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Цифрова економіка як середовище прояву конкурентних переваг України

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Анотація. У статті розглянуто важливість активного впровадження та розвитку цифрової економіки для України. Проведено аналіз понятійного та категоріального апарату, який є наявний у наукових публікаціях щодо проблем якісного цифрового розвитку економіки країни; було виявлено поліваріантність наукового трактування дефініції «цифрова економіка» та визначено основну спільну ознаку у визначенні такого типу економіки, яка відображається у широкому застосуванні як інформаційних, так і комунікаційних технологій. У процесі аналізу були застосовані загально-наукові та спеціальні методи, а саме: аналітичний метод використовувався під час огляду нормативних та правових джерел; метод класифікації надав можливість диференціювати головні компоненти цифрової економіки, а за допомогою методу опису було надано їм детальну описову характеристику; монографічний метод застосовувався під час вивчення літературних джерел з питань розвитку сучасної цифрової економіки на національному ринку; системний та аналітичний метод використовувався щодо обробки наявної та вибір релевантної інформації. Перевагу надано Індексу цифрової економіки та суспільства (DESI), який визначає рівень цифровізації економіки країни, розглянуто поняття Індустрію 4.0 і реальність впровадження його в Україні. Проаналізовано ринок ІТ-послуг в Україні, який демонструє позитивну динаміку в рості виручки, особливо від експорту. Представлено основні стратегічні пріоритети для України, згідно зі стадіями розвитку цифрової економіки, а саме: зародження нової цифрової економіки, перехід до цифрової економіки, повне перетворення сучасної економіки в цифрову. Вивчено тенденції, які фіксуються на ринку ІТ в останні роки. Доведено швидкий динамічний розвиток галузі ІТ, досліджено головні економічні показники розвитку. Оцінено стан і рівень галузі ІТ в України щодо інших краї, гравців ІТ-ринку. Для досягнення високих показників у сфері цифрової економіки необхідне комплексне вирішення таких проблем як: модернізація системи освіти, розбудова нової ІТ-екосистеми та посилення роботи над створенням нових українських технологічних парків

Ключові слова: Індустрія 4.0, Індекс цифрової економіки та суспільства, людський капітал, ринок ІТ-послуг

Digital Economy: An Environment for Ukraine's Competitive Advantages

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Abstract. This study considers the importance of active implementation and development of the digital economy for Ukraine. The authors of this paper analysed the terminology available in other papers regarding the problems of high-quality digitalisation of the Ukrainian economy; identified the multivariance of the scientific interpretation of the term "digital economy" and determined the main common feature in the definitions of this type of economy, which manifests itself in the wide use of information and communication technology. The analysis involved general scientific and special methods, namely: the analytical method was used in the review of regulatory and legal sources; the classification method provided an opportunity to differentiate the main components of the digital economy, and the description method facilitated their detailed descriptive characteristic; the monographic method was employed to study the literature sources on the development of the modern digital economy in the national market; the system and analytical method was used to process available and select relevant information. Preference is given to the Digital Economy and Society Index (DESI), which determines the level of digitalisation of the country's economy. The authors of this paper also considered the concept of Industry 4.0 and the reality of its implementation in Ukraine. The study analyses the IT services market in Ukraine, which demonstrates positive dynamics in revenue growth, especially from exports. The paper also presents the main strategic priorities for Ukraine, according to the stages of the digital economy development, namely: the birth of a new digital economy, the digital economy transition, the complete digitalisation of the modern economy. The authors investigated the trends that have been noted in the IT market in recent years. The rapid, dynamic development of the IT industry is proved, and the main economic indicators of development are studied. The study assessed the state and level of the IT industry in Ukraine relative to other regions that are IT-market players. To achieve high performance in the digital economy, it is necessary to comprehensively solve such problems as modernisation of the education system, development of a new IT ecosystem and intensification of work on the creation of new Ukrainian technology parks

Keywords: Industry 4.0, Digital Economy and Society Index, Human Capital, IT services market

Introduction

In the entire history of its existence, humanity has experienced more than one technological revolution. Usually, on a global scale, any revolution is based primarily on scientific discoveries, innovations, and technological advance. It is believed that the following revolutions had the greatest impact on the development of humankind: agrarian, industrial, and post-industrial. Transformation and further development transpired through the intellectual transformation of human capital. For example, water and steam mechanisms were used in production during the industrial revolution, and electricity was used during the post-industrial revolution.

