

# INFORMATION AND COMMUNICATIONS TECHNOLOGIES

## THE ESSENCE OF THE DIGITALIZATION PROCESS AS A NEW GLOBAL INFORMATIZATION STAGE

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**Abstract.** The article describes the essence of the term "digitalization" and shows the nature of this process. The impact on people's lives and globalization itself have been determined as a result of the conducted study. Particular attention has been drawn to digital transformation, its use in the business context and its impact on such organizations as government, government agencies and other institutions involved in addressing social and global issues such as pollution and aging, using one or more existing and new technologies.

**Keywords:** Digitization, Digital Transformation, Digitalization, Digital Innovation, ICT, Digital Business Transformation.

**JEL:** F60, O31.

### Introduction

Globalization, once characterized mainly by trade in goods and cross-border financing, is now approaching digitization. Huge flows of data and information are transmitted every minute - ideas and innovations are circulating around the world through email, social media, e-commerce, videos etc. As these widespread digital networks connect everything and everyone, companies need to rethink what it means to be global. In our point

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of view, the Internet has become an integral part of our life and has greatly facilitated it.

**The purpose of the article** is to identify the essence of the development of the world electronic environment, its impact on global informatization and its further evolution in the international arena.

### **1. Analysis of recent research and publications**

The issue of the world financial market development has been investigated in the scientific works of the following national scientists: D. Lukianenko, Z. Lutsyshyn, A. Poruchnyk, E. Saveliev, Y. Stoliarchuk, O. Yakubovskiy, and foreign scientists and economists: P. Buckley, I. Krugman, F. Myshkin, M. Posner, A. Rugman, J. Soros, I. Fisher, M. Friedman, S. Brennen, D. Kreiss and others.

Digital payments and financial services are part of the vital infrastructure of today's economy, enabling people, enterprises and governments to operate cheaply and efficiently. The business potential is great for a number of companies, including banks, telecommunication companies, payment providers, financial technology startups, retailers and others.

According to S. Brennen (2014), widely used digital finance has the power to transform the economic prospects of billions of people and introduce new dynamism into small enterprises which are restrained due to the lack of credit today. Rather than expecting revenue generation and traditional banks to expand, transition economies have the opportunity to use mobile technologies in order to deliver digital financial services to everyone, quickly opening up economic opportunities and accelerating social development.

As stated in the study conducted by S. Brennen and D. Kreiss, digital platforms are changing the economic process of doing business across borders, reducing the cost of international interactions and operations. They create global markets and user communities, providing businesses with a huge number of clients and effective ways to achieve great results.

S. Brennen and D. Kreiss report that small enterprises around the world are becoming "micro-multinational companies" using digital platforms such as eBay, Amazon, Facebook and Alibaba to connect with customers and suppliers in other countries. Even the smallest businesses can become global: 86 percent of tech startups we surveyed, report some type of cross-border activity. The ability of small enterprises to enter new markets supports the economic growth globally.

Many companies have become more complex and inefficient as they expanded across borders. However, digital technologies can curb complexity and create more compact models for global development. This is the time for companies to rethink their organizational structures, products, assets and competitors.

Countries cannot afford to abandon global flows, though narrow export strategies lose the real value of globalization: the flow of ideas, talents and contributions that drive innovation and productivity. Digital globalization makes political choices even more complicated. Value chains are changing, new centers are emerging, and economic activity is transforming. This transition creates new discoveries for countries and thereby enhances their role in the global economy. These particular opportunities will influence the infrastructure, institutions and business environment in which their companies and citizens are fully involved.

In many research areas, the term digitization is used to refer to the technical process of converting analog information streams into digital bits 1s and 0s with discrete and discontinuous values. According to T. Feldmann, unlike analog data with "constantly changing values, digital information is characterized only by two different states. Although some people regard digitization as a form of communication, a narrower definition determines the origin of this concept when developing binary numbers. Some scientists trace the foundations of digitization to the end of the 17th century, namely to the work of the philosopher Gottfried Leibniz, who completed his initial research of the system of double digits. Morse code, as a binary system based on only two different states, has proven to be much more resistant to transmission, encoding, and decoding errors than alternative systems. Innovations such as the Morse code (one of the first widely used digitization

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systems) laid the groundwork for the further development of computing and digitization.

