“The level of digital transformation affecting the competitiveness of banks”

AUTHORS	Oleh Kolodiziev http://orcid.org/0000-0002-6715-2901 http://www.researcherid.com/rid/C-6094-2018 Mykhailo Krupka http://orcid.org/0000-0002-8775-1397 Nataliya Shulga https://orcid.org/0000-0002-2010-5884 Myroslav Kulchytskyy https://orcid.org/0000-0002-8747-8677 Olha Lozynska https://orcid.org/0000-0003-2882-3546

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Oleh Kolodiziev (Ukraine), **Mykhailo Krupka** (Ukraine), **Nataliya Shulga** (Ukraine), **Myroslav Kulchytskyy** (Ukraine), **Olha Lozynska** (Ukraine)

THE LEVEL OF DIGITAL TRANSFORMATION AFFECTING THE COMPETITIVENESS OF BANKS

Abstract

The article examines the competitiveness of Ukrainian banks influenced by economy digitalization, the dynamic spread of electronic payments and e-commerce, as well as innovative technologies aimed at providing digital services. When shifting to an Online Platform business model, a bank can expand its range of banking products, attract more customers, thereby forming a competition policy and gaining competitive advantages. The paper aims to assess the digitalization level affecting the general competitiveness of banks and its components based on Ukrainian banks. For this purpose, the following methods were used: standardized input statistical indicators, comparison and ranking, a cluster analysis, and a regression and correlation analysis. The cluster analysis confirmed the current role of digitalization as a competition driver that determines the competitive advantages of banks and creates additional opportunities to expand the customer base and the range of services. The correlation and regression dependence of the competitive position identified by the activity indicators of certain banks on the level of competitive digitalization confirmed a close direct impact on the competitive position of personal deposits arising from the development of digital banking technology; the pre-tax income, profiles of assets and personal loans, and corporate deposits are subject to a significant direct impact, while the weakest direct impact determines corporate loans. The foregoing substantiates the feasibility of large-scale introduction of innovative digital technologies by banks to maintain competitive positions in the banking sector of the economy. Applying the proposed approach based on certain regression equations, managers of Ukrainian banks will be able to assess the efficiency and make appropriate decisions concerning investing in digital tools and services.

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Oleh Kolodiziev, Doctor of Economics, Professor, Head of the Department of Banking and Financial Services, Simon Kuznets Kharkiv National University of Economics, Kharkiv, Ukraine. (Corresponding author)

Mykhailo Krupka, Doctor of Economics, Professor, Head of the Department of Finance, Money Circulation and Credit, Ivan Franko National University of Lviv, Ukraine.

Nataliya Shulga, Doctor of Economics, Professor, Head of the Department of Banking, Kyiv National University of Trade and Economics, Ukraine.

Myroslav Kulchytskyy, Doctor of Economics, Professor, Professor of the Department of Finance, Money Circulation and Credit, Ivan Franko National University of Lviv, Ukraine.

Olha Lozynska, Ph.D. Student of the Department of Banking and Financial Services, Simon Kuznets Kharkiv National University of Economics, Kharkiv, Ukraine.

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INTRODUCTION

Since the banking sector is an integral part of the country's economy, it determines its financial and credit system and the potential for economic growth. Competition among banking institutions establishes market conditions in the sector through the use of more attractive banking tools and methods, as well as banking products for service consumers.

The economy digitalization process, which has become its critical factor over the last few years, has also appeared in banking operations through the active spread of electronic payments, e-commerce, and the introduction of innovative digital services that expand the range of banking products, assist in customer engagement and thus shape a competition policy and gain competitive advantages. Furthermore, the global spread of COVID-19 in 2020 necessitated the transition to a remote banking business model, namely, the Online banking platform.

It is clear from the study conducted by Accenture, an international consulting company, the future growth of banking institutions lagging behind in digital transformation is lower by 11 percent. At the same time, banking leaders are 20 percent ahead of the field while implementing the digitalization program, and 40 percent ahead with regard to the program introducing new FINTECH tools (Accenture, 2017).

According to the abovementioned, analyzing and assessing the competitive capacity of banks influenced by digital transformation make it possible to identify both obstacles to the effective functioning of banks and the drivers contributing to their effective performance.

1. LITERATURE REVIEW

A variety of approaches are used to assess and analyze the competitive capacity of banks.

The Panzar-Rosse test (Panzar & Rosse, 1987), which is the most common approach, offers a means for assessing the bank's competitive position in the banking service market. Some scientists (Shin & Kim, 2013) actively apply the proposed toolkit, whereas others supplement it with factors and conditions for diagnosing the results obtained by the Panzar-Rosse test. Thus, Shaffer and Spierdijk (2015) and Bikker et al. (2009) emphasized the need to consider the bank's operational life, its relative costs, strategy, banking product differentiation degree, and other determinants.

