

# Impact of Digitalization On the Banking System Transformation

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## Abstract

The purpose of the article is to study the impact of digitalization on the transformation of the banking system, taking into account current innovative development trends.

The article analyzes the impact of key factors on the development of the digital economy. Ukraine's ranking positions in terms of digital competitiveness are shown. The necessity of using digital technologies in the sphere of banking activity is substantiated. The dynamics of changes in the number of operating banks in Ukraine is analyzed. The directions of introduction of information technologies in the sphere of banking activity are determined. An analysis of changes in the share of the population of individual EU member states that use the Internet for Internet banking. It is noted that modern transformation trends, digitalization of the economy have a significant impact on the landscape of the banking sector, in this context, the rating of Ukrainian banks in the categories of "Internet Banking" and "Mobile Banking". The advantages and disadvantages of using the capabilities of Internet banking are identified. Based on the study, the importance of expanding the boundaries of digitalization of the domestic banking system is substantiated, which will further increase the level of availability of online services in the field of banking. Prospects for further research are identified in the study of the impact of digitalization on the development of the banking system of foreign countries.

## Key words:

*digitalization, banking system, banking activity, Internet banking, mobile banking.*

## 1. Introduction

In the conditions of transformational changes, digitalization has become one of the important components of the mechanism of economic growth. With the rapid development of the information environment, the expansion of the range of digital services is also subject to transformation of the banking sector. The rapid expansion of financial companies and successful startups requires banking institutions to keep up with the times and introduce new banking products and use innovative methods to be a worthy competitor on a par with digital financial institutions that use automated software services and offer much more profitable credit terms. Therefore, given the digitalization trends in the financial sector, the

digital transformation should become an integral part of the development of the banking sector in order to increase competitive advantage.

The aim of the article is to study the impact of digitalization on the transformation of the banking system, taking into account current innovative development trends.

## 2. Literature review

Problems of development of the banking system, assessment of the impact of digitalization on the activities of banks attracts the attention of many scientists.

However, despite the significant amount of research in these areas, the assessment of the impact of digitalization on the transformation of the banking system remains relevant, given the current trends in the digital economy.

The study of digitalization processes is becoming increasingly important, including the impact of these processes on the transformation of the banking system. Among the scientists who have studied this issue, the following should be singled out: Alchinov A.I. (2021) [1]; Andreeva L. (2021) [2]; Arefieva O. (2021) [3]; Banga L. (2021) [4]; Bhasin N.K. (2021) [5]; Buryakov G. (2021) [6]; Cosmulese C. G. (2019) [7]; Derhaliuk M. (2021) [8]; Dobrovolska O. (2021) [9]; Dubyna M. (2021) [10]; Fedyshyn M. F. (2019) [11]; Hammood W.A. (2021) [12]; Henry J. (2021) [13]; Ivanova N. (2016) [14]; Khalid B. (2021) [15]; Kholiavko N. (2021) [16]; Sheremet O. (2021) [17]; Zhavoronok A. (2021) [18]; Kholod S. (2021) [19]; Kirizleyeva A.S. (2020) [20]; Kosach I. A. (2019) [21]; Li C. (2021) [22]; Margasova V.G. (2009) [23]; Mishra A.K. (2021) [24]; Popelo O. (2021) [25]; Garafonova O. (2021) [26]; Khanin S. (2021) [27]; Quyen D. (2020) [28]; Risin I.E. (2020) [29]; Samoiloanych A. (2021) [30]; Sbarcea L. (2021) [31]; Šeho M. (2021) [32]; Seyfi-Shishavan S.A. (2021) [33]; Shetu S.F. (2021) [34]; Zhuk O. (2018) [35]; Prokopenko V. (2018) [36]; Shkarlet S.M. (2017) [37]; Tarasenko A.V. (2017) [38]; Tseng M.-L. (2021) [39]; Tulchinskiy R. (2021) [40]; Saloid S. (2021) [41]; Vovk O. (2021) [42] and others.

The authors of the article [20] study the trends, problems and opportunities for the development of

banking in developing countries in the context of digitalization. Scientists have analyzed and studied the impact of off-balance sheet transactions on the financial results of banks, which showed a high degree of dependence even at the initial stage of development of new tools and technologies.

