
**DIGITALIZATION AS A VECTOR OF INFORMATION SYSTEMS
DEVELOPMENT AND ACCOUNTING SYSTEM
MODERNIZATION**

Lyudmyla Chyzhevska*

Department of Information Systems in Management and Accounting, Zhytomyr Polytechnic State University, Ukraine

Email: chizhev@ztu.edu.ua

Lidiia Voloschuk

Department of Accounting, Analysis and Audit, Odessa Polytechnic State University, Ukraine

Email: l.a.voloschuk@gmail.com

Liubov Shatskova

Department of Accounting, Analysis and Audit, Odessa Polytechnic State University, Ukraine

Email: lyubash18@ukr.net

Liudmyla Sokolenko

Department of Business-Economic and Administration, Sumy State Pedagogical University, Ukraine

Email: sokol1207@ukr.net

(Received: April 2021; Accepted: July 2021; Published: October 2021)

Abstract: Digitalization causes structural changes in the economic sectors and influences business activity and processes, leading to the companies' increased productivity, competitive advantages and effective development creation and consolidation. This article is purposed to substantiate that the economy digitalization entails the need for companies' system and mechanisms modernization to ensure their competitiveness and to improve management systems. The research is conducted using methods of theoretical generalization, analysis, synthesis, comparison and grouping. This study resulted in defining both global and Ukrainian economies' trends for digitalization with a description of its impact on the business activity and business processes, assessing the economy digitalization effects to the requirements for the company's information system that therefore serves to establishing directions for its modernization through the introduction of digital technologies, such as Electronic Data Interchange, Extensible Business Reporting Language, BigData, Internet of Things, Robotic Process Automation, Artificial intelligence, Real-time Adherence, cloud technologies, blockchain. The directions of companies' accounting digitalization implementation and development are as flows: changes in the

* Corresponding author: Lyudmyla Chyzhevska. *E-mail: chizhev@ztu.edu.ua*

Copyright © 2021 The Author(s). Published by VGUW Press

This is an Open Access article distributed under the terms of the Creative Commons BY 4.0 license (Creative Commons — Attribution 4.0 International — CC BY 4.0) which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited

Chyzhevska, L., Voloschuk, L., Shatskova, L., Sokolenko L. (2021)

Digitalization as a vector of information systems development and accounting system modernization

accounting system in terms of its method elements; application of Assets, Liabilities and Capital new digital forms; advanced training in compliance with the requirements for the accounting personnel digital competencies.

Keywords: digitalization, digital technologies, accounting, information systems, IT industry.

JEL Codes: M15, M41, O33.

1. Introduction

Digitalization is a prerequisite for global social transformations that determines the modern business development path and provides unprecedented opportunities to create value based on its virtualization. It is a logical society development stage that in the sphere of economic relations is manifested in the Industry 4.0 concept. Increasingly, various countries' strategic plans do mention the need to build a digital society, to develop a digital economy, which characteristic signs refer to the virtualization of all socio-economic, educational, social and political processes. Business leaders in all economic sectors are facing these transformations' strategic consequences and the digital technologies development does change the business itself, virtualizing value chains and changing the nature of the interaction between business and its stakeholders.

There is no consensus on what exactly should be understood by the digitalization of the economic sector as not only the technologies for data obtaining, accumulating and processing but the companies' organizational structure also is constantly being improved, keeping in mind that both these technologies and structure are far from being homogeneous. But the digital economy's characteristic feature and essential goal refer to the same optimization striving. Digitalization is associated with the use, along with traditional IT tools, of new technologies that have become widespread not so long ago: artificial intelligence, robotization, "cloud technologies, blockchain.

The IT industry ensures society digitalization so its role coincides with the main factor in information and digital technologies use in all spheres of society's life. It should be noted that IT still being a relatively young industry in the Ukrainian market, it already reached within a few years period the achievements that led to the existing companies' activities renewal and reorientation, as well as to the creation of a large number of new IT-companies and this new direction specialists generation emergence.

The Ukrainian business is still at the early beginning of its digitalization path. The biggest hindrance that Ukrainian companies face while the digitalization process is the lack of skills or resources to manage and implement IT systems. The current crisis does shorten deadlines and forces businesses to accelerate digitalization

Chyzhevska, L., Voloschuk, L., Shatskova, L., Sokolenko L. (2021)

Digitalization as a vector of information systems development and accounting system modernization

because there is no other way to be competitive in the global market. To be successful, one needs to be fast and flexible changing not just at some opportunity occurrence, but when there is a need to modernize the companies' system and mechanisms.

2. Literature review

According to Y. Onyshchenko (2018), "All research in the field of "digital economy" can be divided into three main periods: the first (1995-2001), when the scientific idea about the "digital economy" concept essence and basic innovations have been formed; the second (2010-2016), when this category was approved at the legislative level; the third (current, since 2016), at which fundamental theoretical research is conducted on the "digital economy" concept essence". In this regard, we should recall the experience of new industrial countries such as Hong Kong, Singapore, Taiwan, etc. In this case, digitalization has covered both manufacturing processes and the services sectors, especially the financial sector and the information and telecommunications sector.

An important vector in society digitalization is the public services digitalization (i.e. the electronic public services distribution). These issues have been explored by Margetts H., Dunleavy P. (2002), Buyya R., Ranjan R., Calheiros R.N. (2010), Axelsson K., Melin U. (2012), Lindgren I., Jansson G. (2013) and others. An important vector of economic digitalization refers to the management information systems modernization, in particular the accounting system, this one the most relevant considering herein studied problems. These issues have been explored by Cambridge J. (2018), Ashok M., Abhishek N., Divyashree M. (2019), Gietzmann M., Grossetti F. (2019), Shkulipa L., Maluga N. (2020), Geddes B. (2020), Bezruchuk S., Lozynskyi D. (2020), Schoenfeld J. (2021) and others. Their scientific views become the basis for identifying this study's problematic issues so we shall consider them in more detail.

3. Methodology and empirical data

Based on socio-economic imbalances and economic development asymmetries, there is a need for additional research of differentiation by the network technologies level and cloud services availability to the individuals and companies (see table. 1).

To achieve the research objectives, we use the World Bank data, structuring countries by regions (that allows to assess the population online activity geographical segmentation), by income level (that indicates the countries' difference by service accessibility feature that represents different levels of national income), as well as by the economic development level (based on the assumption that the economic system maturity is closely related to the availability of the

Chyzhevska, L., Voloschuk, L., Shatskova, L., Sokolenko L. (2021)

Digitalization as a vector of information systems development and accounting system modernization

Internet). Special attention should be paid to countries' classification by demographic dividends, because namely this parameter development stage is determined by the population's age structure, availability of education and the return on productivity growth, which is stimulated, among other factors, by the business processes automation and digitalization.