Since the 1970s, electronic technologies, production automation, electronics, and innovations have come to the fore on a global scale. An entirely new term "digital economy" emerges. Today, when humanity has managed to accumulate knowledge regarding digital technologies recently, is approaching a new leap: the industry is ready

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to move to mechanised and automated systems to improve and increase productivity, states can and have the ability to provide services online and services may introduce the use of robots. New digital technologies currently ensure the world's the development and transformation of relations arising between the main participants in economic activity, especially in such industries as banking, education, healthcare, media, economic security, trade, transport, construction, energy, etc.

In modern conditions of globalisation, the priority vector is the development of a high-quality information society of the country, namely through the digital economy development. The digital economy is one of the technologies already used by numerous countries around the world to improve the effectiveness of their national economies and the rational development of new modern information technologies to increase profitability. It serves as the basis for the development of society and a platform for innovative information technologies. The digital economy is a prerequisite for the development of the digital market in Ukraine and integration into the Single European Market. Thus, the key issue lies in the current level of the economy digitalisation in Ukraine and the search for ways to improve it.

Features of the digital economy in modern conditions of globalisation are at the centre of studies of such Ukrainian and foreign researchers: V.V. Alpakova [1], A.P. Dobrynin, S.M. Veretuk [2], S.V. Koliadenko, D. Lyon, V.I. Liashenko, K.A. Semiachkov, but quite numerous questions about the digital economy, its concept and development vectors remain understudied. The importance of developing the digital economy in Ukraine also lacks coverage.

The purpose of this study is to investigate the current state of the digital economy in Ukraine, opportunities and ways for development.

Methodology

The methodological framework of this study comprises the general economic principles of a comprehensive analysis of the priority of digital economy development in Ukraine. The identification of the main problems and obstacles of research, as well as the available solutions, were developed based on a systematic approach to the study of scientific papers of both Ukrainian and foreign researchers, the study of aspects of the digital economy development, as well as regulations and author's original developments. Thus, the methodology of this study is based on the analysis and research of Ukrainian and foreign literature on the subject under study.

The study of the issues of the digital economy involved a dialectical approach to the analysis of the current position and processes of the digital economy development in Ukraine and the world. In addition, the analysis and research involved the following general scientific and special methods: the analytical method was employed to review the regulatory and legal sources; the classification method allowed differentiating between the main components of the digital economy, and the description method facilitated their detailed descriptive characterisation; the monographic method was used during the study of literature sources and resources on the state and development of the digital economy; system-analytical method was employed for information processing. The comparison method was used to process data obtained by the authors of this study in the analysis of the Digital Economy and Society Index.

Results and Discussion

In the classical sense, the digital economy constitutes an activity where digital data (numerical, text) and information become the main means of production. The term “digital economy” was coined in 1995 by Don Tapscott. The digital economy is often referred to as the new economy, the web economy, since it is an economy based on the use of information and telecommunications technology. Such an economy is understood as the production, sale, and supply of products by involving computer networks [3].

V.V. Apalkova argues that the digital economy is the crucial engine of innovative development and competitiveness of the national economy [1, p. 12]. According to S.M. Veretuk, the digital economy constitutes the main component of the economy, where knowledge of subjects and intangible production are a priority. The digital economy is an entirely new economic structure that allows selling competitive and high-quality products with high added value, as well as contributes to the employment creation, the search for effective solutions to social, cultural, and, environmental issues. Highly developed countries of the world pay the greatest attention to the sustainable and integrated development of all elements of the digital economy, the information society and the knowledge economy [2, p. 54].

The widespread use of network digital technologies lately has led to the identification of the main four stages in the development of the digital economy (Table 1).

Table 1. Evolution of the digital economy

Period	Development stage	Main features
1990-2000	Stage I	A special infrastructure is being established to provide access to information via the Internet; Websites are used only to read information, not for promotion
2000-2010	Stage II	Users become active participants in the development and promotion of information and data
2010-2020	Stage III	The era of social networks, apps for instant information sharing
2020-Present	Stage IV	Building a neural network, where communication can be carried out between things, animals, and people using the principles of neurocommunication; Widespread use of artificial intelligence

Source: compiled by the authors

The stages of the digital revolution development occur simultaneously with the industrial revolution because the digital revolution is a tool for the transition from the third to the fourth industrial revolution (Industry 4.0), it had a substantial impact on the creation of GDP in all countries [4, p. 21].

