

Adaptive Management of Business Entities in the Context of Digitalization of the Economy

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ABSTRACT

The advanced development of the world's economies requires a detailed study of the adaptive management of business entities in the economy digitalization. It includes ensuring the economic growth of countries and promoting the use of information and communication technologies in the digital economy. Digitalization of the world's economies is secured by implementing relevant legislation and making political decisions to implement state policy and strategy in the digital economy sector for effective adaptive management of business entities. **The aim of the research** is to establish the regularity of the impact of digitalization in the world's economies on the adaptive management of business entities. This can be achieved by conducting a regression analysis to reflect the dependence of the influence of factors on the level of digitalization in 25 economies of the world according to the IMD digital competitiveness ranking. This is aimed at checking the features of the use of various digital technologies at the enterprise level for 2022. **Research methods:** method of synthesis of information; regression analysis; systematization, generalization. **Results.** It is established that as a result of regression analysis, the value of the coefficient of determination indicates that the regression model explains 78 % of the relationship between the future readiness of countries to implement digital technologies and the use of information and communication technologies, but there are still a small number of other factors that are not included in the regression model. It is determined that large companies in the EU are more digitized than small and medium enterprises. It is confirmed that at least 80% of SMEs in the Scandinavian countries (Sweden, Finland and Denmark) have reached at least a basic level of digital intensity according to the DII index, while in Romania and Bulgaria it is below 30 %. The study found that electronic information exchange through Enterprise Resource Planning (ERP) software is more widespread in large enterprises (81 %) than in SMEs (37 %); social media is used twice as much by large enterprises (61 %) than by SMEs (28 %); SMEs use e-commerce opportunities only to a limited extent: only 18 % sell online (vs. 38 % of large enterprises) and only 9 % sell abroad online (vs. 24 % of large enterprises). It is established that the system of support for adaptive management of business entities in the context of digitalization of the economy includes adequate organizational and economic adaptation measures.

HIGHLIGHTS

- ① The advanced development of the world's economies requires a detailed study of the adaptive management of business entities in the economy digitalization.
- ② Digitalization of the world's economies is secured by implementing relevant legislation and making political decisions to implement state policy and strategy in the digital economy sector for effective adaptive management of business entities.

Keywords: Adaptation, adaptability, business entities, digitalization, digital enterprise management, adaptive management

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At the beginning of the XXI century humanity was swept by a wave of serious global changes. This stage is characterized by intensive development of digital technologies, revolution in the information space and acceleration of globalization and digitalization of the economy. Information has acquired the status of a key resource in government and business processes (Meshcheryakova, 2018; Meshcheryakova, 2017; Dubova, 2019). The spread of digital technologies in life is one of the characteristic features of modern society, therefore, the transition to digitalization is one of the key priorities in the development of the world economy. As the countries of the world intend to carry out a comprehensive digital transformation of the economy, it is necessary to modernize the digital infrastructure, introduce digital practices in all spheres of economy and governance, develop legislation in this area, as well as organize training in the transformation period (Grabovyy, 2019).

Modern society perceives the world through the prism of the spread of digitalization phenomena, namely the Internet, digital communications, software, ICT, etc. (Gnatyshina, Salamatov, 2017). Changes in the socio-economic spheres around the world are enhanced by the growing role of ICT, development and implementation of innovations that have caused structural changes in the economies of all countries (Vrchota, *et al.* 2020). The product of these changes is a new type of economy – the “digital economy”, which is based on digitalization (Czarniewski, 2014; Zaborovskaia, *et al.* 2020).

Today, under the influence of digitalization, the success of a company is measured not by the size of its capital, long-term existence, but by the level of its flexibility to respond to these changes and adapt the business to the new environment. As noted by Babenko, V., Romanenkov, Yu., Yakymova, L., Nakisko, A., a modern enterprise is defined as a complex integral organizational and production system, the components of which are constantly changing, interacting with each other (Babenko, *et al.* 2017). Achieving these goals in the context of increased competition between enterprises leads to an increase in the volume and complexity of production processes, analysis, planning, management, internal and external relations with suppliers, intermediaries, etc (Bilovodska, *et al.* 2016; Bilovodska, *et al.* 2019; Chmutova, *et al.* 2017). There is a transformation of existing business

models in the areas of production, communications, settlements, interaction with partners, promotion of goods and improvement of the company’s image (Shkarlet, Dubyna, 2020).

Digital technologies are becoming a solid basis for all new technological solutions. The process of adapting to the conditions of digitalization becomes flexible and sustainable, preserving the integrity, culture of life philosophy within the value orientations of the state functioning. However, this is difficult to do, as adaptation to digitalization takes place in conditions that are atypical for enterprises, industries and public institutions, which differ significantly from previous reforms, including industrial revolutions, etc. (Ukolov *et al.* 2019).