Table 1 Tasks and information - the methodological basis for studying the digitalization as a vector of the accounting system modernization and information systems development

Problem identified		
The economy digitalization entails the need to modernize the companies' system and mechanisms to ensure their competitiveness and improve management systems		
Task	Data source	Research methods
1	2	3
1. Identifying trends in the economy digitalization worldwide and Ukraine	- expansion of individual use of the Internet (Individuals using the Internet); - Digital Economy and Society Index - ICT Development Index; - Global Innovation Index; - use of Information and communication technologies in companies; - Ukrainian IT-industry companies development trends	Methods of theoretical generalization, analysis, synthesis, comparison and grouping
2. Describing the digitalization effects for business activity and business processes	Researches on the companies' business models modernization problems in the economy digitalization context	Methods of theoretical generalization, analysis, synthesis, and abstraction
3. Assessing the economic digitalization effects on the revised requirements to the company's information system	Researches on the company's information system functioning problems in the economy digitalization context	Methods of theoretical generalization, rising from the abstract to the concrete concept
4. Information systems investigation with reference to the company's management objects and defining its development directions	Researches on the problems of improving the company's information system in the economy digitalization context	Methods of theoretical generalization, analysis, synthesis
5. Determining the accounting system modernization directions in the economy digitalization context	Researches on the problems of forming and improving the accounting system in the economy digitalization context	Methods of theoretical generalization, analysis, synthesis

Source: Own processing

4. Results and discussion

4.1. Results for economics

Despite the fact that Internet accessibility today is not considered as an exclusive benefit, such access extent in the world varies essentially depending on the geographical region. The difference by geographical regions in the proportion of Internet users is shown below in table 2.

Thus, in Europe and Central Asia, 78.93% of the population has access to the Internet (56.1% in 2010) that indicates an intensive development and spread of internet technologies in this region's countries. Note that in 2010 and 2018, respectively in this region's countries with low and middle income the share of the population who had access to the Internet was 35.6% and 73.2%. If we assess EU countries separately, in these years the corresponding percentage was 70.7% and 81.56%, which indicates a high level of internet access to the public. In North America, back in 2000, 43.9% of people had access to the Internet, and in 2010 and 2018, this cipher crossed the 70% mark and amounted to 72.6% and 88.50%, respectively.

However, there are regions where the internet accessibility level is below the global average (48.6%) – these are South Asia (30.2%) and sub-Saharan Africa (22.1%). The Middle East and North Africa (65.1%), East Asia and the Pacific (55.1%), and Latin America (65.9%) ciphers are also quite low.

Thus, the digitalization trend is specific with its rates differentiated by regions of the world. Moreover, if 20 years ago in the "Global North" countries the internet public accessibility level ranged from 1.97% to 43.89%, now the variation in this countries group ranges within 15.3%. The "Global South" indicators are much lower.

From the viewpoint of Internet resources public availability analysis, interesting is the countries classification by the demographic dividends category. In fact, this means a return on the population's certain age structure, its socio-economic and educational characteristics. In particular, there exist several vectors indicating the demographic dividends accessible to a country, e.g. savings, labor supply, human capital, and economic growth. To get those advantages, a country undergoes the demographic transformation: from the stage of a rural agricultural economy where a significant level of birth and mortality combines to low labor productivity (pre-demographic dividends) to an urbanized industrial society with low birth and mortality rates, but high labor productivity (post-demographic dividends).

Chyzhevska, L., Voloschuk, L., Shatskova, L., Sokolenko L. (2021)

Digitalization as a vector of information systems development and accounting system modernization

**Table 2 Share of the population having access to the internet
% (by year and geographical regions of the world)**

Groups of countries	Population share using access to the Internet			
	1990	2000	2010	2018
Worldwide	0.05	6.74	28.73	48.57*
Europe & Central Asia	0.05	13.16	56.09	78.93
– except for high-income countries	0.00	1.97	35.58	73.20
European Union	0.07	20.51	70.71	81.56
Central Europe and the Baltics	0.00	7.05	58.60	75.98
North America	0.74	43.89	72.55	88.50
East Asia & Pacific	0.01	5.62	34.27	55.10*
– except for high-income countries	0.00	1.89	28.96	50.79*
Latin America & Caribbean	0.00	3.89	34.71	65.90
– except for high-income countries	0.00	3.37	34.16	65.84
Middle East & North Africa	0.00	1.69	24.87	65.14
– except for high-income countries	0.00	0.84	20.73	59.64
South Asia	0.00	0.47	7.21	30.19*
Sub-Saharan Africa	0.00	0.51	6.99	22.12*
– except for high-income countries	0.00	0.51	6.99	22.11*

Note: * – 2017 year data.

Source: Compiled by the World Bank.

We assume that the level of public access to the Internet in these conditions will vary, and the return on achieving the goals of social and economic development will increase while demographic dividends growth. Table 3, compiled according to the World Bank data, exposes the analysis of growth dynamics as to the share of the population to whom the internet is accessible, depending on the country's demographic dividends stage.

**Table 3 Share of the population having access to the internet
% (by year and world region by demographic dividend level)**

Groups of countries	Population share using access to the Internet			
	1990	2000	2010	2018
Worldwide	0.05	6.74	28.73	48.57*
Region by demographic dividend				
Pre-demographic dividend	0.00	0.12	6.10	33.85
Early-demographic dividend	0.00	1.23	12.84	37.86*
Late-demographic dividend	0.00	2.47	36.03	58.86*
Post-demographic dividend	0.27	30.55	70.98	85.74

Note: * –2017 year data.

Source: compiled by WorldBank

During the 1990s, in countries with pre-demographic dividends only 0.12% of nationals used internet access, another 6% joined over the next decade, and only in 2018, this share reached 33.8%. For exemplary comparison, in the post-demographic dividends' countries group this share grew to 30.55%, 70.98% during almost three decades from 1990 to 2018, and reached 85.7% in 2018.