The Digital Economy and Society Index (DESI) is used to determine the digitalisation level of the national economy. DESI includes such indicators as communications, digital public services, human capital, digital technology integration, and Internet usage. This document records and tracks the progress of EU Member States in the digital economy and its competitiveness.

According to DESI, in 2019, all EU Member States improved their positions in the digital economy. Finland, Sweden, the Netherlands, and Denmark scored the highest points in the DESI 2019 rating (almost 70 points) and are among the world leaders in digitalisation. These countries are followed by the United Kingdom, Luxembourg, Ireland, Estonia, and Belgium (Fig. 1).

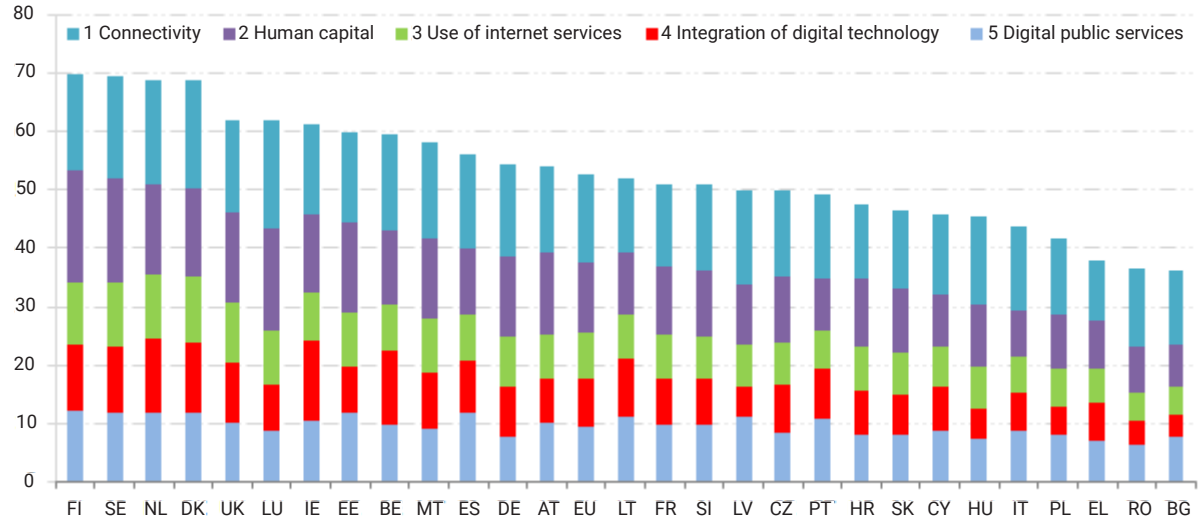

Figure 1. Digital Economy and Society Index (DESI)
Source: developed by the authors based on [5]

First, it is necessary to analyse the communication indicator in the context of the DESI indicators. The best results were recorded in the Netherlands, Luxembourg, and Denmark. The worst – in Greece, Croatia, and Italy. This can be confirmed by the following facts [5]:

1. 98% of the EU population is provided with fixed broadband internet access (at least 30 Mbps);

2. 91% of the EU population is covered by a 4G mobile network.

As for human capital, countries such as Finland, the Netherlands, and Sweden demonstrate the best

results, while Romania, Bulgaria, Greece, and Italy display the worst results. Unfortunately, 43% of Europeans do not even have basic skills in the field of digital technologies at all. However, a positive trend is also observed because the number of EU citizens who do not use the Internet decreased in the overwhelming majority of EU Member States in 2018 by 13% compared to 2017, statistics are presented in Figure 2. The most noticeable changes occurred in Cyprus – by 5%, where the share of people aged 16-74 has never used the Internet, and in Slovenia and Romania – by 4% [5].

