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MODERN DIGITALIZATION TRENDS OF GEORGIA AND UKRAINE

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Abstract

In today's turbulent and unstable environment, international companies, including Ukraine and Georgia, are forced to move to technologies they did not plan to implement for some time and reconsider their strategic priorities. "Become digital or die" is the reality of the COVID-19 epidemic. Companies that will survive in the long run - those that have the best tools that allow them to be flexible, agile, agile; those who are better than others will be able to respond to changes in the product range, control and monitor their factories, regulate supply chains and will be able to use their workforce really anywhere. Mixed research methods were used to analyse the data. The theoretical and methodological basis of the study were the dialectical method of cognition, a systematic approach to the use of general provisions of economic theory. According to the research results, despite the serious positive transformations in the field of digitalization, there are a number of current and significant unresolved issues in the industry. It is established that the digital economy in Ukraine and Georgia, despite a number of existing problems, is developing dynamically. Organizations in various sectors of the economy are beginning to actively implement digital solutions, taking into account the specifics of their activities. Innovation is the engine of economic development, so attempts are made to find and create the most appropriate forms of organizational associations of innovative enterprises, alliances, within which strong cooperative ties can be established. The need for large-scale cooperation and coordination in the form of networking of participants in the innovation process becomes quite obvious, which provides them with a beneficial effect and corresponding competitive advantages.

Key words**:** *digitalization, turbulence, development, management, trend*

INTRODUCTION

The development of information technologies and means of communication, primarily electronic networks, has created a powerful impetus for the formation of a new trend in the functioning of modern business – the digitalization of economic relations. Most information carriers are becoming digital, which determines the main trend in the development of both modern technology and business processes with a predominant share of the electronic component. The electronic form of communication raises the level and effectiveness of communication between buyers and sellers and creates new markets and opportunities for the reorganization of economic processes.

The creation of the Internet made it possible to reduce the cost of electronic communications due to the low cost of information transfer and significantly increase the speed of data exchange, which led to an increase in the turnover of financial and material resources of enterprises. Electronic communications based on Internet technologies create such opportunities for business as a) development of new markets; b) attracting new customers; c) reducing the time spent on doing business; d) prompt response to market changes. The practical experience of using e-commerce systems has shown that savings from using B2B schemes can reach 15% in the procurement process and 22% in the sales process due to logistics optimization, procurement consolidation, reduction of intermediary margin, and achievement of the optimal price [9, 10, 17].

Thus, the search for the most promising areas for the reorganization of business processes of enterprises in Ukraine for the next 5-10 years, the possibility of their adaptation to the

realities of electronic communication is an urgent problem, the solution of which gives both enterprises and their partners many advantages. Prices as sellers of products – increasing the markets of presence, increasing sales volumes, increasing the turnover rate of working capital, reducing costs, increase the competitiveness and sustainability of the business in a dynamic business environment. For buyers, this is convenience, reliability, practicality, and shopping time-saving.

The authors conducted a study of world scientists in the field of electronic systems in business, studied e-business from the standpoint of marketing, studied the problems of management and effectiveness of business decisions in the context of "business - content - management".

Distinctive features of the development of world agriculture are the concentration and specialization of agricultural production, the widespread use of information technology, including navigation technology management of agricultural machinery while reducing specific energy costs and production costs.

Most of the agricultural machinery is equipped with electronics, and modern tractors or combines use many different electronic sensors and an on-board computer to monitor and control it. In recent years, navigation devices have become an indispensable tool for placing agricultural machinery in space and time. Various works are used not only in industry but also in agriculture.

Among the main aspects of research on this issue, scientists have focused on: electronic communications of current business structures: problems of corporate partnerships [17]; the state of development of digitalization in Ukraine [21]; matrix method of competitive analysis of the results of economic activity of enterprises in the conditions of strategization and digital transformation [8]; development of a system of effective use of enterprise resources by balancing the effectiveness of economic activity in terms of resource features [2]; the digital economy and business in the conditions of pandemic [4]; innovation processes and economic growth [22]; strategies of socio-Economic development and mechanisms of their implementation in the conditions of economic [1].

However, the issue of modern development of modern digitalization trends in Ukraine and Georgia is deeply needed. It is expedient to study and establish ways for business in mastering this area.

Digital business is modernity, which is sometimes difficult to give to entrepreneurs who do not know how to start this journey.

The article is for the purpose of defining modern trends in the introduction of digitalization in Georgia and Ukraine, and marks out problematic aspects and prospects, and identification of specific features of digitalization in the sphere of agrarian business.

MATERIALS AND METHODS

The used research methods include comparative and system analysis, expert assessment methods, modelling. At the initial stage, we analyzed the concept of technological revolution includes technological structures, four industrial revolutions and periodization of globalization. Further, the authors studied the dynamics of foreign direct investment in the economies of countries for 2015-2019. We have assessed the position of countries in terms of the components of the Global Innovation Index 2020 and Innovation achievers in 2020: income group, region, and years as an innovation achiever. At the next stage, the distribution of the permanent population of Ukraine and Georgia by age as of 2019 was carried out. Despite serious positive transformations in the field of digitalization, there are a number of relevant and significant unresolved industry problems. At the final stage, the obtained results were processed and analyzed and tasks for further research were formulated.

The information base of the study consisted of scientific works of domestic and foreign scientists on the problems of the research issue, laws and regulations of Ukraine and Georgia, materials of statistical services, sources of information and analytical materials of relevant organizations and

periodicals.

RESULTS AND DISCUSSIONS

The transformation of socio-economic relations, associated with the widespread use of information and communications technologies (ICT), is interpreted differently in different scientific schools.

The most common is the technical-technological approach, which inextricably connects the development of human civilization with the progress of technique and technology. Its current stage, which is called the 4th industrial revolution in the United States, the EU, and other technologically advanced countries, is identified in the EAEA with the formation of the 6th technological order.

The concept of technological revolution is presented on Figure 1.

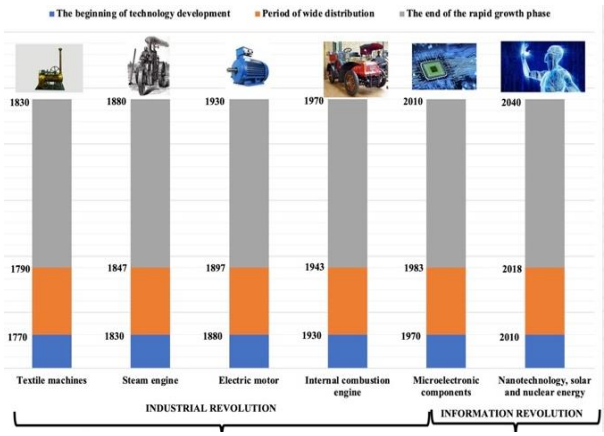


Fig. 1. The concept of technological revolution
Source: systematized by the author's based on research.

Technological structures are groups of technological units that stand out in the technological structure of the economy, and that are interconnected by the same type of technological chains and form reproductive integrity.

Each such method is a holistic and sustainable formation, within which the full macro-production cycle is, including the extraction and production of primary resources, all stages of their processing, and production of a set of final products that meet the appropriate type of public consumption.

