Development and Use of Information and Digital Technologies at Ukrainian Enterprises

Marta Shkvaryliuk[1], *Liliana* Horal[2], *Inesa* Khvostina[2], *Alla* Maksymova[3], and *Vira* Shyiko[2]

[1]NBU, Editorial Department, 01001 Kyiv, Ukraine
[2]IFNTUNG, 76000 Ivano-Frankivsk, Ukraine
[3]Kryvyi Rih Vocational College of State University of Economics and Technology, 50000 Kryvyi Rih, Ukraine

Abstract. The paper considers the problems consider the problems of enterprises digitalization. Based on the research of the scientific literature, it is established that enterprises in the modern world need the active introduction of information and digital technologies to ensure the competitiveness of production and active development in the future. The analysis and assessment of the use and development of communication and information technologies by domestic enterprises is carried out. According to its results, it is established that the main areas of information and communication technologies implementation in domestic enterprises are cloud computing services, sources of "big data" for the analysis of "big data", 3D printing, external links to the Internet, own websites and electronic trade via the Internet, etc. It is determined that due to the rather intensive growth of the number of enterprises in the information and communication industry, the use of their developments in production is rather insignificant. Only 5% of enterprises during the study period used all the above information technologies in their activities. Based on the analysis, the problem areas of the process of implementation and development of communication and information technologies at domestic enterprises are identified and recommendations for improving the efficiency of information and communication technologies are provided. The MatLab Statistic Toolbox built into MatLab is used to determine the trends of the impact of digital innovations and the number of information and communication enterprises on GDP.

1 Introduction

The digital world evolves at a tremendous rate in the last decade. The development of the Internet, mobile communications and online services is a basic tool for shaping the digital economy. These processes affect all sectors of the economy and social activities, manufacturing, health care, education, finance, transport, and so on.

The increase in the efficiency of enterprises necessitates the optimization of the business process management system of the enterprise. This task cannot be solved today without the use of information systems and technologies, because the growth of information needs and the development of information services involves new priorities and requires the use of new management methods.

For Ukraine, it is absolutely necessary to move to an innovative model of enterprise development using the latest production technologies to realize the potential and effectively manage it. Ukrainian enterprises are undergoing significant transformations, in particular, they are taking place in the socio-economic system in recent years and cause significant changes in the definition of development priorities. This is especially felt in the IT sector, which is constantly evolving, using the latest information technologies, introducing new technology for enterprise management. Most companies understand the need for innovation in the strategy, but few manage to implement this area and bring it to a logical conclusion, paying considerable attention to the internal business processes of the enterprise and their optimization. The growth of information volumes, information uncertainty, the complexity of information management of business processes of the enterprise determines the use of the latest information technologies. In addition, many companies in connection with the COVID-19 pandemic have switched to remote work and most likely this model of domestic enterprises will remain in the near future as there is evidence that real resources are saved if the enterprises are skillfully and intelligently managed according to a well-established system and wise use of innovative information and digital technologies. Therefore, there is a problem of analysis and evaluation of the use and development of information and digital technologies in domestic enterprises, development of recommendations for improving the functioning of enterprises in modern conditions and forecasting GDP depending on the introduction of innovations in domestic enterprises and changes in the number of information and communication enterprises.

2 Literature review

The problem of the development and use of information and digital technologies in the enterprises

taking place in a society under the influence of digitization was considered by many authors: Berisha-Shaqiri Aferdita, Berisha-Namani Mihane [1], Thanos Papadopoulos, Konstantinos N. Baltas, Maria Elisavet Balta [2], Urbinati Andrea, Chiaroni Davide, Chiesa Vittorio and Frattini Federico [3], Melissa Liborio Zapata, Lamia Berrah, Laurent Tabourot [4], Robert Eller, Philip Alford, Andreas Kallmünzer, Mike Peters, Antecedents [5], Aijaz A. Shaikh, Ravishankar Sharma, Heikki Karjaluoto [6], Douglas Carl Engelbart, Joseph Carl Robnett Licklider, Richard Lipsey, Joseph Stiglitz [6], V. Soloviev, S. Semerikov, V. Solovieva [7], Horal Liliana, Korol Svitlana, Khvostina, Inesa, Shyiko Vira [8], Anders Olofsson, G. Fransson, J.O. Lindberg [9], V. S. Litvinenko [10], Ning Hu, Zhihong Tian, Hui Lu,Xiaojiang Du Mohsen Guizani [11], G. Mamonova, N. Maidaniuk [12], B. He, KJ. Bai [13], etc.

Berisha-Shaqiri, Aferdita & Berisha-Namani, Mihane in the work [1] present the importance of information technology in economy, computerization trends and the opportunities offered by this technology where consumers have quick and easy access on the global market, as well as in information about goods and services [1]. Scholars [2] have highlighted the role of Digital Technologies (DT) in enhancing productivity and performance in Small and Medium Enterprises (SMEs). However, there is limited evidence on the use of DT for dealing with the consequences of extreme events, such as COVID-19. They discuss this gap by outlining potential research avenues and reflecting on the managerial implications of using DT within SMEs to deal with the repercussions of COVID-19 and securing business continuity. Urbinati, Andrea, Chiaroni, Davide, Chiesa, Vittorio & Frattini, Federico [3] by adopting a capability-based perspective to identify the patterns of actions that firms have to deploy to use and implement a set of digital technologies in their innovation process, the paper [3] provides a map of enabled and enabling capabilities ensuing from and required for their use and implementation. From a methodological point of view, we conducted an exploratory multiple case study analysis, which involved a sample of eight companies operating in different industries and characterized by different size, market share and organizational structure [3]. The aim of paper [4] is to evaluates the facility of digital matureness models in their part of assisting producers of smart production in their digital conversion journeys and offer a set of recommendations to develop the usability of the toolbox in this scenario. To get off this, an evaluation of a extraction of seven matureness models is performed, using some design element to the special case of producers of smart production. In accordance with the most suitable findings, the propositions suggested for the formers are related to the ought for a wider area for the toolbox, a prescriptive state, and a wide business promising in the designation of their greatness. Confirmation of the suitability of the propositions in the small and medium business