Digitization is a process that has both symbolic and material aspects. The symbolic aspect is the conversion of digital signals into bits, which are represented as 1s and 0s. Thus, digitization provides information that can be expressed in many different ways, types of materials and systems. In theory, any material with two readily differentiated states can be used to store and transmit digitized signals, including silicone transistors, punch cards, or atoms. This has prompted many scientists to accentuate the quality of information obtained through digitization as "intangible", while emphasizing the material systems (transistors) on which this information is stored. As they say, it would be a mistake to ignore this digital information, which is ultimately stored and transmitted through the physical direction of material transistors in the form of bits. Although digitized information is not limited to a specific set of materials, it is based on material configurations, as it is a final instance. This is how digitization occurs through material and nonmaterial, which obviously makes it a unique process.

Just as digitized information can be presented on any set of transistors, it is possible to "digitize all forms of data such as alphanumeric text, graphics, still and moving images and sounds." The basic process is that "all signals are divided into small pieces" and coded as 1s and 0s lines. Although, this process can be applied to almost any type of information, this conversion process takes place by means of very specific technical mechanisms and requires specific technical infrastructures that alter the derivative signal itself.

For example, digitization can be done by sampling. As Negroponte describes it, "In order to digitize a signal, you have to take samples from it, which, if close to each other, can be used to reproduce a seemingly perfect replica." However, the definition of "sampling" is to select some aspects of the analog signal and reject others. Although this can be done to produce the perfect replica, the algorithm decides what to store and what to discard during the process of digitization. At the most basic level, algorithms are "coded procedures for converting input data to the desired output based on certain calculations." Hales states that this encoding is a process of "interpretation". Ultimately, programmers wrote these algorithms, just as

engineers designed and built machines that perform digitization processes. Significant scientific work has recognized that digitization provides data with a set of distinctive characteristics. Negroponte emphasizes the versatility of digitized information, saying that "since bits are bits," they have the ability to "connect easily". Bits can interact with each other, regardless of "forms that were originally converted to numbers or what the figures represent when accessed by the end user." However, the versatility of digital information requires it to be devoid of any insignificant "additional information" or any "own repetitions." Some scientists claim that the method of digitization has many shortcomings, while others claim that digitization, by reducing its connection with its main components, produces a lingua franca, which is capable of promoting universal communication (2018).

One can easily store and transmit digitized information, making it "easier to manipulate and display this data". Digitized information also provides "data compression" that allows for "large-scale managed storage." That is, having the ability to be easily manipulated, digital data gives users additional control over the information. This additional control allows users to "gain their own experience". In other words, digitization allows people to extend the degree of interaction between user and information. Lessig argued that this broad idea of digital technologies supports the democratic form of "remix culture".

The implicit ability to control digital information is the ability to easily, cheaply and accurately transfer bits between points. Because digital bits have only two possible states, 1 or 0, receiving nodes are more likely to reduce the number of data transmission and decoding errors in comparison to analog systems. Scientists argue this can lead to "lossless" transmission, generating "fewer errors, duplications and more opportunities for accurate processing and calculation." At the same time, it remains clear that the transmission of digital information does not involve any actual transmission of physical materials. Instead, there is only the transmission of transistor configuration information, particularly, only replicating. Some scientists believe that it destroys the difference between the original and the replica, an idea that is particularly relevant to intellectual property law issues. According to Lessig, this has alarming consequences for the expansion of intellectual property.