At the moment, there are six technological orders (Table 1).

Table 1. Technological structures

Period of development	The core of the technological structure	Predominant infrastructure	Organization of production
1770-1830 The beginning of the industrial revolution	textile industry, textile engineering, iron smelting, iron processing, canal construction, water engine	roads, irrigation canals	factory production
1830-1880 Age of steam	steam engine, railway construction, transport, mechanical engineering, shipbuilding, coal industry, ferrous metallurgy	railways, shipping lines	mechanization of production, urbanization
1880-1930 The steel age	Electrical and heavy engineering, steel production and rolling, inorganic chemistry	power systems, post office, telegraph, radio, telephone, railways	standardization of production
1930-1970 The oil age	Auto and tractor building, non-ferrous metallurgy, production of durable goods, synthetic materials, organic chemistry, oil production and processing	expressways, power systems, pipelines, radio and television communications, shipping and airline	serial production, quality growth
1970-2010 Scientific and technological revolution	electronic industry, computer, fiber-optic technology, software, telecommunications, robotics, gas production and processing, information services	computer networks, satellite communications, Internet, global power systems, airlines	networking, logistics, clusters, outsourcing
2010-2050 The digital revolution	biotechnology based on advances in molecular biology and genetic engineering, nanotechnology, artificial intelligence systems	global information networks and integrated high-speed transport systems	virtual services, 3D printers, Internet of Things, cloud infrastructure

Source: systematized by the author's based on research.

Western publications do not use the concept of technological order, and, considering the fundamental changes in technology that lead to fundamental changes in economic relations and society as a whole, the authors speak of industrial revolutions (Table 2).

Table 2. Four industrial revolutions

Industrial revolution	The main source of growth
1770-1860: 1st Industrial Revolution – the era of steam and spinning production	Steam machines, spinning and weaving machines, metallurgy, lathe
1860-1900: 2nd Industrial Revolution – the era of steel and current production	Telegraph, railways, internal combustion engine, conveyor
1970-2010: 3rd Industrial Revolution – the age of computers	Computers, electronics, nuclear energy, robots
2010-2060: 4th Industrial Revolution - the era of cyberphysical systems, the Internet, the digital economy	NBIC-technologies, genetic engineering, 3D-printers, RES, drones, Internet of Things

Source: systematized by the author's based on research.

There are different periodization of the globalization process. Based on Maddison's E. study "Contours of the World Economy in 2030" [7], it is fair to say that human

civilization in its development has gone through six stages of globalization (Table 3).

Table 3. Periodization of globalization

Stages of globalization	Average annual GDP growth,%	Average annual growth of world trade,%	Excess of trade growth over GDP (times)
Trade Capitalism, European Colonization of America, East India TC (1500-1820)	0.32	0.96	3.0
Industrial capitalism, the rise of European global empires (1820-1870)	0.94	4.18	4.4
The era of imperialism, financial globalization (1870-1914)	2.12	3.40	1.6
Stagnation of globalization – world wars, the Great Depression (1914-1945)	1.82	0.90	0.5
Bretton Woods Monetary System, GATT (1945-1973)	4.90	7.88	1.6
The Golden Age of Globalization: The Jamaican Monetary System, WTO (1973-2010)	3.17	5.38	1.7
Digital Globalization (2011-?)	3.14	10.44	3.3

Source: official data of the Contours of the World Economy in 2030 [7].

Under the influence of the fifth stage of globalization, international economic relations developed rapidly, trade unions and organizations were formed, stable interstate institutional ties were formed, and the mobility of people increased. The sixth stage of globalization began in the 1970s of the XX century and it is associated with the integration of the world economy and the emergence of multinational corporations. One of the most important achievements of the fifth and sixth stages were the GATT-WTO trade rules and the global payment systems SWIFT, VISA, and Europay.

The growing interest in big data technology over the past few years is due to two main factors. The first is the rapid expansion of the use of computers and various digital devices, not only in business but also in the daily lives of many people. Transport, industry, commerce, and healthcare are increasingly using detecting devices and sensors to collect and transmit data on freight traffic, transport, and patient status. As a result, a new space is created in which the objects of the real and virtual worlds communicate with each other through wired and wireless communication channels (the so-called Internet of Things). Secondly, the popularity of big data is due to the increase in information flows on the Internet, which includes tweets, social media posts, search queries, sensor data, and controllers of millions of smart devices.

The first companies that realized the hidden value of large amounts of information were Google, Amazon, Yahoo, Facebook, which developed tools for collecting, analysing, and storing large amounts of data. The development of cloud solutions has led to an increase in the number of data centres and a reduction in the cost of their services, which, in turn, has significantly reduced companies' storage costs.

The survey found that the most widely used big data technologies were found in telecommunications, as well as in mechanical engineering, insurance and finance. The leading areas of big data use are retail, finance, healthcare, and telecommunications.

Big data is now seen as an effective tool for government decision-making. One way to work with big data on the regulation of socio-economic and political processes is to compile and analyze official statistics solely on their basis and in combination with traditional sources: registers, surveys, etc.

In December 2019, the Verkhovna Rada of Ukraine passed a bill containing provisions on virtual assets that are considered property and can be used for payment and investment purposes. The bill proposes a tax rate at a reduced rate of 5% of profits for five years for individuals on cryptocurrency transactions, which is 13% lower than the current tax rate.

The experience of regulators around the world shows that cryptocurrency is difficult to classify as an existing asset class. The mechanical transfer of traditional regulations to cryptocurrency works poorly. More and more regulators are inclined to the obvious view that it should be considered as a unique alternative asset class, different from all others, with its own advantages, risks and its own legal framework. Taking into account that cryptocurrencies are very different from each other – as an example it is possible to consider at least decentralized and centralized projects – then, most likely, it needs to be divided into several categories. Ultimately, how cryptocurrencies are classified largely determines market share.

Countries with strong economies and currencies are introducing cryptocurrency as a

means of payment or as a financial asset. Countries with weak economies and volatile currencies are trying to support the national currency by restricting cryptocurrencies as a means of payment but allowing cryptocurrencies as a means of exchange. Thus, the ambiguous approach to cryptocurrencies in different countries around the world creates additional problems for determining their legal status. This means that Ukraine needs to develop its own approach to the legal regulation of cryptocurrencies, giving them a special legal status, based on the current state of legislation and economic development of the country.

The term "business process" is commonly used to refer to a set of interrelated activities or tasks aimed at creating a specific product or service for consumers. The model of any enterprise consists of a combination of individual business processes, and the success and competitiveness of the enterprise depend on their efficiency. To date, there is no single definition of the term "business process". The founders of process management of the enterprise provided the following definitions of business process: a business process is a set of different activities in which "input" uses one or more types of resources, and as a result of this activity "output" creates a product which is valuable to consumers [10]. The purpose of the business process is to create a product or other useful result for the company's customers, management, owners, other employees or, departments of the company [17].

In the process of building a management system for an industrial enterprise based on business processes, attention is focused on developing mechanisms for interaction between internal structural units and their interaction with stakeholders. The authors identified four groups of entrepreneurial stakeholders: the state, the social environment, the educational environment, and the business environment. Each of the selected groups includes several participants (Figure 2). The social environment includes the population, public organizations, students; the group "state" includes public authorities and local governments; the educational environment is educational institutions and institutions of non-formal education and the business environment includes business associations and business structures.