scenario is also capable through an demonstration of the producer of the Arve Valley [4]. Drawing on the resource-based view, Robert Eller, Philip Alford, Andreas Kallmünzer, Mike Peters, Antecedents first search the effect of three key SME powers on digitalization: digital strategy, employee skills, information technology. Second, they assess the effect digitalization has on financial efficiency. We then search if digitalization intermediates the effect of powers on efficiency. The results of a review of 193 SMEs show how digitalization can effect SME efficiency, with the three powers positively relating to digitalization. And severally, digitalization importantly relates to performance, mediating the impact of information technology on realization. Nevertheless does't mediate the impact of digital strategy or employee skills on efficiency [5]. Scholars [6] have noted that digital innovation is transforming the technological landscape, entrepreneurial practices, and the behaviours, attitudes, and beliefs of consumers across the globe. This research note serves three purposes. First, it introduces digital innovation and enterprise as a fruitful area of research in the sharing economy. Second, it extends the agenda set by Yoo, Henfridsson, and Lyytinen (2010) on "new organising logics of Digital Innovation" to propose contemporary research questions for scholarly collaboration. Third, it attempts to move forward research in digital business from B2B, B2C, mobile-social contexts to emerging eco-systems that address current socio-economic trends. In proposing such a digital business research agenda, the authors reason why Action Design Research studies may be particularly suited for the iterative development, replication and sharing of findings in the form of artefacts such as use-cases [6].

3 Analysis and Methodology

Examining the dynamics of the number of economic entities from 2011 to 2019 (table 1, figure 1) we can conclude that during this period the total number of economic entities increases from 1600127 units in 2012 to 1941701 units in 2019, which indicates on the development of business activity in the economy. Calculating the number of enterprises by type of economic activity (table 1), we can determine that the largest share in the number of enterprises falls on those engaged in wholesale and retail trade; repair of motor vehicles and motorcycles and is 53% in 2012 and 43% in 2019. It should also be noted that in 2012 the next largest share of economic entities in the structure of the number of enterprises accounted for industrial enterprises and amounted to 7%, while in 2019 the second largest share of enterprises was occupied by economic entities engaged in information and telecommunication activity - 11%.

Figure 1 shows the dynamics of the number of enterprises by type of economic activity structure, excluding enterprises engaged in wholesale and retail trade; repair of motor vehicles and motorcycles.

Table 1. Number of business entities by type of economic activity in 2012-2019 years, units.

The type of economic activity	2012	2013	2014	2015	2016	2017	2018	2019
Agriculture, forestry and fishing	68497	71058	75660	79284	74620	76593	76328	75450
Industry	114028	121244	131491	135149	127069	123876	125859	130324
Construction	50830	52983	52189	55128	50208	50261	52531	56855
Wholesale and retail trade; repair of motor vehicles and motorcycles	843075	890658	988694	989064	910413	837797	818217	834159
Transportation and storage	87252	92366	111807	119037	109334	95815	90591	96235
Accommodation and food service activities	44085	52077	57553	58436	57696	57578	61761	69689
Information and communication	66568	86377	114355	116136	129704	146909	174622	206147
Financial and insurance activities	10342	11069	11888	12381	11865	10290	9739	10086
Real estate activities	81726	92013	97794	94077	90921	90553	93383	98361
Professional, scientific and technical activities	87431	97052	115123	131035	125133	121546	126100	134800
Administrative and support service activities	38769	40191	44144	47361	45988	46553	49206	53787
Education	7317	8467	10117	10873	11077	11656	13241	15429
Human health and social work activities	16479	18048	21114	21683	21583	22085	24961	30994
Arts, entertainment and recreation	9238	11620	13523	14887	13873	13045	13797	15168
Other service activities	74490	76847	86709	89908	86147	100587	109336	114217

Source: formed by the author on the basis of [15]
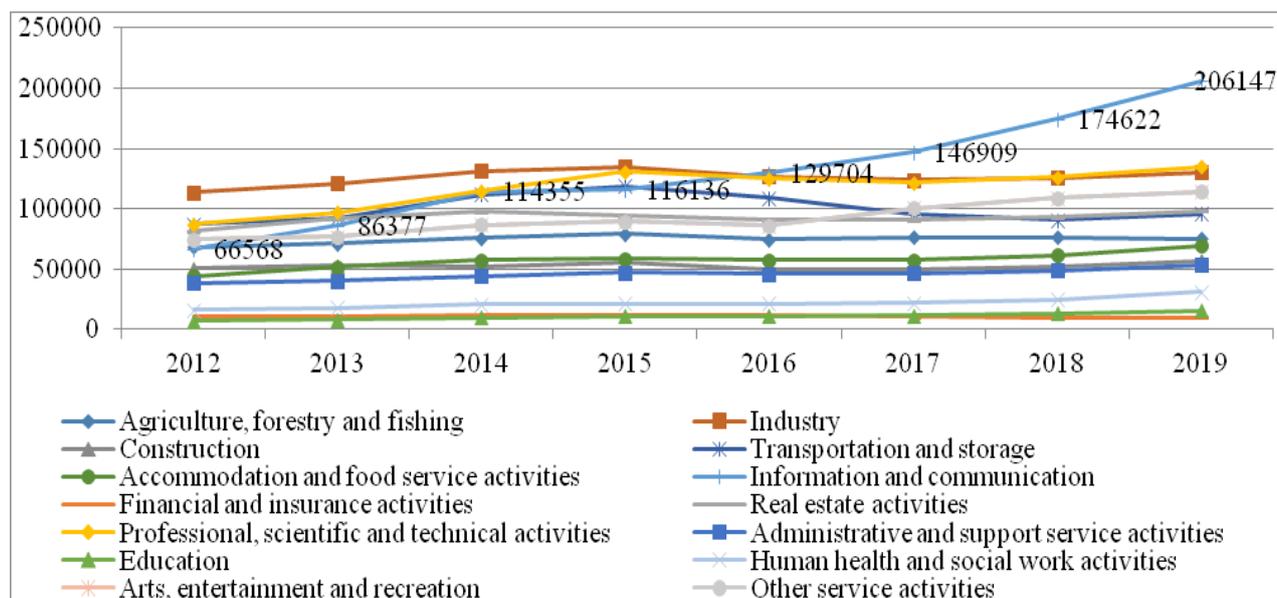
Fig. 1. Dynamics the number of business entities by type of economic activity in 2012-2019 years, units.

