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## DEVELOPMENT OF FINANCIAL SERVICES BASED ON CRYPTOCURRENCIES

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### РОЗВИТОК ФІНАНСОВИХ ПОСЛУГ НА ОСНОВІ КРИПТОВАЛЮТ

**Швидкий розвиток фінансових послуг на основі криптовалют є тенденцією вітчизняних фінансів. Початково, це зумовлювалося тим, що криптовалюти надавали користувачам можливість здійснювати транзакції та зберігати свої активи з певним рівнем анонімності та приватності. Пізніше стало очевидним, що використання криптовалют гарантує безпеку, швидкість, ефективність транзакцій. Наразі криптовалюти не лише відкривають доступ до базових фінансових послуг для людей з обмеженим доступом до традиційних банківських систем, але і надають користувачам можливість здійснювати широкий спектр фінансових операцій з певними перевагами. Відтак, напрямки розвитку фінансових послуг на основі криптовалют представляють тепер великий інтерес в економіці. Відповідно до вищенаведеного, дослідження спрямоване на загальний аналіз та системну характеристику специфіки та напрямків розвитку фінансових послуг на основі криптовалют. За результатами дослідження доведено, що розширюється функціональність використання активів на криптовалютних біржах. Як наслідок, наразі такі біржі дозволяють користувачам купувати, продавати та торгувати криптовалютами, а також забезпечують ліквідність та можливість обміну між різними криптовалютами та традиційними валютами. Розширюється функціональність використання активів у криптовалютних гаманцях**

коштом розширення опцій для операцій зі зберігання та керування криптовалютами активами. Розширюється функціональність використання активів у криптовалютних платіжних шлюзах, внаслідок формування можливостей підприємств та індивідуальних користувачів приймати платежі в криптовалюті та конвертувати її в традиційні валюти або фіатні гроші за поточним обмінним курсом. Розширюється функціональність використання активів у межах криптовалютних заставних позик, з'являється більше послуг, що дозволяють користувачам використовувати свої криптовалютні активи як заставу для отримання позики. Розширюється функціональність децентралізованих фінансових послуг. SMART-контракти, програмні розумні контракти та інші за їх інтеграції з DeFi протоколами перетворюють кожен фінансову послугу на розумну мережу.

*Initially, this was due to the fact that cryptocurrencies provided users with the ability to perform transactions and store their assets with a certain level of anonymity and privacy. Later on, it became evident that the use of cryptocurrencies guarantees security, speed, and efficiency in transactions. Currently, cryptocurrencies not only provide access to basic financial services for individuals with limited access to traditional banking systems but also offer users the ability to engage in a wide range of financial operations with specific advantages. Consequently, the development directions of cryptocurrency-based financial services have garnered significant interest in economic science today. Research is aimed at the comprehensive identification and systematic characterization of the fundamental characteristics and directions of the development of cryptocurrency-based financial services. The research findings have demonstrated that the functionality of asset utilization on cryptocurrency exchanges is expanding. As a result, currently, such exchanges allow users to buy, sell, and trade cryptocurrencies, providing liquidity and the ability to exchange between different cryptocurrencies and traditional currencies. The functionality of asset utilization within cryptocurrency wallets is expanding by increasing options for the storage and management of cryptocurrency assets. The functionality of asset utilization within cryptocurrency payment gateways is expanding by creating opportunities for businesses and individual users to accept payments in cryptocurrencies and convert them into traditional currencies at the current exchange rate. The functionality of asset utilization within cryptocurrency-collateralized loans is expanding, with more services emerging that allow users to use their cryptocurrency assets as collateral to obtain loans. The functionality of decentralized financial services is also expanding. Smart contracts, programmable contracts, proof of validation, and other integrations with DeFi protocols transform each financial service into a smart network.*

*Ключові слова: криптовалюти активи; смарт-контракти; криптовалюти гаманці; криптовалюти біржі.*

*Key words: cryptocurrency assets; smart contracts; cryptocurrency wallets; cryptocurrency exchanges.*