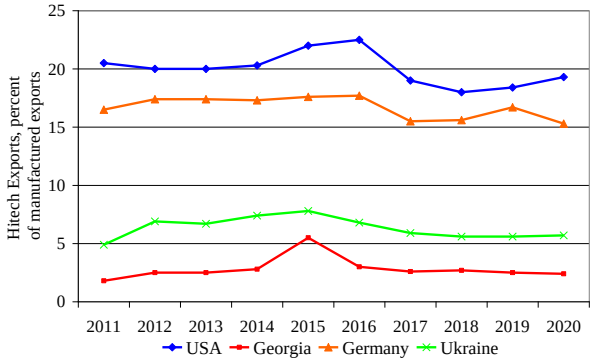


Fig. 2. Hitech Exports, percent of manufactured exports.
Source: official data of the United Nations; The GlobalEconomy.com [18, 20].

Each of the stakeholder groups has certain priority interests in several areas – interaction with each other when working with young entrepreneurs and directly with young entrepreneurs. Each of these groups of stakeholders influences the activities of the enterprise and has its own characteristics. It is proposed to compare some of the parameters that affect business processes, in particular in the context of modern digitalization trends, using the example of Ukraine, Georgia, Germany (as a European benchmark), and the USA.

The first of the parameters that contribute to business development is direct investment. The World Bank (World Bank) published an analytical report "Doing Business in 2015". Singapore ranks first in overall ease of doing business for the eighth year in a row, according to this study, and has consistently pursued reforms aimed at improving the business environment. The top ten countries also included New Zealand, Hong Kong (Special Administrative Region of China), Denmark, South Korea, Norway, the United States, Great Britain, Finland and Australia [12].

It should be emphasized that not only and not so much financial profitability affects the decision to invest in a particular region. A potential investor always takes into account the stability of not only political, socio-

economic, geographical and cultural, but also organizational and legal factors.

For example, Singapore is a country with a favorable investment climate, not only due to low taxes, of which there are only five. Bureaucratic procedures for business have been reduced to a minimum; all reporting is done via the Internet (although there is very little of it).

The country has completely abolished the "permissive" practice and "licensing". There are no taxes on dividends, capital gains, bank interest, and investment income in Singapore.

The transformation of Hong Kong into one of the global financial centers is facilitated by especially liberal tax and currency legislation, which does not cause barriers to the movement of capital, both in terms of volumes and directions of transactions.

In Hong Kong, the process of creating a new company takes no more than four days, and registration takes half an hour, most of the communication with government agencies and the execution of basic documents, as well as in Singapore, are possible online.

Regions can serve not only as an object for investment, but also create conditions for opening and comfortable doing business.

For example, in Hong Kong, the process of business functioning is as convenient as possible.

Entrepreneurs regardless of nationality have access to a developed financial and legal industry, reliable and affordable utilities, advanced communications, and information infrastructure.

Moreover, the Hong Kong authorities provide for a number of grants and sponsorship programs, the purpose of which is financial and educational assistance to teams that work in the intellectual field [19].

In South Korea, the number of procedures required to open a business is kept to a minimum (three procedures on average). The procedure for opening a new company takes a maximum of two weeks.

Let us pay attention to the dynamics of investments over the past 5 years in the countries under study (Table 4).

Table 4. Foreign direct investment (share capital) in the economies of countries in 2016-2020

	Volumes in				
	2016	2017	2018	2019	2020
Georgia, million USD	1,660	1,921	1,270	1,366	534
Germany, million USD	64,708	109,506	158,515	67,619	112,617
The US, million USD	474,388	380,823	214,315	302,199	211,298
Ukraine, million USD	4,128	3,680	4,975	5,796	304

Source: official data of the World Bank [14].

Over the past 19 years, the number of FDIs in the United States has more than doubled. In 2000 the FDI was 1.26 billion USD USA, and in 2019 it increased to 4.46 billion USD USA. Foreign direct investment (FDI) is an investment from a company in one country to a company or organization located in another country. In this case, foreign direct investment is recorded for companies / organizations located in the United States.

However, while the United States receives huge sums of FDI annually, it also invests even larger sums in other countries. For example, in 2018, the United States invested over $ 866 billion in the Netherlands and another $ 758 billion in the UK.

Germany is considered as an attractive country for foreign direct investment (FDI), but the global recession and subsequent Eurozone crisis have hampered the influx of FDI in recent years. According to the 2020 World Investment Report by UNCTAD, FDI inflows in Germany decreased by almost 50% in 2019, reaching 36.6 USD billion compared to the 74 billion USD of the previous year. This is mainly due to uncertainty caused by the Brexit and US tax reforms, a tight labour market, as well as the stagnation in the automotive industry. FDI stock decreased slightly in 2019, reaching 953 billion USD (in general its level has remained constant over the last ten years and it amounted to $955 billion USD in 2010).

According to latest data by OECD, FDI flows to Germany increased by more than 20 billion USD in the first half of 2019. FDIs in Germany are mostly owned by the Netherlands, Luxembourg, the US and the

UK, which represent more than half of the total stock. Switzerland, France, Italy, Belgium, Austria, Japan, Spain and Denmark are also investing in the country. Investments are mainly oriented towards manufacturing and trade, finance and insurance, information and communication, real estate. In 2018, Germany Trade & Invest (GTAI) recorded a record of 2,062 foreign direct investment projects, with corporate and financial services representing 22% of all new projects, followed by ICT & software (16%) and the consumer goods industry (9%). Nevertheless, Germany remains a net capital exporter: in 2019 FDI outflows amounted to USD 99 billion.

It is to be noted that research and innovations play a critical role in ensuring the economic growth and effective use of the export potential in developing countries [6, 16]. (Scientific studies on innovative development and contemporary challenges of digital technologies in the context of Ukraine and Georgia, more detail, see, for example: [1, 2, 3, 4, 5, 6, 8, 11, 13, 15, 16, 17, 21, 22]. Ukraine and Georgia have challenges and considerable potential here.

Among the country's strengths are a highly powerful and diversified industrial network, a highly skilled workforce with a good command of English, reliable infrastructure, a favorable social climate, a stable legal framework, and a location at the heart of Europe. Their main weaknesses are a high tax rate (for both individuals and businesses) and rather inflexible labor laws. The World Bank ranked Germany 22nd out of 190 countries in its 2020 Doing Business report (gaining two positions compared to the previous year).

The volume of foreign direct investment in the Georgian economy in January-June 2019 amounted to $473.1 million, which is 34.9% less than in the same period in 2018, the National Statistical Service reports.

In the second quarter, the inflow of foreign investment amounted to $187 million – 34.6% less than in the previous quarter, and 2.2 times less than in the second quarter of 2018.

According to the statistical service, out of the total volume of foreign investments received in Georgia in the first half of 2019, $210.9 million was invested in the equity capital of enterprises, $161.5 million were reinvestments, and $100.7 million were debt obligations.