Margetts H. & Dunleavy P. (2002) conducted a study of differences in the intensity of internet technology used by different ages' cohorts. In particular, their study focused on the possibility of rendering e-government services to various categories. Their study did not account on particular differences between poor/rich, various ethnic minorities, low/high education, but only on age-related factor. They concluded that "where the nationals really want something to be done, they are willing to try electronic communication. If these services are unavailable, another obstacle to their development may be a simple lack of population's active demand for those services". Therefore, we believe that the economy and society digitalization trend consists in increasing the gap in the level of economic return on human capital development based on gaps in the labor productivity level, public services availability, opportunities for human development, as well as the ability to embody the population's goods and services consumers' rights in particular in the field of education and health.

On the other hand, the global network's widespread use is actively stipulated by underlying intensive innovative transformations, the development of intellectual capital, as well as significant amounts of digital technologies financing. Therefore, the research by Onyshchenko Y. (2018) identifies the following main reasons for the digital economy formation: "The digital economy formation in developed countries reasons study has proved that one of the main reasons is the economy cyclic nature combined with the change in technological patterns. Thus, the stimulus for the transition to the next technological pattern almost always correlates with a sharp decline in GDP growth rates, which leads to the search for new technologies, inventions, discoveries that radically change the content of various types of activities in society". That is, we can state a cyclic dependence of the society digitalization system elements as the qualitative changes in science and education, as well as the life and economic activity SMART environment development is impossible without digitalization implemented. However, digitalization itself is the result of science and innovation development as the economy's quaternary sector. The gap in Internet public accessibility and the level of society digitalization can also be traced by comparing countries with different per capita income levels and different stages of socio-economic development, see Table 4.

Table 4 Population share using the internet access

% (by year and region of the world by the level of economic development and income level)

Groups of countries	Population share using access to the Internet			
	1990	2000	2010	2018
Worldwide	0.05	6.74	28.73	48.57*
Region by economic development				
Fragile and conflict-affected situations	0.00	0.26	6.05	22.46*
Least developed countries: UN classification	0.00	0.10	4.13	17.78*
OECD members	0.24	27.83	67.63	82.84
Region by income				
Low income	0.00	0.10	4.20	15.41*
Lower middle income	0.00	0.56	10.72	33.58*
Middle income	0.00	1.57	21.76	45.33*
Upper middle income	0.00	2.48	33.48	58.43*
High income	0.26	30.46	72.13	86.80

Note: * –2017 year data.

Source: compiled by WorldBank

The illustrated indicators' values gap is extremely large. Meanwhile, it is impossible to trace definitely the complex causal relationships between the GDP level and the Internet public accessibility one. After all, the higher per capita income is, the higher will be the index of computer technologies and telecommunications availability in everyday life. Still, on the other hand, the internet accessibility growth contributes to the development of education and science in the country that in turn leads to an increase in labor productivity and in social product creation.

Even among developed countries, there can be significant gaps in the level of economic and society digitalization, for example, various levels of cloud technologies use whilst economic activities running as observed in EU member states. According to Eurostat, "more than half of businesses used cloud computing in Finland (57%), and more than 40% in Sweden (48%) and Denmark (42%). However, less than 10% of businesses in Bulgaria and Romania (7% each), Latvia and Poland (8% each), and Greece (9%) used cloud computing services."

Therefore, established is that the trend in the digitalization of the economy and the society is to increase the gap in the level of digital society benefits accessibility (depending on the stage of socio-economic development of the country) to the people.

For a broader representation of the society digitalization elements development, we analyzed data from the Digital Economy and Society Index for 2020 having calculated its individual components variation indicators. The indicators set

Chyzhevska, L., Voloschuk, L., Shatskova, L., Sokolenko L. (2021)

Digitalization as a vector of information systems development and accounting system modernization

included point estimates of corresponding components for each EU country. Their visualization is shown in Figure 1.

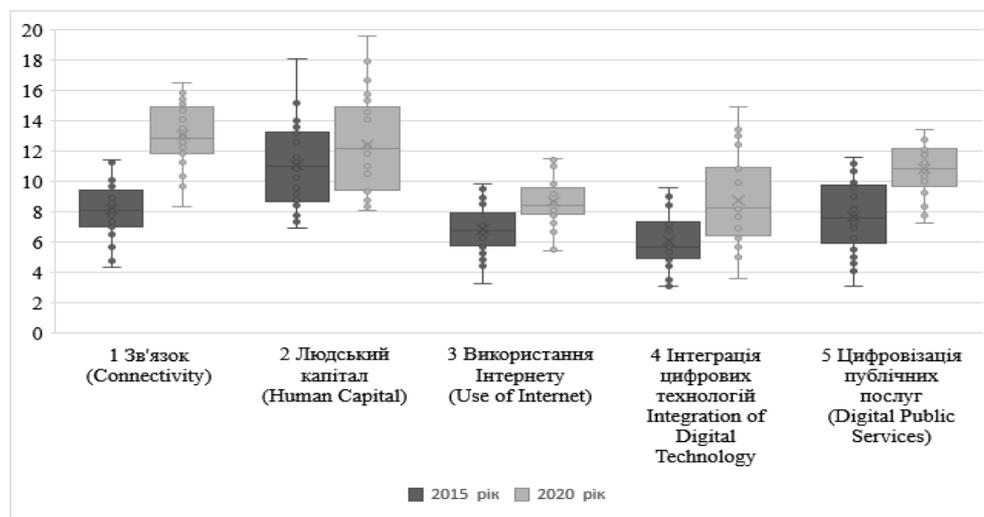


Figure 1 EU countries score variation by individual components of the digital economy and society Index (2015, 2020)

Source: calculated and built according to Digital Economy and Society Index.

In this regard, it should be assumed that economy digitalization causes the need to modernize the companies' systems and mechanisms which include accounting as a component capable to ensure their competitiveness in the "new digital world".

This assumption has been proven along the following sequence:

- 1) analysis of the Internet accessibility impact on the spread of internet technologies;
- 2) analysis of the internet accessibility dynamics in countries with different demographic dividends as prerequisites for the assimilation, perception and dissemination of digital technologies in society.
- 3) analysis of the internet accessibility dynamics in countries with different income levels as a basis for creating their economy's opportunities to finance the society digitalization.