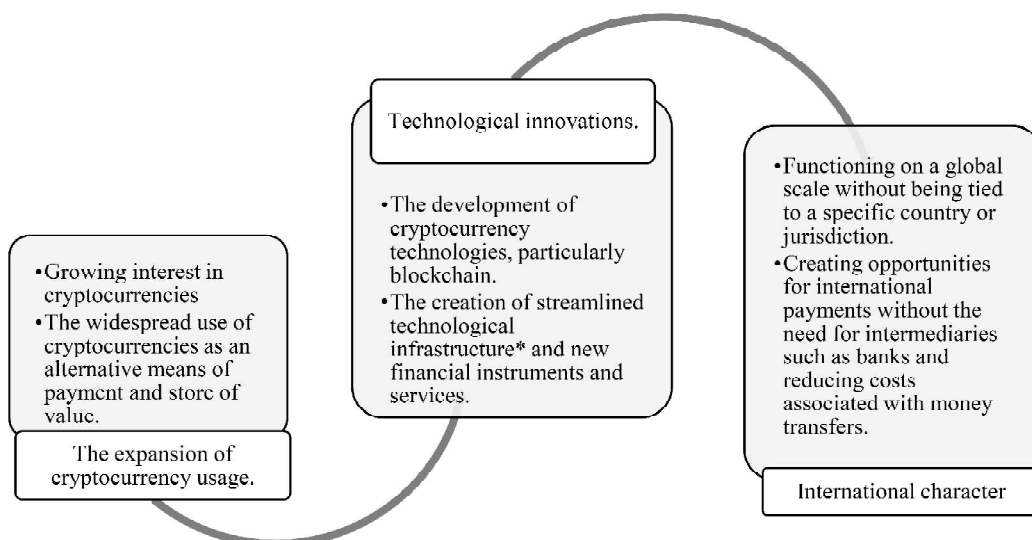
## TARGET SETTING

Initially, this was due to the fact that cryptocurrencies provided users with the ability to perform transactions and store their assets with a certain level of anonymity and privacy. Initially, this was driven by the fact that Bitcoin, Ethereum, and other cryptocurrencies provided users with the ability to transact and store their assets with a certain level of anonymity and privacy. Later on, it became apparent that using cryptocurrencies ensures security, speed, and efficiency in transactional operations (thanks to their cryptographic foundations that provide security and control over the creation of new units). Currently, it is clear that cryptocurrencies not only provide access to basic financial services (including payments, loans, insurance, deposits, etc.) for people with limited access to traditional banking systems but also offer users the

opportunity to engage in a wide range of financial transactions with certain advantages. According to the Global Crypto Adoption Index-2021 by Chainalysis, Ukraine ranks fourth among countries worldwide in terms of cryptocurrency trading volume and the provision of financial services related to cryptocurrencies [5]. This specific ranking highlights the relevance and timeliness of research in this area.

## ANALYSIS OF RESEARCH AND PUBLICATIONS

Among the studies that have been initiated to explore various aspects of the development of financial services based on cryptocurrencies, notable contributions have been made by researchers such as N.P. Teslyuk, O.V. Zhulin, Ya.Ya. Nazarenko, A.V. Kuimova, T.I. Batra-



**Figure 1. The main components of the phenomenon of the development of financial services based on cryptocurrencies**

Note

\* The simplified technological infrastructure has contributed to the growth of financial accessibility and the speed of transaction processing.

Source: formed based on [1; 3; 4].

kova, Ya.Yu. Zublevska, and I.Ya. Kulinak. However, despite the available sources that address the essence and general specifics of cryptocurrency development, they often do not pay much attention to the specific aspects and directions of financial services based on cryptocurrencies. This topic is of great interest in the field of economic science today. This emphasizes the relevance and significance of research in this particular direction.

**THE WORDING OF THE PURPOSES OF ARTICLE (PROBLEM)**

The article's aim is to provide a comprehensive identification and systematic characterization of the main specifics and directions of development for financial services based on cryptocurrencies.