Over the six months of this year, the largest volume of foreign investment was attracted to the energy sector – $112.3 million (23.7% of the total). The hotel and restaurant sector received $86.7 million (18.3%) of foreign investment, the processing industry – $57.7 million (12.2%), the transport sector – $54.7 million (11.6%), the mining industry – $23.9 million (5.1%).

In terms of the number of investments invested in the Georgian economy, Ireland ranks first, from which $133 million (28.1% of the total) was received in January-June this year. Turkey is in second place – $104.1 million (22%), Panama is in third – $59.3 million (12.5%). The top five investors of the republic also include the USA – $50.4 million (10.7%) and the UK – $44.6 million (9.4%).

According to updated statistics, in 2018 the volume of foreign direct investment in the Georgian economy decreased by 35.5% compared to the previous year, to $1 billion 265.2 million (7.8% of GDP).

According to the State Statistics Service, in 2015 Ukraine received $4.3 billion in direct investment. In 2016, the volume of investments increased by almost 2% to $4.4 billion. In 2017, the flow of direct investment in Ukraine fell by 43% and amounted to just over $2.5 billion.

In 2018, the situation improved slightly and investments increased by 14.3% to almost $2.9 billion. In 2019, the amount of money invested in Ukraine decreased by 11.8% and amounted to $2.5 billion.

In 2015, the largest amount of money was invested in the development of finance and insurance ($2.7 billion). The second place in terms of the number of financial injections was taken by the IT industry ($ 0.5 billion). More than $0.3 billion was invested in wholesale and retail trade. Slightly fewer funds were received in the development of the industry. $0.1 billion was invested in real estate transactions.

In 2016, the number of investments increased in all these areas, in particular, in the industry

– by 80%.

In 2017, there was a significant outflow of investments from the financial sector (-54.4%) to $1.3 billion and trade (-66%) – less than $0.2 billion.

In 2018, the financial sector lost another 6% of investments, which during the year amounted to $1.2 billion, the industry – $0.3 billion (-42%), IT industry – $0.1 billion (-22%). At the same time, real estate operations grew by 244% and received $0.4 billion in financial injections. Investments in trade and auto repair increased by 236%, which amounted to $0.6 billion.

In 2019, investment in the financial services sector sank by almost a quarter, but capital investment in the industry doubled. Investing in real estate began to invest 46% less ($0.2 billion), and trade and auto repair received 65% less investment than in the previous year, returning to the positions of 2017 ($0.2 billion).

The region can be not only an object for direct or indirect investment but also a place for the most daring innovations. As an example, we can cite not only the famous Silicon Valley but also other regions.

For example, having come to power in 2007, Sarkozy began to actively implement a policy aimed at the development of innovation, which resulted in support for high-tech industries, the creation of scientific and industrial clusters, the development of regional innovation networks, the modernization of the higher education system and scientific research. The most notable changes in the field of innovation policy were the poles of competitiveness (PC) and the poles of scientific research and higher education (PSRHE), as well as measures aimed at developing university autonomy (2007) [11]. Of course, France is not a pioneer in the implementation of industrial and innovation policy based on cluster principles, but it deserves attention. Competitiveness poles are an association of enterprises, research organizations and educational centers located on the same territory, included in joint activities and designed to accumulate synergy in innovative projects of young entrepreneurs [8]. Scientific, technical and innovative projects designed for the development of the national and regional economy became the basis of the PC's activity.

It is generally recognized that innovation and educational clusters are an effective mechanism for the development of a regional innovation system [2].

In Hong Kong, special attention is paid to the cultivation of skills to bring the achievements of the innovation process to the open commercial market [21].

At the service of companies engaged in scientific development, numerous and accessible high-tech specialized centers have been created, the purpose of which is to help develop promising ideas.

From the point of view of the impact of entrepreneurship on the development of the innovative activity, it should be noted that cooperation between universities, government agencies, public organizations and business makes it possible to establish and implement effective mechanisms to support youth innovative entrepreneurship through synergistic effects achieved in the course of such interaction. In addition, only based on such cooperation, conditions for the sustainable development of interuniversity Start-up centers and the promotion of youth entrepreneurship can be created.

At the same time, one of the main indicators, a generalizing indicator for measuring the level and results of the implementation of the country's innovative potential is the Global Innovation Index, which reflects the main components of the countries' innovative potential [12].

The results of the study of the position of countries in 2020 for the components of the Global Innovation Index are given in Table 5 and Table 6.

Table 5. Assessment of the position of countries by the components of the Global Innovation Index 2020

Country	Global Innovation Index	Institutions	Human capital & research	Infrastructure	Market sophistication	Business sophistication	Knowledge sophistication & technology	Creative outputs
Georgia	63	36	61	81	39	79	67	68
Germany	9	18	5	12	24	12	10	9
USA	3	9	12	24	2	5	3	11
Ukraine	45	93	39	94	99	54	25	44

Source: official data of the Global Innovation Index Database [9].

Table 6. Innovation achievers in 2020: income group, region, and years as an innovation achiever

Economy	Income group	Region	Years as an innovation achiever (total)
Ukraine	Lower-middle income	Europe	2020, 2019, 2018, 2017, 2016, 2015, 2014, 2012 (8)
Georgia	Upper-middle income	Northern Africa and Western Asia	2020, 2019, 2018, 2014, 2013, 2012 (6)

Source: official data of the Global Innovation Index Database [9].

After analyzing the state of development of innovation activity based on the Global Innovation Index, it should be noted that the undisputed leaders are the USA (3rd place) and Germany (9th place). At the same time, these countries consistently occupy such leading positions.

Georgia and Ukraine are relative newcomers to this indicator. For Ukraine, the GII indicator is calculated over the period of 10 years, for Georgia – 6 years. These countries managed to win 45th and 63rd place respectively.

It is noteworthy that the leading countries under study have the lowest results in two components, which coincide in pairs with Ukraine and Georgia. Thus, the USA has the worst result (24th place) in the Infrastructure component, for Georgia it is also the worst result – 81st place. Germany ranks 24th in the "Market sophistication" component, in Ukraine it is 99th.

If we analyze all the components of the GII, it becomes obvious that one of all stimulates the development of the others. Such a component is Human capital & research.

Not just residents are important, but taxpayers will replenish regional and local budgets. The quality of life is one of the most important factors in the innovative development of the economy [14].

In this regard, the experience of Tallinn with the idea of "free travel in exchange for registration" is interesting. All residents of the city who have an official residence permit are exempted from paying fares in public transport. Many called this event "populist". Of course, it required additional investments from the municipal budget. However, the benefits are obvious: the city's tax revenues have increased, people have become more mobile, retail sales have increased, the number of cars on the city's streets has decreased, the environmental situation has improved, and the need to build new parking lots and maintain old ones has disappeared.

It must be said that the city of Tallinn was far from being a pioneer, its experience is interesting because it is the first European capital that began to use this tool to increase the attractiveness of the city for its residents. In 1997 in the Belgian city of Hasselt, in 2009 in the city of Ambage in the south of France, public transport became free. Some cities in Germany and Sweden have also eliminated tolls. Many cities in Europe run free buses, or municipalities are taking steps to reduce ticket prices.