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The law regulates "reproductions" or "copies". But every time creative work is used in a digital context, technology makes a copy. The most advanced work that involves the replicative, interactive and distributive capabilities of digital media comes from legal science, particularly, because digital media has made it difficult to enforce intellectual property rights. Lessig defines the central core of digitized information in the following way: digitized information is "not a contender", meaning it can be reused by several different people, without diminishing or degrading the original digital object, combined with the fact that it has "near zero cost of playback", which allows cheap spreading of digitized content copies. The ease of copying digital information and interactive capabilities, which led to the spread of creative recombination of cultural content and easy dissemination of digital creative work, threatened the monetization of copyrighted content. It undermined the right to claim that cultural goods may be copyrighted as well. On the other hand, industrial enterprises have responded by creating multiple digital rights management technologies that block consumer products and even the "fair use" of copyrighted works, as well as put pressure on platforms and individuals to remove all potentially copyrighted goods, that a court can judge as unfair use of copyrighted content. Indeed, these issues at the intersection of law and digital accessibility were intensified during two decades of Internet regulation activities, in addition to fighting over the core issues of jurisdiction and governance.

In different disciplines, many scholars have come together to shed light on the radical uniqueness of digitizing. Many people believe that digitized information makes it more significant and meaningful. Scientists consider this as characteristics of digital information and the necessary consequences of digitization. Nowadays, there are virtually no analog counterparts in digital technology. The final reason is that digitization reflects social groups and social interactions. Scientists often use the concept of "digitization" to discuss these macro-level changes in social structure and practice.

In the world of VUCA (volatile, uncertain, complex and ambiguous), companies are forced to innovate and constantly adapt in order to remain competitive and successful. It happens mainly in the digital revolution, where destructive businesses emerge and even bypass traditional barriers between

sectors, thereby changing the essence of traditional business and often turning products into services. The digital revolution is not only an opportunity, but also a necessity, because customers become more inclined to use digital products, have more information, compare, seek more quality and want more satisfying customer experience. It means that companies will evolve technologically and culturally, so they will create their digital strategy technologies, which, in their turn, will outline the innovations they need.

## **2. Theoretical foundations of the digital transformation process**

Digital innovations in companies require a revision of all current processes in order to make the necessary changes to achieve their digital and corporate goals. The current confusion lays in the fact, that some companies remain in the digitalization of business processes and others are really making a digital transformation of their business. In literature, there are two terms that are close in meaning - "digitization" and "digitalization", but they have their peculiarities. In addition, the terms "digitization" and "digital transformation" are mixed in many texts, which also have important features to consider. Let's look at the differences between the three terms(Catlin):

1) The process of digitization. Surveys often indicate that companies are digitized, confirming that the latter have reduced or eliminated nearly 100% of the paper documents (digital information storage) and they have created models of processes represented in digital format instead of manual processes. BPMN Notation is a business process and tagging model that was able to automate paper-based manual processes for executing vertical applications and solving the task chain. Workflow engine (Management of business processes) manages the complete digitization process of all workflows.

2) Technology digitization: some digital technologies are used in processes and manage data digitally (digitized data and digital data) for transforming processes (not just digitalization) into ones, that are more efficient, productive, profitable and liked by customers in their digital and physical experience with the company. Thus, digitalization allows the use of

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digital information for streamlining business results, generating new revenues, optimizing costs and new customer experiences, thereby making the use of digital technologies extremely valuable.

3) Digital business transformation. It's about doing things differently - creating new business projects by means of using digital technology. It is not just about automating or inserting technology into an existing process (digitization). It is not just about optimizing the current value chain, but to go further, alter the business model, change the value chain, and certainly create a new offer of products and services (caused by the use or incorporation of digital technologies into products or services before transformation), that lead to a new and better way of providing consumer value. And they will require modernization, streamlining and simplification of current business processes, as well as the creation of new key processes necessary for rethinking new business.

The digital transformation of business provides enormous opportunities for innovation and competitive advantage that need a complete reconsideration of the organization: cultural, strategic, technological, operational changes... where processes and data play a fundamental role. However, digitization does not cause transformation. It is necessary to integrate digital technologies into existing processes in order to achieve business evolution (digitalization), using digital data, providing more value to customers, gaining revenue and optimizing business processes. Yet, digitization is not enough for a complete digital transformation of business.

Digital transformation is a profound transformation of business and organizational activities, processes, competencies and models to fully exploit the changes and capabilities of digital technology and accelerate the impact of different segments of society in a strategic and priority manner, with current and future changes in consciousness.