A considerable number of scientists and rating agencies assess the banks' competitive capacity relying on their financial indicators. The Banker (2021), a periodical that is well-known among the banking sector experts, forms the Top 1000 World Banks rating based on the bank's Tier 1 capital indicators, total assets, their growth rate, profitability, return on assets, and capital. Maochun and Zhixu (2013) added a description of the bank's activity scale to the indicators specified above. Pruteanu-Podpiera et al. (2016) investigated the dependence of competitive capacity on the banking efficiency.

Certain models for assessing the bank's competitive capacity address marketing performance. For instance, Qing (2009) developed five indicators to assess the competitive capacity: uniqueness, strategic value, system integration, prevalence, and dynamics. Barbosa et al. (2015) argue that banks offering not only classic banking products but also financial services (including brokerage, insurance, and others) significantly predominate in terms of their competitiveness over banks that offer classic products only.

Krasovskis et al. (2016) considered the analysis of the main characteristics peculiar to the competitive environment of the banking sector from a holistic perspective, namely, sector concentration, competition intensity, and financial indicators.

Financial indicators reflect both the result of competition (through a comparative assessment of the shaped assets, their profitability, acquired deposits, and existing loans) and the opportunities to finance innovative technologies for service delivery, updating the bank's business model and new products. However, the scientific literature does not explicitly attribute the digital transformation aspects in the banking sector to the competitive capacity assessment but determines them through the competitive capacity results in expanding the range and the customer base.

Mbama and Ezepue (2018) explored the links among digital banking, customer satisfaction, loyalty, and financial indicators.

As demonstrated by Zhao et al. (2019), the innovative Fintech implementation strategies strengthened the competitive capacity of China's banking sector. The authors specify the priorities for applying digital innovations: new business partners, new service concepts, organizational innovations, technological innovations, new customer interactions, and new revenue models.

Busby (2017) compared different options for implementing the bank's basic digital technologies and characterized the digitalization strategy as a significant factor contributing to customer loyalty in the current context.

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Amin (2016), Raza et al. (2015), and Martins et al. (2014) study how the quality of Internet banking services influences customer satisfaction and loyalty.

A wide research range focuses on mobile banking as a digital tool for banking development. A. Ali and H. Ali (2014) applied the mobile banking factor to prove the prerequisites for the increasing use of banking services. Other researchers (Silva Bidarra et al., 2013) identify the relationship among customer trust, risk, banking service volume, and mobile banking. Jun and Palacios (2016) determined five criteria for customer satisfaction/dissatisfaction with mobile banking: convenient mobile devices, accuracy, various functions offered by mobile applications, ease of use, and constant improvement.

Dootson et al. (2016) studied the use of social networks by banking institutions and mentioned the customers' propensity to appreciate this digital tool in the case of maximizing the subjective value and benefits of banking products; as for banks, they also emphasized the improved dialog with banking service consumers.

Koroleva and Kudryavtseva (2020) and Stoica et al. (2015) argue that digital banks are distinguished by higher efficiency, namely, return on assets, but leave undetermined the impact of digital transformation on the share of loans and deposits.

Thus, the fragmentary representation of the digital transformation level taken into account as a factor applied while assessing the bank's competitive capacity can be found in the scientists' works. Therefore, given the current approaches and the urgent need to comprehensively consider the impact exerted on the banks' competitive capacity by digital transformation tools, it is advisable to prove the relationship between the established practices used to analyze and assess the competitive capacity, as well as the bank digitalization indicators.

2. AIMS AND METHODS

This paper aims to assess the impact exerted on the banks' competitive capacity by the level of digital transformation in broad terms and its certain components as illustrated by Ukrainian banks.

The economic and mathematical methods used at the preparatory stage of the research allowed exploring the strength of relations and influence between objects and phenomena in the development of digital transformation processes, proposing approaches to the formation of improved methodological tools, which will further provide bank managers with reliable information about projected parameter values for certain types of banking activity, the bank's competitive positions and strategic development.

The following methods have been applied to achieve the research goal: standardization of input statistical indicators for nineteen Ukrainian banks, which makes it possible to compare and rank them; a cluster analysis used to group banks by the level of their competitive capacity and digital transformation; a regression and correlation analysis performed to determine the strength and direction of the digital transformation impact on the bank's competitive capacity and its certain indicators.

While conducting the study, it is proposed to quantify the competitive capacity level of nineteen Ukrainian banks by their financial indicators, namely, pre-tax income, assets, personal deposits, corporate deposits, personal loans, and corporate loans. With this objective in view, the research included the formation of a spatial series based on the banks' statistical data according to the Forinsurer international journal (Forinsurer, 2020) as of January 11, 2020 and their linear transformation by MINIMAX in the range [0…1], where the minimum and maximum scaled values corresponded to 0 and 1, respectively (Table 1).

The arithmetic average of six indicators was used to determine the complex indicator illustrating the competitive capacity of each bank. The bank's rating among the banks included in the research was established by the ranking method.

Similar analytical procedures were applied to consider the digital transformation indicators of banks (Table 2).