The aim of the article [28] is to analyze the problems of evaluating the e-CRM system in the banking sector for its effectiveness. The authors of the article investigate the factors influencing the successful implementation of e-CRM in banks, among which are: e-CRM strategy; support for senior executives, customer orientation; Information Technology; human knowledge management.

The research [29] is based on the assessment of the level of asymmetry of the Russian banking system, as well as the identification of factors influencing the state of interbank competition in the context of digitalization of banking. The research of scientists is based on the identification of external and internal factors influencing the state of interbank competition. The authors argue that this will identify possible areas for improvement of the regulatory framework and structure of the Russian banking system in terms of digitalization of the economy in general and banking in particular.

The article [5] examines the risks faced by banks in India and the reasons for the increase in banking fraud. The authors explore the issues of new digital banking tools and the possibilities of their application. Researchers argue that continuous training and retraining of bank employees is needed, as both lending and technology require experts to make decisions and manage risk.

The aim of the article [33] is to develop a methodology that examines the role of the banking sector in financing the supply chain, identifies the main risks of this sector in emergencies, such as pandemics. The authors argue that the results of the Turkish banking sector for three different periods demonstrate the validity and applicability of the proposed approach. Researchers show that credit risk, loss of income and liquidity was the most critical factors in the COVID-19 outbreak in the banking sector.

The article [1] investigates that when conducting online payments, registration and other similar actions, we transfer part of our personal data, as well as card data, telephone numbers, etc. The authors argue that the protection of web applications and services should be seen as a very important aspect of modern network security.

The purpose of the study [39] is to spread the theory of innovation to develop a model of service systems for intelligent products in the banking industry. The authors prove that the institutional compression, the functioning of the digital platform and the management of electronic knowledge are causal aspects that help to shape the operational performance of the system of intelligent products in high uncertainty. Researchers have developed

guidelines for the banking industry in Taiwan, encouraging a variety of digital advances to achieve a sustainable goal.

The researchers [15] analyze the impact of accounting information systems on performance management in the Thai banking sector. The authors analyze the financial performance of banks in Thailand, the possibility of applying best management techniques, business development, the development of the current modern business environment and the intensive competitive business environment in the banking sector.

The purpose of the article [12] is the author's development of a model of authentication of online user access for the banking industry. Scientists have identified the shortcomings of existing research and proposed a new model of authentication. A significant difference of the proposed model is that this model provides security of user access without entering a username and password.

The authors of the article [4] investigated the article behavioral biometrics as a tool to reduce fraud. The authors argue that in order to increase the acceptance of mobile payments, decisions should be prioritized and reduce unnecessary barriers. According to the authors, behavioral biometrics achieves this, runs seamlessly in the background and does not interfere with the user's work. Researchers claim that fraud is greatly reduced by completely eliminating configuration authentication and risk-based authentication.

Scientists [6] have monitored the areas of transformational development of financial institutions. The main result of the research is to identify changes in the mechanism of relationship between managed and management systems, identify modern communication tools, justify the emergence and development of socio-economic areas of transformational development of financial institutions in the context of digitalization.

### 3. Results

The process of digital transformation involves the large-scale introduction and dissemination of modern methods of providing banking services. Factors such as the expansion of Internet coverage, the standard of living of the population, which requires constant improvement and innovation of banking services, and the global pandemic COVID-19, which caused a decline in financial activity of individuals and made traditional channels inaccessible, played an important role in accelerating the development of digital banking provision of banking services. Therefore, if until recently Internet banking only appeared in some countries with a high level of development, today, having access to a mobile phone, a large part of the adult population is able to make digital financial transactions.

Assessment of the impact of key factors on the development of the digital economy is shown in Table 1.