Source: built by the author

Thus, the growth of the share of enterprises engaged in information and telecommunications

activities from 4% in 2012 to 11% in 2019 indicates the formation of active demand for their services and favorable conditions for their operation (figure 2).

The results of calculating the dynamics of the number of business entities during the analyzed period showed that at the end of the period the number of enterprises engaged in information and telecommunications activities grew most intensively. There was an increase in their number by 210% compared to the base year 2012 (figure 3). The number

of enterprises engaged in educational activities increased by 111% in 2019 compared to the base year 2012 and the number of enterprises in the field of health care and social assistance increased by 88%. In general, we can note an increase in the number of enterprises in almost all activities, except wholesale and retail trade, repair of motor vehicles and motorcycles and financial and insurance activities, the number of which during the study period decreased by 1% and 2% respectively in 2019 compared to 2012.
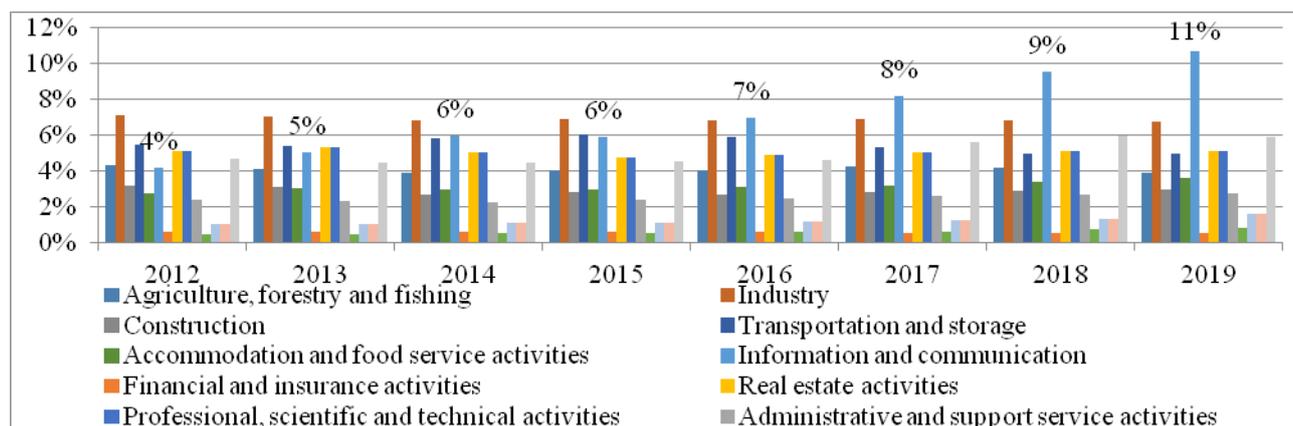

Fig. 2. Share of business entities by type of economic activity in total in 2012-2019 years, %.

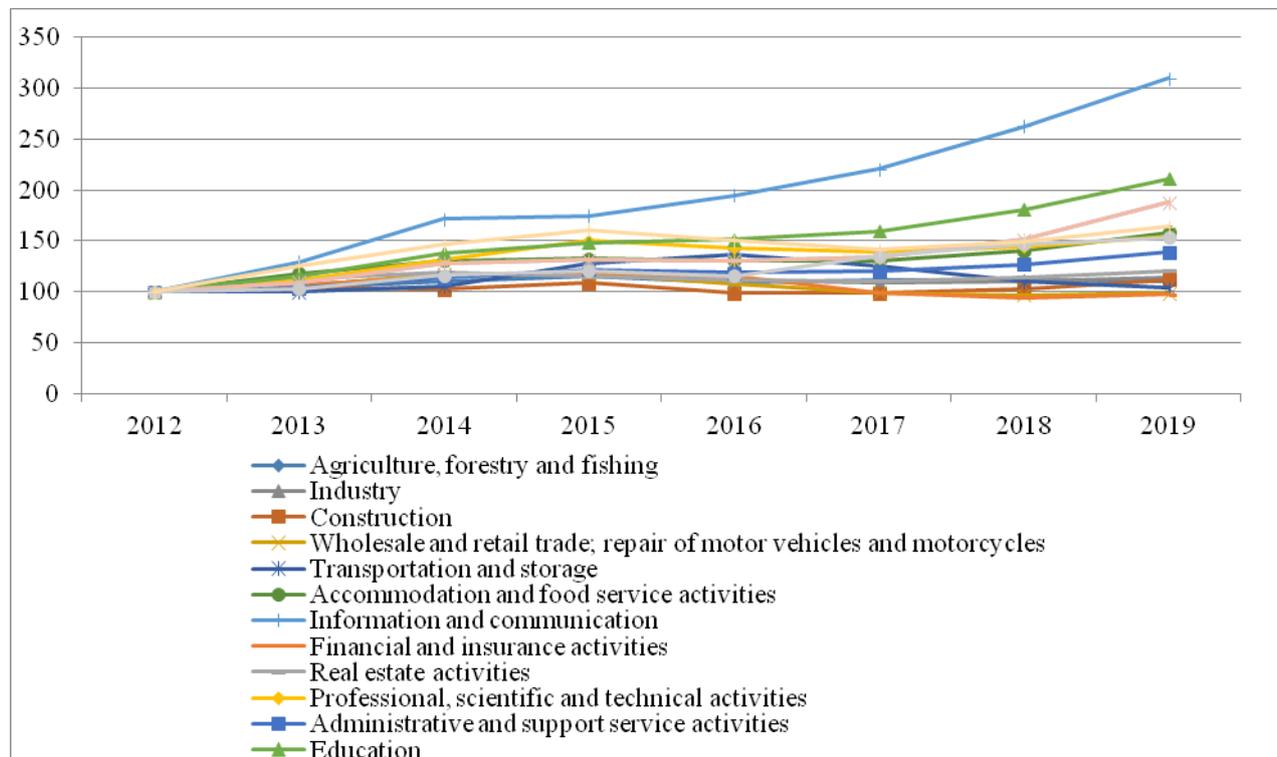*Source: built by the author*

Fig. 3. Dynamics of number business entities by type of economic activity in total in 2012-2019 years, %.