Although digital transformation is predominantly used in business context, it also affects other organizations such as governments, state agencies and organizations involved in social issues such as pollution and aging, using one or more of these existing and emerging technologies.

Current and future shifts and changes, leading to a faster deployment of the digital transformation strategy, can be caused by several reasons (often happening at the same time) concerning customer behaviour and



expectations, new economic realities, changes in society (e.g. population aging), ecosystem or industry disruption and (accelerating implementation and innovation) new or existing digital technologies. In practice, customer experience, optimization, operational flexibility and innovation are key drivers and goals of digital transformation, along with the development of new revenue streams and information ecosystems of value, leading to transformations of the business model and new forms of digital processes. However, before achieving this, it is necessary to solve internal problems, related to legacy systems, as well as shutting down processes. Achieving internal goals is necessary for taking the next steps.

Digital transformation is a journey with multiple intermediary goals, ultimately seeking constant optimization of the processes, units and business ecosystem of the hyper-connected age when building the right bridges (front and back, data from things and decisions, people, teams, technologies, different players in ecosystems, etc.), essential for success.

The human element is a key to it at all levels: the stages of transformation (collaboration, ecosystems, skills, culture, empowerment, etc.) and, obviously, the purposes of digital transformation. As people do not want everything to become "digital", because they value human and personal interactions, there will always be an "offline" element, depending on the context. However, in non-digital interactions and operations, digital transformation plays a role in the empowerment of any agent who faces customers (Verkhovna Rada of Ukraine).

The digital transformation strategy aims at creating possibilities for taking full advantage of the opportunities for new technologies and influencing them faster and better, thus making the future more innovative. The road to digital transformation requires a step-by-step approach with a clear strategy that engages diverse stakeholders beyond silos and internal/external constraints. This strategy takes into account that the end goals will continue changing because digital transformation is a constant process, and so are changes and digital innovations.

Digital transformation encompasses a huge number of processes, interactions, operations, technological evolutions, changes, internal and external factors, industries and so on. Therefore, one needs to keep that in mind when reading digital transformation tips, reports and forecasts. Since

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there are common goals, objectives and features across organizations around the world, there are also huge differences for each industry, region and organization. What can make sense in one region does not make sense in another, even when looking at the regulatory environment.

This is mainly about transforming the digital business. In other words, transformation in the context of digital business, where there is a decentralization shift of focus to the edges of the enterprise ecosystem. Customer (external and internal) is a key aspect in this equation with the experience, employee satisfaction, values/results of stakeholders, partnerships and a clear customer-oriented approach as components.

Technological evolution and technology, ranging from cloud, big data, analyses, artificial intelligence and mobility (a key game change) to IoT and newer technological realities are: 1) digital transformation tools and/or; 2) reasons for digital transformation needs (among others, because they affect consumer behaviour or change entire industries, as in digital transformation of production) and/or; 3) accelerators of innovation and transformation. However, technology is only a part of the equation because digital transformation is integral by its definition.

The Internet of Things, or IoT, by means of which the world is advancing to the next Internet stage, is still at the beginning of its life. Thus, it is pointless to use the essence of the Internet of Things as another general term for connecting devices with a built-in or attached data connection and sensors, transmission, analysis and/or reception using Internet technologies. However, at the same time, it will be useful for the majority of transformational evolutions. In consumer applications, the Internet of Things has offered little value or genuine innovation so far. The core value is evident in the industrial Internet of Things, when industrial markets such as manufacturing and logistics are becoming leaders in transformation. The latter is also related to technologies that are beginning to demonstrate the highest degree of their destructive potential, including additive manufacturing and modern robotics.

Information and communication technology (hereinafter referred to as ICT) is one of the most important factors in stimulating economic growth and development of civil society, employment, expanding competition and helping to overcome the digital divide. ICTs are also directly related to the

inclusion in the digital world and are the engine of its development, since without technology it would not be possible to connect to the Web.