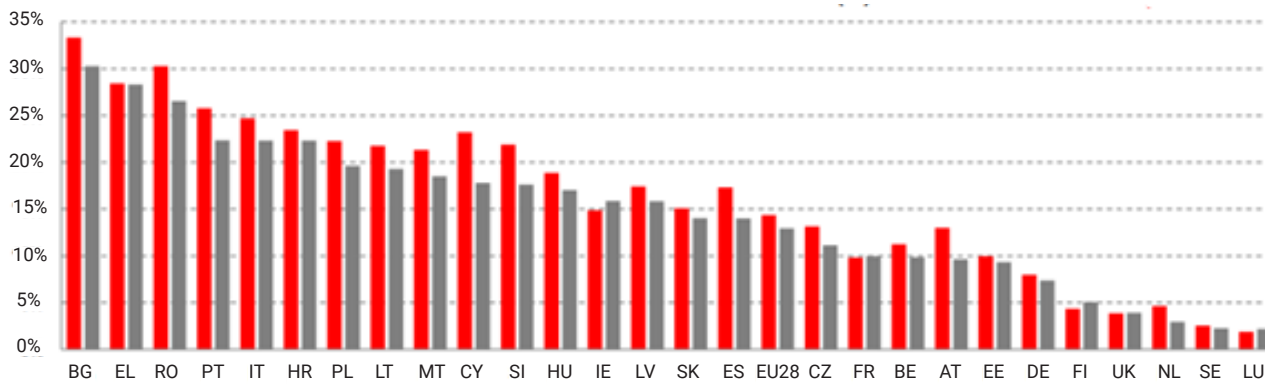

Figure 2. Percentage of the population that does not use the Internet
Source: developed by the authors based on [6]

The number of graduates in science, technology, engineering, and mathematics also increased (19.1 graduates per 1,000 people aged 20-29 in 2015 compared to 18.4 in 2013). In 2016, there were 8.2 million information technology specialists in the EU, which is 7.3 million more than 3 years earlier. Denmark, Sweden, and the Netherlands had the highest number of graduates in science and technology in 2016, while Romania, Italy, and Bulgaria had the lowest number. As for digital integration technologies, they are most frequently used in Denmark, Finland, and Ireland, and least frequently – in Romania, Poland, and Bulgaria. The most popular is the use of software for electronic information circulation (only 26% in 2013, in 2019 – 44%), conducting electronic payments and interacting with customers and partners using digital technologies (from 15% of enterprises in 2013 to 35% in 2019). As for digital public service availability indicators, Finland, Estonia, and Denmark occupy the best position, while Greece, Hungary, and Romania occupy the worst position [5].

Today, when Ukraine is at the 3rd technological stage, the priority task is to create conditions for the development of the digital economy. In Ukraine, the issue of digitalisation of industry and the national economy is being raised at the government level.

At the beginning of 2018, the Government of Ukraine approved the Concept of Qualitative Development of the Digital Economy of the Country, as well as Society for 2018-2020, developed and approved an Action Plan for the introduction and implementation of the Concept. The main purpose is to implement the available initiatives of the Digital Agenda of Ukraine 2020, and therefore the Concept constitutes a digital strategy that should be implemented to quickly eliminate barriers and obstacles arising upon active digital transformation of Ukraine in certain promising areas of development.

The Action Plan identifies the following measures:

1. High-quality regulatory and methodological, as well as organisational support for development;
2. Development and investment in priority areas of the digital economy of Ukraine;
3. Trainings to improve the digital skills of Ukrainian citizens;
4. Modernisation of the country's digital infrastructure.

Importantly, the developed Concept of the Digital Economy in Ukraine outlines the foundation for the digital economy development, forms the main principles of national policy that should be observed during digitalisation processes, encourages initiatives to establish and develop the country's digital infrastructures for high-quality and rapid overcoming of the identified "digital gap", helps elevate the digital skills of citizens, develops incentives for the creation of new innovative, high-tech industries and products, outlines critical areas for the nationwide implementation of digital transformation projects [7].

Industry 4.0 was initiated and put into effect by the federal government of Germany as a priority strategic plan for the development of the national economy with the main purpose of implementing information and communication tools, technologies in the modern

industry of the country through the connection of production components (equipment, personnel, products, etc.) to the world global network of information and data exchange [8].

Industry 4.0 occurs only during the transition from conventional automated production and the use of information and communication technology in production (the third industrial revolution) to combining resources, information flows, objects, and people into a network [9]. The digital economy policy constitutes a coordinated plan of action, state initiatives for prompt and flexible mobilisation of national resources for qualitative acceleration of technological changes, and for taking leadership positions in global competition [10].

The term "Industry 4.0" has existed in Ukraine since 2014, but even today it is not popular [10]. Industry 4.0 is based on information tools and technologies. In Ukraine, information technology (IT) is one of the priority areas of the economy. For the first half of 2018 of the Ukrainian IT-association, the IT industry brought the national economy 1.5 billion US dollars' worth of export revenue, which is 29% more than last year's figures. The number of people employed in the industry increased by 30 thousand people [7].