Table 1. Linear data transformation based on financial indicators designed to analyze the competitive capacity of Ukrainian banks

Source: Calculated based on Forinsurer's data (Forinsurer, 2020).

Bank	Pre-tax income	Assets	Personal deposits	Corporate deposits	Personal loans	Corporate loans
PrivatBank	1.000	1.000	1.000	0.647	1.000	0.242
Oschadbank	0.306	0.471	0.579	0.536	0.204	1.000
Raiffeisen Bank Aval	0.283	0.184	0.147	0.485	0.141	0.669
PUMB	0.230	0.137	0.119	0.291	0.308	0.373
OTP Bank	0.204	0.099	0.082	0.230	0.164	0.321
UkrSibbank	0.177	0.117	0.110	0.306	0.100	0.304
Credit Agricole Bank	0.160	0.083	0.042	0.282	0.106	0.356
Alfa-Bank	0.155	0.168	0.197	0.228	0.421	0.438
UkrGasbank	0.155	0.288	0.139	1.000	0.070	0.682
Ukreximbank	0.000	0.411	0.129	0.559	0.003	0.879
Pravex Bank	0.116	0.005	0.007	0.012	0.015	0.024
Procredit Bank	0.144	0.041	0.035	0.079	0.001	0.323
Sberbank	0.144	0.110	0.011	0.012	0.001	0.165
Kredobank	0.143	0.036	0.030	0.075	0.136	0.113
Universal Bank	0.139	0.048	0.088	0.028	0.311	0.020
Pivdenny Bank	0.136	0.048	0.047	0.083	0.002	0.301
Tascombank	0.134	0.036	0.038	0.074	0.040	0.214
A-Bank	0.131	0.011	0.026	0.000	0.133	0.000
Bank Sich	0.122	0.000	0.000	0.008	0.000	0.008

Table 2. Linear data transformation based on the digital transformation indicators designed to analyze the competitive capacity of Ukrainian banks

Source: Calculated based on Banker's data (Banker, 2020).

Bank	Number of brand inquiries on the Internet	Number of subscribers on social networks	Activity level on the Internet	Popularity of mobile applications	Popularity of the bank's websites (Similar Web Traffic)
PrivatBank	1.000	1.000	0.968	1.000	1.000
Oschadbank	0.829	0.771	1.000	0.974	0.187
Raiffeisen Bank Aval	0.144	0.256	0.641	0.930	0.075
PUMB	0.397	0.490	0.346	0.922	0.059
OTP Bank	0.174	0.150	0.000	0.000	0.005
UkrSibbank	0.342	0.283	0.000	0.000	0.014
Credit Agricole Bank	0.061	0.135	0.000	0.000	0.012
Alfa-Bank	0.460	0.257	0.787	0.957	0.027
UkrGasbank	0.139	0.351	0.194	0.861	0.013
Ukreximbank	0.066	0.023	0.000	0.000	0.010
Pravex Bank	0.059	0.059	0.532	0.009	0.001
Procredit Bank	0.000	0.000	0.000	0.000	0.000
Sberbank	0.000	0.000	0.000	0.000	0.000
Kredobank	0.104	0.086	0.097	0.757	0.009
Universal Bank	0.000	0.000	0.000	0.000	0.000
Pivdenny Bank	0.033	0.204	0.260	0.670	0.007
Tascombank	0.073	0.599	0.373	0.391	0.005
A-Bank	0.000	0.000	0.000	0.000	0.000
Bank Sich	0.000	0.000	0.000	0.000	0.000

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By using the cluster analysis according to Ward's method and Euclidean distance, banks were divided into clusters based on the level of their competitive capacity by financial indicators and the level of their digital transformation.

3. RESULTS

By applying the method of correlation-regression analysis to build the dependence of the competitive capacity level by financial indicators (y) on the digital transformation level (*x*), it is now possible to establish the strength of this relationship and the feasibility of considering digital tools to achieve competitive advantages:

$$y = b_1 x + b_0. \quad (1)$$

The arithmetic average according to Tables 1 and 2 was used to determine the complex indicator illustrating the competitive capacity of each bank, and the bank's rating among the banks studied by financial indicators and the digital transformation level was established (Table 3).

Based on the results obtained from the cluster analysis of complex indicators illustrating the level of banks' competitive capacity by financial indicators and the digital transformation level (Figure 1), five clusters were identified. Table 4 shows the characteristics of these clusters.

The relationship between the creditworthiness by financial indicators (y) and the digital transformation level (x) is determined by forming a regression equation:

$$y = 0.5965\,x + 0.07299. \quad (2)$$

The calculated value of the relationship strength (with the linear correlation coefficient equal to 0.8462) indicates its high level and the direct impact of digital transformation on the banks' competitive capacity.

Figure 2 presents an illustrated graphical interpretation of the cluster characteristics.

