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Innovative technologies in the banking sector of Ukraine in the period of digitalization

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Abstract. Today, interbank competition is gaining momentum, so the introduction and development of innovative technologies in the provision of banking services is becoming particularly relevant. In addition, the improvement of innovative technologies in the banking sector will ensure the efficient operation of the banking system and increase the level of the economy of Ukraine by increasing innovative ways of carrying out financial transactions. The goal is to study the prospects for the integration of financial technologies in the banking sector, to identify strengths and weaknesses, as well as threats and opportunities for the influence of these technologies in the banking industry. The theoretical and methodological main articles are the works of Ukrainian scientists on the implementation of banking innovations and financial technologies. Empirical and theoretical research methods were used in the research process, which made it possible to reveal the essence of the concept of innovative activity and innovative technologies. An analysis of modern promising innovative technologies in Ukraine and in the world was carried out. With the help of SWOT analysis, the strengths and weaknesses of innovative technologies, such as: ManuScan, electronic wallets, electronic payment systems, were investigated. Special attention was paid to the category of threats of such innovative technologies as hacking and virus attacks, since these innovative technologies are used in the banking and financial system at the state level. Innovative technologies are analyzed as a complete innovation of changes in the activity of the financial sphere of Ukraine with the aim of improving the use of the banking and financial sphere of Ukraine, increasing monetary transactions both on the territory of Ukraine and outside of it. The activity of banking institutions using the latest, improved financial products and services is considered. The practical value of the study is that it can become a basis for achieving stable and efficient functioning of banks in the future, as well as provide recommendations for the implementation of the latest electronic payment systems, which are currently gaining popularity

Keywords: retinal or pupil scanner; banking services; fintech; electronic wallets; electronic payment system

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INTRODUCTION

In recent decades, innovative technologies have developed rapidly in global banking practice. Their appearance is explained by the search for new ways of carrying out banking activities with the aim of obtaining high profits.

L. Kloba (2018) noted that the digitalization process is aimed at cooperation with fintech startups with long-term goals to introduce innovative work methods, banking products and services to increase and expand the client base and increase the bank's competitiveness, which is the result of digitalization. The digitalization process itself is primarily related to the transformation of scientific research and development with the aim of improving banking products and services.

V. Kunytsia & Yu. Tsevukh (2019) noted that financial innovations throughout historical development are actively implemented in the practical activities of foreign countries. The authors identified the main reasons for the development of financial innovations, among which information technologies, which are actively interconnected with other financial processes, play a significant role. According to the authors, these innovations are able to increase the efficiency of existing processes, as well as launch completely new ones, thus increasing the interest of customers. The authors highlighted innovative technologies that play the main trend in the development of the financial and banking system. However, independent development at the moment is not as effective as the process of synergy between companies that create innovations and institutions that deliver improved services to their customers.

V. Honcharuk (2019) proved that the digitalization of banks' activities is connected with the transformation of scientific research and development, other scientific and technological achievements into new or improved banking products and services, into an updated or improved banking technological process used in practical activities, or a new an approach to the realization of products and services, their adaptation to current customer requirements. The attractive features of digital banking products are high reliability, profitability and quality. Digitization of banks' activities is aimed at obtaining profit from the introduction of modern financial technologies.

M. Matyukha (2019) indicated that in the last few years, the theoretical and practical issues of the requirements for the automation of banking systems have been highlighted in the specialized literature, but the issues will continue to be relevant in the process of designing, developing and using these banking systems.

A. Kovaleva (2021) noted that the banking sphere of Ukraine is undergoing transformation taking into account new requirements. Today, digital technologies have become an indispensable tool in the banking and financial sector and are developing rapidly. Therefore, the further functioning of the banking sector at the current stage of development is directly related to the development of innovative technologies, which in recent years are an information vector not only for a separate banking system, but also for the entire financial sector and the country's economy as a whole.

The purpose of the article was an in-depth study of the essence of innovations, their content, as well as their role for the banking sector of Ukraine in the era of digitalization; the study of such innovative technologies as electronic scanners, electronic wallets and electronic payment systems in the financial sphere of the economy will enable their effective use in the financial and banking system, increasing the number of transactions with high efficiency and increasing the number of satisfaction of customer needs.

LITERATURE REVIEW

L. Bondarenko & M. Politylo (2018) studied in their works the problems of innovative work of Ukrainian banks in the financial sphere, studied the importance and feasibility of innovative activities of banking institutions to ensure their effective development in the financial market. The foreign experience of innovative banking products and technologies was also studied, thanks to which the main global banking innovations were highlighted. Further prospects of innovative activity in the Ukrainian banking sector in the coming years are analyzed.

D. Dorofeiev (2018) investigated the theoretical and methodological principles of determining the essence of the economic nature, studied the economic nature of financial relations that take place in the financial sector. In his activities, he defined financial innovations as a complete innovation and change in the activities of financial banking institutions that carry out their activities on improved and modified financial innovations. Also, he classified financial innovations according to the scope of their occurrence and use, according to the objects of implementation and to the list of the use of tools in order to improve the management of innovation processes.