The digitalization concept is new for both practitioners and theorists of Economics, in particular those specializing in accounting. In this respect, there occurs a mutual substitution of concepts often erroneously considered synonymous: "informatization" and "digitalization". And while the first of them has long been common in both accounting theory and practice, the second one has been

Chyzhevskaya, L., Voloschuk, L., Shatskova, L., Sokolenko L. (2021)

Digitalization as a vector of information systems development and accounting system modernization

introduced into scientific use recently enough (Tumpach et al (2020)). In particular, informatization does not change the principles of interaction between economic agents, but only creates additional channels for data dissemination, duplicating (and sometimes simply reproducing) its analog form into a digital one. In addition, changing the format of data generation and transmission in an informatized accounting system creates only a number of other information interaction tools used by economic agents and differing from the paper ones. However, the accounting system digitalization predefines a new concept of data generation and use, allowing to digitalize and to parameterize several objects which in traditional representation are not subject to accounting. Therefore, qualitatively new databases on the company's business processes contribute to the formation of the accounting system predictive functions which can be used by all subsystems of the company's management.

Still, a low level of companies' involvement in the use of the Internet for commercial purposes is evidenced by the indicators of orders receiving and sending in Ukraine, see Figure 2.

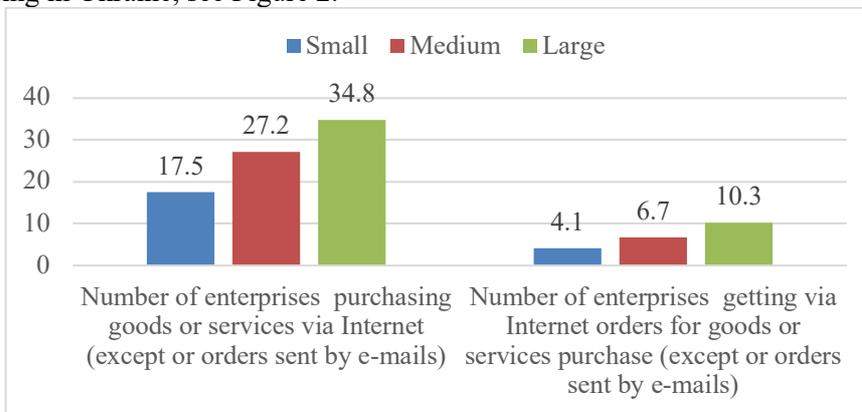


Figure 2 Use of information and communication technologies for receiving/placing orders and providing/receiving invoices by Ukrainian companies in 2019

Data source: based on data published by the state statistics service of Ukraine.

Modern national IT-companies greatly progressed both in the Ukrainian and global markets, leveling alongside to international companies whilst the global economy transition to digitalization mode using the Internet and various software products that simplify the companies' processes: starting from accounting and managerial accountancy activity and ending with the optimization of production, marketing and sales operations. Accordingly registered is a growing demand for IT-companies' products and services for various economical sectors which development trends we shall review further.

Chyzhevska, L., Voloschuk, L., Shatskova, L., Sokolenko L. (2021)

Digitalization as a vector of information systems development and accounting system modernization

Registered is a positive trend towards the growth of all IT-industry activities types involved companies quantitative indicators, see Figure 3. In 2019, compared to 2017, the highest growth rate in the entities number is registered for companies engaged in computer programming – 51.47%, also gaining popularity are the data processing, web sites data posting and related activities – 40.78% and computer games development ones– 36.8%. The lowest growth rate in the number of entities is registered in the category of companies that develop other software products– 19.59%. As evident, the penetration of society and business digitalization technologies renders its effect onto the growth in the number of IT-industry companies that provide this process.

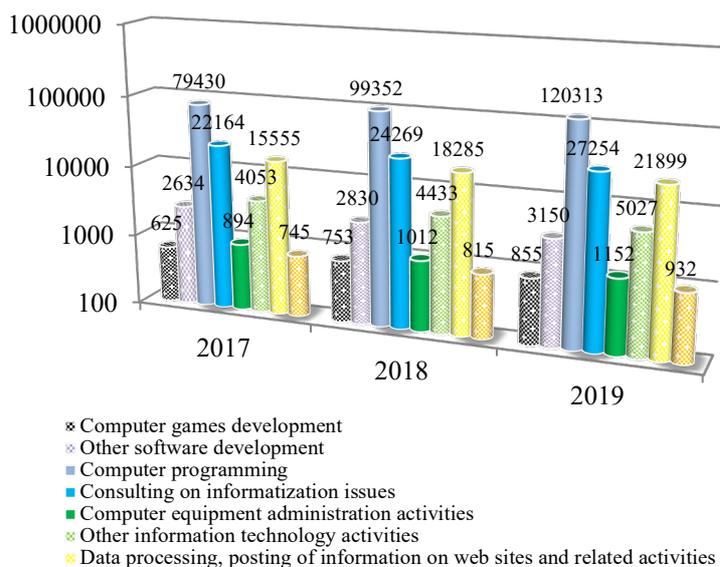


Figure 3 Dynamics of IT-companies number in 2017-2019

Data source: based on data published by the state statistics service of Ukraine

Analyzing the structural volume of IT-products and IT-services sold in 2017-2019,(see Figure 4), it can be determined that the largest share of sales is this of computer programming products and services: 62.1-64.2%, the second and third places are held by the consulting services on informatization issues: 14.7-16.3% and data processing services, information placement on web sites and related activities: 13.6-14.2%, respectively. This list of IT products and IT services sold

Chyzhevska, L., Voloschuk, L., Shatskova, L., Sokolenko L. (2021)

Digitalization as a vector of information systems development and accounting system modernization

confirms the growing demand for digitalization technologies in various sectors of the economy.

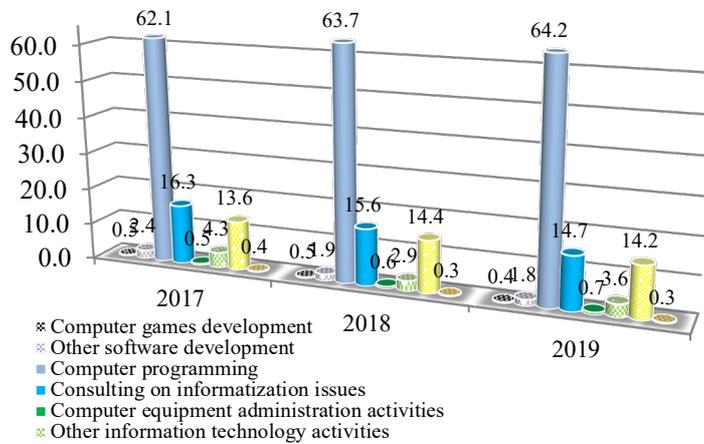


Figure 4 Structure of IT-products and IT-services sales in 2017-2019

Data source: based on data published by the state statistics service of Ukraine.