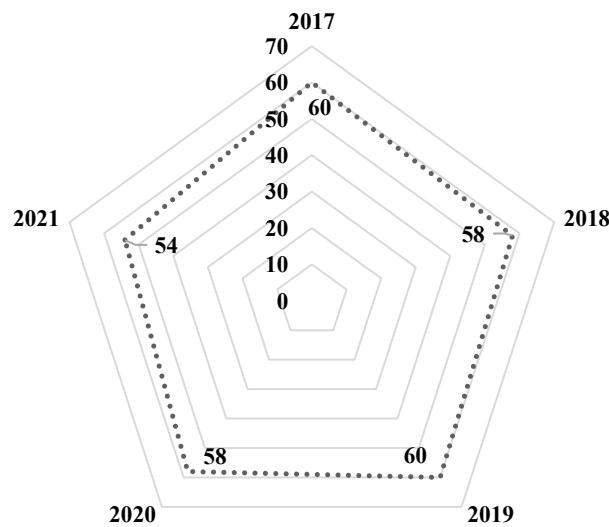
**Table 1:** Assessment of the impact of key factors on the development of the digital economy

Factor	Influence
COVID-19	The destructive impact of the pandemic on the development of mankind has served as a driver in the spread of digitalization, caused by the need to work separately, make financial calculations, etc.
Digital finance	Expanding the range of digital services in the banking sector, electronic transfers, digital currency, mobile money, electronic trading, online payments in the field of trade, etc.
Social networks	Social networks have become a base for collecting and disseminating information, a source of innovative ideas, a platform for influencing social processes and political life.
Improving the competitive position	Assessment of the level of own competitive potential, identification of risks of influence on competitive positions of the organization promotes development and implementation of strategy of existence and functioning of the company.
Digital identification	Use of a single electronic identity system to ensure the security of banking operations, payment of utility bills, access to social services and more.
The data revolution	The focus is on the relationship between innovation, a large body of data and the level of openness. The analysis of a large array of data is used to improve traffic flows and management processes, the assessment of macroeconomic indicators.

Source: compiled by the authors.

Digital rankings, based on a combination of statistics and the results of a survey of business and government representatives, contribute to the formation of strategic priorities in the period of digital transformation. When determining digital competitiveness in accordance with the World Digital Competitiveness Rating developed

by the World Competitiveness Center, such basic factors as knowledge, technology, readiness for the future are taken into account. Assessment of the level of digital competitiveness of Ukraine is shown in Fig. 1.



**Fig. 1** Changes in Ukraine's position in the Digital Competitiveness Rating for 2017-2021.

Source: compiled by the authors according to [43].

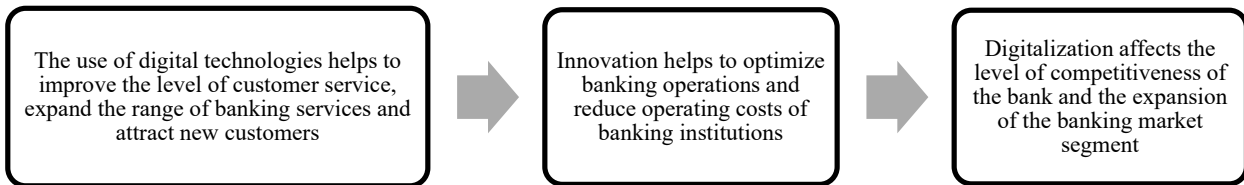
Changes in Ukraine's position in the Digital Competitiveness Rating over the past 2 years indicate an intensification in the direction of creating appropriate conditions for the development of the digital economy. Due

to the rapid spread of innovation, the institutions of the banking sector of Ukraine are also gradually expanding the boundaries of digitalization of their activities.

Digitalization of the bank can be defined as a system of measures aimed at deepening cooperation with FinTech-startups in order to achieve long-term development goals related to the introduction of innovative methods of work, offering new banking products and services to increase and

expand customer base, and also increasing the level of competitiveness of the bank as a whole.

Currently, the need to use the achievements of digital technologies in the field of banking is caused by a number of factors that contribute to the development of the banking system (Fig. 2).