L. Kloba (2018) in his work investigated the digitalization process in banking institutions as a complex of modern economic and organizational and managerial innovations. Today, in the conditions of intensified competition in the market, digitalization contributes to the expansion of the client base, the market share of banking services, the reduction of the volume of expenses and the improvement of the financial stability of the banking institution. Digitalization of banking institutions is primarily related to the transformation

of scientific research and development into the latest or already improved banking products and services used in practical activities. The result of digitization for banking activities is the latest products and services with newer qualities, which includes new intelligent products, modern technological equipment and processes, new approaches to market formation of modern innovative banking products and services.

S. Fatonah *et al*. (2018) conducted a focused review of the available literature for e-commerce e-payment systems to highlight the scope of e-payment systems.

Y. Kryvych & A. Dranitsyna (2019) studied the essence and meaning of the concept of banking innovations, their classification and the relationship between the innovative activity of banks and the formation of customer loyalty and the growth of trust in banks. They established the distinction between financial and banking innovations, considered the chronology of the development of significant banking innovations, and established the relationship between the innovative activities of banking institutions and the scientific achievements of mankind. In particular, product, process, marketing, technological and managerial innovations were established. Special emphasis is placed on the relationship between the innovative activity of banking institutions and the parallel increase in the level of trust in banks.

V. Kunytsia & Yu. Tsevukh (2019) in his works paid attention to the main trends in the development and use of financial innovations in the banking sector, as well as innovations in the field of finance and approaches to their study. Research on the close cooperation of banking institutions with various FinTech companies that are actively implementing innovative solutions, but are unable to test their innovations at scale without the help of established financial institutions.

T. Handayani & A. Novitasari (2020) analyzed the determination of the level of efficiency of digital wallets as a transaction medium. It was found that the number of users of digital wallets is increasing over time, due to the rapid increase in the number of smartphone users. The advantages and disadvantages of electronic wallets were analyzed.

N. Arkhireiska & O. Kuchkova (2021) studied the current trends of the payment market of Ukraine in the direction of cashless payments and electronic wallets. We analyzed the load of the electronic payments system of Ukraine for the period from 2010 to 2020. They analyzed the performance indicators of the NBU electronic payment system and the amount of transfer payments within Ukraine.

A. Ali & A. Salameh (2023) investigated various aspects of the payment and settlement system. We found negative trends in traditional payment systems and calculations in Saudi Arabia. We analyzed the dissatisfaction of users of payments and settlements with such elements as different payment sizes and tracking.

MATERIALS AND METHODS

In the research process, general logical methods and methods of cognition were used, including: empirical and theoretical levels of cognition. When applying the empirical level, the following research tools were used: description, classification, observation, comparison, modeling and forecasting.

The description and classification method were used to identify and classify innovative digital technologies and tools used in banking institutions and their general trends. Thanks to the method of observation, the integration of innovative technologies into the banking and financial systems, which have an impact and cause positive and negative trends in the systems, were investigated. The method of comparison was comparing the results before and after the introduction and use of innovative technologies in the banking and financial systems. Modeling and forecasting for the study of further prospects and threats from the active implementation and use of innovative technologies in the financial and banking sphere based on the experience of foreign countries, such as: Saudi Arabia, Indonesia.

Among the general logical methods and methods of theoretical knowledge, the following were used: analysis, synthesis and induction. The analysis carried out the distribution of the impact of innovative technologies with the help of SWOT analysis on strengths and weaknesses, as well as the identification of threats and opportunities for the activities of the banking sector. The weighting coefficient, which is the Wc x Ae indicator, was calculated by the ratio of such indicators as the weighting coefficient and the authors' evaluation. With the help of synthesis, a combination of the individual data obtained from the implementation of the implementation of innovative digital technologies into a single whole was carried out. Through the method of induction, the results were summarized based on the observation of the application of financial innovations in other countries and the generalization of the conclusion about the nature of the use of these technologies and their impact on the economy of Ukraine.

In order to interpret the research results, the following stages of the research process were used:

1. The research is a search and description of innovative digitization processes, as well as innovative technologies and their impact on the banking and financial sector of the Ukrainian economy.

2. Research algorithm, in which a plan of measures for the application of innovative technologies in the banking sector of Ukraine was carried out, in particular: a set of

scientific research methods was selected, which included empirical, theoretical and general-logical methods and techniques of cognition in order to study the impact of innovative technologies on the banking and financial sector; a sampling strategy was formed, which involved researching the problem of the impact of innovative technologies and determining their threats and weaknesses in the financial sphere offered in the banking sector.

3. Data collection, their analysis and interpretation regarding regulatory support, the practice of using innovative technologies in the banking sector, the availability of digital literacy of the main users of the bank, the creation of digital infrastructure at the state level, for the purpose of formulating a conclusion, as well as preparing a scientific article.

Among the materials used in this article, the information base of legislative and regulatory acts Law of Ukraine No. 40-IV "On Innovative Activity" (2002), which reveals the essence of innovative activity and regulates the process of innovative activity under the influence of digitalization in Ukraine.

The study used graphs of the load of the electronic payments system in Ukraine by the number of initial payments and the amount of initial payments, charts of the total volume of payments, million pieces, processed in the electronic payments system, and the total amount of payments, trillion UAH, processed in the electronic payment system payments, as well as involved banking institutions in using the electronic payment system in their payment system, such as: JSC CB "Privat Bank", JSC "Oshchadbank", JSC "Raiffeisen Bank Aval" and others (Report on the compliance..., 2020).