Despite the fact that the IT industry is steadily growing and develops increasing the volume of exports and tax payments, tax authorities are constantly looking for opportunities to collect as many taxes as possible from this industry, that affects the level of IT companies' profitability. The highest profitability indicators registered in other activities branch of Information Technologies field reached 10.5-18.9%, the most stable indicators for all 4 years being observed in the computer programming sector: 6.6-7.9%, and the computer equipment administration activities in the last two years were unprofitable, – see Figure 5. The need to develop IT-industry priority areas raises therefore a question of determining favorable conditions for regulating IT companies' economic activities to ensure the country's competitiveness.

In addition to statistical data analysis, we represent a SWOT analysis of the Ukrainian IT-industry (Bartosova et al (2019)), which highlights: among strengths – the presence of IT clusters and human capital of a high-level IT-specialised education, lower operating costs, a significant presence in the national and foreign market; among weaknesses – a low level of infrastructure development and the gap in Internet accessibility, software low aggregate share in the IT-market, unstable fiscal policy, differentiation of digitalization rates by region; among opportunities – e-commerce, development of cloud technologies and smart environments, relations

Chyzhevska, L., Voloschuk, L., Shatskova, L., Sokolenko L. (2021)

Digitalization as a vector of information systems development and accounting system modernization

with foreign partners, transition to remote work and provision of distant activities; among threats, these are: decrease in domestic demand for IT-products and IT-services due to economic instability; human capital outflow abroad from the Ukrainian IT-sector; low development of education in IT-sector; lack of security for business, – see Figure 6.

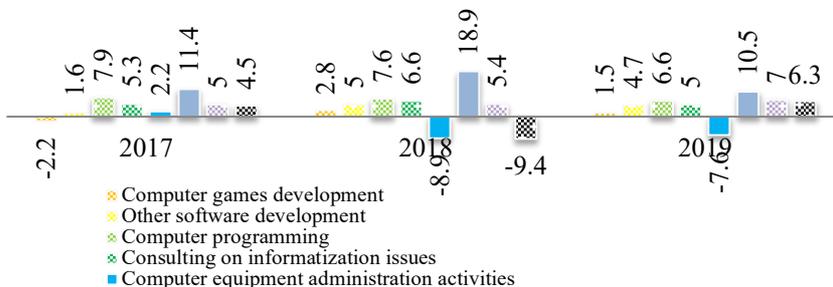


Figure 5 Level of IT-companies profitability (unprofitability) in 2017-2019

Data source: based on data published by the state statistics service of Ukraine.

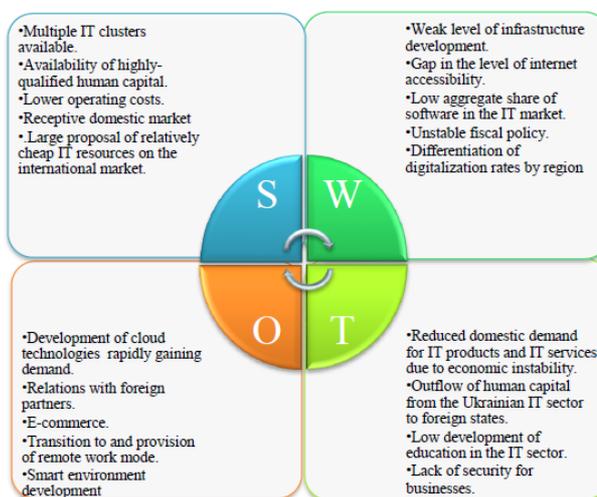


Figure 6 SWOT-analysis of the Ukrainian IT-industry

Source: Own processing.

Summarizing the above, the economy digitalization trends are highlighted thus, business activity and business processes digitalization impact is substantiated as shown in Table 5.

Table 5 Influence of economy digitalization trends on companies' business activity and business processes

Trend	Impact on business activity and business processes
Differentiation of digitalization rates by regions and subregions of the world	<ol style="list-style-type: none"> 1. Determines the degree of national economies digitalization in particular the companies' involvement in the use of digital technologies for business processes organization. 2. In the context of economic digitalization, the companies transform their business models based on the revision of the company values, models and tools of interaction with stakeholders, digital technologies integration into the management systems mechanisms. 3. With respect to the economic development degree differentiation by region, the business model's digitalization intensity is also region-specific.
Cyclic dependence between the society digitalization processes and the parameters of return on human capital development	<ol style="list-style-type: none"> 1. The social processes digitalization contributes to the development of education and science, the formation of digital competencies and skills, which determines the readiness of personnel and civilians to use digital technologies in work and everyday life. 2. The readiness for digitalization predetermines the emergence of consumers' demand to companies for the implementation of digital technologies in business processes and the development of interactive environment used while goods and services consumption.
Increase in the digital society benefits' public accessibility levels gap according to the stages of socio-economic development	<ol style="list-style-type: none"> 1. The productivity of human potential use is higher in high demographic dividends degree countries usually developed countries with a high socio-economic level), that determines the efficiency of using labor resources in business processes. 2. Factors of the country's inclusion in the global digital environment, as well as the public availability of the Internet, are determined by that country's socio-economic development level. Globally, the gap between countries of the world on these indicators is growing, which determines the degree of local companies and local communities' digitalization. 3. In these circumstances, local companies focus their business processes on the analog format of interaction with stakeholders, restrain competitive advantages and create value without using digital technologies

Source: author's view.

To determine the economic digitalization impact on the requirements for the company's information system, we will study some of the management objects. The studied information systems are grouped according to their functional purpose: Project Management Information Systems; Business Process Modeling Information Systems; Resource Management Information Systems; Personnel Management Information Systems; Document Management Information Systems; Budgeting, Accounting and Analysis Information Systems; Integrated Information Systems, table 6.

The definitive choice made while implementing information systems for economic objects management depends on the coverage breadth and underlying management functions integration, on the ability to prepare quickly for changes in the external environment and the information needs.