Let us conduct an analysis in Ukraine that shows the state of development of the information society with the help of the following indexes:

- ✓ ICT Development Index (used to measure the digital divide and compare ICT productivity in different countries and between countries)
- ✓ E-participation index (measures e-participation, focusing on the use of online services: electronic information sharing, stakeholder engagement ("electronic consultation" and electronic decision-making)
- ✓ E-Government Development Index (reflects the most important indicators of e-government, namely: scale and quality of online services, telecommunication infrastructure development status and human capital index)
- ✓ Index of network readiness (identifies countries' propensity to use ICT)
- ✓ Open data index (shows the development of open government data in Ukraine).

According to the ICT Development Index, as of 2017, Ukraine ranked 79 (176 countries in total), compared to 78 in 2016 with 5.62, while the best indicator is almost 9 and the worst is less than 1.

Ukraine is at a high level in the UN e-Government Survey Report on e-participation. There is also progress in e-participation across all regions, compared to 2016-2018(IST, 2018). The number of countries with high levels of e-participation has doubled from 31 to 62. However, electronic decision-making is still a serious problem, which is the third level of the e-participation model.

For more than a year, the Ministry of Justice has been providing one of the key business-related services in electronic form - state registration of individual entrepreneurs and creation of legal entities online.

Among the initiatives aimed at developing e-participation in electronic information, it is worth mentioning the following: the creation of an online public procurement platform "Prozzoro" in 2015, the adoption of legislation on open data, the creation of a Single State Open Data Portal, the Open Data Portal of the Supreme Council of Ukraine, Official Portal of Public Finance of Ukraine E-Data, introduction of electronic declaration of income

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and property of state officials (National Institute for Strategic Studies). The ProZorro system has now saved UAH 37.6 billion budget funds for our state.

According to the index of e-government development, as of 2018, Ukraine takes 82<sup>nd</sup> place with an indicator of 0.6, which is considered a high level, although our indicator is one of the lowest among European countries.

According to the World Economic Forum, as of 2016, Ukraine ranks 64 in the Network Readiness Index (139 countries in total) with an indicator of 4.2 (World Economic Forum, 2016). Singapore has the highest figure of 6.0 and the lowest one is 2.2. That is, the indicator of Ukraine suggests that the level of network development in the country is average.

The development of open government data in Ukraine will increase the openness, transparency and efficiency of government bodies activity and will be the foundation of the development of a new digital industry for Ukraine - the open data industry.

Integration of the State Open Source Web Portal of Ukraine into the European Union Open Data Portal is the main task of this initiative. The European Union Open Data Portal is the point of entry for open data from European Commission institutions and organizations, as well as EU Member states. It establishes uniform requirements for open data development policies and requirements for their standards.

Therefore, in terms of indicators, Ukraine does not occupy a leading position on any of these indices and is at an average level of development. We have sufficient conditions to create an information society. Most of the country's population are using the Internet and we have skilled IT professionals, who are in demand even abroad and many new, fully-fledged technologies are awaiting their time.

The faster we build an information society, the greater our prospects for economic and political integration with the world will be. Above all, our citizens need education in a global information world.

Last year, the IT industry came in third place in the overall list of Ukrainian export. PwC Ukraine has researched the impact of the IT industry on the country's economy. Figure 1 shows the IT professionals' forecast for 2025.

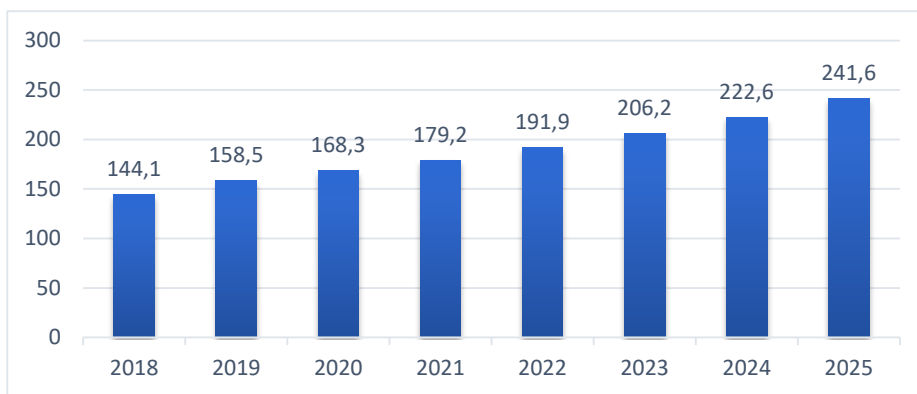


Figure 1. Forecast of the growth of the number of IT specialists in 2018 – 2025, thousand people (Pilipenko, 2017)