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

Overall, the phenomenon of the development of the financial services sector based on cryptocurrencies has been quite rapid and has had common characteristics for all countries worldwide, due to the interconnectivity of its main components.

The starting point of development can be traced back to 2009 when the popularization of the first and most well-known cryptocurrency, Bitcoin, occurred. Bitcoin was created under the pseudonym Satoshi Nakamoto, who introduced the innovative technology of blockchain to the financial sector. This technology enabled relatively secure and decentralized financial transactions. The emergence of Bitcoin in the second half of the 2010s triggered the development of operations with this cryptocurrency, including in Ukraine. Over the following years, both globally and in Ukraine, not only did many other cryptocurrencies (such as Ethereum, Ripple, Litecoin, and others) emerge, but their usage also expanded. The phenomena of widespread adoption of cryptocurrencies as an alternative

means of payment and store of value, the development of cryptocurrency technologies (particularly blockchain, enabling the creation of new financial instruments and services), and their functioning on a global scale without being tied to a specific country or jurisdiction created a broad sphere of financial services. So, the main components of the phenomenon of the development of financial services based on cryptocurrencies are highlighted in Figure 1.

It should be noted that the current landscape of financial services based on cryptocurrencies includes the following components (Table 1): cryptocurrency exchanges, cryptocurrency wallets, cryptocurrency payment gateways, cryptocurrency collateralized loans, and decentralized financial services. In all these components, cryptocurrencies serve as multifunctional digital assets that can be used for various financial transactions.

According to the aforementioned characteristics of the sphere of financial services based on cryptocurrencies, the key features of this sphere can be identified as follows:

1. The development of a decentralized environment that transcends clear national boundaries (not dependent on any specific country or government), but requires legalization and the determination of cryptocurrencies as objects of civil rights at the level of individual countries. In Ukraine, this is currently being carried out under the provisions of the Law "On Virtual Assets," which has allowed foreign and Ukrainian cryptocurrency exchanges to operate legally in Ukraine, and banks to open accounts for companies involved in cryptocurrency transactions.

2. A unique service format that is accessible to users regardless of their location (through smart contract systems on the blockchain). For example, it enables the ability to send and receive payments, invest, exchange cryptocurrencies, and participate in DeFi protocols from anywhere in the world with internet access.

**Table 1. Characteristics of the financial services sector components based on cryptocurrencies**

Component of financial services	Characteristics of components	Features of financial services	Common features of constituents
cryptocurrency exchanges	Platforms where you can buy, sell, and trade cryptocurrencies.	Providing liquidity and the ability to convert between different cryptocurrencies and fiat currencies.	A decentralized environment with no clear national boundaries*. Accessibility to users regardless of their location. The attractiveness of financial services from an economic standpoint.
cryptocurrency wallets	Platforms with services that allow you to store, manage, and use cryptocurrencies.	Ability to make payments and receive transfers through cryptocurrency wallets or digital wallets.	
cryptocurrency payment gateways	Services that enable businesses to accept cryptocurrencies as a form of payment for goods and services.	Processing payments and facilitating the exchange of cryptocurrencies for fiat money.	
cryptocurrency collateral loans	Platforms provided by financial institutions that allow for lending or borrowing, using cryptocurrencies as collateral.	Ability to use cryptocurrency as collateral for obtaining loans in either cryptocurrency or fiat currency.	
Decentralized financial services	Platforms offering a wide range of financial products and services that can be obtained without the involvement of traditional financial institutions.	Access to loans, insurance, deposits, and trading without the involvement of traditional financial institutions.	

Note

\* Ukraine has approach to the regulation of cryptocurrencies and their use.

Source: formed based on [1; 3; 4].