Table 6 Information systems by company management objects

Name of Information Systems	Objects						
	Production	projects	finance	innovations	marketing	organization	staff
<i>Project Management Information Systems</i>							
Atlassian JIRA, MindjetProjectDirector	-	+	+	+	-	+	+
DeltekMaconomy	+	+	+	+	+	+	+
CProjectMindManagerEnterprise	+	+	+	+	-	+	+
<i>Business Process Modeling information systems</i>							
FoxManager, MFG / PRO business engineer	+	-	-	-	-	+	+
AlloyNavigator	-	-	-	+	-	+	+
MFG/PRO, NOVA, AVA. BaanErp	+	-	+	-	-	+	+
<i>Resource Management Information Systems</i>							
SIKE ERP, IFS Applications SAP BusinessOne, InforCloudSuiteIndustrialP, infor: COM	+	-	+	-	+	-	+
iRenaissancMillennium BSA	+	-	+	-	+	-	+
<i>HR Management Information Systems</i>							
RI-MANAGEMENT, RI-STAFF, ExperiumANY-TRADE	-	-	-	-	-	+	+
<i>Document Management Information Systems</i>							
DeloProe, DocLib, OPTiMA-WorkFlow, PayDox, 1C-bitrix	-	-	-	-	-	+	+
<i>Information systems for budgeting, accounting and analysis</i>							
ComtecforBusiness, CleverSystems, BusinessControl, Comshare MPC, DMReports, 1C: Enterprise 8	-	-	-	-	-	+	+
<i>Integrated Information Systems</i>							
NOTE-MATRIX, BSManager CRM/ERP, Oracle E-BusinessSuite, FinExpert, Global, J.D.Edwards, Lawson M3 ERP Microsoft System21 Aurora, Dynamics 365,SQL	+	-	+	-	+	+	+
OrganicERP, SAP R3, EpicoriScala, HansaWorldEnterprise,	+	+	+	-	+	+	+
mySAPBusinessSuite, TRONIX	+	-	+	-	+	+	+
IT Enterprise	+	-	+	+	+	+	+

Source: author's view.

The modernization of information management systems aiming to ensure the company's competitiveness can be carried out through introducing digital technologies, such as: Electronic Data Interchange(EDI)– sending and receiving information data in structured digital form, based on regularly assigned formats; Extensible Business Reporting Language(EBRD) – preparation, exchange and

Chyzhevska, L., Voloschuk, L., Shatskova, L., Sokolenko L. (2021)

Digitalization as a vector of information systems development and accounting system modernization

analysis of financial reports and audit schedules; BigData – storage, processing and analysis of large data amounts systematized on special servers; Internet of Things (IoT) – a kind of relationships between different components: equipment, installations or devices that collect information, networks transmitting the received information, cloud servers and various applications for consumers; Robotic process automation (RPA) – robotic automation of routine processes that fit into clear algorithms; Artificial Intelligence (AI) – accumulation of knowledge and their application modes to solve problems on machine learning methods, computer vision and big data analysis; Real-time adherence (RTA) – real-time management, Cloud Computing – a set of technologies which allow using the remote systems resources; Blockchain – a pattern of information registers structuring according to certain rules, that represents an growing sequence of units divided between participants.

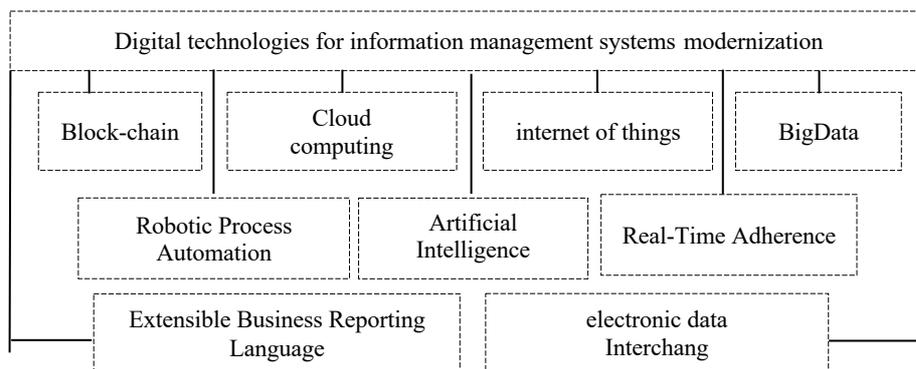


Figure 7 Digital technologies for information management systems modernization

Source: author's view.

Digitalization of management allows the company's employees to: reduce time spent searching for the necessary information and to apply the experience of the company's leading specialists, it simplifies the access to valuable information; reduces the number of errors due to lack of awareness or previous experience ignoring; thus it allows generating new knowledge through replication, acquisition and exchange of existing knowledge. In general, business digitalization combines qualitatively new approaches and methods of work in the company, thus providing an opportunity to use competitive advantages by reducing the interaction cost, expanding markets and areas of activity, serving to greater mobility and efficiency in solving various issues using remote communication.

4.2 Results for accounting

At our own research issue, we identified the place of accounting and audit digitalization, these two embodying one of the management functions, in society digitalization as a whole and the economy digitalization in particular. Please refer to Figure 8.

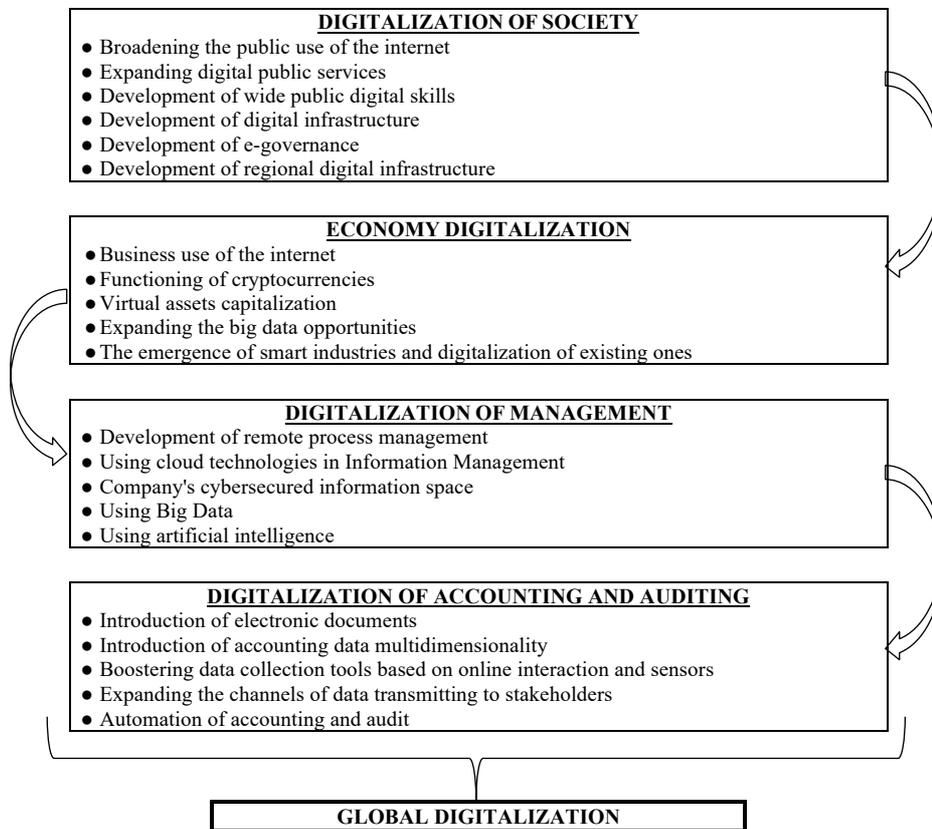


Figure 8 Place of accounting and audit digitalization in the society and economy digitalization