The importance of the practical use of the research results lies in the further analysis of the impact of factors on the adaptive management of business entities in the digitalization of the economy, to facilitate the implementation of digital policy and the economy of states.

The aim of the research is to establish the regularity of the impact of digitalization of the world’s economies on the adaptive management of business entities by conducting a regression analysis to reflect the dependence of the influence of factors on the level of digitalization in 25 economies of the world according to the IMD digital competitiveness ranking. This is aimed at checking the features of the use of various digital technologies at the enterprise level for 2022.

Research objectives of the article

1. Analysis of the progress of the EU member states for the period 2017–2022 according to the DESI index.
2. Analyzing the ranking of countries by DiGiX, IMD Digital Competitiveness Ranking and DESI.
3. Analyzing the share of SMEs with a DII baseline for 2021.
4. Determining the percentage of enterprises that have implemented digital technologies for the period 2020–2021.
5. Analyzing the features of the use of various digital technologies at the enterprise level for 2022.

6. Conducting a regression analysis to reflect the dependence of the influence of factors on the level of digitalization in 25 economies of the world according to the IMD digital competitiveness rating between the results of the future readiness of countries to implement digital technologies and the use of ICTs.
7. Determining the role and place of adaptive management technologies in the system of strategic management of business entities in the context of digitalization of the economy.

Literature Review

Modern economy is characterized by the growing role of knowledge and human capital in the organization of modern production and services. Science and technology have expanded the limited capabilities of economic resources, offered consumers radically new types of goods and services and ensured the growth of national corporations that are actively implementing innovations at the global level (Singareddy *et al.* 2019; Akhmadeev *et al.* 2018). There are a number of factors that contribute to these tendencies. First of all, it is the digitalization of economic relations, which makes it possible to bring closer the interconnection of science, education, production and the market. This also includes globalization, which erases the boundaries of national economies (Vasilev *et al.* 2020).

Digitalization is a modern concept that involves business entities in the business world. The transformation process due to the conditions of digitalization is defined as a procedure used to reorient the state economy to the systemic level (Brennen, Kreiss, 2016; Unruh, Kiron, 2017). Companies that fail to align their business digitalization strategy with the competitive environment will face serious problems (Kumarasinghe, Athambawa, 2020). According to the Gartner IT Glossary, "Digitalization is the use of digital technologies to change the business model to drive new revenues and valuable creative opportunities" (Brennen, Kreiss, 2014).

Digitalization is formed on the basis of three components: the information and communication technology (ICT) sector; the e-commerce market, measured as online sales of goods; offline consumer spending on digital equipment (Digital McKinsey,

2018). Rapid progress towards digitalisation, driven by the exponential growth of technologies such as advanced robotics, artificial intelligence, the Internet, 3D printing and nanotechnology, has made digital connectivity an increasingly prominent feature of the global digital economy. This process is also facilitated by the accelerated market penetration of key technologies - such as cloud computing, the Internet and mobile devices - that form the backbone of digitalization. At the same time, there is a huge increase in both the volume and speed of digital data flows. Due to digitalization, the transformation of traditional production methods is already underway, where the advances in digital technologies are changing production capabilities and specialization patterns within and across countries. Digitalization enables the specialization of production processes in both manufacturing and services, facilitating the fragmentation of tasks and supporting the efficient process of global value chains (Asian Development Bank, 2019; The Commonwealth, 2020).

Digitalization facilitates market integration by significantly reducing communication costs and increasing compliance efficiency. This, in turn, increases the competitive advantage of those who use innovative technologies. They support the reduction of barriers to entry by offering online services, such as globally accessible cloud computing and online marketing platforms for SMEs and start-ups, by significantly reducing the fixed costs of doing business in both domestic and foreign markets (Sepashvili, 2020).

In recent years, the digital economy has experienced unprecedented growth as it is an important component of the fourth industrial revolution (UNCTAD, 2019). In the scientific works of foreign scientists, in particular Trașcă, D. L., *et al.* considerable attention is paid to the study of the impact of digitalization on the economic performance of the enterprise (business activity of the enterprise, exports) (Trașcă, 2019). Rauter, R. *et al.* studied the impact of digitalization on innovative business models, changing company values and analyzed the challenges associated with business digitalization (Rauter *et al.* 2018). Reichstein, C. *et al.* conducted a study of the impact of digitalization on the effectiveness of innovation, data privacy, mobility and new business models

(Reichstein, *et al.* 2018). These scientists have made a significant contribution to the development of the theoretical foundations of digitalization; however, there is still a need to systematize the peculiarities of economic activity and business under the influence of digitalization. (Shkarlet, Dubyna, 2020).

