 7 (8%), Roskilde University - 5 (5.7%), University of Copenhagen - 4 (4.6%).

The scientometric analysis of publications on the query "digital economy" and "Denmark" allowed for the identification of three main thematic clusters covering various aspects of the digital economy in this country (figure 2).

Cluster "Digital economy", indicated in red, encompasses studies dedicated to the concept of the digital economy and its development in Denmark. The second cluster – "Knowledge management" (blue) - focuses on works related to knowledge management, defining its important role in enhancing the innovativeness of Danish companies in the context of digital transformation, including industrial production.

The third, green cluster – "Innovation" – involves study on innovations in the context of Denmark's digital economy. This cluster comprises articles on the role of digital technologies in stimulating innovations, creating new business models, enhancing the competitiveness of Danish companies, as well as the impact of innovations on economic growth and the country's development.

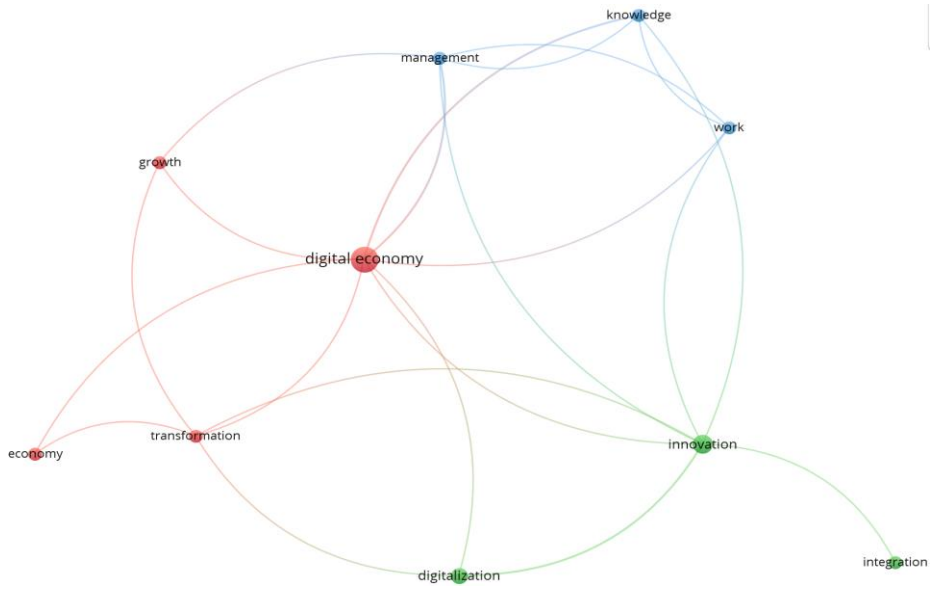

Figure 2. **Results of scientometric analysis by "Co-occurrence:keywords" criterion**
** Compiled by the authors*

The scientometric analysis of publications in the Clarivate Analytics (WoS) database revealed significant academic interest in researching the digital economies of Estonia and Denmark, with both countries being the subjects of intensive digitization research.

Main part. The recent focus on ensuring sustainable development in the national economies of European countries through international cooperation, clustering mechanisms, and the formation of cluster infrastructure has become particularly relevant.

The implementation of cluster policy in Estonia is associated to the adoption of the national innovation strategy for the development of science, research, and innovation for the period 2007-2013, which envisaged the development of innovative export-oriented sectors with high added value, including through clustering. Since 2008, Estonia has launched a state support program for clusters aimed at implementing joint cluster initiatives of Estonian enterprises to enhance competitiveness at the international level. Within the framework of the "Estonian Research and Development, Innovation and Entrepreneurship Strategy, 2021-2035", Estonia plans activities to increase the welfare of Estonian society and the productivity of the economy [10].

Currently, assistance in cluster formation in Estonia is provided at three levels: supranational within the framework of pan-European cluster development programs, national, and local. Major clusters, such as the information and communication technology cluster, logistics, aviation, and maritime clusters, contribute to the competitiveness of Estonia's economy, work on technology and product development, help create new companies and workplaces, and facilitate finding business partners abroad. In Estonia, clusters and joint initiatives are supported at the national level within three programs of Enterprise Estonia EAS: the first is intended for the advancement of technological development centers, the second - for the development of clusters, and the third - for competence centers. Estonia has created national clusters based on a group of products or services, as well as regional clusters based on the value chain. Among the largest and most well-known clusters, the following should be highlighted (figure 3).