In general, the IT services market in Ukraine demonstrates positive dynamics – consistently high growth rates: according to official NBU data, in the first half of 2018 alone, the IT industry managed to bring 1.5 billion US dollars of export revenue to the Ukrainian economy. This is 29% more than last year's figures. The number of IT specialists was more than 150 thousand people with an average salary of 1.8-2 thousand US dollars per month (Fig. 3).

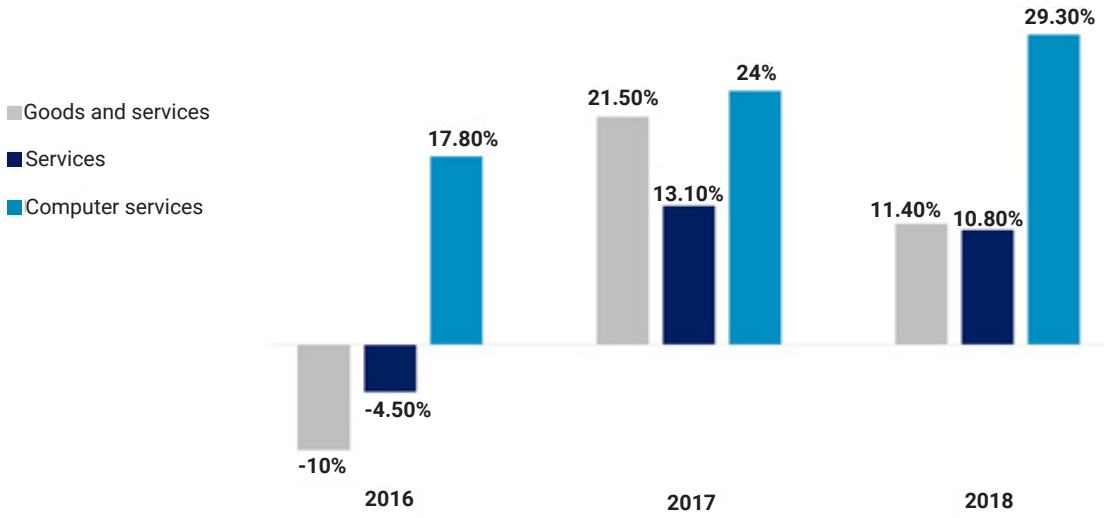

Figure 3. Dynamics of Ukrainian exports according to the NBU for 2016-2018

Source: [7]

According to leading experts of Pricewaterhouse-Coopers (PwC), the main elements of IT services in Ukraine today are as follows [11]:

- IT consulting and digitisation of data;
- IT support and outsourcing – services for maintaining, hosting, upgrading, and configuring IT products developed by third parties.
- Custom Application Development (CAD) – provision of services during the full or certain part of the new software development cycle, which provides additional value to the company through the development of an IT product (the right to intellectual property belongs to customers).
- Business process R&D outsourcing – a variety of services with relatively high added value, presented as a mixture of IT consulting and CAD, but with pre-defined boundaries and pre-determined constant repetitions of the software development cycle [11].

In 2019, there were 1,142 enterprises in the field of information and telecommunications, of which 21 were medium-sized and 1,121 were small [12]. The geographical structure of the IT market in Ukraine demonstrates the priority features of regional policy – Kyiv (44.3%), Kharkiv (15.4%), Lviv (12.0%), Dnipro (7.2%), Odesa (5.3%), Vinnytsia (2.2%), Zaporizhzhia (1.7%). 2.5% of respondents work remotely [13].

Annual growth rates have stopped. In 2019, the number of specialists in the top 25 companies according to dou.ua increased by 13% compared to 2018, and this is 5 points less than the 2018 growth rate compared

to 2017. As for the overall growth rate of the top 50, the annual figures are better – almost +15% in 2019. Comparison of quantitative data indicates that the number of specialists in the top 25 in 2019 increased by 5,750 people (6,983 in 2018). And in general, in the top 50 – by 8,671 in 2019 against 8,710 in 2018 (Fig. 4).