The determination coefficient R^2 = 0.7157, i.e. in 71.57% of cases the change in the digital transformation level determines the change in the bank's competitive capacity.

According to Fisher's criterion $F > F_{table}$, therefore, the determination coefficient is statistically signifi-

Table 3. Assessment of the competitive capacity of Ukrainian banks

Bank	Complex indicator of the competitive capacity by the financial indicators	Complex indicator of the competitive capacity by the level of digital transformation	Rating by the financial indicators	Rating by the level of digital transformation
PrivatBank (C1)	0.815	0.994	1	1
Oschadbank (C2)	0.516	0.752	2	2
Raiffeisen Bank Aval (C3)	0.318	0.409	5	5
PUMB (C4)	0.243	0.443	7	4
OTP BANK (C5)	0.184	0.066	9	12
UkrSibbank (C6)	0.186	0.128	8	11
Credit Agricole Bank (C7)	0.171	0.041	10	13
Alfa-Bank (C8)	0.268	0.498	6	3
UkrGasbank (C9)	0.389	0.312	3	6
Ukreximbank (C10)	0.330	0.020	4	14
Pravex Bank (C11)	0.030	0.132	18	10
Procredit Bank (C12)	0.104	0.000	12	15
Sberbank (C13)	0.074	0.000	16	15
Kredobank (C14)	0.089	0.211	15	9
Universal Bank (C15)	0.106	0.000	11	15
Pivdenny Bank (C16)	0.103	0.235	13	8
Tascombank (C17)	0.090	0.288	14	7
A-Bank (C18)	0.050	0.000	17	15
Bank Sich (C19)	0.023	0.000	19	15

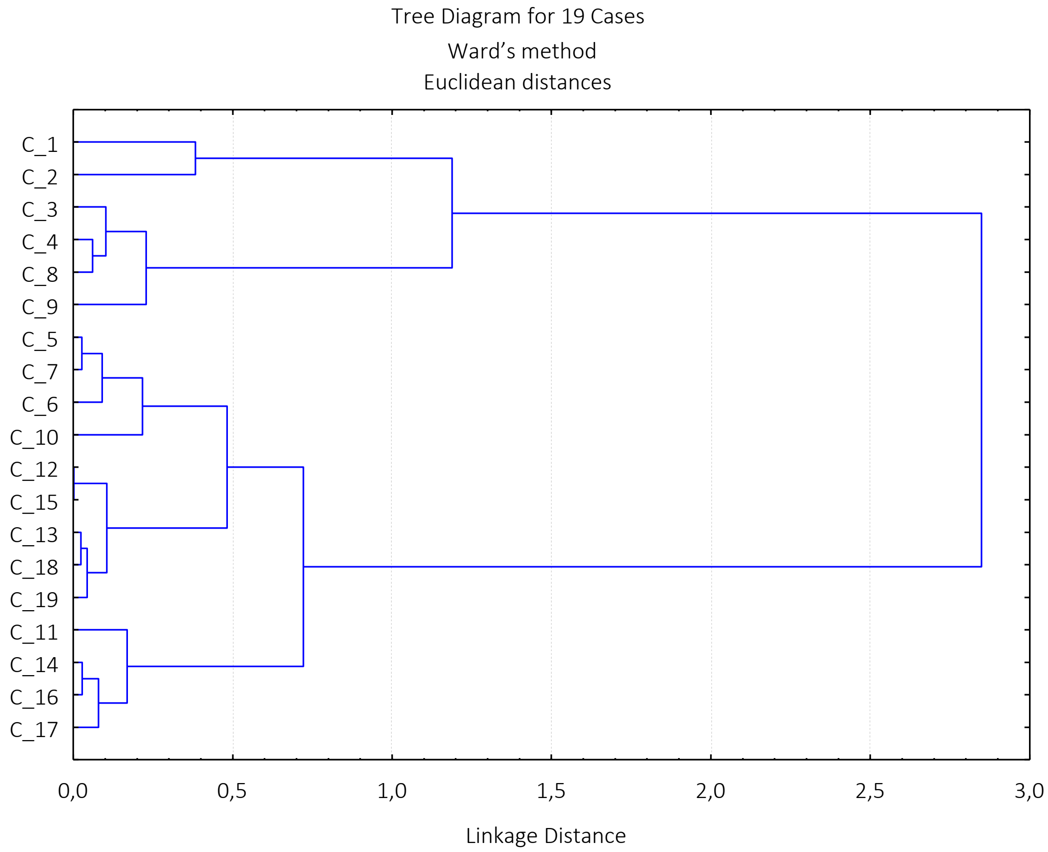

Figure 1. Dendrogram by complex indicators illustrating the competitive capacity level by financial indicators and the digital transformation level