Information from the experience of Saudi Arabia and Indonesia with the active use of electronic wallets in their financial system was studied from the scientific activity of Ukrainian authors (Tovkun & Akhmedova, 2020), as well as the strengths and weaknesses of the use of electronic wallets in the banking system of Ukraine were studied (Yarosh & Romanovska, 2017).

Regarding the study of the technology of the electronic palm vein scanner and the use of such scanners in practice for the purpose of researching prospects and threats, the materials of the Infocom website "Biometric personal identification system" (Biometric personal identification system, n.d.) were analyzed.

RESULTS AND DISCUSSION

According to the Law of Ukraine No. 40-IV "On Innovative Activity" (2002), the term "Innovative activity" means activity aimed at the use and commercialization of the results of scientific research and development and leads to the release of new competitive goods and services to the market.

L. Avramchuk & I. Korkach (2019) noted that all civilized countries are trying to reduce the number of cash transactions and cash in circulation as much as possible. For this, central banks and governments apply a number of measures, one of which is settlement using payment systems with plastic cards (primarily domestic, as well as international).

V. Honcharuk (2019) noted that the digital economy is a relatively new concept in Western and Ukrainian literature, which has many understudied aspects and "white spots", in particular regarding the construction of its financial infrastructure. Therefore, the identification of the key components of the financial infrastructure of the digital economy is an urgent task for Ukraine, especially in the context of the strengthening of crisis tendencies in the global financial system.

In the era of digitization, a new trend that is gaining popularity is "Biometric identification". This technology was supported by the EU as a reliable identification of a person. Thus, in Ukraine there is a system "ManuScan", developed by the Sinfocom company, which is able to identify a person by scanning the pattern of veins in the palm. This method of identification is considered the most simple and reliable than such complex protection systems as scanning the retina or pupil of the eye (Biometric personal identification system, n.d.).

According to the Infocom website (Biometric personal identification system, n.d.), the scanner sensor illuminates the hand with safe infrared radiation, the system recognizes the palm vein pattern, which is unique to each person, even twins, and does not change throughout life, for greater safety is also monitored the presence of a pulse, and the system grants access to the premises or territory only to those whose vein pattern is entered into the identification system.

In the course of researching this technology, we will use SWOT analysis, the application of which for a banking institution is shown in Table 1.

Table 1. *SWOT analysis of the application of the "ManuScan" system from Sinfocom for a banking institution*

Strengths	Weighting coefficient (Wc)	Authors' evaluation (Ae)	Wc x Ae	Weaknesses	Weighting coefficient (Wc)	Authors' evaluation (Ae)	Wc x Ae
Accurate and fast identification of a person	0.3	6	1.8	Impossibility of application when the power grid is turned off in the region	0.4	9	3.6

Table 1, Continued

Strengths	Weighting coefficient (Wc)	Authors' evaluation (Ae)	Wc x Ae	Weaknesses	Weighting coefficient (Wc)	Authors' evaluation (Ae)	Wc x Ae
Hygienic application	0.4	7	2.8	High costs for the purchase of equipment	0.3	7	2.1
Stable performance under any weather and climatic conditions (from -25°C to +85°C)	0.3	6	1.8	Insufficient distribution for use in domestic banking institutions	0.3	7	2.1
Total:			**6.4**				**7.8**
Opportunities	**Weighting coefficient (Wc)**	**Authors' evaluation (Ae)**	**Wc x Ae**	**Threats**	**Weighting coefficient (Wc)**	**Authors' evaluation (Ae)**	**Wc x Ae**
Transition to a simplified identity verification system	0.3	7	2.1	The possibility of hacking	0.3	8	2.4
Integration into all access control systems	0.3	8	2.4	Replacing the identity verification system in banks	0.2	5	1.0
Triple encryption system	0.4	9	3.6	Collection and storage of information about a person for life	0.5	9	4.5
Total:			**8.1**				**7.9**

Source: *authors' own development based on Biometric personal identification system (n.d.)*

Having conducted a SWOT analysis of the Sinfocom ManuScan system for use in banking institutions, it was established that the sum of the products of the weighting coefficients and the authors' evaluations is dominated by opportunities, the total score of which was 8.1. Among the component possibilities, the following were considered: the transition to a simplified system of identity verification, which shows the development of innovative technologies and their further direction to simplify the identification of people; integration into all access control systems, which will provide an opportunity to monitor and check all employees of the banking institution; the triple encryption system significantly increases the chances of protecting data about all users, which is an essential point for consumers when using digital technologies.

In second place according to the total score, there are threats with 7.9 points. Among them, the greatest attention should be paid to the collection and storage of information about a person for life. And it is not surprising, because by leaving information in the global database, a person forever leaves behind a digital footprint. The replacement of the identity verification system in banks also plays a significant role for banking institutions, because the banking institution needs to replace the old system with a new one, which is quite a costly affair, and also the transformation of an already familiar technology into an as yet unknown (new, modern) one will take some time and require certain energy and mental efforts of the bank's staff. The last factor – the possibility of hacking – will always be present, because no matter what the security system is, there is always a risk of its hacking.

Weaknesses in the use of technology scored 7.8 points. One of the weaknesses was the impossibility of using the technology when the power grid was turned off in the region, which is quite a common phenomenon today. Almost all technologies depend on the supply of electricity (and this problem has not yet been solved). The cost of purchasing equipment is also the main drawback, because for each computer that will be part of this system, it is necessary to purchase its own scanner. However, it is important that cheap scanners are not durable and have a high error rate, which requires the purchase of more reliable and therefore more expensive ones. Insufficient prevalence for Ukrainian banking institutions is still in the position of weaknesses. However, with the speed of development of new technologies, we believe this will not last long.