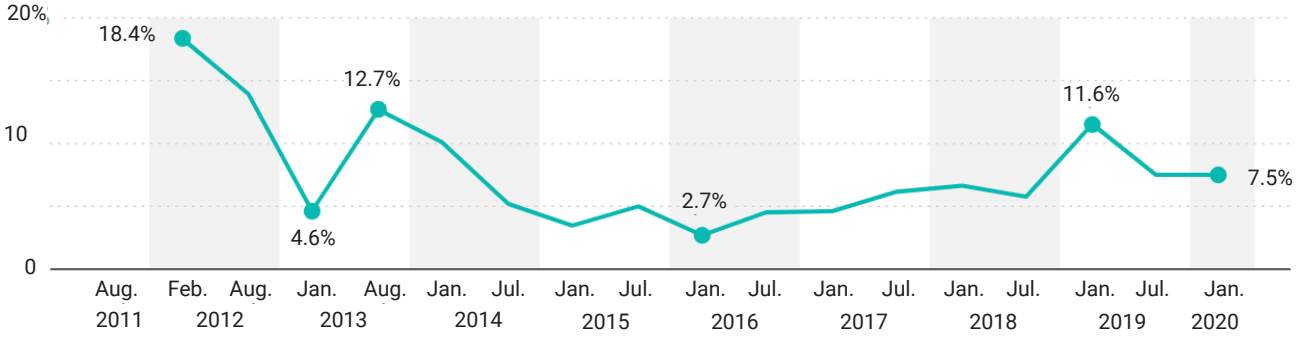

Figure 4. Relative growth rates in the IT industry

Source: [13]

In 2019, the number of specialists in 5 of the most successful IT companies in Ukraine increased by 13% (3,072 specialists).

The leader of the rating is EPAM, which is constantly increasing the number of employees (July 2019 – 7 thousand employees, January 2020 – 8 thousand employees). EPAM explains this activity by the constant increase in the share of complex end-to-end projects and cooperation with already available partners [14]. EPAM continues to develop its field of study, and establishes cooperation with higher educational institutions, opens special laboratories. The second place is occupied by SoftServe, which grew by 363 specialists between July 2019 – January 2020. GlobalLogic (+237 specialists), the company's priority areas are projects in the telecom, media, medicine, automotive industry (Fig. 5).

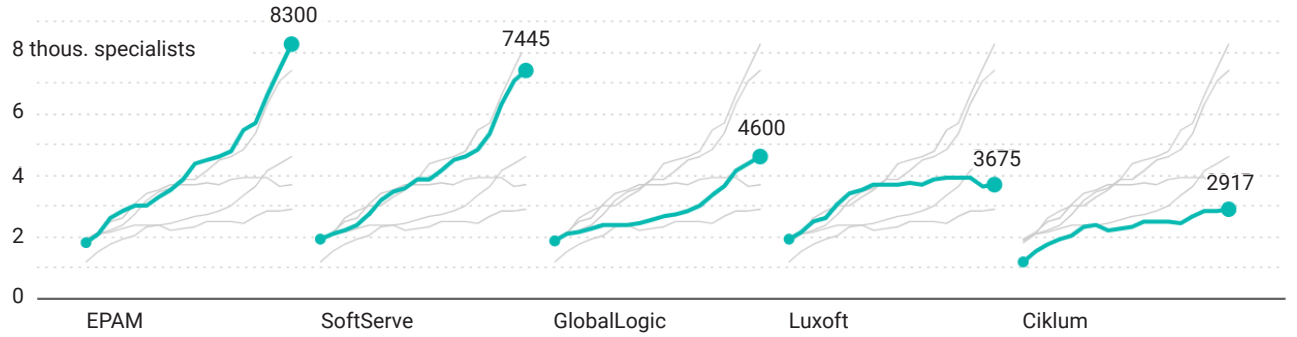

Figure 5. Growth dynamics of the 5 most successful IT companies for August 2011 – January 2020

Source: [14]

Conclusions

The digital economy constitutes the foundation of economic success and innovation. Competitive advantages in further integration into the EU are ensured by an increase in the quality and level of originality of Ukrainian goods and services. Therewith, the need for high-technological research, fundamental developments, the upbringing of a certain "digital" culture, and the implementation of the ideas of "smart cities" in Ukraine is ensured. In Ukraine, there is no general assessment of the economy digitalisation, and therefore a problem occurs regarding the understanding of the overall picture of the digital infrastructure used. The main reason is that Ukrainians do not have a digital field. To achieve high performance, Ukraine, and players in the information and digital technology market need a comprehensive solution to such problems as simplification of employment of foreigners, development of human resources, modernisation of the education system, removal of obsolete regulatory barriers, development of an entirely new IT ecosystem and strengthening work on the creation of new Ukrainian technology parks.

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