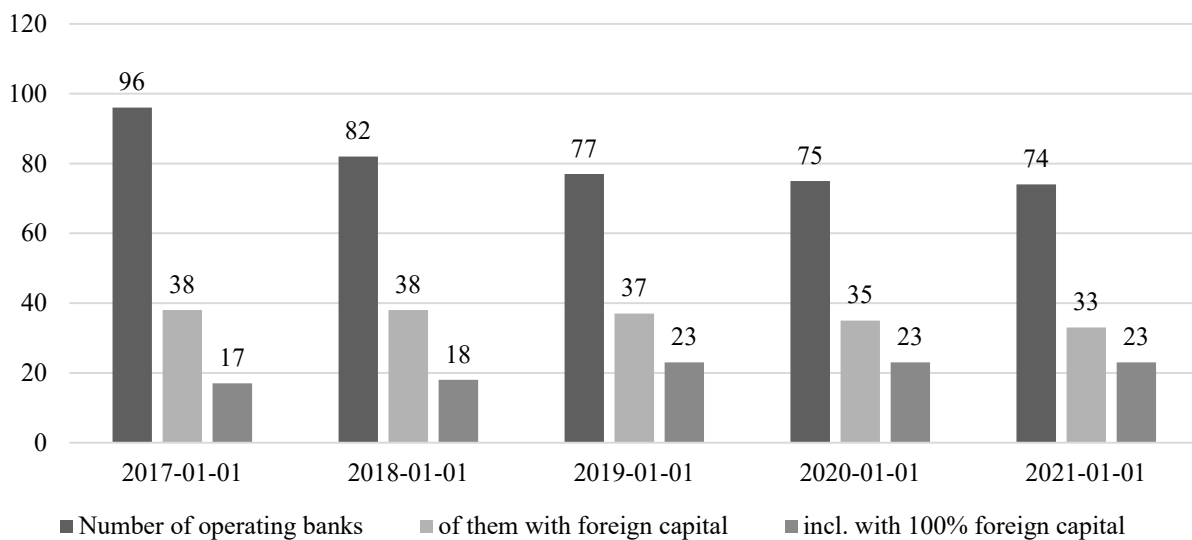


**Fig. 2** Factors influencing the development of digitalization of banking.

Source: compiled by the authors.

Trends in the number of operating commercial banks in Ukraine are characterized by instability (Fig. 3). One of the factors reducing the number of banks is also the scale of

use of digital technologies, as it directly affects the level of their competitiveness and financial stability and determines the process of optimizing their number.



**Fig. 3** Trends in the number of operating banks in Ukraine for 2016-2020.

Source: compiled by the authors according to [44].

Current trends in the financial sector lead to increased consumer interest in the use of various forms of electronic

banking. Directions for the introduction of information technology in the field of banking are shown in Table 2.

**Table 2:** Directions of introduction of information technologies in the sphere of banking activity

No	Stages of implementation	Features of development
1	Establishment of corporate computer systems	Expanding the scale of electronic document management Settlement and clearing system Settlement inter-branch networks
2	Sales of banking and support services on the Internet	Client bank Telebanking Internet banking Mobile banking or WAP-service E-commerce Internet trading
3	Development and automation of the internal banking management system	Management of relations with consumers (clients) with the use of technological systems Management of the efficiency of the banking institution Resource planning of a banking institution Accelerate the receipt of management information

Source: compiled by the authors.

It can be noted that today Ukrainian banking institutions use a comprehensive system of innovations in their activities, including organizational and economic innovations, such as: process-oriented management; business process reengineering; benchmarking; a balanced system of performance indicators for the loyalty program and automation of customer relationships.

An assessment of the trend in the share of the population in some EU countries shows that, on average, slightly more than half of the population uses the Internet for Internet banking (Table 3). Every year the number of active users of the benefits of Internet banking increases, which is caused by the rapid increase in the scale of digitalization.

**Table 3:** Trends in the share of the population of individual EU member states that use the Internet for Internet banking in 2016–2020, % of persons

Country	2016	2017	2018	2019	2020
Germany	53	56	59	61	65
Norway	91	92	93	95	94
Luxembourg	71	76	68	71	71
Austria	53	57	58	63	66
Poland	39	40	44	47	49
Hungary	35	38	41	47	51
Lithuania	54	56	61	65	68
Latvia	62	61	66	72	76
Netherlands	85	89	89	91	89
Finland	86	87	89	91	92
Italy	29	31	34	36	39
Greece	19	25	27	31	37
Portugal	29	31	39	42	47
Sweden	83	86	84	84	85

Source: compiled by the authors according to [45].

Modern transformational trends, digitalization of the economy, have a significant impact on the landscape of the banking sector. One of the drivers for the spread of the use of innovative achievements in the field of banking was the pandemic COVID-19, in particular, increased the share of

online payments and the number of customers who became users of mobile applications. Among the Ukrainian leaders in the nominations "Internet Banking" and "Mobile Banking" are Oschadbank and PrivatBank (Table 4).