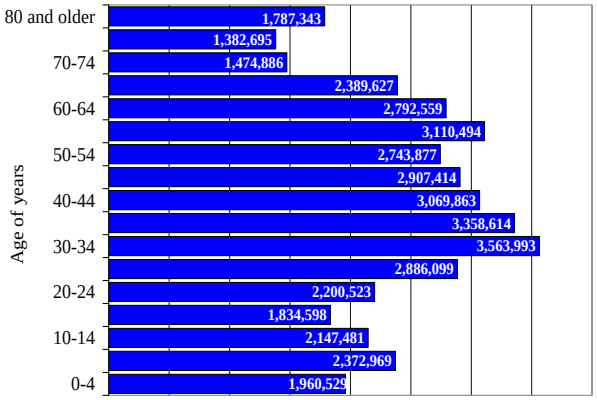


Fig. 3. Distribution of the resident population of Ukraine by age as of January 1, 2019.
Source: official data of the State Statistics Service of Ukraine [13].

Regarding the population of Ukraine as of January 1, 2019 (Figure 3), the largest number of citizens, namely 3,563,993 men, falls on the age category of 30-34 years.

This is the age at which the vast majority of young entrepreneurs operate. In general, citizens aged 15-34 in Ukraine are 24.97%, which is a quarter of the total population and 36.83% of the economically active population of the country.

This statistic shows the distribution of the population of Georgia by age group in 2019. In 2019, about 13.7 percent of the population in Georgia was between 25 and 34 years old (Figure 4).

The US population (Figure 5) was estimated at approximately 328.2 million in 2019, with

the largest age group being adults aged 25 to 29. There were 12 million men and about 11.5 million women in this age group.

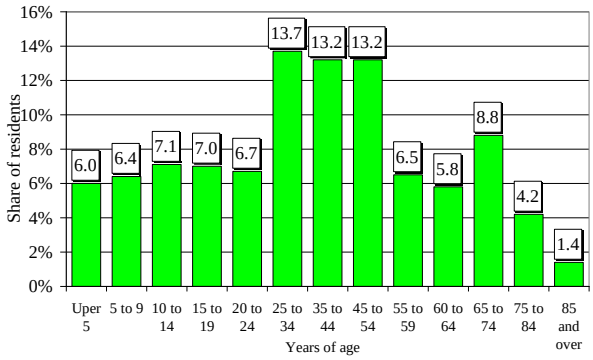


Fig. 4. Distribution of resident population of Georgia in 2019, by age group, %.
Source: official data of the Global Innovation Index Database [9].

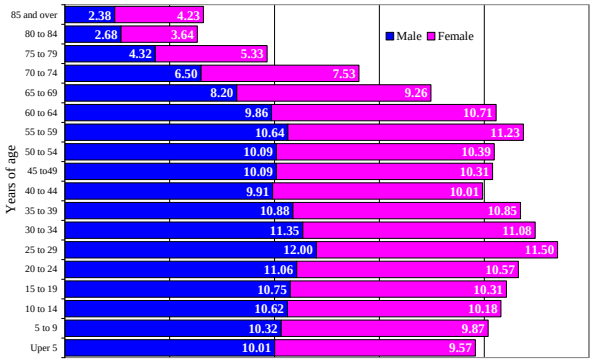


Fig. 5. The resident population of the United States by sex and age in 2019 (in millions).
Source: official data of the Global Innovation Index Database [9].

The population of the United States continues to grow, and the country ranks third in the world in terms of population after China and India. The gender distribution remained unchanged for many years, with the number of women slightly exceeding the number of men. In terms of where the residents live, California was the state with the highest population in 2019.
The United States is known worldwide for its diverse population. In 2019, the number of blacks or African Americans was estimated at 44 million, which is four million more than in the 2010 census. The population of Asia has also increased at the same rate over the same period of time. The Latin American population in the United States continues to grow, and in 2019, approximately 18.5% of the total population belonged to this ethnic group.
People aged 40-59 are the largest age group in Germany - 23.6 million people. The latest data for 2019 confirm that the next largest age group was 65 years and older - 18.09 million people (Figure 6).

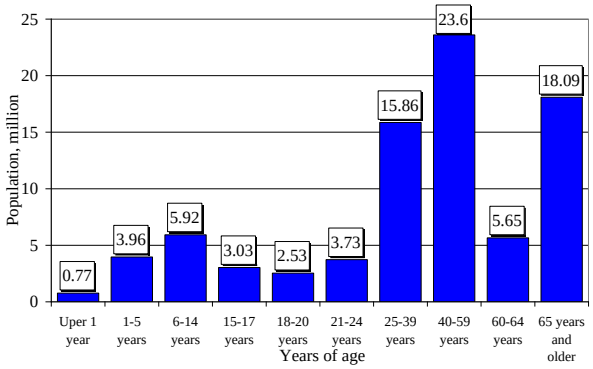


Fig. 6. Population of Germany in 2019, by age group (in millions).
Source: official data of the Global Innovation Index Database [9].

As the number of older people is significantly higher than the number of young people, in recent years it has become clear that Germany's population is aging faster than it is developing. In fact, data on the age structure in Germany for the decade ended 2017 show a steady trend towards a slow increase in the proportion of the population over the age of 65. Meanwhile, the share of the population aged 0 to 14 is declining, which is also reflected in fluctuations in the national birth rate in recent years.
Currently, the total population of Germany is 82.79 million people. Although an increase in this number is projected, the same applies to the age group of 65 years and older. This means that the country's population will continue to age.
The second part of the GII Human capital & research component is research. Therefore, the educational aspect should be considered.
In France, in order to reform research and educational institutions, a policy was pursued to develop cooperation between higher educational institutions – universities and research structures (Poles of Scientific Research and Higher Education – PSRHE), located in the same geographical area, in order to combine efforts in certain scientific areas and efficient use of the resources at their

disposal. In this way the PSRHE "Sorbonne – Universities", "Paris – science and literature of Latin Quarter" appeared. Much attention was paid to the integration of universities in the life of the territory where they are located. Representatives of territorial authorities sit on the administrative boards of universities, influence the development of university policy, participate in the reconstruction of university buildings and dormitories, allocate scholarships, and finance research. In turn, the university seeks to adapt the education it provides to the needs of the local labor market [10].

All living conditions for a comfortable stay have been created for students, from hostels to fares. For example, in the city of Grenoble and its district, where are, according to various estimates, from 80 to 100 thousand students per year, mostly foreigners, a system of affordable hostels has been created: these are not only traditional hostels in our understanding, but also modern residence apartments in which are rented only to university students. A public transport ticket for students is cheaper than for young children.

Higher education in Ukraine is the choice not only of promising Ukrainian youth, but also of many students from neighboring countries and Asian countries. Most of all students come to Ukrainian universities from Turkmenistan, Azerbaijan, India, Nigeria, China, Iraq and Russia. And the most demanded areas of training in Ukraine for foreigners are medicine, economics, law, engineering and aviation.

Despite the fact that European universities are traditionally considered an indicative example of the high quality of education, in recent decades there has been a tendency to strengthen the position of Ukrainian universities in the list of the best educational institutions in Europe. And although there are only 6 of them so far, while 203 universities have been issued a license to accept foreigners, there are prospects for getting an education in Ukraine, but there is already a European level, which is used by the majority.