Source: calculated and built by the author

According to the information provided on the website of Ukrstat for the period from 2017 to 2019, statistical observations are conducted on the intensity of the information and communication technologies

usage at domestic enterprises. Thus, according to the observations, domestic enterprises in their activities use cloud computing services, sources of "big data", 3-D printing, information and communication

technologies to provide invoices, carry out e-commerce via the Internet, actively establish external communication with the Internet and develop their own sites.

The use of these information and digital technologies and other types is a time requirement, which is declared in key documents: Industry 4.0 and domestic regulationsFor industrial enterprises, the transition to a digital economy has been defined as Industry 4.0 - the fourth industrial revolution. The use of the latest information technologies in business, economics, public administration and other fields is an extremely necessary condition for effective development. If this condition is not met at the appropriate level, there will be a slowdown in development and there will be an opportunity to get into the ranking of lagging behind and ineffective. The EU pays great attention to the development of the digital economy, believing that the level of the continent's economy will depend on how efficiently companies use digital technologies. Businesses that are not integrated into the digital space will not belong to the World Market.

Modern information technologies are computer processing of information according to pre-developed algorithms, storage of large amounts of information on various media, analysis and visualization of data and transmission of information at any distance in the shortest possible time. A new era has come - the era of "Big data" and "Data mining". 3D printers using viscous plastic instead of ink are becoming widespread. When working with a digital file, a 3D printer can "build" a three-dimensional object by printing out its "layers" in turn.

That is why in economics and business, information technology is used to process, sort and aggregate data, to organize the interaction of process participants and computers, to meet information needs, for operational communication at all stages and phases of the life cycle of the organization. In general, modern business to ensure a competitive position solves a threefold strategic task: first, it is necessary to establish closer relationships with suppliers and customers; secondly, to increase the level of own operational efficiency; third, to increase the competitiveness of products.

Table 2 shows the distribution of the number of enterprises by types of modern information and communication technologies used. Judging by the data given in Table 2, most domestic enterprises use external communication with the Internet in their activities. At the beginning of the study period, 39,528 companies were Internet users and their number increased to 43,758 units in 2019. The growth rate of enterprises using the Internet is about 10% per year. It should be noted that the largest number of enterprises that have used this technology is in the processing industry, wholesale and retail trade; repair of motor vehicles and motorcycles and their number increases annually during the study period. In their activities, most companies use fixed broadband Internet access.

An important trend is the development and use of companies' own websites. In 2017, 16,240 companies

had their own websites and their number grew every year, and in 2019 it was already 17,856 companies, which indicates a 10% increase in the number of companies that have their own websites.

Table 2. The use of different types of information technologies in domestic enterprises

The type of information technologies used by enterprises	2017	2018	2019	Growth rates	
				2018/ 2017	2019/ 2017
Cloud computing services	4135	4831	5207	116,83	125,93
Sources of "big data" for the analysis of "big data"	10252	9188	9280	89,62	90,52
3-D printing		1219	1471	100,00	120,67
E-commerce via the Internet	10764	12059	12609	112,03	117,14
External connection to the Internet	39582	43303	43785	109,40	110,62
Own website	16240	17522	17856	107,89	109,95

Source: formed and calculated by the author on the basis of [15]

The next information and communication technology used by domestic enterprises is e-commerce via the Internet. And as can be seen from the table in 2017, this information and communication technology was used by 10,764 companies, there is an annual increase in the number of companies using this technology, namely in 2018 their number increased by 12.03% and amounted to 12059 units, and in In 2019, the growth rate was 117.14% of the base period, equal to 12,609 users. Over the past two years, there has been an increase in the volume of sold products (goods, services) received from trade through websites or applications from 228035634.7 thousand UAH in 2017 to 292731939.1 thousand UAH. in 2019, which is respectively 3.5% and 4.5% of the total sales of products (goods, services) of enterprises. It should also be noted that a larger number of domestic enterprises purchased goods or services via the Internet (except for orders sent by e-mail). Whereas the number of enterprises that received orders via the Internet for the sale of goods or services (excluding orders received by e-mail) was 2476 units in 2018 and 2440 units in 2019.

The trend of using "big data" sources for "big data" analysis is positive. Although at the end of the study period the number of enterprises that used this technology decreased compared to the base year 2017, but compared to the previous period their number increased from 9188 enterprises 2018 to 9280 enterprises in 2019. If we consider the distribution of the number of enterprises by sources of "big data"

usage (Table 3), most companies analyze the "big data" using data obtained from smart devices or sensors. In 2017, the number of such enterprises was 3194 units, during the study period, their number decreased and in 2019 amounted to 2896 units, which is 10% less than the base period. During the study period encreases the number of enterprises that analyzed the "big data" based on geolocation data obtained from portable devices. At the beginning of the study period, their number was 1584 companies, and in 2019 their number increased by 18.31% and amounted to 1874 companies. Another source of "big data" is social media, which were used by 1,659 businesses at the beginning of the period, and at the end of the analyzed period their number decreased slightly and amounted to 1,600 companies in 2018 and 1,658 companies in 2019. To determine which companies are the most active "big data" users, a diagram was constructed with the distribution of the number of companies by industry. (Table 3).

As can be seen from Figure 4, the largest users of "big data" are enterprises in the processing industry (23.02%), wholesale and repair of motor vehicles and motorcycles (25.99%), construction (9.32%), transport, warehousing, postal and courier delivery (9.20). In general, domestic enterprises analyze "big data" on their own (71.5%).