**Table 4:** Rating of Ukrainian banks in the nominations "Internet Banking" and "Mobile Banking" for 2020-2021

	Rating of banks in the nomination "Internet banking"		Rating of banks in the nomination "Mobile Banking"	
	2020	2021	2020	2021
1	PrivatBank	PrivatBank	PrivatBank	Universal Bank
2	Industrialbank	Raiffeisen Bank Aval	Alfa-Bank	PrivatBank
3	Oschadbank	Ukrsibbank	Oschadbank	Alfa-Bank
4	Bank Credit Dnipro	Alfa-Bank	Universal Bank	FUIB
5	FUIB	Oschadbank	A-Bank	A-Bank
6	Credit Agricole Bank	OTP Bank	FUIB	Oschadbank
7	Concord	Concord	Raiffeisen Bank Aval	Ukrsibbank
8	Piraeus Bank	FUIB	Ukrsibbank	Raiffeisen Bank Aval
9	Forward Bank	Piraeus Bank	Industrialbank	Concord
10	Tascombank	A-Bank	OTP Bank	Ukrgasbank

Source: compiled by the authors according to [46].

Thus, the use of Internet banking is characterized by a number of advantages, in particular:

- opportunities to perform banking operations online;
- round-the-clock access to the system provided you connect to the Internet;
- does not require the use of special software products, but only any Web-browser;
- Simplified connection procedure and in most cases free help and support; mutual authentication of the bank and clients;
- protection of client transactions through the use of passwords stored by the system in encrypted form;
- use of feedback opportunities regarding the work of Internet banking; constant control over the integrity and accuracy of the transmitted information;
- use of electronic digital signature mechanism.

Along with a number of advantages of Internet banking, there are many disadvantages:

- the creation and operation of specialized programs and services that provide customer service is quite expensive;
- high cost of services to ensure reliable protection against cyberviruses and Internet fraudsters;
- high level of distrust in the bodies responsible for personal data protection, as well as in the institutions of the banking system in general and non-banking financial institutions;
- significant investments in the development of neobank;
- suspension of any operation, accounting documentation in case of problems with servers until they are debugged;
- lack of investment funds;
- low level of financial literacy in the country and the world, which creates advantages for traditional banks;
- competition with traditional banks and well-known companies (Google, Apple, Uber, WeChat), which have access to customer information and provide them with a number of services, including financial;
- distrust in the use of alternative payment systems;
- high level of competition;

- significant costs to maintain the competitiveness of banking institutions in the financial market.

However, the modern development of the banking system of Ukraine is impossible without the use of the latest achievements in the field of innovation. This was also confirmed by the approval in March 2021 of the Concept for the Development of Digital Competences, which will serve to increase the use of digital technologies in the spheres of public life, including in the banking sector.

#### 4. Conclusions

In today's digital transformation, the development of the banking system has become inseparable from the development of digital technology to maintain competitiveness along with the development of financial ecosystems. The historical development of the banking system shows that banking activities must be under the control of the state, because there are a number of banking operations that must be strictly regulated. However, modern digital technologies have begun to play a key role in the transformation of Ukraine's banking system. Prior to the COVID-19 pandemic, digital development was seen as something "fashionable" and "innovative", as it was possible to increase volumes in both classical and classical ways, by increasing the branch network, but in 2020 it became enough to actively develop without digitizing its processes difficult. Currently, the Ministry of Digital Transformation and the NBU are cooperating to expand the digitalization of the domestic banking system, which will further increase the availability of online services in the field of banking.

Prospects for further research are to study the theoretical and practical aspects of the impact of digitalization on the development of the banking system of foreign countries.