Danish national clusters play an important role, promoting and encouraging cooperation in the ecosystems of Denmark's strongest and most promising industries. In collaboration with the Danish Business Development Commission, the Ministry of Higher Education and Science has appointed 13 organizations as national clusters in their respective business and technology areas.

The appointment of national clusters is based on the cluster program "Innovation Power: Danish Clusters for Knowledge and Business 2021-2024". The aim of the cluster program - is to strengthen the productivity and competitiveness of Danish companies through cooperation on innovation and knowledge transfer between companies and educational institutions [11].

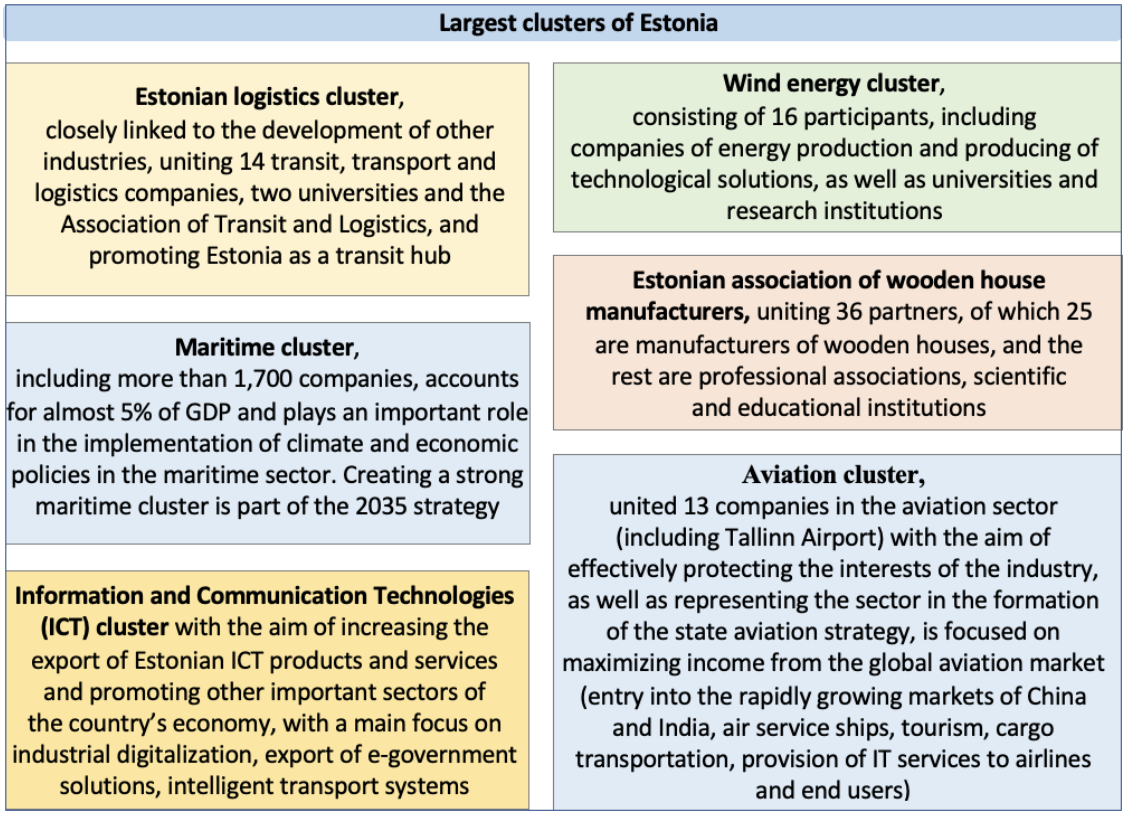

Figure 3. **Estonian largest clusters**

** Compiled by the authors based on the source [12]: https://www.tallinn.ee/en/clustersinestonia/estonian-clusters*

For example, the cluster in the field of digital technologies "DigitalLead" facilitates bridges between businesses, entrepreneurs, and educational institutions. DigitalLead increases the use of digital technologies in the public sector and provides access to up-to-date knowledge in this area, offering a wide range of networking events, knowledge dissemination, and projects throughout the country to strengthen digital professions and continue the digitization of Danish society.