Table 4. Characteristics of bank clusters by the level of competitive capacity

Cluster	Banks	Characteristics
Cluster 1	PrivatBank, Oschadbank	Leaders: relatively high financial indicators of banking activity and the highest applicability and popularity of Internet banking and mobile banking
Cluster 2	Raiffeisen Bank Aval, PUMB, Alfa-Bank, UkrGasbank	Active focus on cooperation with legal entities (deposits, loans), an average digital transformation level, the significant development of the bank's mobile applications
Cluster 3	OTP BANK, UkrSibbank, Credit Agricole Bank, Ukreximbank	Active focus on cooperation with legal entities (deposits, loans), low activity on the Internet, poorly developed mobile applications and the website
Cluster 4	Pravex Bank, Kredobank, Pivdenny Bank, Tascombank	The insignificant volume of financial transactions and financial results, yet, an average level of digital tool implementation
Cluster 5	Procredit Bank, Sberbank, Universal Bank, A-Bank, Bank Sich	The lowest volume of financial transactions and financial results, a low level of digital tool implementation

Table 5. Dependence of the competitive position by certain financial indicators of banks' activity on the competitive level of digital transformation (*x*)

Competitive position by factors	Regression equation	R	R^2	Standardized R^2	Stand. error
Pre-tax income	$PTI = 0.0685+0.5700x$	0.783227	0.613444	0.590706	0.13009
Assets	$A = 0.0147+0.6660x$	0.775986	0.602155	0.578752	0.155644
Personal deposits	$PD = -0.0315+0.7564x$	0.870773	0.758245	0.744024	0.12279
Corporate deposits	$CD = -0.1312+0.5390x$	0.547914	0.30021	0.259046	0.236591
Personal loans	$PL = 0.0150+0.6341x$	0.752617	0.566432	0.540928	0.159493
Corporate loans	$CL = 0.2399+0.4137x$	0.400146	0.160117	0.110712	0.272406

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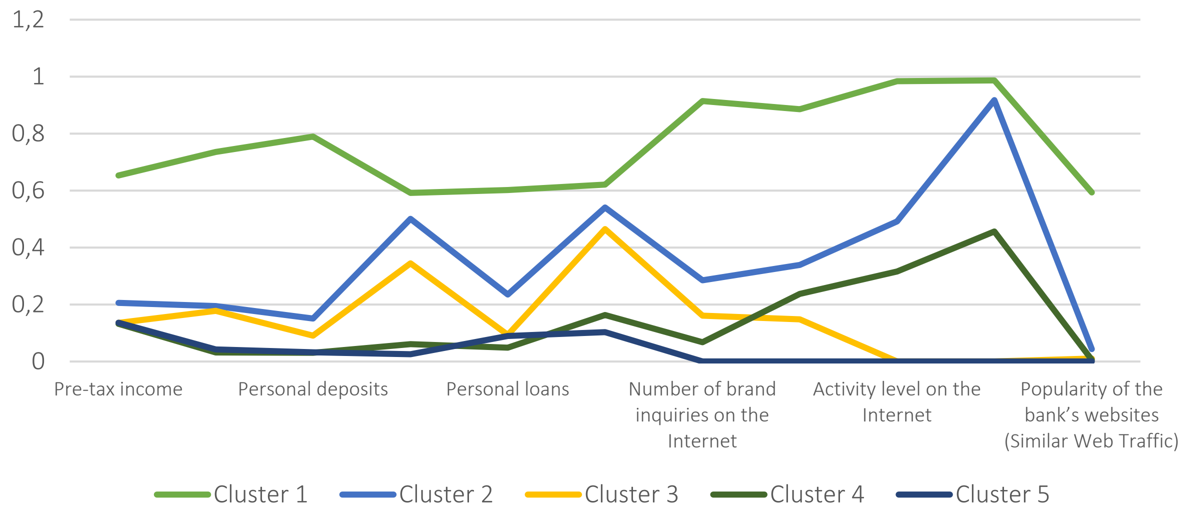

Figure 2. Graphical interpretation of the bank cluster characteristics by the competitive capacity level