## References

- [1] Alchinov, A.I., Yalovenko, O.V., Sygotina, M.V. (2021). Main architectural patterns of web applications and web services using the example of banking systems. *Journal of Physics: Conference Series*, 2032(118), 012116. DOI: 10.1088/1742-6596/2032/1/012116.
- [2] Andreeva, L., Alukhanyan, A., Andreeva, O., Selivanova, A. (2021). Technologies for ensuring financial security of the banking system in conditions of informational alteration of business. *E3S Web of Conferences*, 273, 08096. DOI: 10.1051/e3sconf/202127308096.
- [3] Arefieva, O., Tulchynska, S., Popelo, O., Arefiev, S., Tkachenko, T. (2021). The Economic Security System in the Conditions of the Powers Transformation. *IJCSNS International Journal of Computer Science and Network Security*, 21(7), 35-42. <https://doi.org/10.22937/IJCSNS.2021.21.7.4>.
- [4] Banga, L., Pillai, S. (2021). Impact of Behavioural Biometrics on Mobile Banking System. *Journal of Physics: Conference Series*, 1964(623), 062109. DOI: 10.1088/1742-6596/1964/6/062109.
- [5] Bhasin, N.K., Rajesh, A. (2021). The role of emerging banking technologies for risk management and mitigation to reduce non-performing assets and bank Frauds in the Indian Banking System. *International Journal of e-Collaboration*, 18(11). DOI: 10.4018/IJeC.290293.
- [6] Buryakov, G., Sysoeva, E. (2021). Monitoring of Russian banking system in terms of digital transformation. *E3S Web of Conferences* *Открытый доступ*, 273, 08087. DOI: 10.1051/e3sconf/202127308087.
- [7] Cosmulese, C.G., Grosu, V., Hlaciuc, E., Zhavoronok, A. (2019). The Influences of the Digital Revolution on the Educational System of the EU Countries. *Marketing and Management of Innovations*, 3, 242-254. <http://doi.org/10.21272/mmi.2019.3-18>.
- [8] Derhaliuk, M., Popelo, O., Tulchynska, S., Mashnenkov, K., Berezovskyi, D. (2021). State policy of the potential-forming space transformation in the context of the regional development intensification. *CUESTIONES POLITICAS*, 39(70), 80-93. DOI: 10.46398/cuestpol.3970.04.
- [9] Dobrovolska, O., Marhasova, V., Momot, O., Borysova, L., Kozii, N., Chyzyshyn, O. (2021). Evolution and Current State of Money Circulation in Ukraine and the World. *Estudios De Economia Aplicada*, 39(5). <http://ojs.ual.es/ojs/index.php/eea/article/view/5042>.
- [10] Dubyna, M., Zhavoronok, A., Nitchenko, K., Sadchykova, I., Chiipesh, N., Murashkovska, I. (2021). Current Trends in the Development of the Credit Services Market of the European Union. *IJCSNS International Journal of Computer Science and Network Security*, 21(10), 59-66. <https://doi.org/10.22937/IJCSNS.2021.21.10.8>.
- [11] Fedyshyn, M.F., Abramova, A.S., Zhavoronok, A.V., Marych, M.G. (2019). Management of competitiveness of the banking services. *Financial and credit activity: problems of theory and practice*, 1(28), 64-74. <https://doi.org/10.18371/fcaptp.v1i28.163340>.
- [12] Hammood, W.A., Arshah, R.A., Mohamad, Asmara S., Hammood, O.A. (2021). User Authentication Model based on Mobile Phone IMEI Number: A Proposed Method Application for Online Banking System. *Proceedings - 2021 International Conference on Software Engineering and Computer Systems and 4th International Conference on Computational Science and Information Management, ICSECS-ICOCSIM 2021* (pp. 411-416). DOI: 10.1109/ICSECS52883.2021.00081.