Table 3. Number of enterprises that conducted "big data" analysis, according to "big data" sources

"big data" sources	2017	2018	2019	Growth rates	
				2018/ 2017	2019/ 2018
The data obtained from smart devices or sensors	3194	2917	2896	91,33	90,67
Geolocation data obtained from portable devices	1584	1697	1874	107,13	118,31
The data generated from social media	1659	1600	1658	96,44	99,94
Other sources	3815	2974	2852	77,96	74,76

Source: formed and calculated by the author on the basis of [15]

Cloud computing services were used by 4135 enterprises at the beginning of the analyzed period, it should be noted that in 2019 the number of such enterprises increased by a quarter and amounted to 5207 business entities.
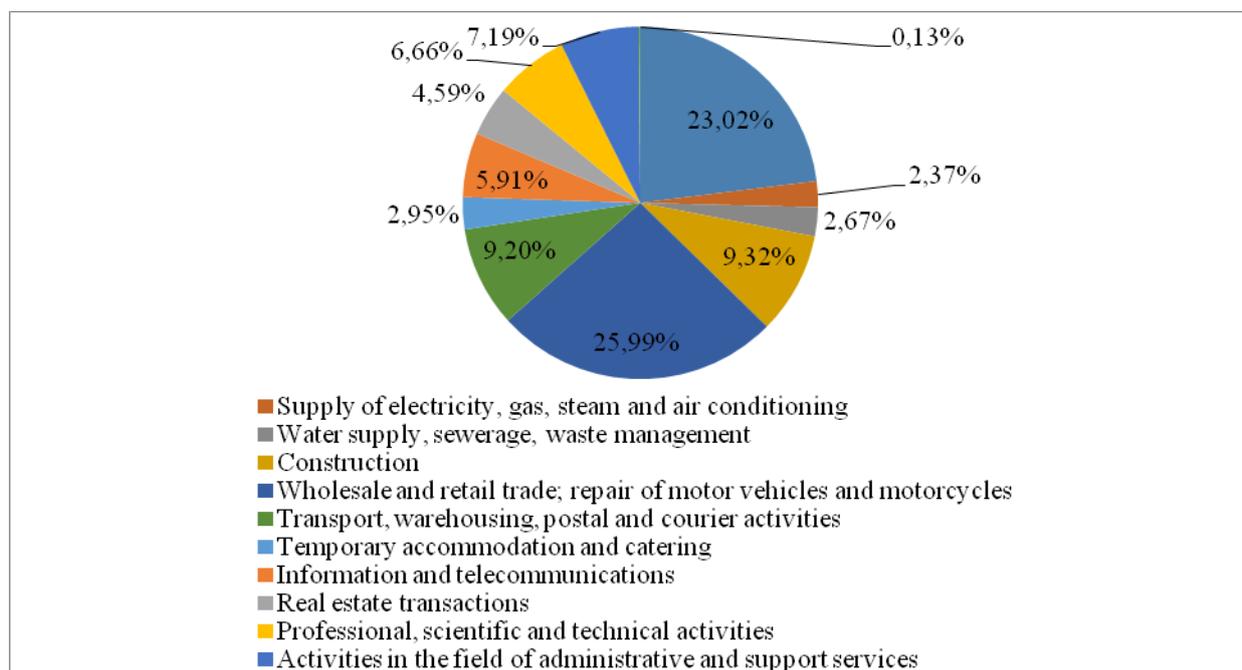
Fig. 4. Distribution of enterprises according to the level of "big data" usage in 2019

Source: built by the author

Examining the statistics of the types of cloud computing that enterprises use in their activities (Table 4), we can conclude that their number is growing every year. According to the information provided in Table 4, increases the number of enterprises purchasing file

storage services from 1447 business entities in 2017 to 2139 in 2019 is growing the most, which is 47.82% more than in the base period. At the end of the period, the number of enterprises purchasing a database of enterprises increased by 40.92%, if in 2017 the number

of such enterprises was 1449, in 2019 there were already 2042 business entities.

The number of enterprises that use customer relationship management programs in their activities is growing from 1,050 businesses in 2017 to 1,453 in 2019, which is 38.38% more than the base period. The number of enterprises purchasing e-mail services increased by 36% in 2019 and amounted to 2,972 business entities against 2,175 enterprises in 2017.

Table 4. Distribution of the number of enterprises that used cloud computing services in 2017-2019, units
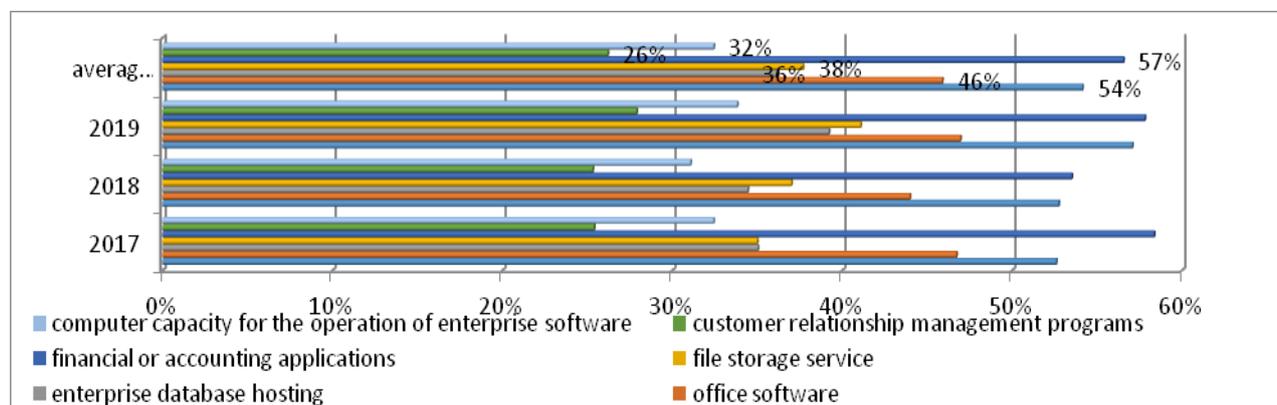
Types of cloud computing services	2017	2018	2019	Growth rate	
				2018/ 2017	2019/ 2017
Email	2175	2548	2972	117,2	136,6
Office software	1932	2125	2445	110,0	126,6
Enterprise database hosting	1449	1664	2042	114,8	140,9
File storage service File storage service	1447	1788	2139	123,6	147,8
Financial or accounting applications	2413	2585	3010	107,1	124,7
Programs for customer relationship management	1050	1223	1453	116,5	138,4
Computer power for the operation of enterprise software	1341	1501	1761	111,93	131,32

Source: formed and calculated by the author on the basis of [15]

On average, during the study period, 57% of enterprises in their activities purchased financial or accounting applications, 54% - e-mail services, 46% - office software, 38% - file storage services, 36% - file storage hosting, 32% - computer power for the operation of enterprise software and 26% - programs for relationship management.