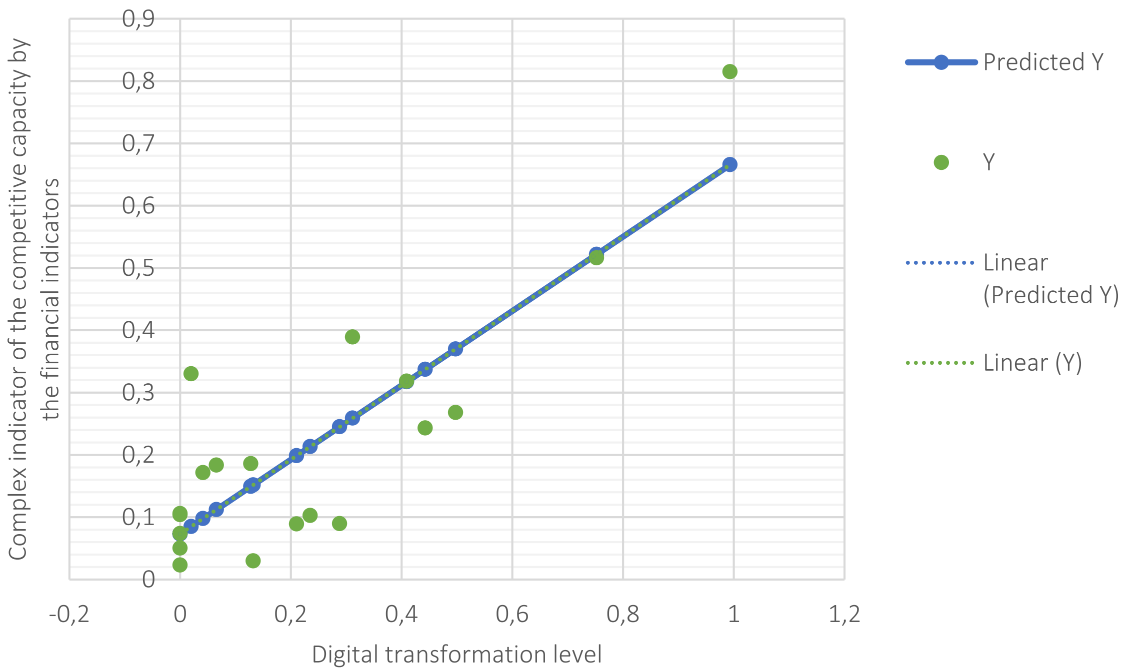

Figure 3. Dependence of the competitive capacity of banks on the digital transformation level

cant and the estimation of the regression equation is statistically reliable.

The regression dependence is illustrated in Figure 3.

Table 5 shows the formed regression equations that allow determining the dependence of the competitive position by certain financial indicators of banks' activity on the competitive level of digital transformation.

4. DISCUSSION

The results of the cluster analysis have confirmed the potential of digital transformation to become a competition driver under current conditions; it determines the competitive advantages of banks and creates additional opportunities to expand their customer base and range of services.

The conducted cluster analysis allowed identifying the most competitive Ukrainian banks both by the financial indicators and the digital transformation level: PrivatBank and Oschadbank, as well as those that actively use the tools of social networks and mobile banking (Raiffeisen Bank Aval, PUMB, Alfa-Bank, and UkrGasbank).

PrivatBank and Oschadbank offer a wide range of banking products to legal entities and individuals through the Internet and mobile applications. PrivatBank has 11 mobile applications, an informative website, uses the modern technologies of Apple Pay, Google Pay, Face Pay, provides means for remote payments of utility charges, buying electronic tickets, mobile phone top-up, making payments by QR-code, and receiving an online payment card. Oschadbank offers three mobile applications, the technologies of Apple Pay, Google Pay, a digital card; it is presented on the popular social networks Facebook, Instagram, and TikTok. The high digital transformation level of both banks displays the basis for the highest amounts of pre-tax income in the Ukrainian banking sector. Both in terms of the complex indicator of the competitive capacity by financial indicators and in terms of the digital transformation level, PrivatBank and Oschadbank are prominent leaders with a rating of 1 and 2.

The active development of online services (though less significant than in the first cluster), in particular, the popularity of banks' mobile applications represents a feature of the second cluster.

The average pre-tax income of the third and fourth clusters is almost the same within the sector, but the third sector banks (OTP Bank, UkrSibbank, Credit Agricole Bank, and Ukreximbank) focus on the supply of banking products mostly in the traditional way, while the fourth sector (Pravex Bank, Kredobank, Pivdenny Bank, and Tascombank) applies a more aggressive policy of online platforms and services. The cumulative effect of the traditional business model on the large third-cluster banks and the digital model of the fourth-cluster banks considered smaller in terms of their activity is balanced by the banks' financial results.

Procredit Bank, Sberbank, Universal Bank, A-Bank, and Bank Sich, which represent the fifth cluster, appear to be the most passive in implementing digital technologies. Their online platforms offer quite limited Internet banking, and their mobile banking is almost not applied. Given the volume of transactions and financial results, this cluster is among the credit rating outsiders.

As can be seen from the above, the qualitative research of the results obtained from the cluster analysis proves that digitalization is becoming a competition driver in modern conditions; it determines the banks' competitive advantages and expands their customer base as well as the range of services.

Using the regression analysis results, it becomes possible to substantiate the hypothesis and prove the close connection between the digital transformation of banks and their competitive capacity.

Determining the dependence of the competitive position by certain financial indicators of banks' activity on the competitive level of digital transformation suggests that the bank's digital technologies have the greatest and direct impact on the competitive position of personal deposits and a significant impact on the pre-tax incomes, assets and personal loans. A moderate impact is observed with regard to corporate deposits, and a weak one – for corporate loans.

The research findings can thoroughly demonstrate that digital transformation is a driving factor for the increasing competitive capacity of domestic banks, mainly those focused on providing services to private customers. The formulated position fills the gap found while studying the impact exerted on some of the bank's competitive positions by digital transformation, which determines the focus of banking products under the digital transformation conditions.