Among the strengths that received the lowest number of points (6.4), the accuracy and speed of operations deserve special attention, which essentially simplifies ordering for consumers in the online store and work in rather harsh conditions. Such a factor as hygiene ensures contactless application of the technology, while the user does not even need to touch the scanner, which is very important during the coronavirus pandemic.

M. Chuprina & T. Lazorenko (2021) noted that this technological and innovative system is currently used mainly in homes, but in the future they plan to use it widely in banking institutions as well.

The next innovative technology in the banking sector is digital wallets based on the electronic payment system. Today, electronic payment systems are mostly taken care of by the banking sector. The implementation of such systems by the National Bank of Ukraine made it possible to quickly reduce the number of intrabank and interbank payments. When making a payment in an online store, most consumers do not want to leave their data on sites and applications for each individual purchase. This problem was solved by creating digital wallets. Thus, the user does not need to enter his card data every time when paying for any goods or services on the website of the online store. Masterpass wallet allows you to use any bank card: MasterCard, Visa. This technology is supported by most banks, because making a payment from your card to such a wallet (or vice versa) creates electronic money circulation (Masterpass wallet…, n.d.).

Saudi Arabia has foreign experience in using electronic wallets with their "Sadad" payment system. Statistics showed that in 2007, payments amounted to 43,513,397 payments, of which 43.39% were through the Sadad system itself, and 56.61% were through others. However, already in 2021, the indicators amounted to 311,568,408 payments, among which 94.09% were through the "Sadad" system, and 5.91% were through other systems. This example shows that the number of payments not only increases absolutely, but also proportionally. A negative trend is observed in the traditional payment and settlement system, i.e. payments and settlements using personal and commercial checks, as well as interbank commercial checks 2012-2021. Mada and E-payment (SADAD and SARIE) are the largest sources of online payments, while POS is the fastest growing means of payment and settlement in Saudi Arabia. The contribution of traditional means of payment and settlement is insignificant and tends to decrease. Most of the customers who use online payment and settlement services are satisfied with different sizes (Ali & Salameh, 2023).

Currently, the banking industry is one of the demonstrative examples of rapid digital development. It should be noted that the leaders of the banking sector pay considerable attention to IT development services – digital factories are emerging. Thus, one of Canada's largest banks, the Bank of Nova Scotia, or Scotiabank, recently announced the development of a new digital factory project that will create and implement digital innovations and solutions for the bank's clients (Malakhova, 2019).

In order to investigate the expediency of using the electronic wallet system in a banking institution, we will compile a SWOT analysis (Table 2).

Table 2. *SWOT analysis of the application of the electronic wallet system in a banking institution*

Strengths	Weighting coefficient (Wc)	Authors' evaluation (Ae)	Wc x Ae	Weaknesses	Weighting coefficient (Wc)	Authors' evaluation (Ae)	Wc x Ae
Speed of operations	0.3	9	2.7	This platform is not supported by some organizations	0.3	7	22.1
Conduct operations anywhere	0.4	9	33.6	Impossibility of access when the power supply is turned off	0.4	8	33.2
Carrying out operations around the clock in 24/7 mode	0.3	9	2.7	Insecurity of electronic account from blocking	0.3	8	22.4
Total:			**9.0**				**77.7**
Opportunities	**Weighting coefficient (Wc)**	**Authors' evaluation (Ae)**	**Wc x Ae**	**Threats**	**Weighting coefficient (Wc)**	**Authors' evaluation (Ae)**	**Wc x Ae**
Saving time for transactions	0.4	9	33.6	Presence of hacker and virus attacks	0.4	9	33.6
The possibility of carrying out operations abroad	0.3	6	11.8	Charging a higher commission	0.3	6	11.8

Table 2, Continued

Opportunities	Weighting coefficient (Wc)	Authors' evaluation (Ae)	Wc x Ae	Threats	Weighting coefficient (Wc)	Authors' evaluation (Ae)	Wc x Ae
The possibility of receiving additional funds	0.3	6	11.8	Gradual replacement of paper money	0.3	8	22.4
Total:			**77.2**				**77.8**

Source: *authors' own development based on V.I. Yarosh & Yu.A. Romanovska (2017)*

Having conducted a SWOT analysis of the application of the electronic wallet system in a banking institution, the weaknesses and strengths of this system in Ukrainian banking institutions were investigated. Yes, strengths have the highest rating – 9 points. An important component here is the implementation of operations in any place, which is a priority for consumers of this service today. After all, there is no need to stand in line or even leave the house, it is enough to have a mobile phone with Internet access nearby.

The next components that scored the same number of points are the speed of transactions and 24/7 access. These components are important for banks and no less important for consumers, which affects their choice, and ultimately affects the competitiveness of a banking institution both on the national and global financial markets.

Threats have the second highest overall score – 7.8 points. Among the threats with the highest rating (3.6 points) are hacker and virus attacks. Since electronic wallets involve the storage and circulation of electronic money, it is extremely important to ensure reliable protection of these systems, both for individual consumers and for the country's economy as a whole. The increase in protection systems affects the increase in the interest of customers in electronic wallets – this is an obvious fact.