3. The attractiveness of financial services from an economic standpoint. several domestic cryptocurrency exchanges are operating in Ukraine, as well as some international ones, including EXMO, Binance, KUNA, WhiteBIT, BTC TRADE UA, QMALL, and others. Based on their experience, several key directions of development can be identified

So, the development of cryptocurrency exchanges is one of the important components of the cryptocurrency-based financial services sector. Currently,

**Table 2. Characteristics of the main providers of cryptocurrency wallets, which is the basic constituent of the domestic financial services sector based on cryptocurrencies**

Available types of cryptocurrency wallets	Provider of cryptocurrency wallets*	Functionality of cryptocurrency wallets
Trust Wallet	Open from the cryptocurrency exchange Binance, it provides a convenient interface for asset management.	The wallet supports multiple cryptocurrencies, including Bitcoin, Ethereum, and other ERC-20 tokens.
EXMO Wallet	Open from the cryptocurrency exchange EXMO, which also provides a wallet for storing cryptocurrency assets.	The wallet supports various cryptocurrencies and enables convenient transaction execution.
Freewallet	Open from the cryptocurrency exchange Freewallet, which also offers various wallets for storing cryptocurrency assets.	The wallet is available as a mobile application and supports operations with a wide range of cryptocurrencies.
Atomic Wallet	Open from the startup company Atomic Labs, which offers extensive capabilities for secure management of cryptocurrency assets and a user-friendly interface.	The wallet supports multiple cryptocurrencies and allows for direct cryptocurrency exchanges from within the wallet. Atomic Wallet is available for desktop computers and mobile devices.
Ledger Wallet	Open from the startup company Ledger, which develops reliable tools for ensuring cryptocurrency security.	The wallet ensures a high level of security as private keys are stored on a physical device. It supports a wide range of different cryptocurrencies.

Note

\* Companies that provide cryptocurrency wallets are identified as providers because they enable access to the distributed network. Cryptocurrencies are based on a distributed network, which requires interaction with the blockchain or other cryptocurrency protocols. Wallet provider companies grant users access to these networks, allowing them to perform cryptocurrency transactions.

Source: formed based on [3; 4; 6].

**Table 3. Characteristics of operators of cryptocurrency collateral loans that affect the development of the domestic financial services sector based on cryptocurrencies**

Operators	Characteristics of the operator's activity direction	Features of providing cryptocurrency collateral loans
Aave	A decentralized financial platform that offers collateralized loans.	Built on the Ethereum platform, it allows users to use any of their cryptocurrency assets (from an approved list) as collateral to obtain a loan.
Compound Nexo	A decentralized financial platform that offers cryptocurrency collateralized loans and earnings on cryptocurrency deposits.	Built on the Ethereum platform, it enables users to borrow loans using their cryptocurrency assets, provided they are included in the platform's approved list.
Nexo	A platform that provides instant collateralized loan services using cryptocurrency assets.	Allows users to borrow loans using Bitcoin, Ethereum, and some other cryptocurrencies (if they are included in the approved list).
Celsius Network	A centralized financial platform that offers cryptocurrency loans and earnings on deposits.	Enables users to borrow loans using Bitcoin, Ethereum, and some other cryptocurrencies (if they are included in the approved list).

**Note**

\* They provide platforms where users can deposit their cryptocurrency assets as collateral and obtain loans based on those assets. As a result, they are identified as operators.

Source: formed based on [1; 2; 4; 6].

for cryptocurrency exchanges: 1) Expansion of the available assets for trading (in particular, exchanges gradually add new projects and tokens, allowing traders a broader range of choices); 2) improvement of security (includes a continuous process of enhancing the security system through improvements in authentication systems, implementation of "cold wallets," security audits, and other measures aimed at finding ways to strengthen the protection of users' assets); 3) functionality expansion (involves exchanges constantly improving their features and adding new tools for traders); 4) expansion of geographical coverage: In particular, exchanges are working to make their services available worldwide, not limited to specific platforms. It is achieved through the networks of cryptocurrency exchange terminals development, also known as cryptocurrency ATMs or Bitcoin ATMs. The terminals facilitate the exchange of cryptocurrencies and contribute to the broader accessibility of services on a global scale. As a result, the functionality of asset usage on cryptocurrency exchanges is expanding. While there is still a conditional division between exchanges where users can exchange cryptocurrencies for fiat currencies and those where only cryptocurrency-to-cryptocurrency exchanges are allowed, in practice, a significant portion of exchanges are becoming multifunctional. It allows users to buy, sell, and trade multiple cryptocurrencies. Additionally, these exchanges strive to provide liquidity and enable exchange between various cryptocurrencies and traditional currencies.

