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DEVELOPMENT OF DIGITAL FINANCIAL TECHNOLOGIES (FINTECH) IN THE FINANCIAL SECTOR OF UKRAINE

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РОЗВИТОК ЦИФРОВИХ ФІНАНСОВИХ ТЕХНОЛОГІЙ (ФІНТЕХ) В ФІНАНСОВОМУ СЕКТОРІ УКРАЇНИ

Digital financial technologies (fintech) exist as many as the financial services industry in Ukraine and are evolving in a unified system, constantly changing their technological features. The category was originally applied in the 1980s to describe a bot that made automatic changes to email. Until 2008, fintech existed exclusively as internal developments and processes of financial institutions, which were not accessible to consumers of financial services. However, after the economic crisis of 2008, companies in the financial sector with more efficient and modern digital technologies displaced traditional providers of classical financial services. At the same time, the content of fintech transformed into a broader category. Accordingly, the research is aimed at studying the specifics of fintech development in the financial sector of Ukraine as a component of the function of various spheres of the financial sector.

According to research findings, it has been proven that the development of digital financial technologies (fintech) in the financial sector of Ukraine is an integral part of the modern world. This is because fintech is a technological component of the function of providing financial services in the financial sector, which exists in the form of various services, software applications, gateways, processes, and methods of data processing. It should be noted that digital financial technologies themselves are not functional, but acquire such functionality within certain technological structures, among which are mobile applications, electronic money, blockchain, cloud technologies, and artificial

intelligence. Each of these structures is a set of interconnected technologies and service processes that have a single technical level, develop and function synchronously. Technological structures, and the technologies that form them, allow financial institutions to improve the efficiency of their work and provide more convenient and faster access to financial services for clients, by collecting and analyzing data about borrowers, assessing credit risks, creating omnichannel communications with clients, predicting market behavior of clients, developing and testing software, cloud-based cybersecurity and client information protection, responding to changes in the industry and customer requirements, expanding opportunities for automation of operations, transferring money to bank accounts, purchasing goods and services online, and conducting other financial transactions.

Цифрові фінансові технології (фінтех), фактично, існують стільки ж, скільки й індустрія фінансових послуг в Україні та еволюціонують у єдиній, постійно змінюючи свої технологічні риси системі. Власне, вперше категорія була застосована у 80-х роках минулого століття для опису бота, який вносив автоматичні зміни в електронну пошту. До 2008 р. фінтех існував виключно як внутрішні розробки та процеси фінансових установ, до яких у споживачів фінансових послуг не було доступу. Однак, після економічної кризи 2008 р., компанії фінансового сектору з більш ефективними та сучасними цифровими технологіями витіснили традиційних постачальників класичних фінансових послуг. При цьому зміст фінтех трансформувався у ширшу категорію. Дослідження спрямоване на вивчення специфіки розвитку фінтех в фінансовому секторі України як складової функції різних сфер фінансового сектору. Відповідно до результатів дослідження доведено, що розвиток цифрових фінансових технологій в фінансовому секторі України є невід'ємною частиною сучасного світу. Це зумовлено тим, що фінтех є технологічною складовою функції надання фінансових послуг в фінансовому секторі, що існує у формі різних сервісів, програмних додатків, шлюзів, процесів та методів обробки даних. Звернено увагу, що самі по собі цифрові фінансові технології не функціональні, однак набувають такої функціональності у межах певних технологічних структур (серед яких мобільні додатки, електронні гроші, блокчейн, хмарні технології, штучний інтелект). Кожна з таких структур — це сукупність пов'язаних між собою технологій та сервісних процесів, що мають єдиний технічний рівень, розвиваються та функціонують синхронно. Технологічні структури, а також формуючі їх технології, дозволяють фінансовим установам покращити ефективність своєї роботи та забезпечити більш зручний та швидкий доступ до фінансових послуг для клієнтів. Це досягається за рахунок зібрання та аналізу даних про позичальників, оцінки ризиків кредитування, створення омніканальних комунікацій з клієнтами, прогнозування ринкової поведінки клієнтів, розробки та тестування програмного забезпечення, хмарного підвищення кібербезпеки та захисту клієнтської інформації, реагування на зміни в галузі та вимоги клієнтів, розширення можливостей з автоматизації операцій, переказу грошей на банківські рахунки, купівлі товарів та послуг в Інтернеті та здійснення інших фінансових операцій.

Key words: mobile applications; electronic money; blockchain; cloud technologies; artificial intelligence; cybersecurity; data analysis.