Examining the statistics of the types of cloud computing that enterprises use in their activities (Table 4), we can conclude that their number is growing every year. According to the information provided in Table 4, increases the number of enterprises purchasing file storage services from 1447 business entities in 2017 to 2139 in 2019 is growing the most, which is 47.82% more than in the base period. At the end of the period, the number of enterprises purchasing a database of enterprises increased by 40.92%, if in 2017 the number of such enterprises was 1449, in 2019 there were already 2042 business entities. The number of enterprises that use customer relationship management programs in their activities is growing from 1,050 businesses in 2017 to 1,453 in 2019, which is 38.38% more than the base period. The number of enterprises purchasing e-mail services increased by 36% in 2019 and amounted to 2,972 business entities against 2,175 enterprises in 2017. Given the fact that domestic enterprises are actively using information and communication technologies, there is a growing need to increase computer capacity for the operation of enterprise software, so the statistics in Table 4 indicate that during the study period, the number of enterprises that increased computer capacity from 1341 enterprises in 2017 to 1761 in 2019, which is 31.32% more than the base period. At the end of the period, the number of enterprises purchasing office software increased by 26.55% from 1,932 enterprises in 2017 to 2,445 in 2019. There is an annual growth of enterprises that use financial or accounting applications in their activities, namely, if in 2017 their number was 2413, then in 2019 their number increased by 24.74% and amounted to 3010 businesses. Figure 5 shows the shares of enterprises in the total number of enterprises (4135 in 2017, 4831 - in 2018, 5207 - in 2019) by types of cloud technologies used in their activities.

Fig. 5. Shares of enterprises in the total number of enterprises by types of cloud computing used in their activities.

Source: built by the author

The most active users of cloud computing services during the analyzed period were wholesale and retail enterprises; repair of motor vehicles and motorcycles and the manufacturing industry account for an average of 28.10% and 23.16%, respectively (Table 5). 9.88% of construction companies use cloud computing in their activities. From 7% to 6% of enterprises in the field of professional, scientific and technical activities, information and telecommunications, administrative and support services, transport, warehousing, postal and courier activities use cloud computing services. In other industries, less than 5% of enterprises use cloud computing in their activities (Table 5).

An important component of the of domestic enterprises development in the context of active digitalization is the development and use of their own websites to improve their activities. According to the analysis, it can be concluded that at the beginning of the study period, 16,240 companies had their own websites, and in 2019 they became 9.95% more, ie 17,856 (Table 2.). The largest share of the enterprise on average for the studied period, which have developed websites, falls on the processing industry (30.14%) wholesale and retail trade; repair of motor vehicles and motorcycles (26.26%). In all other activities, less than 10% of businesses have their own websites.

Thus, according to the data in Table 6, it can be concluded that the examined enterprises were mainly used for customer service (47% of the surveyed enterprises). 46% of elaborated companies use sites to quickly find them on social media. In 30% of companies, websites advertise vacancies or apply for vacancies online. 29% of the websites of enterprises are formed in such a way that visitors have the opportunity to form orders for goods and services online and in 26% of cases the sites have the ability to monitor the status of placed orders.

18% of the surveyed companies have the opportunity to supply products and services online on websites.

In less than 15% of companies, the developed websites have a personalized content of the website for regular or repeat customers and have the opportunity to

train staff. Positive is the growing trend of all opportunities to use websites.

Table 5. Distribution of enterprises from their total number by types of economic activity that use cloud computing in their activities in 2017-2019

Type of economic activity	2017	2018	2019	average
Processing industry	22,47%	23,27%	23,74%	23,16%
Supply of electricity, gas, steam and air conditioning	1,86%	1,51%	1,71%	1,69%
Water supply; sewerage, waste management	2,08%	1,76%	2,07%	1,97%
Construction	9,72%	10,02%	9,89%	9,88%
Wholesale and retail trade; repair of motor vehicles and motorcycles	28,17%	28,48%	27,64%	28,10%
Transport, warehousing, postal and courier activities	6,63%	6,13%	6,28%	6,34%
Temporary accommodation and catering	2,85%	2,71%	2,98%	2,85%
Information and telecommunications	6,89%	6,91%	7,32%	7,04%
Real estate transactions	4,43%	4,33%	3,99%	4,25%
Professional, scientific and technical activities	7,47%	8,07%	8,07%	7,87%
Activities in the field of administrative and support services	7,23%	6,54%	6,16%	6,65%
Repair of computers and communication equipment	0,19%	0,27%	0,15%	0,21%