However, another threat posed by the electronic wallet system is exclusion from the system of circulation of paper money. Electronic money is becoming more and more popular in the financial market not only because of its convenience, but also because of its environmental friendliness. Environmental safety implies the need to save paper (and forests on the planet). The only thing that can prevent the complete disappearance of paper forms of money from circulation is the replacement of natural paper with artificial paper.

Among the weaknesses, which have a total score of 7.7 points, such main components can be identified as: the lack of protection of the electronic account against blocking and the impossibility of access when the power supply is turned off, which is a rather significant and everyday drawback for such electronic technology, which so far cannot be avoided, but can be minimized.

This type of payment system is included in "Electronic payment systems" (SEP). Today, this system belongs to banking institutions. According to the report of the National Bank of Ukraine, the workload of SEP in 2010-2021 steadily increased (Report on the compliance..., 2020), which can be seen in Figure 1.

It was established that during the researched period, the number and amount of initial payments increased every year. And although the amount of payments tended to decrease in the period 2013-2015, it later increased and amounted to UAH 65 trillion by the end of 2021 (Report on the compliance..., 2020).

As for the number of initial payments, it grew steadily throughout the studied period, and by the end of 2021 it already amounted to more than 400 million units. (Report on the compliance..., 2020). These indicators testify to the incredibly effective growth of SEP in the banking sector of Ukraine (Fig. 2).

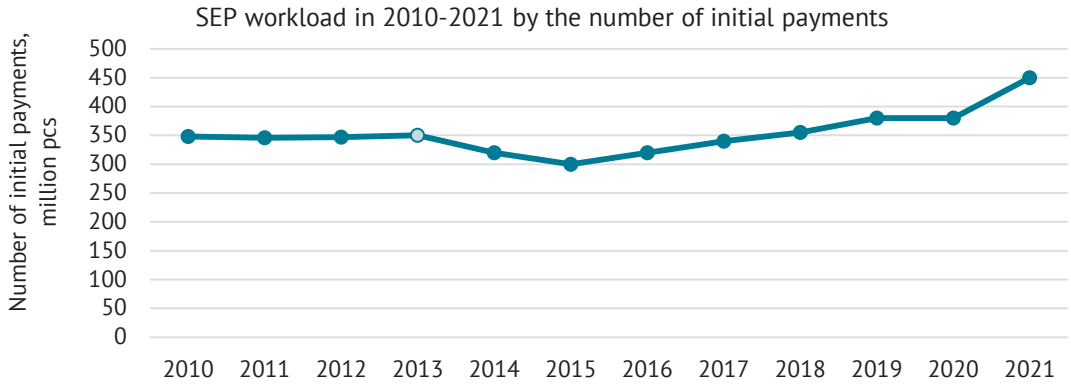

Figure 1. *SEP workload in 2010-2021 by the number of initial payments*

Source: *developed by the authors based on research Electronic payment system... (2021)*

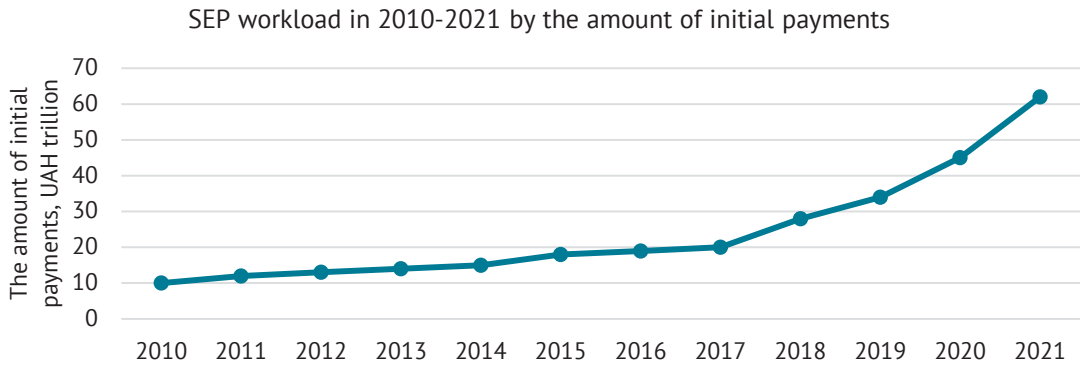

***Figure 2**. SEP workload in 2010-2021 by the amount of initial payments*
***Source**: developed by the authors based on research Electronic payment system... (2021)*

According to the NBU report (Report on compliance..., 2020), in 2020, SEP processed 385.3 million initial payments in the amount of UAH 44.8 trillion, which is 0.4% more in number and 38.1% in amount , than in the previous year, in general, in 2020, SEP processed an average of 1.5 million payments in the amount of UAH 178.6 billion per day (Report on the compliance..., 2020).

It was established that the total volume of payments had a growing pace and reached its maximum value in 2020, which is due to the introduction and flourishing of innovative technologies. Thus, the indicators were calculated among the five largest SEP participants (by payment amount) (Report on the compliance..., 2020):

1. National Bank of Ukraine – 25.9% of the amount of payments;
2. State Treasury Service of Ukraine – 7.4% of the amount of payments;
3. JSC CB "PrivatBANK" – 7.1% of the amount of payments;
4. JSC "Oschadbank" – 6.0% of the amount of payments;
5. Raiffeisen Bank Aval JSC – 5.5% of the amount of payments.