Ключові слова: мобільні додатки, електронні гроші, блокчейн, хмарні технології, штучний інтелект, кібербезпека" аналіз даних.

PROBLEM SETTING (DESCRIPTION OF THE PROBLEM BEING ANALYZED IN GENERAL AND ITS CONNECTION WITH IMPORTANT ACADEMIC OR PRACTICAL TASKS)

Digital financial technologies (fintech) exist as much as the financial services industry in Ukraine and are evolving in a unified system that constantly changes its technological features. The category was first used in the 1980s to describe a bot that made automatic changes to email (in an article by P. Knight titled "Fintech" in the Sunday Times). Until 2008, fintech existed solely as internal developments and processes of financial institutions, which were not accessible to financial services consumers. However, after the 2008 economic crisis, companies with more efficient and modern digital technologies in the financial sector displaced traditional providers of classic financial services (since they significantly changed the accessibility and specifics of performing all operations with monetary assets, including investing, asset management, securities operations, and so on). At the same time, the content of fintech transformed into a broader category that became considered a component of the function of various sectors of the financial industry — namely, the provision of financial services.

It should be noted that digital financial technologies (or fintech) are to some extent implemented in the functions of financial services and in the processes of

Table 1. Technological structures of digital financial technologies (fintech) in the financial sector of Ukraine

Technological structure	Process structure description
Mobile applications	Mobile applications that allow users to perform various financial transactions.
Electronic money	Digital equivalents of cash that can be used for payment of goods and services, money transfers, and storing funds in an electronic account. The outlined technological structure encompasses infrastructure, computer networks, the internet, and electronic payment services.
Blockchain	A distributed database that allows for the storage and transmission of financial information in a secure environment.
Cloud technologies	Cloud technologies allow for storing and processing financial information on remote servers.
Artificial Intelligence	Technologies that allow analyzing and predicting financial risks and trends using machine learning algorithms.

Source: Formulated based on [1; 2; 4; 6—8].

providing financial or ancillary services by all entities offering them in the financial sector. Currently, they are developing not only in the deposit corporations' sector (in the provision of both the central bank and other deposit corporations (banks) and money market funds), but also in the sector of other financial corporations (in the provision of services of investment funds (except money market funds), other financial intermediaries, auxiliary financial institutions, captive financial institutions, and lenders, etc.).

THE ANALYSIS OF THE LAST RESEARCH AND PUBLICATIONS IN WHICH THE SOLUTION TO THIS PROBLEM IS BEGUN

A significant number of scientific works by foreign and domestic researchers, such as H.M. Pochenchuk [3], A.Yu. Semenog, Ya.M. Kryvyich, S.V. Tsyrulyk [5], L.A. Dudinets [2], Yu. Teereshko, T. Tardaskina, V. Alkhimova, O. Bilous [6], and others, are devoted to the theoretical and applied aspects of studying the essence of digital financial technologies (fintech) and the specifics of their development in the financial sector of Ukraine.

While acknowledging the substantial results of scientific achievements, it should be noted that a range of theoretical and practical issues regarding the development of digital financial technologies (fintech) in the financial sector of Ukraine requires further study and analysis.

FORMULATING OF ARTICLE PURPOSES (THE PURPOSE OF THE STUDY)

The research aims to study the specifics of the development of digital financial technologies (fintech) in the financial sector of Ukraine as a component of the function of various spheres of the financial sector.

Table 2. Release of mobile applications in Ukrainian banks

Mobile applications	The evolution of mobile applications	Mobile app functionality
Privatbank	September 2011- iBank	receiving information about the status of accounts
Ukreximbank - "mEksim" and"Smartbank"	September 2012 - "mEksim' for iOS platform	Viewing account balances, reviewing transaction history, and transferring funds between one's own accounts.
	November 2013 - mobile application "Smart bank"	Ability to make payments for services, buy transport tickets, and pay for utilities.
Raiffeisen Bank	July 2012 - "Mobile Banking"	Checking account balances, transferring money, paying bills, and much more.
Alfa-Bank	October 2013 -"Alfa-Mobile Ukraine"	Getting information about account balances, transferring money, paying bills, and much more.
UkrSibbank	2013 - Mobile Banking	Access to information about account balances, ability to transfer funds, pay bills, and perform other financial transactions from a mobile phone.
PUMB (Pravex-Bank)	2013 - "PUMB Online"	Operations with your own accounts from a mobile phone.
OTP Bank in Ukraine	December 2013 - "OTP Smart"	Checking account balances, transferring money, paying bills and other financial transactions from a mobile phone
Crédit Agricole in Ukraine	2013 - "Mobile Banking CA"	Checking account balances, transferring money, paying bills and other financial transactions from a mobile phone
Citibank	March 2013 - "Citi Mobile"	Check your account balance, transfer money, pay bills and manage your credit cards
ProCredit Bank	April 2013, - "ProMobile"	allowed customers to view account history, make money transfers and replenish mobile account
Taskombank in Ukraine	February 2014 - "T-Bank "	allowed bank customers to monitor the status of their accounts, transfer money, pay bills and much more
Oschadbank Ukraine	2015 - Oschadbank Ukraine	transactions with your accounts from your mobile phone