At the moment, the education system of Ukraine is undergoing significant changes, which contributes to an increase in its prestige and demand for knowledge gained during training. In addition, education received in Ukrainian universities is recognized today in many countries of the near abroad, where specialists with knowledge of Ukrainian and Russian, in addition to their state language, are in great demand in the labor market.

There are also a number of more prosaic advantages that higher education in Ukraine offers, namely:

- having your own home saves costs;
- the familiar environment and language of teaching, as well as the absence of the need for a break;
- social contacts reduce stress from the transition to a new stage of life;
- lower study fees than in foreign Universities makes higher education more accessible;
- double degree programs offered by some universities help to obtain an international diploma without going abroad.

The headcount enrollment for the 26 institutions of the University System of Georgia (USG) in Fall 2019 was 333,507, representing an increase of 1.5 percent – or 4,795 students – over the Fall 2018 enrollment of 328,712, according to USG's Fall 2019 Semester Enrollment Report. This continues a six-year trend of modest increases in student enrollment within USG. This fall also marks the fifth consecutive year of growth to reach an all-time high in the number of students enrolled in USG institutions (Figure 8).

Meanwhile, enrollment patterns varied by institution across the USG. Headcount enrollment grew by 3.8 percent in research universities and 1.8 percent in comprehensive universities. Enrollment declined by 1.2 percent at state universities and 2.5 percent at state colleges. Enrollment increased at 11 institutions, while 13 had a decline and 2 were relatively flat.

Dual enrollment increased by 203 from 12,394 in Fall 2018 to 12,597 in Fall 2019, an increase of 1.6 percent. Most of this growth occurred at the comprehensive and state universities. This is the smallest fall-to-fall increase in dual enrollment since Fall 2015.

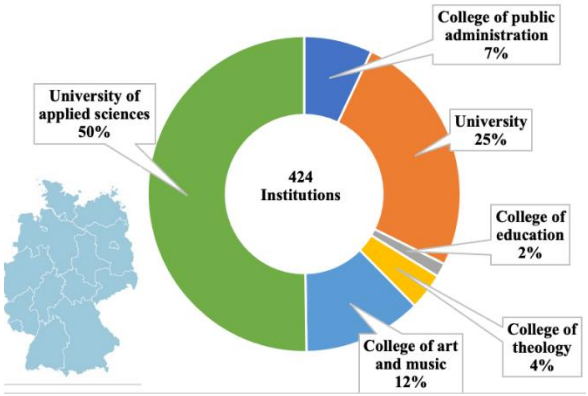


Fig. 7. Higher education institutions, by types and Länder (Germany)
Source: official data of the Global Innovation Index Database [9].

Taking into account the low percentage of young people, Germany is open to international students. Germany is becoming a very popular study destination standing alongside the US, the UK, Canada and Australia. Consequent to this high attractiveness the country has reached its long-term of welcoming 350,000 international students, by 2020, three years earlier in 2017.
In 2017, there were 4,313 higher education institutions in the United States. This is less than in 2015, when there were 4,583 higher education institutions in the country. In the United States in 2019, there are about 5,300 colleges and universities (Figure 8).

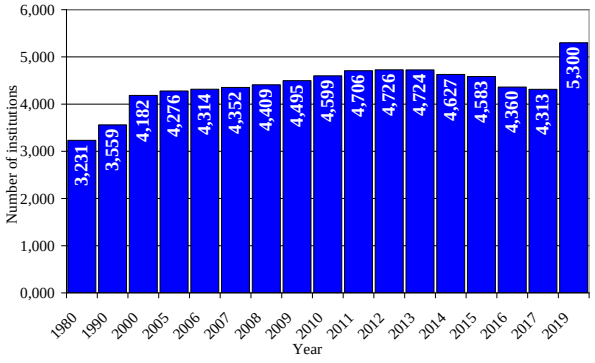


Fig. 8. Number of higher education institutions in the U.S.
Source: official data of the Global Innovation Index Database [9].

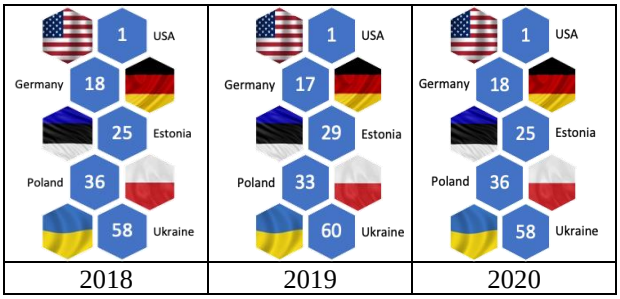
Higher education in the United States refers to the country's colleges and universities. The United States has some notable differences in higher education compared to the rest of the world, including NCAA sports, Greek living, and high attendance costs. However, the vast majority of the world's best universities are located in the United States. Some of these universities include eight Ivy League schools, the Massachusetts Institute of Technology and Stanford University.
The cost of universities in the United States has risen significantly over the past few decades. As a result of such a high cost of education, students began to take exorbitant student loans. Both the federal and state governments have reduced funding for public schools, but compulsory spending on higher education is expected to increase in the next few years. In 2017, California had the highest level of higher education spending by state and local governments. California also has the largest number of higher education institutions in the country.
Comparative data on the level of digitalization of the economy and society as a whole in different countries, which are contained, in particular, in the global digital competitiveness rating are also of great interest [10]. The comparative assessment of countries in this ranking is carried out by their ability to perceive and effectively use digital technologies as a means of ensuring the transformation of regulatory practices, business models and society as a whole. The comparative assessment of countries in this ranking is carried out by their ability to perceive and effectively use digital technologies as a means of ensuring the transformation of regulatory practices, business models and society as a whole. This assessment is carried out on the basis of three complex factors that have received such generalized names: knowledge, technological environment, openness to the future. Each of these factors is further broken down into three sub-factors, which, in turn, are detailed using six indicators. The knowledge factor is understood as a system of knowledge necessary for the discovery, understanding and creation of new technologies and which are divided into the following three sub-factors: talent, education and retraining, scientific concentration. The technological environment factor is subdivided as a sub-factor into regulatory framework conditions, capital and technological framework

conditions. The openness of the future is detailed using the sub-factors of adaptability, business agility and IT integration.

In 2019, the United States held the number one spot in the rankings, with all five of the country's top economies unchanged: the US, Singapore, Sweden, Denmark and Switzerland. The top 5 share a common thread of terms with their focus on knowledge generation, but they all had different approach to digital competitiveness. The US and Sweden take a balanced approach between generating knowledge, creating a supportive environment for technology development and a willingness to do so to embrace innovation. Singapore, Denmark and Switzerland give priority to one or two factors. In the Top 10, the Netherlands, Hong Kong South Africa and South Korea moved up (to 6th, 8th and 10th respectively), while Norway dropped to 9th and Canada fell from 8th to 11th.

The IMD World Digital Competitiveness Ranking presents the 2020 overall rankings for the 63 economies covered by the WCY. The rankings are calculated on the basis of the 52 ranked criteria: 32 Hard and 20 Surveydata. The countries are ranked from the most to the least digital competitive and the results from the previous year's scoreboard (2019) are shown in brackets. The index value or "score" is also indicated for each country.