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CONCLUSION

In the context of the Ukrainian economy, the development of the banking sector and its competition scale force banks to search for effective tools aimed at managing the range of banking products and disseminating innovative services.

This paper represents a study directed at a new object field, namely, assessing the impact exerted on the banks' competitive capacity by the level of digital transformation in broad terms and its certain components, as illustrated by Ukrainian banks.

According to the results obtained from the cluster and regression analysis, it can be considered proven that in the digital economy, the influence of Internet banking and mobile banking technologies initiates the transformation of competitive factors found in ensuring the banks' competitive capacity through revolutionary changes from a traditional model to an online platform model with a wide outreach of customers and tools. The banking service market leaders in Ukraine (PrivatBank and Oschadbank) also hold leading positions when being assessed with regard to their digital technologies.

The implementation of these methods at the research stage made it possible to substantiate the significance of the factor of digital transformation level considered when assessing the competitive capacity of a bank.

The relationship between the level of bank's competitive capacity and the level of digital transformation was close and direct. Digital transformation influences all significant indicators of the bank's activity: income, assets, volumes of deposits and loans. The foregoing identifies an effective tool for competition, determines the direction and opportunities for the development of banking institutions.

The most significant impact of digital transformation is noticeable in the increasing amount of personal deposits and loans, income, and assets. At the same time, the analyzed digital transformation level of Ukrainian banks testifies to a moderate impact on the involvement of legal entities.

In conclusion, it is worth noting that banks should thoroughly aim to introduce innovative digital technologies in their activities to maintain a competitive position in the banking sector. When applying the proposed approach based on certain regression equations, they will be capable of assessing the efficiency and making appropriate management decisions about investing in digital tools and services.

Further research should be aimed at developing a methodological approach to a comprehensive assessment of the bank's digital transformation and its effectiveness.

AUTHOR CONTRIBUTIONS

Conceptualization: Oleh Kolodiziev, Olha Lozynska.
Data curation: Mykhailo Krupka, Nataliya Shulga.
Formal analysis: Oleh Kolodiziev, Myroslav Kulchytskyy.
Investigation: Nataliya Shulga, Myroslav Kulchytskyy.
Methodology: Oleh Kolodiziev, Olha Lozynska.
Project administration: Mykhailo Krupka, Myroslav Kulchytskyy.
Supervision: Oleh Kolodiziev, Olha Lozynska.
Validation: Oleh Kolodiziev, Mykhailo Krupka.
Visualization: Myroslav Kulchytskyy, Olha Lozynska.
Writing – original draft: Mykhailo Krupka, Nataliya Shulga.
Writing – review & editing: Nataliya Shulga, Olha Lozynska.