Source: Formulated based on [1, 6—8].

THE PAPER'S MAIN BODY WITH FULL REASONING OF ACADEMIC RESULTS

Within this article, the category of digital financial technologies (or fintech) will be considered as a technological component of the function of providing financial services in the financial sector (which exists in the form of various services, software applications, gateways, processes, and data processing methods [6]).

Digital financial technologies themselves are not functional, but acquire such functionality within certain technological structures (a set of interrelated technologies and service processes that have a common technical level, and develop and operate synchronously). Such technological structures are systematized by us in Table 1.

The implementation of fintech in the provision of financial services promotes their technologization through the use of cutting-edge technologies to facilitate and improve financial services. Let's consider the development of each technological structure (including mobile applications, electronic money, blockchain, cloud technologies, and Artificial Intelligence) in more detail.

Table 3. Development of electronic money systems in Ukraine

Electronic Money Systems/Provider	Characteristics of the electronic money system	Functionality of electronic money system
"Portmone" (founded in 2002)	Specializes in delivery services and online payment of bills for various goods and services using international payment cards such as Visa and MasterCard through the Internet.	Payment for purchases in online stores and other online services, transfers, payment for utilities and other regular payments, mobile account top-up, and so on.
LiqPay (founded in 2008)	Specializes in payment acceptance and money transfer services using mobile phones, the internet, and payment cards worldwide.	Creating payments from 0.02 UAH, mass payments; accepting payments on the website; withdrawal of funds to VISA system cards or any PrivatBank card (VISA/MASTERCARD); creating API platforms.
EasyPay (founded 2007)	Specializes in conducting offline and online payments as well as through mobile applications, and offers the possibility of opening virtual Visa or Mastercard cards.	Using push payments, it is possible to pay for any service or goods, for example, to pay for public transportation fare.

Source: Formulated based on [1; 5; 7].

The development of mobile applications in the financial sector of Ukraine has been rapid, as illustrated by the data in Table 2.

In particular, in September 2011, the first mobile application "iBank" was launched by PrivatBank, which allowed customers to view their account balance from their mobile phones, making it the first of its kind in Ukraine. Later, the bank updated and added new features to its application for the convenience of its customers. In July 2012, Raiffeisen Bank released its first mobile application ("Mobile Banking"), while UkrEximBank released its "mEksim" application in September of the same year. In 2013, mobile applications were launched by Alfa-Bank in Ukraine (Alfa-Mobile Ukraine), UkrSibbank (Mobile Banking), PUMB (Pravex Bank) (PUMB (Pravex Bank)), OTP Bank ("OTP Smart"), and Credit Agricole in Ukraine ("Mobile Banking CA"), among others. Oshchadbank of Ukraine began developing its mobile application in 2014, but the first version of the application was released in April 2015 (since then, several updates and versions of the application have been released to improve its functionality and provide a more convenient service for customers).

In fact, by 2015, mobile applications of most of the largest Ukrainian banks had appeared in the financial sector. They allowed clients to carry out basic banking operations via their mobile devices (such as transferring money, checking balances, and topping up mobile phones). At the same time, as a result of updates and adding functions, today most banks in Ukraine have their mobile application, which allows their clients to view their account balances, make money transfers, pay bills and loans, set up automatic payments, and receive information about bank promotions and special offers, among other things.

In addition to traditional banks, mobile financial services have also started to appear in the market, allowing customers to open accounts and conduct financial transactions through mobile applications without the need to visit bank offices. For example, the mobile application Monobank appeared on the Ukrainian market in October 2017. This application was created as part of the Fintech Band startup, founded by former employees of PrivatBank. The Revolut mobile applications became available to users in Ukraine in October 2018 and now provide the ability to use free payments and transfers of money within and outside the country, currency exchange at optimal rates, free cash withdrawals at ATMs, and other financial operations. Such services are becoming increasingly popular, especially among young and technologically savvy users. According to Google and AppsFlyer, over 60% of mobile device users in Ukraine use mobile applications of financial institutions.