Significant development has been observed in the robotics and drone technology cluster in Denmark, which includes around 600 companies involved in robot, drone, and industrial automation manufacturing, employing a total of 18,500 people. In 2022, the industry generated a turnover of 3.7 billion euros, of which 1.8 billion euros were received from exports [13].

Due to a favorable business environment suitable for rapid development, innovation, and the launch of software solutions, including intelligent monitoring, data-driven manufacturing, autonomous robots, and digital platforms, further growth of the digital economies of Estonia and Denmark is expected in the era of the industrial Internet of Things. Let's consider some successful examples of Estonian and Danish companies transitioning to Industry 4.0 technologies (table 1).

Table 1.

Examples of the use of digital tools/digital platforms by industrial enterprises of Estonia and Denmark

Company's name	Implemented digital tools / digital platforms	Key Performance Indicators of digital tools / platforms
Estonia		
Starship Technologies – a startup producing unmanned robotic ground vehicles (delivery robots)	Unmanned robots, having completed over 6 million deliveries, address the "last mile" issue at 80 locations worldwide, including the USA, UK, Germany, Denmark, Estonia, and Finland.	1) investments totaling 214 million euro will enable Starship Technologies to apply advancements in AI and machine learning and further develop its technologies, including infrastructure for wireless charging;

		2) Starship Technologies' robots have reduced carbon dioxide emissions by almost 1.8 million kg.
Enefit – an energy conglomerate comprising over 20 companies - the largest renewable energy producer in the Baltic countries	The digitalization process of "Enefit" is called "e-Energy", allowing flexible data processing, ensuring high efficiency and competitiveness.	In addition to Estonia, "Enefit" is also active in Latvia, Lithuania, Poland, and Finland, offering technological solutions and services for industrial companies in these countries. Over the past 10 years, existing business processes have been improved through information technologies and innovations, focusing on customer needs; the results of these changes include: 94% of customers served online; 90% of all electricity contracts concluded or renewed digitally; 90% of all invoices sent/received digitally, and others.
Skeleton Technologies – developer and manufacturer of energy storage systems for transportation and power grids	In 2022, the company began construction of a new plant based on an agreement with Siemens for the digitalization of the Leipzig Super Plant to create a fully automated digital manufacturing process for supercapacitors in Germany.	1) support from Siemens through the company's Digital Enterprise portfolio and expertise in industrial battery elements production; 2) creation of 240 jobs in the region; 3) investment amount - 220 million euro.
Denmark		
Vestas Wind Systems A/S – one of the world's largest wind turbine manufacturers	1) Operator Advisor platform from PTC, where all production instructions are available through easily understandable visual cues, reducing the need for paper instructions; 2) Shop.Vestas - a leading global online store with 24/7 access to spare parts and services for turbines, currently featuring over 88,000 items on the platform; 3) VestasOnline digital platform, providing turbine owners access to turbine-specific self-service services that can be performed remotely at any time as needed.	The VestasOnline platform provides: – real-time information on upcoming service visits and detailed reports on completed service orders for turbines; – viewing and downloading invoices and account statements for services provided by Vestas; – receiving a report on the status of the blades; – submission of new support requests and others.
Lego Group – the largest manufacturer producing toys in the form of assembly sets and modeling various items - constructors	After facing bankruptcy in 2002-2004, the company implemented a comprehensive approach to the use of digital technologies: 1) implemented the SAP-platform as a logistics, sales, information technology, and production centre, as well as the Lego Enterprise platform - a central hub for resource planning, management of personnel, equipment, software, supply chain, etc., becoming the foundation of Lego's business processes; 2) in 2011, Lego expanded its Enterprise platform with a product lifecycle management (PLM) system, allowing for faster product releases and a 50% increase in product output; 3) in 2016, Lego radically changed its operating model, transitioning from a monolithic platform to an API-oriented system to leverage new digital capabilities such as high-speed internet, hyper-	The new Lego leadership team increased revenue by 11% through the digitalization of supply chain processes and the centralization of information flows. For the year 2022, which marked the company's 90th anniversary, revenue for the reporting period increased by 17% to Danish krone 64.6 billion (USD 9.2 billion US dollar), net profit increased by 4% to 2 billion US dollar, and operating profit -by 5%- to 2.6 billion US dollar. In 2023, revenue increased by 2% , reaching 65.9 billion Danish krone (9.65 billion US dollar); however, net profit decreased by 4.9% by the end of 2023, amounting to USD 1.92 billion US dollar.