Source: author's view

However, the risks associated with the institutional environment shortcomings at both the micro and macro levels are also significant. At the national legislation system level, there is an urgent need to systematize the requirements concerning the due digital signatures implementation ensuring as well as the legitimization of

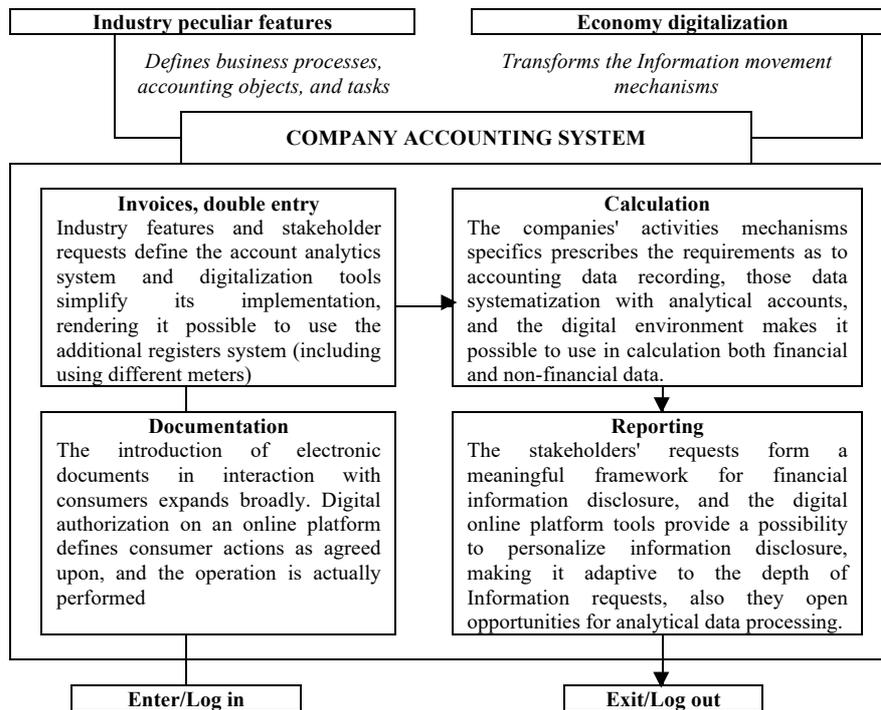
Chyzhevska, L., Voloschuk, L., Shatskova, L., Sokolenko L. (2021)

Digitalization as a vector of information systems development and accounting system modernization

other financial transactions authenticating tools. The tools engaged by the company's clients (individuals) when using its online services form the basis to confirm legal grounds for a business transaction carried out, although in fact these operations are implemented in the absence of a digital signature.

Among the main directions of companies' accounting digitalization implementation and development one can mention changes in the accounting system in terms of its method elements; using new digital forms of Assets, Liabilities and Capital; advanced training in the requirements for accounting office personnel digital competencies.

To determine the impact rendered by digitalization properly said and its individual levels' characteristics afore mentioned, the authors team built a schematic representation of the understanding how these characteristics' influence the application of accounting method individual elements in the company's activities, see Figure 9.



**Figure 9 Digitalization impact on the accounting system
 (in terms of its method elements)**

Source: author's view.

Creating an institutional environment for accounting functions implementation in a digital environment is necessary for the sake of ensuring the legitimacy of transactions the system operates, and which previously did imply the presence of a paper document with seals and signatures as a prerequisite. Therefore, prior to modernizing the accounting system's organizational and methodological foundations, it is necessary to develop regulations and protocols for accessing information, data placing and using, operations authorization, and so on. So, an indispensable component of the modernization vectors set refers to the structuring of the entity's accounting system digital management. Within its framework, the various subjects' powers system concerning the accounting system digital tools use should be regulated. A further mandatory step is to create an appropriate regulatory framework to identify the accounting entities and stakeholders for accessing the open data array, as well as those data further use identifying.

The range of accounting objects in the society and business digitalization context also undergoes significant changes due to the emergence of new forms of Assets, Liabilities and Capital, such as cryptocurrency and new digital currencies; tokens as digital analogs to real values and liabilities; smart assets and smart contracts, transactions based on blockchain technology; virtual monetary and non-monetary assets and property rights. Their representation in the accounting requires is not just a simple complement to the existing methods but implies forming new criteria for their recognition and their value assessment.

An integrated approach to accountancy digitalization implies advanced training in line with the requirements for the accounting personnel's digital competencies including computer literacy, skills in communication and interaction, digital content, and security. In the context of accounting digitalization, an accountant should not only apply the relevant accountancy principles and rules but also carries out functions of analyst and configurator of digital technologies-operating information systems.

Ethical threats and digitalization risks do imply the accounting system's digital culture formation. That concerns not only the issues of ensuring accounting data reliability and financial statements transparency but, first of all, the need to form the accounting personnel's competencies on performing accounting procedures in a digital environment. This will contribute to following both corporate and professional ethics as to engaged subjects as well as to maintaining accounting records in accordance with business processes specifics and will serve to transform the forms of communication with stakeholders.