Electronic money began to appear in Ukraine in the late 1990s. In 2010, the National Bank of Ukraine started regulating the segment by coordinating the rules of operation for electronic money systems such as MoneXy, GlobalMoney, and Maxi. Currently, several major providers are developing the structure of electronic money in the Ukrainian market (Table 3), including "Portmone" (founded in 2002), "LiqPay" (founded in 2008 and currently an alternative to Webmoney and PayPal), and "EasyPay" (founded in 2007, and in 2009, the company's owners created and registered the first non-bank payment system "Financial World" in Ukraine).

In Ukraine, there are other providers besides those banned by the National Bank, including Webmoney, Yandex.Money, QIWI Wallet, Wallet one/Unified Wallet. Among the Ukrainian payment systems that issue e-money, the most common are Maxi, Global Money, Prostir (NSMEP), and e-wallets on Visa and Mastercard cards.

The development of blockchain technology in Ukraine has been growing in recent years, and the financial sector is no exception. A significant number of Ukrainian banks have adopted these technologies. For example, PrivatBank has launched the first blockchain platform for gas trading in Ukraine, which uses "smart contract" technology, and has issued its own token on the blockchain — Privat24-Coin, which allows the bank's clients to make free transactions with each other.

Additionally, in 2018, PrivatBank established a blockchain laboratory to develop new technologies based on blockchain. UkrEximBank is also actively implementing blockchain technology to enhance its financial services (including launching its own blockchain platform in 2019 that allows for faster and more efficient operations through "mEksim" and "Smartbank"). In 2019, Raiffeisen Bank Aval announced the launch of a blockchain system for electronic document signing, which reduces processing time for banking documents and provides greater reliability compared to traditional methods. In 2020, JSC "Ukrgasbank" successfully implemented a blockchain platform for electronic deposits and market launch. Other banks are also exploring and actively experimenting with implementing blockchain technology to improve their business processes. The "BankID on Blockchain" pilot program launched in 2018 is an indication of the development of the technological structure of blockchain

in Ukraine, which allows bank customers to use a single identification number to access various banking services, reducing the risks of financial crime and improving customer service quality.

It is worth noting that many of these providers currently collaborate with banks and other financial institutions, which creates opportunities for users to transfer money to their bank accounts, purchase goods and services online, and carry out other financial transactions. Furthermore, as part of the implementation of the provisions of the Law of Ukraine "On Payment Services," the National Bank of Ukraine has established rules and standards for working with electronic money, which ensures their security and protection against fraud.

The development of cloud-based technological systems in the financial sector of Ukraine has been one of the key trends in recent years. Currently, the majority of banks and other financial institutions in Ukraine use various cloud solutions, such as cloud storage, cloud computing, and cloud services for software development and testing, cloud-based cybersecurity and customer information protection, as illustrated in Table 4.

Table 4. Development of cloud technology systems in the financial sector of Ukraine

Cloud Technology Systems	Characteristics of cloud technology systems	Functionality of cloud technology systems
"Smart cashier" by "PrivatBank"	Using cloud technologies to automate cashier work and optimize work processes in branches.	Cashiers can serve customers more quickly and efficiently, while customers can make payments for goods and services more quickly.
Cloud-based open banking service by "PrivatBank"	Implementation of open banking that allows customers to use online banking without unnecessary risks to their security.	The system ensures the security of open banking operations, including customer authentication and monitoring their activity, protection against fraudsters and malicious programs.
Processing financial information by "PrivatBank".	Allows to increase data processing speed and ensure greater security of data storage and transmission.	The system allows banks and other financial institutions to reduce costs on equipment and software.
Raiffeisen Bank's electronic document management system was developed in collaboration with Microsoft.	Enables the bank to process a large volume of documents quickly and efficiently while ensuring their security, as well as reducing the time needed to process paper documentation.	With the system, bank clients can receive electronic documents and sign them directly in online banking, making the interaction process between the bank and the client more convenient and efficient.
Customer data storage and processing by Alfa-Bank.	Enables the bank to process and analyze large volumes of data quickly and efficiently.	The system allows for the improvement of customer service quality and the reduction of financial transaction risks.
Storage and processing of customer data on Microsoft Azure by UkrSibbank.	The bank can store large volumes of data in a secure cloud environment.	The system provides fast access to information and ensures high reliability and data security, allows scaling of infrastructure, and implementing new features and services for clients.
Improvement of service quality and internal processes at ProCredit Bank.	Provides fast and efficient access to banking services for clients, enables storage and processing of large volumes of data, as well as improving business process management.	The system allows to improve its efficiency and identify trends in customer behavior. The system enables banking operations to be carried out at any time and from any location.