Particular attention is paid to the problem under consideration in foreign and domestic literature. At the same time, many authors study adaptation to the conditions of digitalization mainly in terms of adaptation to the introduction and use of digital technologies. Attention is also paid to other issues indirectly related to adaptation through digitalization, virtual space and virtual reality. Adaptation to digitalization is related to virtual space and affects the psychology of staff communication. As noted by Bauer, V.P., Podvoisky, G.L., Kotova, N.E., studying the problem of adaptation strategies of US companies, digitalization has become a significant driving force and one of the drivers of modern business, however rapid systemic changes have become even more dramatic (Ukolov *et al.* 2019).

Consequently, if effectively applied, digitalization can accelerate economic growth, increase productivity and create jobs in countries, as well as facilitate access to markets and business services for micro, small and medium enterprises (UNCTAD, 2017). The main indicators characterizing digitalization include: DiGiX, IMD Digital Competitiveness Ranking and DESI. Each index has different methodological approaches and contains different factors that help to investigate the impact on the level of digitalization in the world's economies (DiGiX, 2022; DESI, 2022; IMD, 2022).

An in-depth analysis of the issues outlined in the scientific article allows to make a conclusion that the topic of adaptive management of business entities in the context of digitalization of the economy is insufficiently studied nowadays by foreign and Ukrainian scientists. Therefore, the issue of adaptive management of business entities in the context of digitalization of the economy remains relevant and open for further research, taking into account the reports of the European Commission, UNCTAD, DiGiX Index, IMD Digital Competitiveness Ranking and DESI Index.

MATERIALS AND METHODS

The implementation of the purpose of this study involves the use of such research methods as:

- ♦ analysis of the ranking of countries by DiGiX indexes, IMD Digital Competitiveness Ranking and DESI in 2022;
- ♦ systematic and logical analysis, a method of synthesizing information on the progress of EU member states for the period 2017–2022 according to the DESI index, the share of SMEs with a baseline DII indicator for 2021, the percentage of enterprises that have implemented digital technologies for the period 2020–2021;
- ♦ systematization, synthesis of the latest scientific publications and statistics published by governments and accountable organizations on the peculiarities of the use of various digital technologies at the enterprise level for 2022;

The method of generalization was applied to determine the role and place of adaptive management technologies in the system of strategic management of economic entities in the context of digitalization of the economy.

Regression analysis was used to reflect the dependence of the influence of factors on the level of digitalization in 25 economies of the world according to the IMD digital competitiveness rating between the results of the future readiness of countries to introduce digital technologies and the use of information and communication technologies.

RESULTS

Table 1 shows the results of regression modeling, which allow to reflect the dependence of the influence of factors on the level of digitalization in 25 economies of the world according to the IMD digital competitiveness rating between the results of the future readiness of countries to implement digital technologies and the use of information and communication technologies:

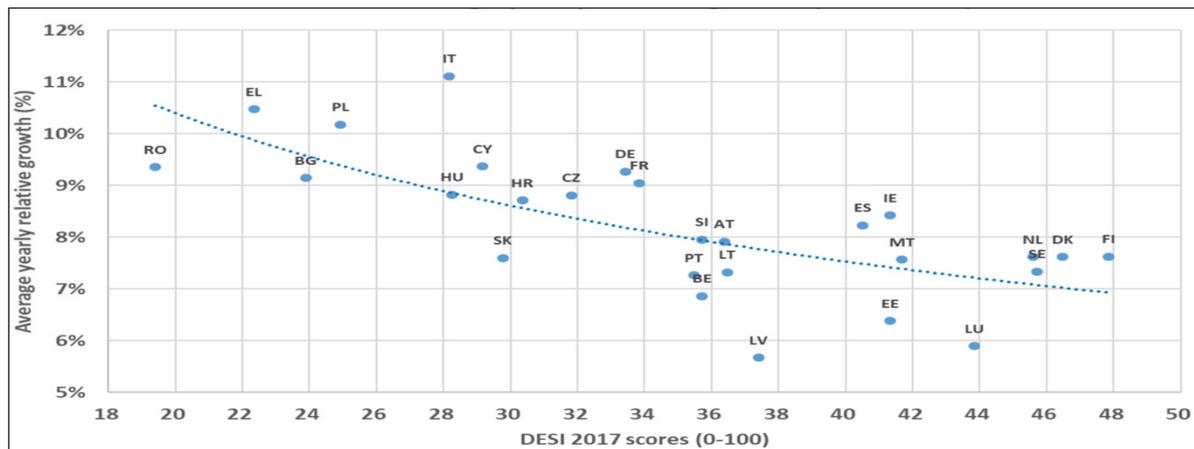
$$\text{Level of digitalization} = 0,95 + 0,89 * \text{Future readiness} + 2,34 * \text{Technology}$$