Source: formed and calculated by the author on the basis of [15]
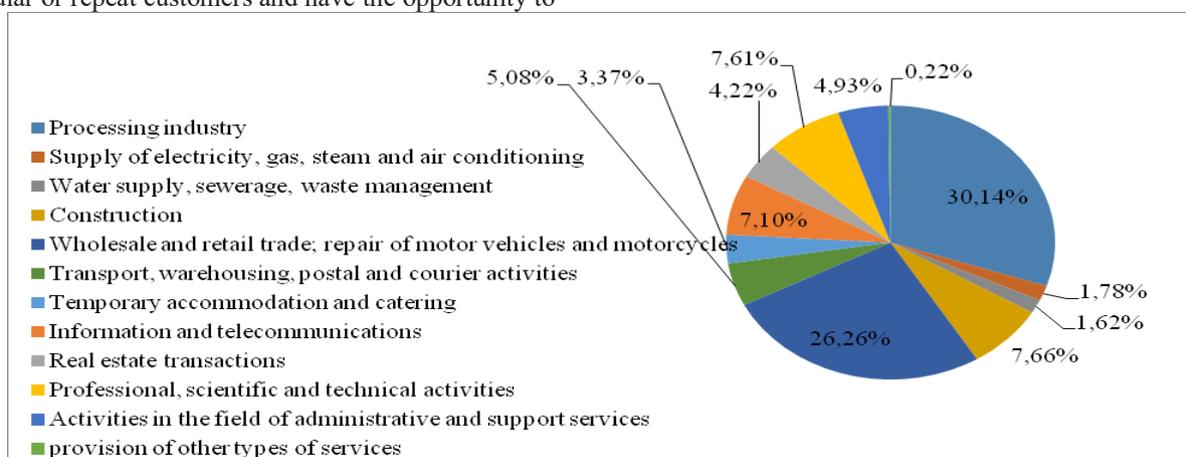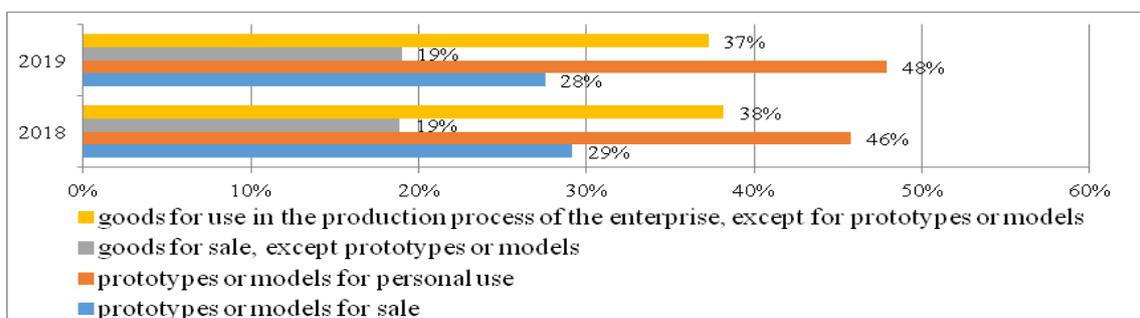

Fig. 6. Distribution of enterprises (on average for the study period) from their total number by type of economic activity, that have their own websites

Source: built by the author

Table 6. Distribution of enterprises according to the capabilities provided by the developed website.

Possibilities of using websites	2017	2018	2019
customer service	46%	47%	47%
delivery of products and services online	17%	18%	18%
the ability of visitors to place orders for goods and services online	27%	29%	29%
monitoring the status of placed orders	25%	26%	26%
personalized content of the website for regular or repeat customers	25%	12%	12%
links to the company's website on social media	42%	46%	46%
vacancy announcements or applications for vacancies online	28%	30%	30%
staff training	10%	11%	11%

Source: formed and calculated by the author on the basis of [15]

Domestic enterprises actively use 3D printing technology in their activities. Official statistics on the number of enterprises since 2018. And as shown in table 2 in 2018, 1219 companies used 3-D printing in their activities, and in 2019 there were 1471. And it should be noted that 52% of the examined companies carried out 3-D printing with their own 3-D printers, and the remaining 48% of enterprises used 3D printing services provided by other enterprises. The uses of 3-D printer products are shown in Figure 6.

According to the results of statistical surveys (Figure 7) in 2019, 48% of enterprises used printed prototypes and models for their own use, 37% of enterprises - printed on 3-D printer products for use in the production process, 28% of enterprises used printed prototypes or models for sale and 19% of businesses used 3-D printers to print goods for sale, except for prototypes or models. About 40% of manufacturing enterprises use 3D printers in their activities, less often they are used by those enterprises that repair computers and communication equipment.

Fig. 7. Areas of products printed by 3-D printers usage

Source: built by the author

Having studied the processes of development and use of information and digital technologies at domestic enterprises, there is a need to determine the dependence of GDP on the number of enterprises that use information and digital technologies in their activities.

We will solve this problem in the MatLab environment. First, we form a matrix of input data and calculate the correlation coefficients using the function "corrcoef" (Table 7).

Next, we use the function regards (responses, DATA, 'model'), which is designed to calculate the parameters of the multiple regression model for the vector of the dependent variable responses values, the matrix of independent variables DATA, regression model 'model' . The function displays a graphical window with a set of statistics that are used to assess the quality of the multiple regression models. To select, it is necessary to note the relevant notes. Selected statistics with specified variable IDs will be calculated and exported to MATALAB (figure 8).

Table 7 Input date to determine the dependence of GDP on the number of enterprises that use information and digital technologies in their activities

Year	The share of the number of enterprises that implement information innovation, % (x2)	Information and communication (x1)	GDP, mln. UAH. (Y)
2012	13,6	66568	1 404 669
2013	13,6	86377	1 465 198
2014	12,1	114355	1 586 915
2015	15,2	116136	1988544
2016	16,6	129704	2385367
2017	14,3	146909	2 983 882
2018	15,6	174622	3 560 596
2019	13,8	206147	3 974 564

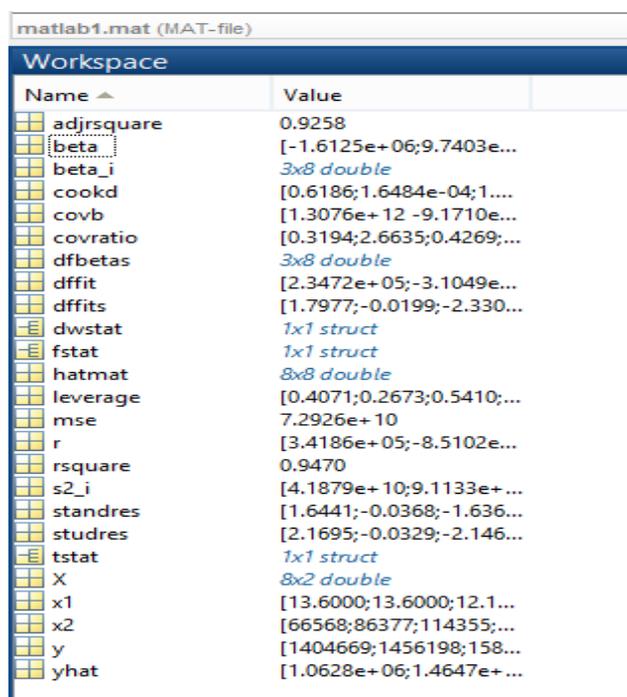Source: formed and calculated by the author

```
>> x1=[13.6 13.6 12.1 15.2 16. 14.3 15.6 13.8]';
>> x2=[66568 86377 114355 116136 129704 146909 174622 206147]';
>> y=[1404669 1456198 1586915 1988544 2385367 2983882 3560596 3974564]';
>> X=[x1 x2];
>> R = corrcoef([y X])

R =

    1.0000    0.3916    0.9656
    0.3916    1.0000    0.2860
    0.9656    0.2860    1.0000
```