Source: Formulated based on [5, 7].

In addition, cloud technologies allow for greater scalability and flexibility, enabling financial institutions to quickly respond to changes in the industry and customer demands, as demonstrated by the experience of using Microsoft Azure by UkrSibbank. Microsoft Azure represents a move towards secure remote banking customer identification [7]. UkrSibbank has developed a mobile application for secure customer identification that utilizes facial recognition technology. However, what is unique is that the application not only processes customer data in the Microsoft Azure cloud environment, providing high reliability and security but also offers a wide range of network services and much more [7]. Thanks to these services, the bank can instantly scale its infrastructure by increasing or decreasing the computing resources they use, depending on the need.

Artificial intelligence (AI) is becoming increasingly popular in the financial sector of Ukraine, as it can improve decision-making efficiency and accuracy, reduce risks, and enhance customer service. Among the applications of technological systems, AI is at the forefront [7]:

1. Automation of the credit scoring process. Banks use AI systems to collect and analyze data on borrowers and make a more accurate assessment of their credit risks. For example, KreditAgricole Bank uses a credit scoring system that automates the loan application review process and reduces the time required for review. Raiffeisen Bank Aval uses Experian's solution to assess credit risk. UkrSibbank BNP Paribas Group uses the FICO Score system to assess credit risk. This helps banks reduce the number of undesirable loans and increase profits.

2. Development of virtual financial assistants that can answer customer questions, recommend products and services, and provide personalized offers. For instance, VUSO ChatBot allows PrivatBank customers to receive information about their bank accounts, credit cards, and other financial services through messengers and can answer questions and provide advice on financial transactions. Alpha-Bank's Voice Assistant can answer customer queries, provide recommendations on financial services and transactions, and assist customers with bank account operations. Monobank ChatBot can answer customer questions, assist with service activation, and provide information on exchange rates. In effect, the development of virtual financial assistants improves the quality of customer service and increases customer loyalty to the bank.;

3. Forecasting market behavior, allows banks to analyze the market and make predictions about its development, as well as make strategic decisions. For example, OTP Bank uses the SAS system, which allows the bank to obtain accurate forecasts of market changes and respond to them on time. PrivatBank uses the DataRobot system, which allows for analyzing large volumes of data and making accurate predictions of market trends. Raiffeisen Bank Aval uses the FICO Decision Management Suite system, which allows the bank to forecast market changes and make effective decisions based on data analysis.

According to the above, it is obvious that the potential advantages of technology-enabled financial service providers in the financial sector are: speed and convenience (users can access financial services more easily and quickly); a wide range of financial services (which can be purchased remotely, regardless of location); more favorable terms for services compared to traditional companies (the function does not require physical infrastructure, such as branch network), personalization through the ability to collect and store more information about clients.

CONCLUSIONS FROM THIS STUDY AND PROSPECTS FOR FURTHER EXPLORATION IN THIS AREA

According to the research results, the authors have drawn several conclusions, including:

Fintech is the technological component of financial service providers in the financial sector, which exists in the form of various services, software applications, gateways, processes, and data processing methods. The implementation of fintech in financial service provision contributes to their technological advancement.

Digital financial technologies themselves are not functional but acquire functionality within certain technological structures, including mobile applications, electronic money, blockchain, cloud technologies, and artificial intelligence. Each of these structures is a set of interconnected technologies and service processes that have a unified technical level, and develop and function synchronously.

Technological structures and the technologies that form them allow financial institutions to improve the efficiency of their work and provide more convenient and faster access to financial services for clients, by collecting and analyzing data on borrowers, assessing credit risks, creating omnichannel communications with clients, predicting client market behavior, developing and testing software, cloud-based cyber security, and client information protection, responding to changes in the industry and client requirements, expanding automation capabilities, transferring money to bank accounts, purchasing goods and services online, and conducting other financial operations.

According to the obtained results, the prospects for further research include the formalization of the impact of technological structures on the development of the financial sector in Ukraine.

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