Thus, the influence of factors on the level of digitalization in 25 economies of the world according to the IMD digital competitiveness ranking depends on the future readiness of countries to introduce

Table 1: The results of regression modeling

Regression Statistics								
Multiple R	0,89							
R Square	0,79							
Adjusted R Square	0,78							
Standard Error	3,73							
Observations	25							
ANOVA								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	1	1180,86	1180,86	84,83	0,0000000035			
Residual	23	320,18	13,92					
Total	24	1501,04						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95,0%</i>	<i>Upper 95,0%</i>
Intercept	0,95	0,10	9,21	0,0000000035	0,74	1,17	0,74	1,17
Future readiness	0,89	1,54	0,58	0,57	-2,29	4,07	-2,29	4,07
Technology	2,34	2,80	0,83	0,41	-3,46	8,14	-3,46	8,14

Source: Compiled by the authors based on official data of IMD (2022).



Source: Compiled by the authors based on official data of DESI (2021), European Commission (2022).

Fig. 1: Digital Economy and Society Index – Member States' progress in the period 2017–2022

digital technologies and the use of ICTs. The model parameters are statistically significant, as indicated by *t Stat* of 0.58 and 0.83 and *P-value* of 0.57 and 0.41.

The value of the coefficient of determination indicates that the model explains 78 % of the relationship between the future preparedness of countries to implement digital technologies and the use of ICT. This indicates that there are still a small number of other factors influencing the level of digitalization in 25 economies of the world that are not included in the regression model (IMD, 2022). According to the ranking of countries according to the DiGiX Index, which fully use information and communication technologies to increase the competitiveness of the level of digitalization of economies, the top

10 countries are Denmark, the USA, Singapore, the Netherlands, Finland, Switzerland, Hong Kong, the UAE, Sweden, and the United Kingdom of Great Britain. The IMD Digital Competitiveness Ranking 2020 shows that the top 10 economies in the world have changed after 2 years of unchanged ranking. The United States continued to lead the IMD Digital Competitiveness Ranking for the fourth year in a row, but in 2022 lost first place to Denmark. The TOP-10 includes Denmark, the USA, Sweden, Singapore, Switzerland, the Netherlands, Finland, the Republic of Korea, Hong Kong, and Canada (see Table 2).

Fig. 1 illustrates the progress of Member States in terms of the overall level of digitalisation of their economy and society over the last 5 years.

Table 2: TOP-30 countries according to DiGiX Index and IMD Digital Competitiveness Ranking 2022

DiGiX			IMD Digital Competitiveness Ranking			
Rank	Country	Score	Overall	Technology	Future readiness	Knowledge
1	Denmark	1.00	Denmark	Singapore	Denmark	Switzerland
2	United States	0.98	USA	Hong Kong SAR	Korea Rep.	Sweden
3	Singapore	0.93	Sweden	UAE	USA	Canada
4	Netherlands	0.93	Singapore	Netherlands	Sweden	USA
5	Finland	0.90	Switzerland	Sweden	Netherlands	Singapore
6	Switzerland	0.89	Netherlands	Taiwan, China	Finland	Denmark
7	Hong Kong	0.88	Finland	Denmark	Switzerland	Hong Kong SAR
8	United Arab Emirates	0.84	Korea Rep.	Finland	Taiwan, China	Netherlands
9	Sweden	0.84	Hong Kong SAR	USA	Norway	Finland
10	United Kingdom	0.83	Canada	Norway	Singapore	Israel
11	Estonia	0.83	Taiwan, China	Iceland	Canada	Germany
12	Germany	0.82	Norway	Switzerland	Estonia	United Kingdom
13	Iceland	0.81	UAE	Korea Rep.	Austria	Austria
14	Japan	0.81	Australia	Canada	Israel	Australia
15	New Zealand	0.80	Israel	Australia	China	UAE
16	Ireland	0.80	United Kingdom	France	United Kingdom	Korea Rep.
17	Luxembourg	0.79	China	Qatar	Australia	China
18	Norway	0.78	Austria	China	Hong Kong SAR	Taiwan, China
19	Israel	0.78	Germany	Luxembourg	Germany	Norway
20	Australia	0.78	Estonia	Thailand	UAE	France
21	Canada	0.78	Iceland	Estonia	Iceland	Belgium
22	Austria	0.75	France	Israel	Ireland	Ireland
23	Korea, Rep.	0.75	Belgium	Bahrain	Qatar	Estonia
24	France	0.74	Ireland	Belgium	Lithuania	Lithuania
25	Malaysia	0.74	Lithuania	United Kingdom	Belgium	Malaysia
26	China	0.69	Qatar	Saudi Arabia	New Zealand	Slovenia
27	Saudi Arabia	0.69	New Zealand	Germany	Spain	Spain
28	Qatar	0.68	Spain	New Zealand	Japan	Japan
29	Belgium	0.68	Japan	Malaysia	Czech Republic	Portugal
30	Cyprus	0.67	Luxembourg	Japan	Kazakhstan	Kazakhstan