So, three banks (JSC CB "PrivatBANK", JSC "Oschadbank", JSC "Raiffeisen Bank Aval") in 2020 showed the greatest result and were at that time leading and recognized, because they actively implemented innovative methods of payments

Having conducted an analysis of the total volume and amount of payments processed in the SEP for 2016-2020, it is possible to conclude that these indicators increased during the period under study. Whereas in 2016, the indicator of the total volume of payments was 313 million units, while in 2020 this indicator was 385 million units, which shows a significant increase in the number of payments made in the SEP and their growth. However, in 2019, during the pandemic, there was a significant increase in the number of payments (Fig. 3).

Thus, the total amount of payments in trillions of hryvnias processed in the SEP in the 2016-2020 period also had a significant growth. In 2016, this figure was 20 trillion UAH, and in 2020 it will be 45 trillion UAH, twice. Thus, in 2019, during the pandemic, a significant upward trend is also observed. Therefore, the general trend is to increase the number and amount of payments through SEP, and therefore to give preference to SEP clients (Fig. 4).

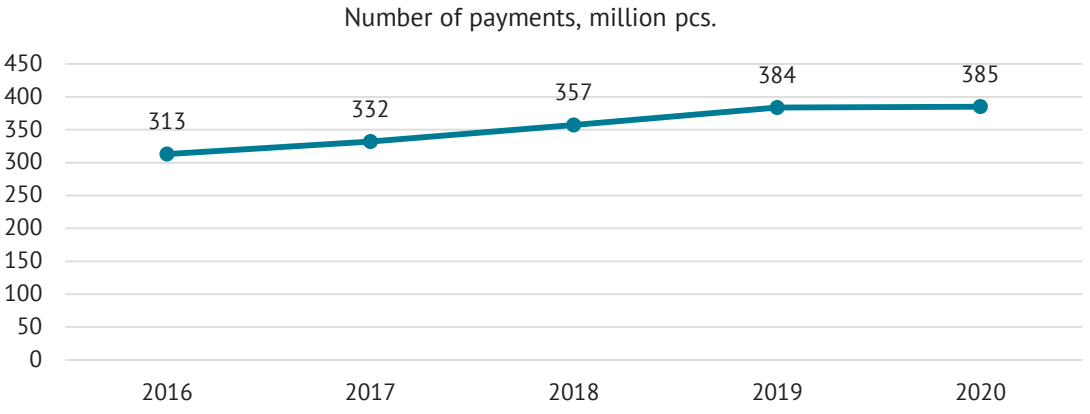

***Figure 3.** Total volume of payments, million pcs. processed in SEP 2016-2020*
***Source**: developed by the authors based on research Report on the compliance... (2020)*

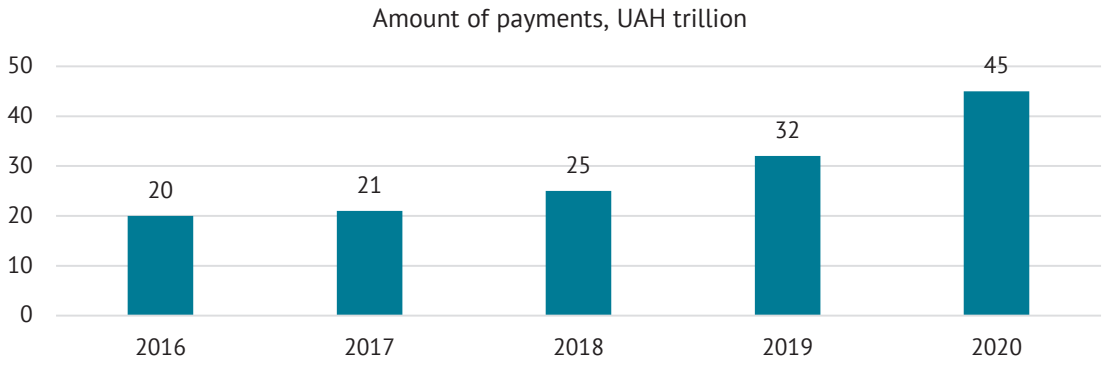

Figure 4. *Total amount of payments, UAH trillion, processed in SEP 2016-2020*
Source*: developed by the authors based on research Report on the compliance... (2020)*

For a more qualitative study of the use of the electronic payment system, a SWOT analysis was used to identify strengths and weaknesses, opportunities and threats (Table 3).

Having studied the strengths and weaknesses of the use of the electronic payment system with the help of a SWOT analysis, it was established that the overall score is dominated by threats (8.7 points). Among the listed threats, special attention is paid to the gradual replacement of paper money in the financial market and the bankruptcy of one or more payment service providers. Since the SEP affects the general method of payments, it is capable of creating a global economic revolution, displacing paper forms of money from the financial market. And such a risk as the bankruptcy of payment system providers can shake the implementation of financial transactions and cause negative consequences for the entire payment system. The next place was taken by strengths (total score was 8.4 points).