There are more than 140, 000 IT specialists in Ukraine in 2018. According to the forecast, by 2025 the number of jobs will increase to more than 240, 000.

Figure 2 shows the impact of the IT industry on Ukraine's economy.

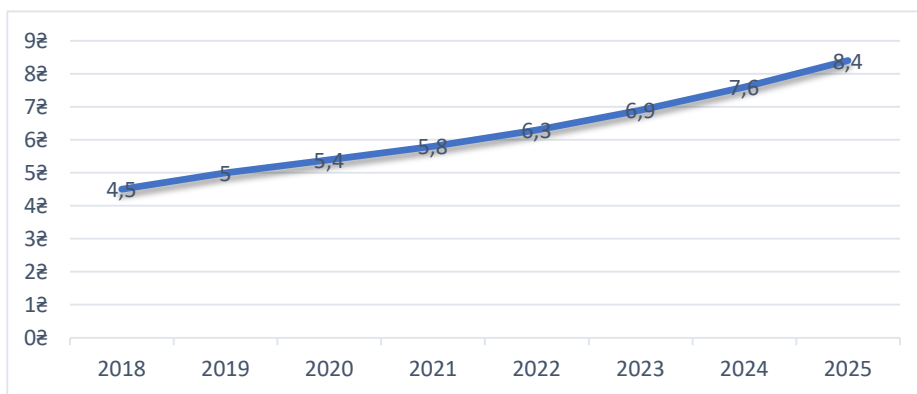


Figure 2. IT professionals' income growth forecast for 2018-2025, billion USD (Pilipenko, 2017)

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According to Figure 2, our specialists generate more than \$ 4.5 billion in revenue, offering value-added services across the entire software development lifecycle. The PwC study estimates that the industry could grow to \$ 8.4 billion by 2025.

Figure 3 shows the inclusive share of Internet buyers as of 2017 in the regions of the world.

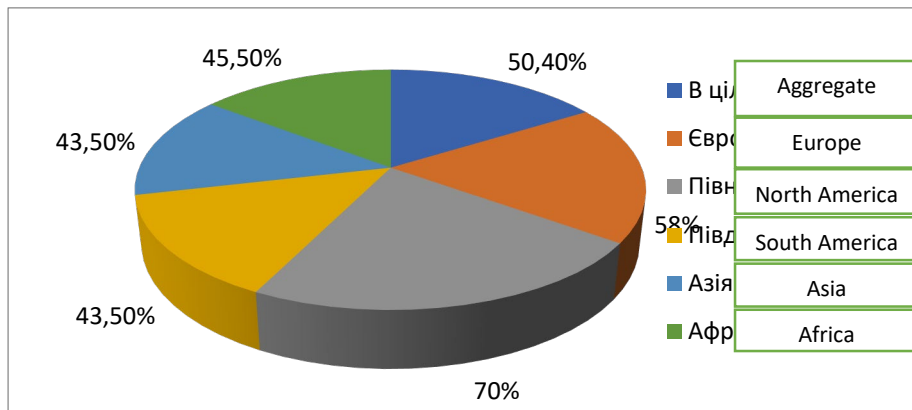


Figure 3. Share of online shoppers in 2017, by region, %  
(Global b2c e-commerce country report 2018)

Figure 3 shows that the biggest percentage of online buyers is in North America - 70%. Europe is catching up with 50% of purchasers. The lowest rate is seen in Asia and South America with 43.5% in both regions.