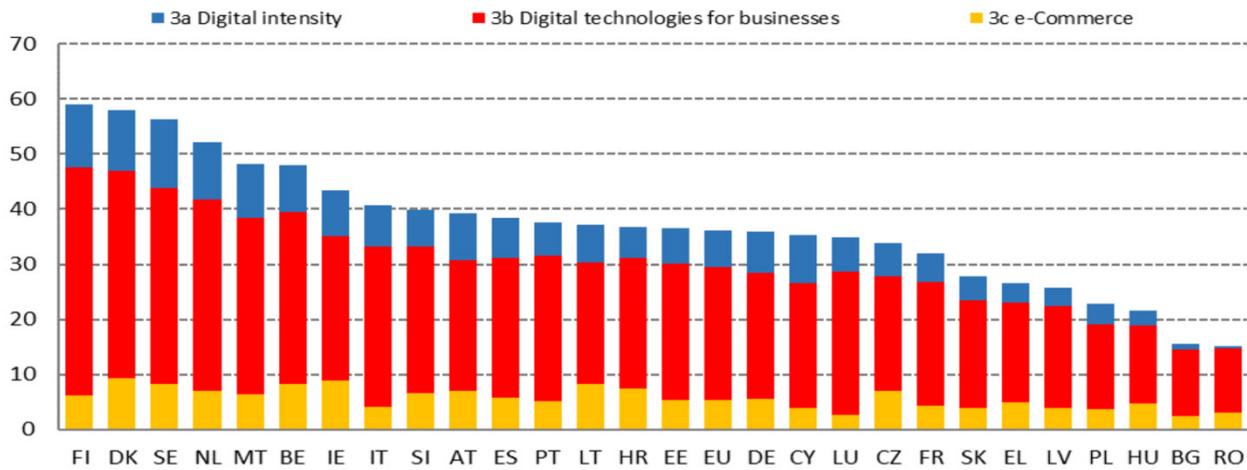
Source: Compiled by the authors based on official data of IMD (2022), DiGiX (2022).

For each country, the figure shows the correlation between its 2017 DESI score (horizontal axis) and the average annual DESI growth over the period 2017–2022 (vertical axis). The DESI scores clearly show a general pattern of convergence in the EU between 2017 and 2022. The blue line in the figure is the estimated convergence model. Countries above the blue line have grown more than expected by the convergence curve and are therefore “overshooting”, and the opposite is true for countries below the blue line.

The Digital Intensity Index (DII) measures the use of various digital technologies at the enterprise level.

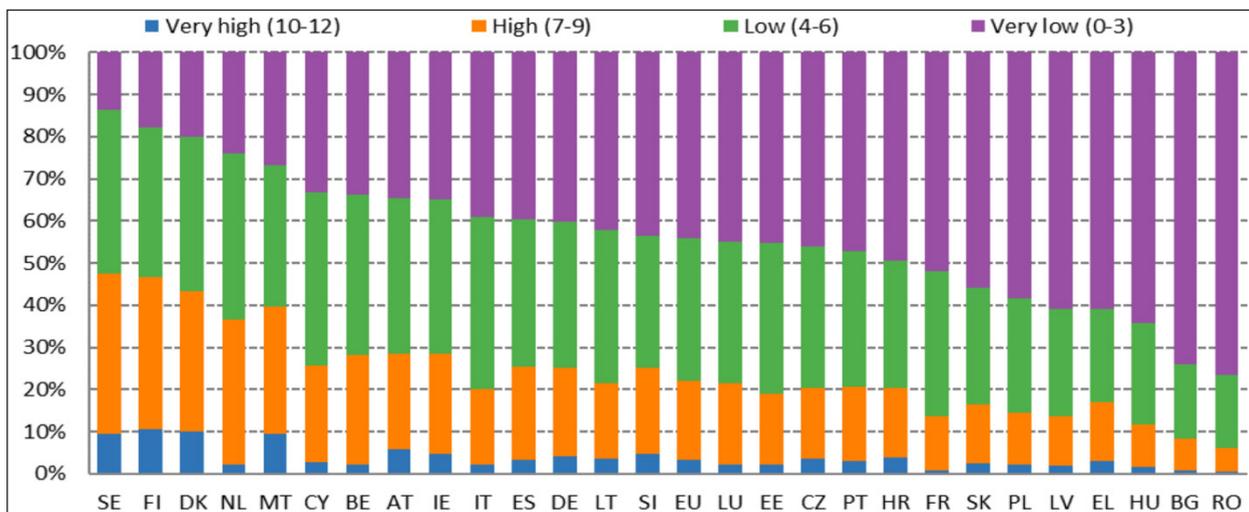
An enterprise’s DII score is based on calculating how many of 12 selected technologies are adopted. Fig. 2 shows the DII in 2022, which shows the degree of integration and speed of adoption of different technologies in EU countries.