Table 3*. SWOT analysis of the use of the electronic payment system in the banking sector of Ukraine*

Strengths	**Weighting coefficient (Wc)**	**Authors' evaluation (Ae)**	**Wc x Ae**	**Weaknesses**	**Weighting coefficient (Wc)**	**Authors' evaluation (Ae)**	**Wc x Ae**
Ensuring continuity of payments	0.3	8	22.4	Impossibility of access when the power supply is turned off	0.3	7	22.1
Use of a new cryptographic information protection system	0.4	9	33.6	Emergency events	0.3	8	22.4
Conducting operations 24/7	0.3	8	22.4	Quite a significant volume of operations	0.4	9	33.6
Total:			**88.4**				**88.1**
Opportunities	**Weighting coefficient (Wc)**	**Authors' evaluation (Ae)**	**Wc x Ae**	**Threats**	**Weighting coefficient (Wc)**	**Authors' evaluation (Ae)**	**Wc x Ae**
Creation of prerequisites for transparent interaction of payment systems and remote service systems	0.4	8	3.2	Carrying out hacker and virus attacks	0.3	9	2.7
Carrying out operations abroad	0.3	7	2.1	Gradual replacement of paper money in the financial market	0.4	9	3.6
Verification of SEP participants by the Paying Organization.	0.3	9	2.7	Bankruptcy of one or more payment service providers	0.3	8	2.4
Total:			**8.0**				**8.7**

Source*: developed by the authors based on research Report on the compliance... (2020)*

Among the important components of strengths is the use of a new cryptographic information protection system (3.6 points). This protection system provides for the transformation of information data into a form inaccessible for understanding and transmission. However, like any security system that can be hacked, this system has the same risk, but to break it requires methods based on complex quantum solutions, which makes it difficult for hackers.

Regarding the weaknesses (the total score is 8.1), it should be noted that 3.6 points is taken here by a fairly significant volume of transactions, which is explained by the increase in the number of transactions between participants, and this can affect the implementation of errors when the system is loaded.

Extraordinary events, which are another weakness, include unplanned situations: natural disasters or power outages, which can make it impossible to access payment transactions.

Among the opportunities (total score – 8 points), the main ones are the creation of prerequisites for transparent interaction of payment systems and remote customer service systems, because in the innovative period, remote service is a convenient and more effective way to which almost all users of payment systems switch. Such a factor as verification of SEP participants by the Payment Organization allows to constantly monitor and prevent the possibility of hacking and suspicious transactions, which minimizes risks.

The banking system is an extremely powerful transformer of savings into investments. The implementation of scientific achievements and inventions in the organization of banking services ensures the constant improvement of banking products and applied technologies of customer service. That is why the study of problems related to the innovative activities of domestic banks is extremely relevant (Yashchenko, 2019).

Of course, there are still threats to the use of this system, but the strengths and opportunities are becoming increasingly important over time. Progress does not stand still, it moves rapidly and, in our opinion, will lead to the replacement of paper money with electronic money with a quantum protection system. At the same time, the possibility of hacking will practically disappear, but under the condition that these protection systems will work only within the banking sector.

The authors of the article investigated the security of payment systems, thereby creating public trust in electronic payment systems. It is thanks to digital innovations that dynamic changes are taking place in the business environment, where the process of transition from cash transactions to electronic transactions is ongoing, however, S. Fatonah *et al*. (2018) argued that building public trust in electronic payment systems can influence the future of electronic payment systems. The introduction of electronic payment system was not introduced to replace cash, but as a better alternative to cash and trade barter, because electronic payment system is an important aspect of electronic commerce. Other methods are strongly recommended for future research to collect data, improving and generating latent problem solutions for several issues, especially those related to future electronics.

The research conducted showed that the introduction and use of electronic wallets brought positive changes in the transaction activity in the population communities, but T. Handayani & A. Novitasari (2020) argued that the development of transactions is currently quite fast, comparing with the development of technology and information. Digital wallets are used not only in cities, but also in other regions, which ensures the convenience of transactions for all users, regardless of their location. The number of users of digital wallets is increasing over time, parallel to the number of smartphone users, which is one of the various aspects that are driving the growth in the use of digital wallets. Based on this, the use of digital wallets will increase with the development of electronic systems based on the web network, which are becoming more and more complex every year. In this way, countries will be able to make a financial transition from conventional banking operations using cash to electronic banking operations.

The authors of the article came to the conclusion that the further development of the electronic payment system contributes to the negative trend in settlements using personal and commercial checks, as well as interbank commercial checks, and later their gradual withdrawal from the financial and banking markets, however, A. Ali & A. Salameh (2023) argued about the gradual replacement of registered commercial checks and interbank commercial checks by electronic payment systems. They also investigated customer satisfaction with online payment and settlement services, as they primarily care about security, which is the main factor and the main factors for ensuring customer satisfaction in the payment and settlement system, the fear of hacking bank websites, the security of all transactions and the confidentiality of customer interest, as the disclosure of the source of income, the lack of a standard format for transferring funds, the complexity of tracking transactions and the lack of a systematic process to learn about transfers from other parties creates a low traceability of the payment system. Therefore, all variables in the banking system are to increase the security and tracking of payments and settlements. One of the main negative trends in the use of electronic and settlement systems was the excessive cost of transactions in Sadivska Arabia.

The article states that today's banking sector has already undergone radical changes under the influence of digitalization, but I. Kochuma (2021) argued that the development of the digital transformation process is caused on the one hand by customers who are increasingly using digital innovations to provide banking services, and on the other other use of such innovative technologies on the part of the bank allows to create fundamentally new banking products and services, attracting modern fintech companies that are actively entering the financial services market today. The interaction of such systems will lead to non-standard and effective development of innovative banking business models.