	scalability, and greater computing power.	
Maersk – a global logistics integrator company	1) online platform “Maersk Logistics Hub” - a centralized solution for supply chain transparency, providing consolidated cargo overview, tasks, logistics updates, and necessary information using artificial intelligence; 2) “Maersk App” application, essential for improving control over the supply chain, allowing receiving notifications for real-time cargo tracking; selecting departure and destination locations and confirming bookings through the terminal; preparing all shipping documentation in a few clicks; providing feedback through 24/7 chat support; ensuring the best rates, implementing booking for inland and ocean transport through Maersk Spot.	The combination of big data technologies and artificial intelligence algorithms makes all aspects of logistics more accurate and efficient. As of 2024, Maersk ranks second in the world in container shipping with a market share of 14.6%, trailing behind the Swiss Mediterranean Shipping Company.

** Compiled by the authors based on companies' websites information*

Particular attention should be paid to the important role played by organizations such as the Innovation Fund Denmark (Copenhagen), the Danish Centre for Digital Research (Aarhus), and the Centre for Artificial Intelligence and Robotics AIRE (Tallinn), which contribute to the digitization of industrial enterprises in Denmark and Estonia by conducting research, providing funding and expertise, facilitating collaboration to stimulate innovation and technological progress in the industrial sector.

The Innovation Fund Denmark was established to strengthen and support strategic research and innovation projects across Denmark. The fund invests in research and innovation projects in the following thematic areas: digitization, technologies and innovations; research in green technologies and innovations; biomedical research, healthcare, and welfare technologies.

The Danish Centre for Digital Research (DIREC) is a national research and innovation center for advanced digital technologies. DIREC finances joint projects where academic knowledge is combined with industry ideas to accelerate innovation and shift from cutting-edge concepts to real-world applications. The Center has financed over 40 joint projects involving more than 55 private companies and government organizations, totaling more than 81 million Danish krone (approximately 11.7 million US dollar). One of the largest projects is “Business Transformation and Organizational Decision Making based on Artificial Intelligence” for the period 2021-2025 with a budget of 16.8 million Danish krone (approximately USD 2.4 million US dollar).

The Centre for Artificial Intelligence and Robotics (AIRE) aims to enhance the competitiveness of Estonian industrial companies by helping them make decisions in the field of artificial intelligence and robotics. The Centre offers companies innovative solutions in artificial intelligence and robotics - whether it be testing new technology or software, data analysis methods, cloud solutions, predictive maintenance, or digital twins development. AIRE services include: training and consultations for business companies on digitizing various processes; finding opportunities for additional project funding; assessing the digital maturity of companies; evaluating the opportunities for industrial companies to implement AI solutions; presenting solutions, technologies, and software before making large investments; conducting company process analysis to assess the feasibility of company automation.

Considering the cumulative experience of foreign countries, as well as Denmark and Estonia specifically, a list of effective tools is determined, that will serve as the basis for developing a toolkit for assessing the level of digital readiness of industrial enterprises in Kazakhstan for the implementation and adaptation of digital ecosystems: the presence of a digital transformation strategy of the company; establishment of partnerships with experts in the development and implementation of projects for the deployment of digital ecosystems (research organizations, government agencies, etc.); availability of qualified personnel in the company for implementation and training in digital ecosystems (engineers, IT specialists, HR and finance specialists, etc.); availability of infrastructure in the organization for successful implementation of Industry 4.0 technologies; investment in ICT capital by the organization, including equipment, intellectual property objects; use of CRM systems, HRM systems, automated production accounting systems; warehouse and transportation management systems WMS, TMS; use by industrial

organizations the cloud services, broadband internet access technology, AI, Big Data, digital twins, RFID, IoT; presence of automated lines and industrial robots in the company; participation in electronic procurement; presence of electronic platforms (marketplaces), company website, social networks, telegram bot for effective B2B and B2C communication.