REFERENCES

1. Accenture. (2017). *Accenture Research Analysis on Capital IQ data*, March 13. Retrieved from https://www.accenture.com
2. Ali, A., & Ali, H. (2014). Customers' perception of m-banking adoption in kingdom of Bahrain: an empirical assessment of an extended tam model. *International Journal of Managing Information Technology,* 6(1), 1-13. https://doi.org/10.5121/ijmit.2014.6401
3. Amin, M. (2016). Internet Banking Service Quality and its Implication on e-Customer Satisfaction and e-customer Loyalty. *International Journal of Bank Marketing, 34*(3), 280-306. https://doi.org/10.1108/IJBM-10-2014-0139
4. Banker.ua. (2020). *Top 20 DIGITAL-banks of Ukraine.* Retrieved from https://banker.ua
5. Barbosa, K., Rocha, B., & Salazar, F. (2015). Assessing competition in the banking industry: A multi-product approach. *Journal of Banking & Finance, 50,* 340-362. https://doi.org/10.1016/j.jbankfin.2014.05.003
6. Bikker, J., Shaffer, Sh., & Spierdijk, L. (2009). Assessing Competition with the Panzar-Rosse Model: The Role of Scale, Costs, and Equilibrium. *Review of Economics and Statistics, 94*(4), 1025-1044. https://doi.org/10.1162/REST_a_00210
7. Busby, D. (2017). Adopting the best approach for a digital banking solution: combine the benefits of the 'build', 'buy' or 'outsource' options. *Journal of Digital Banking, 2*(1), 43-50. Retrieved from https://www.ingentaconnect.com/content/hsp/jdb001/2017/00000002/00000001/art00006
8. Dootson, P., Beatson, A., & Drennan, J. (2016). Financial institutions using social media – do consumers perceive value? *International Journal of Bank Marketing, 34*(1), 9-36. https://doi.org/10.1108/IJBM-06-2014-0079
9. Forinsurer. (2020). *Reyting bankov Ukrainy NBU [Rating of Ukrainian banks NBU].* (In Russian). Retrieved from https://forinsurer.com/ratings/banks/20/9
10. Jun, M., & Palacios, S. (2016). Examining the Key Dimensions of Mobile Banking Service Quality: An Exploratory Study. *International Journal of Bank Marketing, 34*(3), 307-326. https://doi.org/10.1108/IJBM-01-2015-0015
11. Kolodiziev, O., & Gontar, D. (2014). Scenario modeling of the bank's market value strategic management. *Economic Annals-XXI, 9-10*(2), 19-23. (In Ukrainian). Retrieved from http://soskin.info/userfiles/file/2014/9-10_2014/2/Kolodiziev_Gontar.pdf
12. Kolodiziev, O., Mints, A., Sidelov, P., Pleskun, I., & Lozynska, O. (2020). Automatic machine learning algorithms for fraud detection in digital payment system. *Eastern-European Journal of Enterprise Technologies, 5*(9), 14-26. https://doi.org/10.15587/1729-4061.2020.212830
13. Koroleva, E., & Kudryavtseva, T. (2020). Factors Influencing Digital Bank Performance. *The 2018 International Conference on Digital Science* (pp. 325-333). https://doi.org/10.1007/978-3-030-37737-3_29
14. Kozmenko, S., & Bielova, I. (2015). Identification of the critical level in accumulation of systemic financial risk in the economy of countries of Central and Eastern Europe. *Problems and Perspectives in Management, 13*(3), 7-17. Retrieved from https://businessperspectives.org/media/zoo/applications/publishing/templates/article/assets/js/pdfjs/web/6842
15. Krasovskis, D., Limanskis, A., & Pancenko, E. (2016). Measuring competitiveness of banks in Latvia. *Copernican Journal of Finance & Accounting, 5*(2), 125-147. http://dx.doi.org/10.12775/CJFA.2016.019
16. Maochun, Z., & Zhixu, S. (2013). The research on the competitiveness of commercial banks by factor analysis. *6th International Conference on Information Management, Innovation Management and Industrial Engineering* (pp. 367-370). Xi'an, China. https://doi.org/10.1109/ICIII.2013.6703594
17. Martins, C., Oliveira, T., & Popovic, A. (2014). Understanding the Internet Banking Adoption: A Unified Theory of Acceptance and Use of Technology and Perceived Risk Application. *International Journal of Information Management, 34*(1), 1-13. https://doi.org/10.1016/j.ijinfomgt.2013.06.002
18. Mbama, C., & Ezepue, P.O. (2018). Digital banking, customer experience and bank financial performance: UK customers' perceptions. *International Journal of Bank Marketing, 36*(2), 230-255.
19. Panzar, J. C., Rosse, J. N. (1987). Testing for monopoly equilibrium. *Journal of Industrial Economics, 35*(4), 443-456. https://doi.org/10.2307/2098582
20. Pruteanu-Podpiera, A., Weill, L., & Schobert, F. (2016). Banking Competition and Efficiency: A Micro-Data Analysis on the Czech Banking Industry. In J. C. Brada and P. Wachtel (Eds.), *Global Banking Crises and Emerging Markets.* Palgrave Macmillan, London. https://doi.org/10.1007/978-1-137-56905-9_4
21. Qing, D. W. (2009). The introduction of financial ethics business silver pound core competitiveness index system. *Financial Theory & Practice, 3,* 27-30.
22. Raza, S. A., Jawaid, S. T., & Hassan, A. (2015). Internet Banking and Customer Satisfaction in Pakistan. *Qualitative Research in Financial Markets, 7*(1), 24-36.
23. Shaffer, Sh., & Spierdijk, L. (2015). The Panzar-Rosse revenue test and market power in banking. *Journal of Banking & Finance, 61,* 340-347. https://doi.org/10.1016/j.jbankfin.2015.09.019

http://dx.doi.org/10.21511/bbs.16(1).2021.08

24. Shin, D. J., & Kim, B. H. (2013). Bank consolidation and competitiveness: Empirical evidence from the Korean banking industry. *Journal of Asian Economics, 24,* 41-50. https://doi.org/10.1016/j.asieco.2012.07.004

25. Silva Bidarra, S. H., Muñoz-Leiva, F., & Liébana-Cabanillas, F. (2013). Analysis and modeling of the determinants of mobile banking acceptance. *The International Journal of Management Science and Information Technology (IJMSIT), 8,* 1-27. Retrieved from https://www.econstor.eu/handle/10419/97874

26. Stoica, O., Mehdian, S., & Sargu, A. (2015). The impact of internet banking on the performance of Romanian banks: DEA and PCA approach. *Procedia Economics and Finance, 20,* 610-622. https://doi.org/10.1016/S2212-5671(15)00115-X

27. The Banker. (2020). Retrieved from http://www.thebanker.com/

28. Zhao, Q., Tsai, P.-H., & Wang, J.-L. (2019). Improving Financial Service Innovation Strategies for Enhancing China's Banking Industry Competitive Advantage during the Fintech Revolution: A Hybrid MCDM Model. *Sustainability, 11*(5), 1419. https://doi.org/10.3390/su11051419