- [13] Henry, J. (2021). Banking system stress testing and COVID-19: A first summary appraisal. *Journal of Risk Management in Financial Institutions*, 14(1), 7-24.
- [14] Ivanova, N., Butko, M. (2016). The Modern Trends of Infrastructure Development. *Baltic Journal of Economic Studies*, 2(3), 37-41.
- [15] Khalid, B., Kot, M. (2021). The impact of accounting information systems on performance management in the banking sector. *IBIMA Business Review*, 2021, 578902. DOI: 10.5171/2021.578902.
- [16] Kholiavko, N., Popelo, O., & Tulchynska, S. (2021). Priority Directions of Increasing the Adaptivity of Universities to the Conditions of the Digital Economy. *Revista Tempos E Espaços Em Educação*, 14(33), e16383. <https://doi.org/10.20952/revtee.v14i33.16383>.
- [17] Kholiavko, N., Popelo, O., Bazhenkov, I., Shaposhnykova, I., Sheremet, O. (2021). Information and communication technologies as a tool of strategy for ensuring the higher education adaptation to the digital economy challenge. *IJCSNS International Journal of Computer Science and Network Security*, 21(8), 187-195. <https://doi.org/10.22937/IJCSNS.2021.21.8.25>.
- [18] Kholiavko, N., Zhavoronok, A., Shaposhnykov, K., Krylov, D., Morozova, L., & Babiak, N. (2021). Integrated Model of the Higher Education Financing Under the Quadruple Helix Concept. *International Journal of Computer Science and Network Security*, 21(7), 125-132. <https://doi.org/10.22937/IJCSNS.2021.21.7.16>.
- [19] Kholod, S., Iefimova, G., Margasova, V., Hamed Rashed Sayed Abdullah Alnuaimi, & Taleb Abdullah Mohammed Ali Alhammadio (2021). Risk Management Tools for Emergencies in the Context of Global Informatization. *Estudios De Economia Aplicada*, 39(5). <http://ojs.ual.es/ojs/index.php/eea/article/view/4780>.
- [20] Kirizleyeva, A.S. (2020). Improving the System of Regulation and Conduct of Banking Operations in the Era of Digitalization. *Lecture Notes in Networks and Systems*, 129 LNNS, 509-519. DOI: 10.1007/978-3-030-47945-9\_56.
- [21] Kosach, I.A., Zhavoronok, A.V., Fedyshyn, M.F., Abramova, A.S. (2019). Role of commission receipts in formation of the revenue of the commercial bank. *Financial and credit activity: problems of theory and practice*, 4(31), 22-30. <https://doi.org/10.18371/fcaptp.v4i31.190781>.
- [22] Li, C., Zuo, X., Huang, L. (2021). The influence of external factors on the development of China's banking industry: a system dynamics modelling approach. *Wireless Networks*, 27(7), 4353-4362. DOI: 10.1007/s11276-021-02647-6.
- [23] Margasova, V.G., Rogovyi, A.V. (2009). Efficiency estimation of joint-stock company's financial planning under market conditions of management. *Actual Problems of Economics*, (12(102)), 93-97.
- [24] Mishra, A.K., Jain, S., Abid, M. (2021). Non-performing assets and its determinants in the Indian banking system: An empirical analysis using dynamic panel data models. *International Journal of Finance and Economics*, 26(4), 5948-5962. DOI: 10.1002/ijfe.2102.