Chyzhevska, L., Voloschuk, L., Shatskova, L., Sokolenko L. (2021)

Digitalization as a vector of information systems development and accounting system modernization

5. Conclusions and further directions of research

Nowadays the digital strategy has become part of the company's overall strategy that provides opportunities to implement the company's business processes digitalization tasks and, in particular, its information systems tasks as the company's single integrated strategy. And adapting the business processes' digitalization strategic and tactical goals to the trends of business scaling and internationalization will allow a quick response to the risks present in the company's operating environment under open economy. Thus, our study identified trends in the economy and society digitalization, which include: digitalization rate differentiation by regions and sub-regions of the world, cyclic dependence between the society digitalization processes and the return on-human-capital -development parameters, increasing gap in the level of digital society benefits accessibility to the population varying by the stages of socio-economic development. These trends substantiation elaborated we reached to the possibility to determine their impact on the business activity and business processes transformation in the economy digitalization context. It is established that digitalization modifies, firstly, the business processes environment, virtualizing it; secondly, digital tools do change management mechanisms, expanding the virtual management interaction inventory; thirdly, digitalization changes the concept of accounting personnel organizational behavior, serves to revising its competencies requirements, expanding the boundaries of professional ethics applicability. But most important point is that the digitalization transforms the company's business model by defining not only areas and means of digitalizing the business processes that create value, but also these as to the companies' interaction with stakeholders.

This problematic area further research direction is prospected as the development of stages sequence for digital technologies implementing at companies' accounting system.

Acknowledgments

The authors thank the anonymous reviewers and editor for their valuable contribution.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Author Contributions

Lyudmyla Chyzhevska and Liubov Shatskova elaborated methodology and empirical data, empirical results and conclusions. Lidiia Voloschuk and Liudmyla

Chyzhevska, L., Voloshchuk, L., Shatskova, L., Sokolenko L. (2021)

Digitalization as a vector of information systems development and accounting system modernization

Sokolenko were responsible for reference sources analysis and this research filed embodiment.

Disclosure Statement

The authors declare no conflict of interests from other parties.

References

1. Ashok, M., Abhishek, N. & Divyashree, M. (2019), Emerging Trends in Accounting: An Analysis of Impact of Robotics in Accounting, Reporting and Auditing of Business and Financial Information. *International Journal of Business Analytics and Intelligence*, 7 (2), 28-34. Retrieved from: <http://dx.doi.org/10.2139/ssrn.3524486> (Accessed 27 April 2021).
2. Axelsson, K. & Melin, U. (2012), Citizens' Attitudes towards Electronic Identification in a Public E-Service Context—An Essential Perspective in the eID Development Process. *International Conference on Electronic Government*, Springer, Berlin, Heidelberg, 260-272.
3. Bartosova, V., Voloshchuk, L., Romanovska, Yu., Podra, O. & Ivanyshyna, G. (2019), Directions of reduction of the audit risks in the conditions of the electronic economy. *Academy of Accounting and Financial Studies Journal*, Vol. 23, Special Issue 2.
4. Bezruchuk, S. & Lozynskyi, D. (2020), Social reporting quality determinants: a qualimetric analysis. *Public Policy and Accounting*, 1, 3-17.
5. Buyya, R., Ranjan, R. & Calheiros, R. (2010), Intercloud: Utility-oriented federation of cloud computing environments for scaling of application services. *International Conference on Algorithms and Architectures for Parallel Processing*, Springer, Berlin, Heidelberg, 13-31.
6. Cambridge, J. (2018), *Cloud Business and Closing the Gap Between Accounting Theory and Practice: A Case Study of Accounting*. Retrieved from: <http://dx.doi.org/10.2139/ssrn.3317955> (Accessed 27 April 2021).
7. *Cloud computing use in EU enterprises*. Retrieved from: <https://ec.europa.eu/eurostat/en/web/products-eurostat-news/-/DDN-20170330-1> (Accessed 01 April 2021).
8. *Digital economy and society index*. Retrieved from: <https://digital-agenda-data.eu/datasets/desi/visualizations> (Accessed 01 April 2021).
9. Geddes, B. (2020), Emerging Technologies in Management Accounting. *Journal of Economics and Business*, Vol.3, 1. Retrieved from: <https://ssrn.com/abstract=3525673> (Accessed 27 April 2021).
10. Gietzmann, M. & Grossetti, F. (2019), *Blockchain and other Distributed Ledger Technologies: Where is the Accounting?* Retrieved from: <http://dx.doi.org/10.2139/ssrn.3507602> (Accessed 27 April 2021).
11. Individuals using the Internet (% of population), *World Bank*. Retrieved from: <https://data.worldbank.org/indicator/IT.NET.USER.ZS> (Accessed 01 April 2021).
12. Lindgren, I. & Jansson, G. (2013), Electronic services in the public sector: A conceptual framework. *Government Information Quarterly*, T. 30, 2, 163-172.

Chyzhevska, L., Voloschuk, L., Shatskova, L., Sokolenko L. (2021)

Digitalization as a vector of information systems development and accounting system modernization

13. Margetts, H. & Dunleavy, P. (2002), Better Public Services through e-government: *Academic Article in support of Better Public Services through e-government.*
14. Number of business entities by type of economic activity (2010-2019), *State Statistics Service of Ukraine*. Retrieved from: <http://www.ukrstat.gov.ua> (Accessed 05 April 2021).
15. Onyshchenko, Y. (2018), The theoretical approach evolution to the definition of "Digital Economy". *Business navigator*, 6, 9-13.
16. Profitability of operating and all activities of enterprises by type of economic activity with a division into large, medium, small and micro enterprises (2010-2019). *State Statistics Service of Ukraine*. Retrieved from: <http://www.ukrstat.gov.ua> (Accessed 05 April 2021).
17. Schoenfeld, J. (2021), BigTech, Cloud Computing, and Accounting. Tuck School of Business Working Paper No. 3596065. Retrieved from: <http://dx.doi.org/10.2139/ssrn.3596065> (Accessed 27 April 2021).
18. Shkulipa, L. & Maluga, N. (2020), The Financial Reporting Taxonomy: Ukrainian Realities and International Experience. *Economic and Business Administration Development: Scientific Currencies and Solutions: I International Scientificpractical Conference*, Kiev, 22 October 2020. Kiev: National Aviation University, 232-235. Retrieved from: <http://dx.doi.org/10.2139/ssrn.3724614> (Accessed 27 April 2021).
19. The use of information and communication technologies in enterprises (2019). *State Statistics Service of Ukraine*. Retrieved from: <http://www.ukrstat.gov.ua> (Accessed 05 April 2021).
20. The volume of sold products (goods, services) of economic entities by type of economic activity (2010-2019). *State Statistics Service of Ukraine*. Retrieved from: <http://www.ukrstat.gov.ua> (Accessed 05 April 2021).
21. Tumpach M., Surovičová A., Juhászová Z., Marci A. & Kubaščíková Z. (2020), Prediction of the Bankruptcy of Slovak Companies Using Neural Networks with SMOTE1. *Ekonomický časopis*, 68, č. 10, 1021-1039