The authors of the article analyzed the trend of development and implementation of the electronic payment system, their strengths and weaknesses, as well as threats and opportunities, but, L. Avramchuk & I. Korkach (2018) argued that in order to develop and implement measures to improve money circulation through massive non-cash payments and reduce the share of cash settlements, it is necessary to create a transparent financial system and attract significant financial resources through the banking system.

The authors of the article investigated that the introduction of digital technologies created the conditions for virtual conduct of real business, instead of M. Chuprina & T. Lazorenko (2021) argued that the introduction of innovative lending technologies in the field of Internet commerce was carried out due to the increase in the provision of a package of Internet services in the banking and financial system.

The study showed that for the successful further development of electronic payment systems in Ukraine, it is necessary to take into account the modern requirements and experience of developed countries in this field, however, L. Tovkun & A. Akhmedova (2020) argued that changes should be made to Ukrainian legislation that would allow not only banks to issue electronic money, which would contribute to ending the monopoly in this field and increasing competition and effective regulation of the electronic money market. In addition, the NBU should develop a provision that would define a list of requirements and criteria that the issuing company must meet, which in turn would be a model for such institutions, which should be ready for such a process both technically and organizationally.

The authors of the article investigated the positive and negative advantages of using electronic wallets in Ukraine, but, C. Okonkwo *et al.* (2023) investigated the main factors that influence the adoption and performance of e-wallets based on theories of innovation diffusion, technology adoption model and information systems success, from 631 Cameroonian e-wallet users, using Cameroon, a Central African country, as the case study. Among the main five factors that are positive for the population from the use of electronic wallets are: relative advantage, utility, quality of information, quality of system and quality of service. It was found that ease of use does not significantly affect the use of an e-wallet.

CONCLUSIONS

By conducting research on digital innovations such as: Sinfocom's ManuScan system – an electronic scanner, electronic payment systems and electronic wallets, the strengths and weaknesses, as well as the opportunities and threats of these systems were identified. In the "ManuScan" system, the category of possibilities prevails over all others, in which the triple encryption system, which is the main feature of this technology – the protection of data and all information about users, is the most highly rated. The next category was threats, where the collection and storage of information about a person for life became important. However, today all innovative technologies are used for the purpose of collecting information and offering the user requests to search the Internet or to protect his data. However, for banking and financial institutions, the advantages will be the quality and security capabilities of the system to ensure that their data is reliably protected.

The e-wallet system has many strengths, such as making transactions anywhere. Today, for users of the Internet, the advantage in choosing a digital innovation will be accessibility from any point, which ensures the speed of operations. Therefore, this technology has an advantage in the choice for the population in making payments.

In the system of electronic payments, the biggest threat is the gradual replacement of paper money on the financial market, which ensures the transition of the country to electronic currency. And during a power outage, it is generally impossible to access electronic money.

The total volumes and amounts of payments through the SEP in the periods of 2016-2020 were analyzed and an upward trend was revealed. Consequently, the population of Ukraine increasingly prefers to make payments through SEP, which facilitates the process of making payments. It became especially relevant during the pandemic, when there was a significant growth of electronic systems and technologies for making online payments.

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CONFLICT OF INTEREST

None.

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Інноваційні технології у банківському секторі України в період цифровізації

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Анотація. На сьогодні міжбанківська конкуренція набуває наростаючого характеру, тому впровадження та розвиток інноваційних технологій у наданні банківськими послугами набуває особливої актуальності. Крім того, удосконалення інноваційних технологій в банківській сфері забезпечить ефективну діяльність банківської системи та підвищення рівня економіки України, шляхом збільшення інноваційних шляхів здійснення фінансових операцій. Мета полягає у дослідженні перспектив інтеграції фінансових технологій у банківський сектор, визначенні сильних та слабких сторін, а також загроз та можливостей впливу даних технологій у банківській галузі. Теоретико-методологічну основну статті становлять праці українських науковців із питань впровадження банківських інновацій та фінансових технологій. В процесі дослідження було використано емпіричні та теоретично-оглядові методи дослідження, що дало змогу розкрито сутність поняття інноваційна діяльність та інноваційні технології. Здійснено аналіз сучасних перспективних інноваційних технологій в України, та у світі. За допомогою SWOT-аналізу було досліджено сильні та слабкі сторони інноваційних технологій, таких як: ManuScan, електронні гаманці, електронні системи платежу. Особливу увагу було приділено категорії загроз таких інноваційних технологій, як хакерські та вірусні атаки, оскільки ці інноваційні технології використовуються в банківській та фінансовій системі на державному рівні. Проаналізовано інноваційні технології як повне нововведення змін у діяльність фінансової сфери України з цілю покращення використання банківської та фінансової сфери України, підвищення грошових операцій як на території України, так і за її межами. Розглянуто діяльність банківських установ з використанням новітніх, вдосконалених фінансових продуктів і послуг. Практична цінність дослідження полягає в тому, що воно може стати базою у досягненні стабільного та ефективного функціонування банків у майбутньому, а також надати рекомендації по впровадженню новітніх систем електронних платежів, які на сьогодні набирають популярності

Ключові слова: сканер сітківки або зіниці ока; банківські послуги; фінтех; електронні гаманці; система електронних платежів