- [25] Popelo, O., Dubyna, M., Kholiavko, N. (2021). World Experience In The Introduction Of Modern Innovation And Information Technologies In The Functioning Of Financial Institutions. *Baltic Journal of Economic Studies*, 7(2), 188-199. <https://doi.org/10.30525/2256-0742/2021-7-2-188-199>.
- [26] Popelo, O., Garafonova, O., Tulchynska, S., Derhaliuk, M., & Berezovskyi, D. (2021). Functions of public management of the regional development in the conditions of digital transformation of economy. *Amazonia Investiga*, 10(43), 49-58. <https://doi.org/10.34069/AI/2021.43.07.5>.
- [27] Popelo, O., Tulchynska, S., Tulchynckiy, R., Khanin, S., Hrechko, A. (2021). Modeling and forecasting of the integrated index of innovation activity of regions. *Management Theory and Studies for Rural Business and Infrastructure Development*, 43(2), 307-315. DOI: <https://doi.org/10.15544/mts.2021.27>.
- [28] Quyen, D., Sayapina, K. (2020). Efficiency evaluation of e-crm system in banking sector under digitalization. *Journal of Advanced Research in Dynamical and Control Systems*, 12(4), 1800-1807. DOI: 10.5373/JARDCS/V12SP4/20201665.
- [29] Risin, I.E., Sysoeva, E.F., Kostyanskaya, M.R. (2020). The Influence of the Asymmetry of the Banking System of the Russian Federation on Interbank Competition in the Conditions of Digitalization of Banking Activities. *Lecture Notes in Networks and Systems*, 115, 233-242. DOI: 10.1007/978-3-030-40749-0\_28.
- [30] Samoilovych, A., Garafonova, O., Popelo, O., Marhasova, V., Lazarenko, Yu. (2021). World experience and ukrainian realities of digital transformation of regions in the context of the information economy development. *Financial and credit activity: problems of theory and practice*, (3(38)), 316-325. <https://doi.org/10.18371/fcaptop.v3i38.237462>.
- [31] Sbârcea, L., Batuşaru, C. (2021). European Banking System - Before and after Brexit. *Studies in Business and Economics*, 16(2), 218-229. DOI: 10.2478/sbe-2021-0035.
- [32] Šeho, M., Ibrahim, M.H., Mirakhor, A. (2021). Does sectoral diversification of loans and financing improve bank returns and risk in dual-banking systems? *Pacific Basin Finance Journal*, 68, 101619. DOI: 10.1016/j.pacfin.2021.101619.
- [33] Seyfi-Shishavan, S.A., Gündoğdu, F.K., Farrokhizadeh, E. (2021). An assessment of the banking industry performance based on Intuitionistic fuzzy Best-Worst Method and fuzzy inference system. *Applied Soft Computing*, 113, 107990. DOI: 10.1016/j.asoc.2021.107990.
- [34] Shetu, S.F., Jahan, I., Islam, M.M., Ara, Hossain R., Moon, N.N., Narin, Nur F. (2021). Predicting Satisfaction of Online Banking System in Bangladesh by Machine Learning. *ICAICST 2021 - 2021 International Conference on Artificial Intelligence and Computer Science Technology* (pp. 223-228), 9497796. DOI: 10.1109/ICAICST53116.2021.9497796.
- [35] Shkarlet, S., Dubyna, M., Zhuk, O. (2018). Determinants of the financial services market functioning in the era of the informational economy development. *Baltic Journal of Economic Studies*, 4(3), 349-357.
- [36] Shkarlet, S., Prokopenko, V., Dubyna, M. (2018). Directions of development of the financial services market of Ukraine. *Baltic Journal of Economic Studies*, 4(5), 412-420.
- [37] Shkarlet, S.M., Dubyna, M.V. (2017). Essence and features of information society development. *Scientific bulletin of Polissia*, 1(2(10)), 152-158.
- [38] Shkarlet, S.M., Dubyna, M.V., Tarasenko, A.V. (2017). Basic descriptors of the information economy development. *Scientific bulletin of Polissia*, 1(3(11)), 8-15.
- [39] Tseng, M.-L., Bui, T.-D., Lan, S., Lim, M.K., Mashud, A.H.M. (2021). Smart product service system hierarchical model in banking industry under uncertainties. *International Journal of Production Economics*, 240, 108244. DOI: 10.1016/j.ijpe.2021.108244.
- [40] Tulchynskiy, R., Chobitok, V., Dergaliuk, M., Semenchuk, T., Tarnovska, I. (2021). Strategic Guidelines for The Intensification of Regional Development Under the Impact of Potential-Forming Determinants in the Conditions of Digitalization. *IJCSNS International Journal of Computer Science and Network Security*, 21(8), 97-104.
- [41] Tulchynska, S., Vovk, O., Popelo, O., Saloid, S., Kostiumik, O. (2021). Innovation and investment strategies to intensify the potential modernization and to increase the competitiveness of microeconomic systems. *IJCSNS International Journal of Computer Science and Network Security*, 21(6), 161-168. <https://doi.org/10.22937/IJCSNS.2021.21.6.22>.
- [42] Vovk, O., Tulchynska, S., Popelo, O., Tulchynskiy, R., & Tkachenko, T. (2021). Economic and Mathematical Modeling of the Integration Impact of Modernization on Increasing the Enterprise Competitiveness. *Management Theory and Studies for Rural Business and Infrastructure Development*, 43(3), 383-389. <https://doi.org/10.15544/mts.2021.35>.
- [43] Digital Competitiveness Ranking. URL: <https://worldcompetitiveness.imd.org/countryprofile/UA/digital>.
- [44] Number of banks in Ukraine (2008-2021). <https://index.minfin.com.ua/banks/stat/count/>.
- [45] Individuals using the internet for internet banking. URL: <https://ec.europa.eu/eurostat/databrowser/view/tin00099/default/table?lang=en>.
- [46] Official site - 50 leading banks of Ukraine. <https://banksrating.com.ua/>.