The share of Internet users over the age of 55 has increased during the last three years from 12% to 15%. Today, penetration in the 55-64 age group reaches 44%, 15% of Ukrainians over 65 are using the Internet.

As we can see from Table 1, Sweden has the highest internet penetration rate in 2018 - 99.7%.

At EU Member state level, the highest proportion of Internet access is in Sweden, Switzerland and Iceland in 2018. In five other countries, this proportion is over 90%: Denmark, the Netherlands and Luxembourg (97%

each), the United Kingdom (96%) and Norway (96%). Finland and Austria - 94.7% and 93.6% respectively.

*Table 1  
Top 10 countries with the highest rate of Internet access in Europe, 2018*

Country	Internet access, %	Population with Internet access, million.
<b>Europe</b>	83,11	631,3
<b>Top 10</b>	96,72	123,89
Sweden	99,7	9,95
Switzerland	98,3	8,4
Iceland	98	0,33
Denmark	97	5,58
The Netherlands	97	16,57
Luxembourg	97	0,57
The United Kingdom	96	63,91
Norway	96	5,14
Finland	94,7	5,25
Austria	93,6	8,19

Table 2 presents the top 3 countries with the lowest Internet access in Europe in 2018.

*Table 2  
Top 3 countries with the lowest internet access in Europe, 2018*

Country	Internet access, %	Population with Internet access, million.
<b>Europe</b>	83,11	631,3
<b>Top 10</b>	96,72	123,89
Croatia	69,6	2,89
Albania	66,8	1,96
Ukraine	66	29,04

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As Table 2 shows, Ukraine has the lowest Internet penetration in Europe (66%). Slightly higher rate is in Albania (66.8%) and Croatia (69.6%).

Over the last ten years, the proportion of people with Internet access has almost doubled and continues to grow rapidly. Although our country's online population is much higher than in Albania and Croatia, internet access is still lower.

A key component of Internet inclusion is access to information. The Ukrainian Internet Association (hereinafter referred to as UIA) publishes Internet penetration studies in Ukraine, conducted by research company Factum Group Ukraine in May 2018, which was the initiative of UIA. These studies indicate that the number of Internet users in Ukraine has stabilized. Since 2015, it has been around 21-22 million users over the age of 15. However, given the decrease in the total population of Ukraine, Internet penetration has slightly increased during this period and it is 64.9% as of May 2018 (number of Internet users per 100 inhabitants).

Inclusion at micro-level (in the context of broadband) is reflected in its fair development in a specific country between the urban and rural areas. The lack of infrastructure and slow expansion of high-speed networks for upgrading outdated services leave many rural areas behind the richer and more densely populated urban areas.

More than half of Ukrainian villages (52%) have Internet connection. However, more than a third of villages do not have high-speed Internet access. Moreover, 53% of schools, 99% of health care facilities have no connection to Broadband Internet.

There is also a gradual decrease in the digital divide - the inequality of the use of modern digital technologies (especially the Internet) by different social groups. Thus, the aggregate share of Internet users in villages and cities with population up to 100 thousand increased from 51% three years ago (at the end of the second quarter of 2015) to about 56% today, while Internet penetration in Ukrainian villages reached 53%. The remaining 44% of Internet users live in cities with a population above 100, 000, with penetration reaching 75%.

With such high rates of Internet penetration, it is no wonder that the whole world has changed. And those rates will continue growing by at least 5% in each country every year. These changes have affected not only



organizations that have moved to the Internet, but also politics and other life spheres.

### **Conclusions**

In the 21st century, digital transformation and digital technologies are integral part of people's lives. This process is not going to cease in the future and the tendency will continue to prevail.

In a few years' time, some of the public services will be provided in electronic form. The digital learning format is also being actively introduced in the world, and there are more and more open online courses, webinars and trainings that can be viewed by anyone at home at a convenient time. Presently, people can even make an appointment with a doctor online.

Overall, digital finance is a powerful means of extending access to financial services in other sectors, including agriculture, transport, water supply, medicine, education and clean energy. Digital money is also likely to play a role in much more complex transactions or contracts, such as bilateral financial agreements and complex derivatives.

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