Fig. 8. Input date

Source: calculated by the author

Name ▲	Value
matlab1.mat (MAT-file)	
Workspace	
adjrsquare	0.9258
beta	[-1.6125e+06;9.7403e...
beta_i	*3x8 double*
cookd	[0.6186;1.6484e-04;1....
covb	[1.3076e+12 -9.1710e...
covratio	[0.3194;2.6635;0.4269;...
dfbetas	*3x8 double*
dffit	[2.3472e+05;-3.1049e...
dffits	[1.7977;-0.0199;-2.330...
dwstat	*1x1 struct*
fstat	*1x1 struct*
hatmat	*8x8 double*
leverage	[0.4071;0.2673;0.5410;...
mse	7.2926e+10
r	[3.4186e+05;-8.5102e...
rsquare	0.9470
s2_i	[4.1879e+10;9.1133e+...
standres	[1.6441;-0.0368;-1.636...
studres	[2.1695;-0.0329;-2.146...
tstat	*1x1 struct*
X	*8x2 double*
x1	[13.6000;13.6000;12.1...
x2	[66568;86377;114355;...
y	[1404669;1456198;158...
yhat	[1.0628e+06;1.4647e+...

Fig. 9. Statistics with specified variable IDs
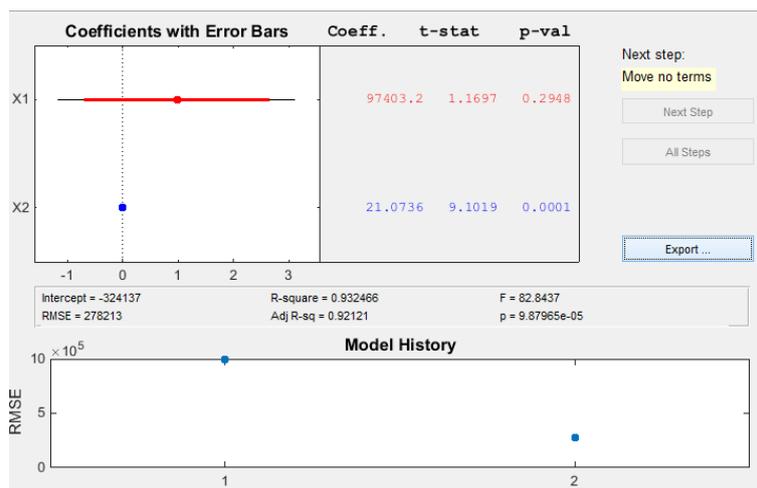
Source: formed and calculated by the author

According to the results of statistical processes, the following regression model was obtained:

$$Y=-1612467,74+20,29*x_1+97403,15*x_2 \qquad (1)$$

Based on the characteristics given in Figures 8 and 9, it can be concluded that the formed model is adequate as the statistical characteristics are within acceptable limits. Thus, if the share of the number of enterprises that innovate increases by 1%, GDP will increase by 20.29 million. UAH under other constant conditions. If the number of enterprises in the information and communication industry increases by 1%, GDP will increase by UAH 97,403.15 million. However, examining the correlation between dependent and independent variables, it can be concluded that there is not a close relationship between the GDP function and the share of the number of enterprises that innovate, so it is necessary to conduct a stepwise regression using the stepwise function.

The results of the implementation of this function are shown in Figure 10. To do this, we should implement a step-by-step regression algorithm with the exception of variables (stepwise function), given that the equation should include only one of the closely related variables.

Fig. 10. Coefficients with Error Bar

Source: formed and calculated by the author

According to the results of the statistical processes, the following functional dependence was obtained:

$$Y = -324137 + 21.0736 * x_1 \qquad (2)$$

After the implementation of the step-by-step regression process, it can be concluded that the increase in the number of enterprises in the information and communication sphere by 1 will lead to an increase in GDP by UAH 21.0736 million.

4 Conclusions and recommendations

After conducting a study of the development of industries, it was found that during the study period, the total number of businesses is growing, which indicates a revival of economic activity by the end of 2019. The largest growth rate of the business entities number is characterized by the information and communication industry, the growth rate of their number was 11% at the end of the period. Which indicates the intensification of the information and digital technologies development and, their introduction into the activities of economic entities? Therefore, there is need to assess the level of information and communication technologies usage in domestic enterprises. Research has shown that domestic companies use cloud computing services, big data sources to analyze big data, 3D printing, external links to the Internet, their own websites and e-commerce through the network, Internet, etc. The most intensive use is usually external communication with the Internet, but only 20% of Ukrainian enterprises had the maximum speed of a fixed broadband connection (from Mbps and more) to the Internet. This problem indicates the need to increase the speed of a fixed broadband connection (from 100 Mbps and more) to the internet. Regarding websites, only 35% of domestic enterprises had their own websites; the main areas provided by the company's own websites were customer service and the implementation of electronic links to company profiles on social media. This situation indicates rather undeveloped directions of this information communication technology, so it is necessary to expand the functionality of websites developed in enterprises. However, e-commerce is developing quite intensively, however, only 20% of the total number of enterprises purchased goods or services via the Internet and only 5% of domestic enterprises received orders via the Internet to sell goods or services. Therefore, e-commerce should be intensified. The positive point is the use of "big data" sources for the analysis of "big data" in the activities of domestic enterprises. However, in the realities of domestic enterprises, only 5-6% of enterprises analyze the "big data". Regarding cloud computing, only 10% of enterprises purchase cloud computing services, which accordingly indicates the need to develop this area of information and communication technologies.

Studies of the relationship between GDP and the number of enterprises in the information and communication industry have shown that there is a close relationship between the resulting and factorial feature, and the above equation (2) is adequate and can be used for forecasting.

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