The development of cryptocurrency wallets is a fundamental component of the cryptocurrency-based financial services sector. Currently, there are several popular cryptocurrency wallets available in Ukraine that enable users to store, send, and receive cryptocurrencies. Some of these wallets include Trust Wallet, EXMO Wallet, Freewallet, Atomic Wallet, and Ledger Wallet [6]. Most of them are platforms operated by international startup companies and foreign cryptocurrency exchanges, as indicated in Table 2.

Based on the experience of cryptocurrency wallet providers, several key directions of cryptocurrency exchange development can be identified: 1) development of multi-platform support (operators strive to equip wallets with software that enhances their universality, ensuring compatibility with various operating systems and accessibility on different devices, including computers, smartphones, and hardware devices); 2) improved security (there is a process of continuous improvement of private key storage systems necessary for access to cryptocurrency assets); 3) expanded functionality (in particular, operators strive to equip wallets with hardware devices that will expand their functionality in terms of balance viewing, transaction execution, account management, and interaction with partner cryptocurrency-related applications and services.); 4) additional services integration (in particular, operators strive for their offered wallets to expand their functionality, allowing users to interact with additional services such as decentralized cryptocurrency exchanges, payment systems, and decentralized financial services applications). As a result, the functionality of asset utilization within cryptocurrency wallets is expanding, with the integration of software or hardware tools for storing and managing cryptocurrency assets in various payment directions, receiving and sending cryptocurrencies, and more.

The development of cryptocurrency payment gateways is indeed a relatively new trend. Currently, in Ukraine, there are several functioning gateways such as Paytomat, which is a Ukrainian cryptocurrency payment gateway providing integration services for cryptocurrency payments to businesses. There is also CoinsBank, a leading cryptocurrency payment gateway that operates in Ukraine, and BitPay, one of the world's leading cryptocurrency payment gateways, which is also available in Ukraine.

All available gateways provide solutions for restaurants, shops, and other businesses, enabling them to accept payments in various cryptocurrencies. Based on their functioning experience, several key directions of

development for cryptocurrency exchanges can be identified: 1) integration with payment systems and POS terminals (to enable real-time acceptance of cryptocurrency payments); 2) expansion of the supported cryptocurrencies list to provide more flexibility for users; 3) enhancement of security and customer data protection (through improvements in cryptographic protocols, multi-level authentication, data encryption, etc.); 4) expansion of supported countries and currencies; 5) development of mobile applications and user-friendly interfaces; 6) provision of additional features (such as cryptocurrency exchange, use of cryptocurrency cards, and more). As a result of regulatory harmonization, the functionality of using assets within cryptocurrency payment gateways can expand, along with the opportunities for businesses and individual users to accept payments in cryptocurrency and convert them into traditional currencies at the current exchange rate. The development of cryptocurrency-backed loans in Ukraine is primarily happening through international platforms such as Aave, Compound, Nexo, and Celsius Network. Each of these platforms enables users to utilize their cryptocurrency assets as collateral to obtain loans (Table 3).

Based on operational experience, several key directions for the development of cryptocurrency collateral loans in Ukraine can be identified: 1) decentralization (aimed at implementing decentralized financial protocols); 2) smart contracts (aimed at automating loan conditions such as interest rate determination, collateral management, and loan repayment); 3) improvement of collateral locking procedures (the system of depositing cryptocurrency into special contracts that lock it until loan repayment is currently being enhanced, along with the mechanism of its automatic realization in case of default); 4) expansion of supported countries and currencies (expanding as internet accessibility and cryptocurrency wallet systems become more widespread). The functionality of using assets within cryptocurrency collateral loans is expanding. As a result, there are increasing services that allow users to utilize their cryptocurrency assets as collateral to obtain a loan.

