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UKRAINIAN ECOSYSTEM TRANSFORMATION CHALLENGES OF FINTECH PRODUCTS IN THE COVID-19 CONDITIONS

ABSTRACT

The article is devoted to the peculiarities of the development of fintech and the need to create innovative products and services, as the COVID-19 pandemic significantly affected the identification of vectors for the formation of financial technologies and innovative products and contributed to their development. It is established that with the development of new technologies the competition in both banking and non-banking segments of the financial market increases. The main goal of key players in the financial ecosystem is to meet the needs of end users, who in the process of their activities require the use of various financial instruments to achieve their own goals. Based on the determination of the impact of the components of the fintech products ecosystem, the importance of each of them for the development of the fintech products ecosystem has been established, especially in the context of the Covid pandemic. The dependence of the used potential of fintech products ecosystem development on its components by countries has been researched.

Calculations show that based on the economic content of the growth parameters of the ecosystem of fintech products by 1%, with the stability of all other components, the production of fintech products will increase by 0.29%. Increasing the efficiency of regulation by 1% will increase the scale of production by 0.16%. In turn, the scale of production will increase by 0.72% due to a decrease in corruption by 1% with the same value of other components. And increasing the efficiency of regulatory and legal support by 1% will increase the scale of production by 2.31%. The success of the whole ecosystem depends on the coordinated, mutually beneficial work of the participants, which is based on openness and respect for the interests of the participants. The needs of all economic activity subjects must be met through the provision of appropriate financial services by members of the financial ecosystem.

Keywords: ecosystem, fintech products, startup, public administration, potential, technologies, financial sector

JEL Classification: O31, O38

INTRODUCTION

Taking into account that the impact of data and related communication technologies advancement in the process of financial services production and presentation are developing it should be considered that digitalization is a common feature of most modern financial innovations [1, 2]. During the COVID-19 Pandemic, radical changes in the financial technologies area have been implemented, which are associated with an increased level of automation, openness, and consumer orientation.

The combination of ecosystem functioning and emergence creates a system of correspondent indicators that determines the inventive articles' creation pace and fintech development. In recent years, FinTech has become quite popular among investors. FinTech companies create, on the one hand, additional risks to maintain the competitive position of banks in the financial market, and on the other hand, the opportunity to establish partnerships between these structures and banks. This topic is especially relevant in the current development of the banking business and the simultaneous growth of the virtual market.

In response to the existing risks of the spreading of new technologies in the field of finance, a number of governments have already tried to introduce regulatory elements specifically for the fintech industry. Such measures include the creation of appropriate units in state oversight bodies, the introduction of various licenses, and the creation of monitoring programs. However, in summary, actions by the state take the form of promotion and support rather than the development of rules and frameworks for their future activities in most cases. Thus, the probable conversions in the power balance in the financial market require governments not only to promote the development of fintech projects, which are already quite popular today but also to modernize the legislative system and all its institutions so that it anticipates and prevents the malicious use of new technologies, provides proper control over their development and maintains the stability of the financial system.

LITERATURE REVIEW

The development of technology, e-commerce, the use of smartphones, and digital currencies have led to the transition of traditional banking and operations with financial instruments into cyberspace. Improving the regulation of the payment market infrastructure in accordance with EU standards has contributed to the development and cheapening of non-cash payments, the creation of a large number of FinTech companies in Ukraine. The NBU has created a Sandbox to stimulate the development of FinTech companies. Regulation of crowdfunding and virtual asset operations has been introduced. Due to the rapid change in the needs of financial market participants, traditional payment activities have been restructured into digital format, non-cash payments have increased (ratio of non-cash transactions to total transactions - 75%), financial services became available 24/7 regardless of customer location, using various methods of remote identification, increased competition in the financial market by FinTech companies and the emergence of new IT solutions and tools in the financial sector, including regulatory and supervisory technologies.

One of the priorities of financial sector regulators is to ensure cybersecurity of payment, depository and exchange infrastructure. Digitalization in the financial sector stimulates the development of the digital society in Ukraine.

Fintech ecosystem development benefits have been highlighted by the crisis caused by the Covid-19 pandemic that is especially true in the banking sector. The state of the world economy confirms the fact that almost all economic systems during the pandemic period face the challenge of lack of financial resources, business shutdown or its transition to a remote work system that requires a completely different toolkit for customer relations.

Most of the world leading countries with traditional economies need to consider relations within the country while developing a new model of post-Covid economics of fintech products, which will be based on inclusivity and sustainability.

The highest expectations of consumers in the conditions of "contactless economy" (coronomics) are simple online access to financial services, improving the reliability of transactions, speed of decision-making on loan issuance, reducing the cost and even better – free payments for individuals.

All these requirements are implemented today through the development of fintechs, which make them more and more popular. However, fintech inclusions in the economic systems and financial sector have not acquired their defining position yet.

Numerous scientists' projects are dedicated to theoretical aspects of research of the functioning of the market of fintech products as subjects of innovative activity. In particular [3, 4, 5] analyze the essence of startup projects, their characteristics, life cycle stages and success factors. The work [6] is dedicated to the research of the existing approaches to the classification of startup projects.