Among the studied countries, the United States consistently ranks 1st place, Germany is in 18th. Ukraine improved its performance by 2 positions and took 48th place in 2020. Georgia is not yet included in this rating, which indicates the need to improve and develop the direction of digitalization.



Fig, 9. Digital competitiveness ranking
Source: official data of the IMD World Digital Competitiveness Ranking [19].

In 2020, USA held the top position for the third consecutive year. Singapore held the 2nd spot, while Denmark overtook Sweden to claim 3rd place. Hong Kong climbed three ranks to 5th, and Switzerland dropped one place to claim the 6th spot. 2020 has been a challenging year for the world. Every aspect of our lives has been affected by COVID-19 and technology has been incorporated to address the pandemic in different dimensions from communication to monitoring, assessing and, hopefully in the non-distant future, finding a cure for the virus.

Digitalisation in agriculture

New electronic equipment and information technology open up opportunities for the broad development of smart agriculture, which is understood as the use of strategic management using information technology, obtaining data from various sources for decision-making related to agricultural production, market, finance and people.

Smart agriculture is a modern concept of agricultural production, based on the introduction of new technologies: geographic information systems, satellite navigation, digitalization of agricultural production processes that increase productivity and quality while reducing costs.

An example of the digitalization of the agricultural sector in Ukraine is the digital agribusiness transformation project #DigitalAgriBusiness, launched by Kernel Company in 2016 to ensure growth and efficiency by digitizing crop production based on BigData. It was noted that if the digitalization of grain growing is a project for the whole country, it will increase production in Ukraine from the current 60 to 85 million tons and increase exports from 36 to 63 million tons (ROI=30-90%).

Farmers and producers must have effective adapted technologies, calculate the costs of growing crops and raising livestock in advance, program the level of yield and calculate the cost of production. Only in this case they will be competitive with other domestic and foreign manufacturers.

Smart agriculture has been practiced in the United States, Japan, Western Europe (Germany, England, Holland, Denmark) and China since the 1980s, while in Eastern

Europe since 1990. It is currently experiencing a real boom in South America, particularly in Brazil, due to rapid economic growth and the desire to reduce production costs.

Digitalization and mechanization are becoming part of Georgia's agriculture as more and more producers invest in precision farming technology. Georgian companies are contributing to this process by building an agricultural business, where almost every decision is based on the analysis of data obtained using digital tools directly from the field. In the next few years, the companies plan to develop the entire value chain and become a provider of consulting services for others.

Smart agriculture has become possible in those countries where the material, technical and economic base has been formed, as well as trained specialists in the field of information technology. World experience shows that work on the introduction of new technologies is successful where groups of scientists and practitioners of various specialties are created: soil scientists, agronomists, livestock breeders, engineers, economists and programmers (Table 7).

Table 7. The use of smart agriculture in advanced countries

Used forms of smart agricultural				
USA: 80% of American farmers use various precision farming technologies with high efficiency and profit	Germany: More than 60% of farms use this technology, both small farms and large enterprises	The Netherlands and Denmark: Precision farming is used to reduce feed costs for the livestock industry	Japan: plant growth models are used, as well as combines with automatic control, robots are operating	Brazil: Precision farming introduced 60% of agricultural land, with 11% increase in sown area, 10% increase in grain yield

Source: systematized by the author's based on research.

Smart farming, or precision farming, was originally associated only with precision farming, but in recent years precision farming has evolved into dynamic livestock – precision farming and its industries: precision dairy farming, precision pig farming and precision poultry farming.

Precision farming is a differentiated management of agricultural operations that provides constant control, reliability and reproducibility in agricultural production, which helps reduce costs, variability and increase predictability of results.

If we collected the top 10 innovations without which there could be no precision farming, it would look like this: satellite navigation systems, mobile devices, robotics, irrigation systems, Internet of Things, sensors, variable seeding rate, weather change monitoring, nitrogen monitoring in the soil, standardization.

Integrated precision farming is based on three components: informational, technological and scientific (Table 8).

Table 8. The main elements of precision farming

Basic elements of precision farming		
Information: yield characteristics, soil properties, requirements for fertilizers and plant protection products, yield data	Technology: traditional, intensive and innovative	Scientific management: combining the received information and available technologies into a holistic system

Source: systematized by the author's based on research.

Only through the use of precision farming did they become broader, more detailed and take into account all the many factors that affect crop yields: weather conditions, soil, its characteristics, including acidity, fertilizers, terrain, landscape, seeds, soil preparation technology sowing, sowing, planting and harvesting, differential fertilization, pest, weed and disease control chemicals and other factors. In general, the technology of precision farming includes the following stages of work:

- creation of an electronic field map;
- formation of a database by fields by area size, yield, agrochemical and agrophysical properties, level of plant development, etc.;
- conducting analysis using applications and issuing recommendations for decision development;
- download commands for decisions in the device on agricultural units for differentiated agricultural operations.

Appropriate technical means are required for the introduction of precision farming

technology:
- satellite navigation system that allows getting accurate information about the location and speed of any object;
- electromagnetic, infrared, ultrasonic sensors used to determine various parameters: grain yield, mineral content in the soil, its moisture, density, hardness, amount of biomass and type of weeds;
- modern on-board computer as a multifunctional information and control system that collects information recorded by sensors and stores it on a memory card, combined with electronic processors of agricultural machinery and implements;
- geographic information system (GIS) that serves to output information collected by sensors in a readable form.

GIS provides a cartographic component of the system of precision farming. GIS is based on multilayer terrain maps with the possibility of rasters (images, scanned maps, etc.) of vector maps (topographic base, field maps, thematic maps, etc.) and matrices (relief surface, soil quality, productivity, etc.). The maps are used to record agricultural land, agrochemical monitoring, visualize the movement of equipment and display the status of monitoring objects.

Precision farming system ensures safety, speed limits and targeted transport, optimize routes, control fuel consumption, improve the quality of technological operations, reduce operator fatigue, increase operator speed, reduce overlap and reduce production costs, operational collection and analysis of weather data, reduction the cost of mineral fertilizers and their rational use, as well as improving product quality.

In the new economic environment, increasing agricultural production and improving its quality can and should be ensured through lower specific consumption of resources. That is why saving resources and energy is considered one of the most effective ways to increase the efficiency of agricultural production. In this case, the most significant effect can be achieved by saving resources (fertilizers, pesticides, seeds, fuels and lubricants), reducing or replacing technological operations. As the analysis of the conducted researches shows, the maximum efficiency from realization of exact agriculture is reached at differentiated performance of all basic technological operations: tillage, sowing, fertilization, care of plants, harvesting.

In addition to reducing costs and increasing yields, precision farming allows equalizing the physical and agrochemical properties of the soil, the field acquires the correct shape, convenient for agronomic operations. In addition, differentiated feeding, where necessary, minimizes the impact on the environment. This is why the technology has become so widespread, especially in Europe.