Large companies in the EU are more digitized than small and medium-sized enterprises (SMEs). According to the “Path to the Digital Decade”, more than 90 % of SMEs should reach at least a basic level of digital intensity by 2030. The basic level of DII requires the use of at least four technologies and includes SMEs with very high, high and low DII. There are only three countries in the EU



Source: Compiled by the authors based on official data of DESI (2022), European Commission (2022).

Fig. 2: Digital Economy and Society Index (DESI) 2022, Integration of digital technology



Source: Compiled by the authors based on official data of Eurostat (2021).

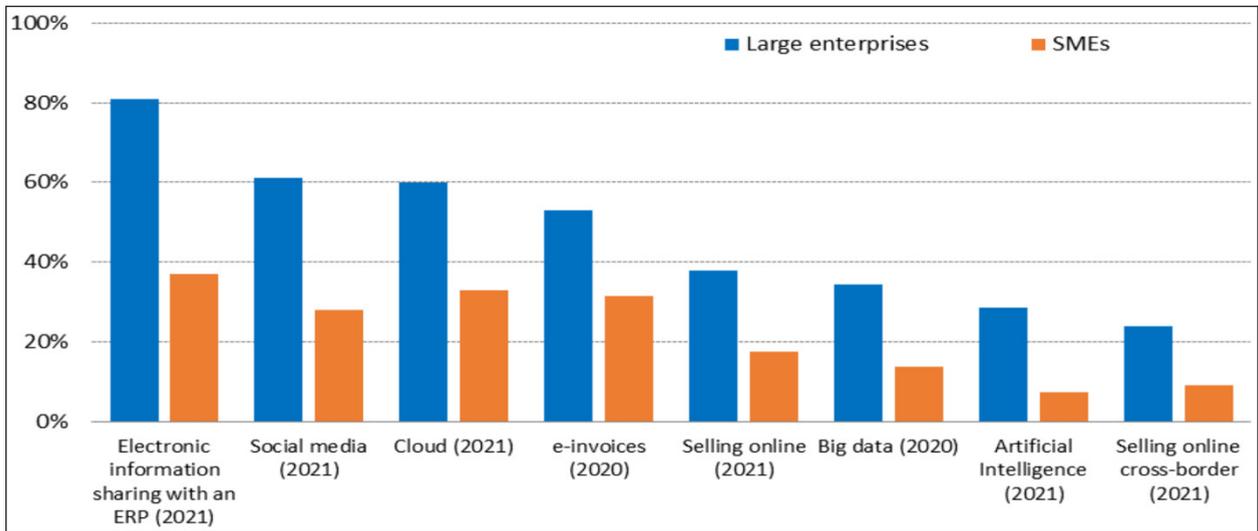
Fig. 3: Digital Intensity Index by level (% of enterprises), 2021

(Finland, Denmark and Sweden) where the share of enterprises with very high DII (i. e. owning at least 10 out of 12 monitored digital technologies) exceeds 9 %. Fig. 3 shows the share of SMEs with a basic DII score, where at least 80 % of enterprises in the Nordic countries (Sweden, Finland and Denmark) have reached at least a basic level of digital intensity, while in Romania and Bulgaria it is below 30 %.