Conclusion. As a result of the study, the following conclusions can be drawn:

– the main aspects of forming and developing digital economies in Estonia and Denmark have been studied, which include active investment by the state and private companies in digital technology infrastructure, education and development of digital skills of the population, investment in scientific research in the field of digitization, support for startups, etc.;

– the role of the Innovation Fund Denmark, the Danish Centre for Digital Research, and the Centre for Artificial Intelligence and Robotics AIRE in the digitization of industrial enterprises in both countries has been examined;

– practical examples of the application of digital platforms and digital tools by industrial enterprises and clusters in Estonia and Denmark have been provided.

The experience of Estonia and Denmark in digital transformation issues is valuable and practically significant for research and development within the framework of further research on the effective methodology and toolkit for assessing the level of digital readiness of industrial enterprises in Kazakhstan for the implementation and adaptation of digital ecosystems.

This research was funded by the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan (Grant No. AP19680223).

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ЭКОНОМИКАНЫҢ ЦИФРЛЫҚ ТРАНСФОРМАЦИЯСЫ: ЭСТОНИЯ МЕН ДАНИЯ ТӘЖІРИБЕСІ

Аңдатпа

Бұл мақала Эстония мен Данияның цифрлық экономиканы қалыптастыру және дамыту саласындағы озық тәжірибесін зерттеуге арналған, өнеркәсіптік сектордағы бәсекеге қабілеттілікті арттыру мақсатында

елдердің кластерлік саясатына талдау жүргізілді, Эстония мен Даниядағы өнеркәсіптік кәсіпорындар мен кластерлердің цифрлық платформалар мен цифрлық құралдарды қолдану мысалдары қарастырылды. Бұл зерттеу Эстония мен Данияның өнеркәсіптік компанияларының цифрлық трансформациясының практикалық мысалдарын қарастыру кезінде талдау және синтез әдісі, кейс-стади әдісі сияқты жалпы ғылыми зерттеу әдістерін, сондай-ақ ғылыми жарияланымдарды контент-талдау әдісін, Дания мен Эстонияның цифрлық экономикасындағы ғылыми қоғамдастықтың қызығушылық деңгейі мен белсенділігін бағалау үшін деректерді ғылыми-метрикалық талдау әдісін қолданды VOSviewer бағдарламасындағы жақтауларды графикалық құру әдісі. Эстония мен Данияның тәжірибесіне сүйене отырып, зерттеу цифрландыруды ұлттық деңгейде түсіну және сәтті басқару үшін қажетті негізгі тақырыптар мен аспектілерді көрсетеді. Сенімді цифрлық инфрақұрылымға инвестициялар, үкімет, өнеркәсіп, ғылыми қоғамдастық арасындағы жемісті ынтымақтастық, сондай-ақ ғылыми ұйымдардың қызметкерлердің цифрлық құзыреттерін дамытуға қосқан үлесі осы елдердің цифрлық трансформациясына ықпал ететін инновациялық экожүйелерді қалыптастырудың кілті болып табылады.

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ЦИФРОВАЯ ТРАНСФОРМАЦИЯ ЭКОНОМИКИ: ОПЫТ ЭСТОНИИ И ДАНИИ

Аннотация

Данная статья посвящена исследованию передового опыта Эстонии и Дании в области формирования и развития цифровых экономик, проведен анализ кластерной политики стран с целью повышения конкурентоспособности промышленного сектора, рассмотрены примеры применения цифровых платформ и цифровых инструментов промышленными предприятиями и кластерами Эстонии и Дании. В рамках данного исследования использовались такие общенаучные методы исследования, как метод анализа и синтеза, метод кейс-стади при рассмотрении практических примеров цифровой трансформации Эстонских и Датских промышленных компаний, а также метод контент-анализа научных публикаций, метод наукометрического анализа данных для оценки уровня интереса и активности научного сообщества в области цифровой экономики Дании и Эстонии и метод графического построения фреймов в программе VOSviewer. Основываясь на опыте Эстонии и Дании, исследование выделяет ключевые темы и аспекты, необходимые для понимания и успешного управления цифровизацией на национальном уровне. Инвестиции в надежную цифровую инфраструктуру, плодотворное сотрудничество между правительством, промышленностью, научным сообществом, а также вклад научных организаций в развитие цифровых компетенций работников являются ключом к формированию инновационных экосистем, способствующих цифровой трансформации данных стран.