The development of decentralized financial services is related to the development of all other components of the financial services sector, including cryptocurrency exchanges, cryptocurrency wallets, cryptocurrency payment gateways, and cryptocurrency collateral loans. Among the fundamental aspects of developing decentralized financial services in Ukraine is the integration of DeFi protocols.: 1) into the system of decentralized financial services of cryptocurrency exchanges (these protocols provide opportunities for users to generate income from cryptocurrency trading and exchanging them for traditional currencies). For users, the opportunities to participate in various financial instruments offered in the DeFi ecosystem are expanding; 2) in the system of blockchain projects of decentralized financial services, which cover various areas, including the collection of material and other funds for socially significant projects, logistics, public safety and so on. In particular, blockchain projects in Ukraine utilize DeFi protocols to implement unique financial solutions, such as

organizing lending platforms, creating decentralized insurance markets, or facilitating fund distribution and asset management. In the conditions of the war in Ukraine, such projects have become powerful tools in the fight against Russian aggression. Since the occupation, notable blockchain companies have not only created fundraising opportunities but also directly directed irrevocable financial assistance to users in Ukraine. In addition to the mentioned aspects of decentralized finance (DeFi) development, protocols in Ukraine are starting to integrate into cryptocurrency wallets and cryptocurrency collateralized lending. Essentially, this development is related to the introduction of new features in cryptocurrency-based financial services (such as smart contracts, programmable smart contracts, proof of stake, and others) through their integration with DeFi protocols, transforming them into a smart network. However, such integration is currently limited due to certain legislative conflicts. Specifically, the Law of Ukraine "On Virtual Assets" defines that virtual assets are not considered a means of payment within the territory of Ukraine; thus, companies will not be able to use cryptocurrencies for settlements. A collision arises from the definition of virtual assets according to the Law of Ukraine "On Prevention and Counteraction to Legalization (Laundering) of Proceeds from Crime," which states that virtual assets can be traded in digital format or transferred and used for payments.

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

According to the above, the development of financial services based on cryptocurrencies is one of the key trends in the domestic financial industry. It has been proven that cryptocurrencies are now multifunctional digital assets that can be used for various financial operations. Based on this, the following conclusions can be made:

1. The functionality of using assets on cryptocurrency exchanges is expanding. As a result, these exchanges now allow users to buy, sell, and trade cryptocurrencies. Additionally, these exchanges provide liquidity and the ability to exchange between different cryptocurrencies and traditional currencies.

2. The functionality of using assets within cryptocurrency wallets is expanding. As a result, these wallets are equipped with software or hardware tools for storing and managing cryptocurrency assets in various payment directions, such as making payments, receiving and sending cryptocurrencies, and more.

3. The functionality of using assets within cryptocurrency payment gateways is expanding. As a result, after regulatory alignment, the functionality of using assets within cryptocurrency payment gateways can be extended, along with the ability for businesses and individual users to accept payments in cryptocurrency and convert them into traditional currencies at the current exchange rate.

4. The functionality of using assets within cryptocurrency-collateralized loans is expanding. As a result, an increasing number of services emerge that allow users to utilize their cryptocurrency assets as collateral to obtain a loan. These services operate based on smart contracts

that automatically establish loan conditions, such as the loan amount, interest rate, and repayment term.

5. The functionality of decentralized financial services is expanding, driven by the development of all other components within the realm of financial services, including cryptocurrency exchanges, cryptocurrency wallets, cryptocurrency payment gateways, and cryptocurrency collateralized loans. In essence, this development is associated with the new features introduction in the financial services field based on cryptocurrencies, such as smart contracts, programmable smart contracts, proof of validation, and other integrations with DeFi protocols. These innovations transform the financial services sector into an intelligent network.

The research results on the fundamental characteristics and directions of the development of cryptocurrency-based financial services can assist financial institutions, companies, and government bodies in formulating strategic plans for the implementation and advancement of cryptocurrency-based financial services. It can identify potential opportunities, ascertain advantages and challenges, and determine specific development directions

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