Large enterprises are more likely to implement the latest technologies. For instance, electronic exchange of information through enterprise resource planning (ERP) software is more common in large enterprises (81 %) than in SMEs (37 %) (see Fig. 4). Social media is used twice as much by large enterprises

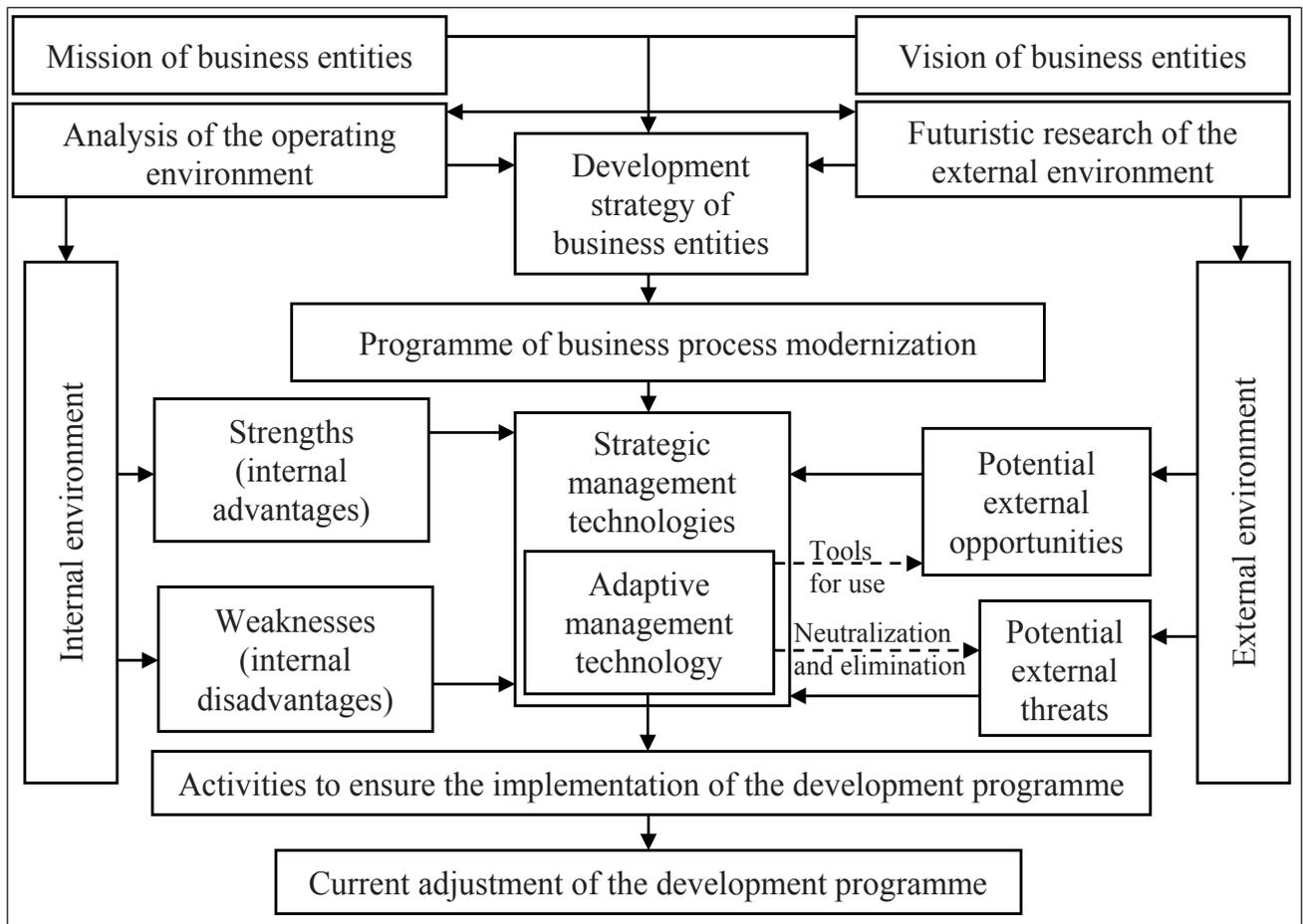
(61 %) than SMEs (28 %). SMEs use e-commerce opportunities only to a limited extent: only 18 % sell online (vs. 38 % of large enterprises) and only 9 % sell abroad online (vs. 24 % of large enterprises) (see Figure 4). There are many other technological opportunities that have yet to be exploited by SMEs, such as cloud services, artificial intelligence, big data, etc.

The system of support for adaptive management of business entities in the context of digitalization of the economy should provide for the development of an action program (see Fig. 5) for the adaptation of business entities to the challenges of the external environment, which includes adequate organizational and economic adaptation measures,



Source: Compiled by the authors based on official data of Eurostat (2021).

Fig. 4: Adoption of digital technologies (% enterprises), 2020, 2021



Source: Compiled by the authors.

Fig. 5: The role and place of adaptive management technologies in the system of strategic management of business entities in the context of digitalization of the economy

including the whole range of measures – from mobilizing all available competitive factors, financial, labor and other resources to retraining personnel, etc.