A separate issue for identifying and obtaining efficiency, as well as benefits, should be considered a new system of production management when using technology with navigation equipment. Space and aerial photography opens up many new things for production management and not only provides an opportunity to increase crop yields. They present a visual picture of the condition of plants, field boundaries, operation of equipment, it's movement and show other important data. Precision farming technologies allow obtaining reliable information with the help of various remote sensors, for example, on the moisture content in the soil, the distribution of nitrogen fertilizers. The color of the plant mass and its condition can predict the yield of agricultural plants, determine the weediness of fields. Aerospace photography is especially important during periods of intensive sowing and harvesting. New technologies of precision agriculture allow managing production in a different way (Figure 10).

Fig. 10. Example of a cyberphysical system.
Source: systematized by the author's based on research.

If the digitalization of grain growing is a project for the whole country, it will increase production in Ukraine and Georgia by about 50% and increase exports by 53%.

Agricultural science and practice of agriculture, agricultural engineering should take into account global trends and achievements in agricultural engineering, which aim to reduce the specific energy costs of agricultural production and its costs (Figure 11.).

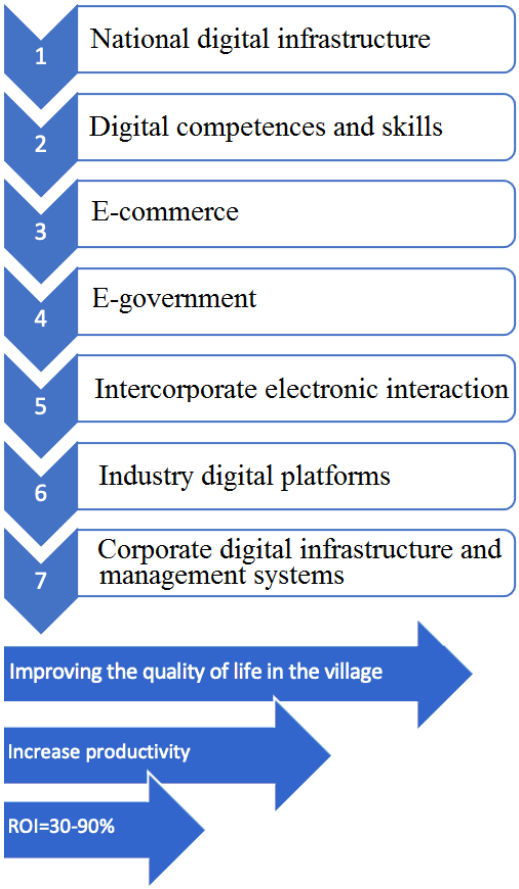


Fig. 11. The scheme of the process from the transformation of the object to the digitalization of the industry, related industries and the economy.
Source: systematized by the author's based on research.

Smart dairy farming is the use of technology to measure the physiological characteristics of the behavior and productivity of individual animals to improve farm management. In animal husbandry, there are RFID tags introduced to animals ensure the implementation of veterinary protocols, automatic collection of information about the work with livestock, while providing an individual approach to each unit of livestock.

Examples of precision or so-called smart dairy farming technologies include automatic milking machines, automatic calf feeding stations (feeders), automatic health monitoring for signs of illness, prevention of calving time and lameness. The use of these technologies is a great opportunity for dairy farming to improve farm management. Technological advances provide comfort and health to cows and improve the quality of life of farmers.

Autodrinker. Assessment of environmental conditions automatically allows determining the required amount of water. An automated drinking system frees up a significant amount of staff for more important work.

Automatic supply lines. It is possible to calculate the individual need for food for an individual. The feeding process can be increased to the recommended 6-8 times. In case of refusal of manual feeding, additional costs are not included in the cost of milk.

Integrated herd management system. Wi-Fi or 3G is used to monitor the herd. If something happens to the animal, the breeder receives an email with a recommended list of procedures for the animal within a month. In the near future, it is planned to switch to NFC tags to identify the animal and find out all the information without expensive scanners using tablets and smartphones.

Health and reproduction monitoring system. It is able to detect decreased appetite in individuals and reduce possible losses. It is also able to detect the onset of heating in cows for which acceleration sensors are used.

Shepherd robot. A team of engineers from the University of Sydney has created a four-wheeled semi-autonomous car that will be able to control its actions in the future. Thanks to 2D and 3D sensors, as well as GPS, the device determines where animals need to graze. One of the important qualities of a shepherd robot is speed: it is designed to move at the same pace as cows. The price of this work was announced at 1 million Australian dollars.

Precision farming, with the use of geographic information systems equipped with global positioning sensors, on-board computers, control mechanisms capable of differentiating agricultural technologies depending on the

soil cover, is a new stage in the development of agriculture. Precise animal husbandry is a new direction in animal husbandry, based on the introduction of digital technologies that allow individual care of animals based on the latest technologies for measuring the biological condition of animals.

CONCLUSIONS

For most countries the responses of our survey were acquired during the first wave of COVID-19. To be clear, the questions we ask do not refer specifically to issues related to the pandemic. Still, if technology is the most important tool in our battle against the pandemic, some of the trends we identify have an added significance. For 2020, economies that top our ranking focus on building their talent pool and thus strengthen the knowledge infrastructure necessary to develop and employ digital technology with Singapore, Switzerland, and the Netherlands holding the top three positions respectively.

In addition, most leading economies in our ranking provide an effective regulatory framework that enables the development and introduction of technologies. Singapore, Norway, UAE and Denmark capture the top four places in this sub-factor.

Finally, top performers in digital competitiveness also combine individual adaptability with business agility in their economies. The Republic of Korea, Denmark and the USA excel in the dimension of individual adaptive attitudes while Taiwan-China, the USA, the Republic of Korea and China capture the four highest places in the area of business agility. The traditional economy is strongly influenced by the electronic component of business relations, generates progressive forms of business processes, under the influence of which not only the structure of market entities changes, but also the technology for managing them. However, in the process of optimizing business processes, it is important to adequately assess the specifics of the introduction of digital technologies into business processes, and the current level of efficiency of their application is also potentially possible. The development of digital business processes at enterprises in Georgia and Ukraine will be facilitated, firstly, by the training of qualified personnel specializing in electronic communications; secondly, the development of new services for convenient delivery of online orders covering regions; thirdly, the development and improvement of electronic payment systems; fourthly, optimization of business processes in the field of logistics and sales.

Despite serious positive transformations in the field of digitalization, there are a number of relevant and significant unresolved industry problems:

- high costs at an early stage of information systems operation;
- high transaction and transformation costs associated with the transition to the use of digital technologies by all economic agents;
- disproportions between the industry's demand for highly qualified specialists and the training of relevant educational institutions that form professional competencies, which causes a shortage of professional personnel;
- lack of unified standards, technical regulations and relevant legal norms governing relations in the field of digital technologies;
- insufficient level of protection of digital technologies from unlawful encroachments.

Summing up the study, we can conclude that the digital economy in Ukraine and Georgia, despite a number of existing problems, is developing dynamically. Organizations in various sectors of the economy are beginning to actively implement digital solutions, taking into account the specifics of their activities. Innovations act as an engine of economic development, therefore, attempts are being made to find and create the most appropriate forms of organizational associations of innovatively active enterprises, alliances within which strong cooperative ties can be created. It becomes quite obvious the need for large-scale cooperation and coordination in the form of network interaction by participants in the innovation process, which provides them with a useful effect and corresponding competitive advantages.

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