Thus, further determination of the influence of factors on the level of digitalization of the world's economies will contribute to the formation and implementation of effective policies that will increase the adaptive management of business entities in digitalization of the economy.

DISCUSSION

In this article, having studied the adaptive management of business entities in the digitalization of the economy, it was found that digitalization serves an important purpose, namely the formation of economic and social benefits for societies and communities. First, the current scientific literature on adaptive management of business entities in the context of digitalization of the economy and the impact of factors on the level of digitalization of the world's economies often combines the driving forces of the formation of an effective economy with the factors underlying entrepreneurial activity (Grabovyy, 2019; Gnatyshina, Salamatov, 2017; Zaborovskaia *et al.* 2020; Sepashvili, 2020; Vasilev *et al.* 2020; Kumarasinghe, 2020).

The findings of a significant number of researchers explain that a sufficient level of digitalization is achieved through the use of information technology resources, which helps sectors of the economy to digitize their processes. In addition, the relevant sectors of the economy affect the ability of enterprises to digitally transform, and positive beliefs and practices using information technology resources increase the ability to digitally transform (Shkarlet, Dubyna, 2020).

High adaptability of enterprises of the real sector of the economy, based on the interests of business, society and government, can be achieved only if the state creates the conditions for this. The main conditions are: the formation of a national strategy for adaptation to digitalization; the adoption of basic regulatory documents governing the processes of adaptation to digitalization; the creation of various training programs for the active working population and society as a whole to constantly changing living conditions. In the context of regulation, the state should also determine the

permissibility of using certain forms and methods of adaptive management of economic entities of the real sector of the economy to the conditions of digitalization (Ukolov *et al.* 2019). National governments should develop strategies and policies that will facilitate the digital transformation of their economic sectors and the adaptation of business entities given its promising role in driving business and economic growth. To increase international competitiveness, governments should invest in digital technologies and their components, as they have been proven to have a significant impact on business performance and economic growth (Shkarlet, Dubyna, 2020). Digitalization has the potential to increase productivity, create new jobs and improve the quality of life of society as a whole (Ukolov *et al.* 2019).

Due to globalization processes, economic sectors will have to function in a more complex information and technological environment. This is due to the fact that the world's economies will be integrated to a new level of digitalization, which is significantly different from the current state of information technology support. Consequently, the sectors of the economy will face new challenges, as the transition to a new level of digitalization of the world's economies will lead to increased attention to improving legislation in the information technology environment. Thus, the studies conducted by scientists do not provide relevant information on the adaptive management of business entities in the digitalization of the economy. Therefore, it is considered expedient to focus further research in this direction to analyze the adaptive management of business entities in the conditions of the digitalization of the economy.

CONCLUSION

As a result of the analysis of the adaptive management of business entities in the context of digitalization of the economy, it was found that due to the conditions of intensification of information and technological processes, improving the functioning of the sectors of the economy of countries is becoming increasingly important. Adaptation of business entities to the requirements of the external environment is not a one-time event, but a continuous and long-term process, which should ultimately ensure the competitiveness of the

entity in the regional and national markets and its high image among the population and entrepreneurs who are consumers of its services. The scientific and methodological foundations of the organization of adaptive management of business entities in the context of digitalization of the economy, formulated in the article, take into account the specifics of the business sphere, the need for its forecasting for the medium and long term, and provide for the planning of adaptive transformations of business entities on a long-term basis. In other words, in the context of the digitalization of the economy and dynamic changes in the external environment and the need to take into account the prospective nature of training specialists, a systematic, continuous adaptation process should be carried out. It should be based on forecasts of the development of the external environment, which has a proactive nature.

The results of the implementation of an adaptive strategy for managing business entities in the context of digitalization of the economy can be determined by the criterion of improving the quality of business services, the individual result of the employee as a ratio of the actual level of competencies acquired in the digitalization sector. Therefore, in order to ensure an effective level of digitalization of economies, it is necessary to address issues such as proper Internet infrastructure, regulatory framework in the digital economy, business readiness to implement information and communication technologies. Thus, the implementation of legislation in the digital economy sector is becoming a topic of great interest for both business entities and the public sector as a whole.

The practical significance of the study lies in the fact that the theoretical provisions, conclusions and recommendations developed by the author and proposed in the article can be used for: implementation of adaptive management of economic entities in the digitalization of the economy. Further research can be aimed at improving legislation to facilitate the implementation of policies in the digital economy sector, which will ensure adaptive management of business entities and improve the economic activity of business entities and the current economy level. Empowerment and widespread use of innovative, information and technological, economic, political, research and development approaches to regulating

policy in the digital economy sector at the interstate level can become the basis for strategies for future periods.

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