Companies using technology and innovation form the industry of commercial technology that is a fair and strong competitor to traditional commercial institutions (banks and brokers in the financial services market) [7].

The study of threats posed by the development of financial technologies had been carried out [8, 9, 10]. The essence of fintech ecosystem security has been identified. [11]. When analyzing the possibilities of financial technologies, attention is focused on the use of their tools to ensure the security of the financial sector [12]. Other researchers have investigated the nature and purpose of regulatory technologies [13].

According to the Oxford Dictionary's definition, it states that fintech is a program in connection with other computing technologies that are created to support or run banking and commercial services. Upon closer study of the problem, it becomes clear that this phenomenon forms its ecosystem, in which the production and implementation of new technologies are used to better the commercial system productivity indicator.

Ukrainian research in the startup sector is still isolated and unsystematic. This is explained both by the lack of reliable sources of statistical information on the startup market and by the relatively short history of its development in Ukraine. In particular, scientific works [14] and consider a number of sources of investment by startups [15], other scientists, namely [7] are considering the peculiarities of the formation and development of the Ukrainian sector of information technology startups in the context of their multiplier influence on the competitive development of the domestic high-tech market. Simultaneously with the worldwide startup growing quantity, the fintech products global ecosystem progress path is becoming relevant. Completely different models and classifications of fintech exist according to the scientific literature examination. Authors believe that the development of commercial technologies can enhance greatly only in close connection with the ecosystem's efficient functioning.

At the present stage, fintech is seen as an ecosystem that unites all participants in the financial market. The functioning of fintech product ecosystems should comply with the following principles: sustainability (the presence of stable links between ecosystem actors, formed between them on the basis of a common vision of change) [16]; consistency (achieving a common goal - the development of technology and innovation) [17] manufacturability (fintech product ecosystems are strategically developed around a particular technology); balance (a decentralization and the balance of interests: ecosystem management is distributed between the state, key partners, venture investors and innovators) [18]; circularity (exchange of resources between ecosystem actors, including the flow of knowledge, expertise, experience, ideas) [18,19]; compliance (combination of intellectual resources with business resources, which are usually a share of profits from commercial activities) [17]; transparency (the ecosystem is open to new participants with innovative ideas [18], sharing with the external economic space resources, especially intellectual); adaptability (constant transformations of ecosystem elements and their network connections ensure the dynamic compliance of the ecosystem with the urgent needs of society in innovation, as well as the sustainability of the ecosystem in the long run).

Financial technologies are a composite of digital technologies and innovations in the financial sector. These are used by technology companies to provide, expand and distribute financial services. Fintech is a compound system that unites sectors of new technologies and financial services, startups, and related infrastructure. Fintech companies in the development and supply of products compete with each other for increasing demand and exceeding consumer expectations. The main categories of fintech products consumers are households, corporate, financial, and public sectors [20].

The components of the ecosystem of public management of fintech products are singled out and substantiated, namely demand, technologies, human capital, regulation, and access to financing. The technology demand market is the basis for the fintech product ecosystem. The dynamism of the changing market needs the improvement and stimulation of technology, in particular, technological progress is the driving force of demand change. However, the pace of development of the fintech product ecosystem also depends on companies' access to finance, human capital, and the effectiveness of government regulation.

To ensure the ecosystem of fintech products access to human capital is required [21]. Taking into account the impact of COVID-19 on the growth of financial technologies the government should improve the institutional structure of fintech, monitor the most progressive global financial technologies, adapt them to international regulatory rules and supervisory practices and modernize legislation to ensure the conditions for their application. Thus, a number of key initiatives aimed at developing the ecosystem of fintech products and financial technology segments in Ukraine, as well as overcoming existing constraints should be identified in the future. Nowadays, all over the world is noticed a rapid development of financial technologies caused by the COVID-19 crisis. There is competition among banks for their clients, so it is vital for them not only to adapt to the time realities but also to introduce new technologies. Financial technologies provide the client with competitive advantages.

It is crucial for the public management of fintech activities to anticipate and evaluate trends in technology evolution, responding to their emergence by sufficient changes in regulations. However, the appropriate bills should not be circumstantial or constraining. In the field of public management of fintech products, public authorities need to take a balanced approach. The task of public authorities is to create a favorable environment for the development of innovation on the one hand, on the other – to control and minimize the risks associated with the functioning of the fintech products market. Such features require a qualitative response from regulators, who face problems in obtaining information and maintaining market stability. It is a well-known fact that standard regulatory tools that are suitable for the business sector cannot be effective for managing the activities of fintech firms. In particular, international regulatory institutions must closely monitor developments in the world of financial technology to avoid crisis cycles, in particular, such as those caused by COVID-19.

AIMS AND OBJECTIVES

The main purpose of the article is to study the impact of components on the development potential of the fintech product ecosystem. Determining the importance of the components of development potential in the structure of the fintech product ecosystem and proving their importance, especially on the scale of fintech product production in the conditions of COVID-19. Also, with the help of mathematical apparatus to substantiate the accelerated growth of the fintech product ecosystem, which will contribute to the further actualization of the banking sector and public administration for the development of the fintech product ecosystem in Ukraine.

METHODS

The advantages provided by fintech products are quite significant in the development of any field of activity, and the practice of effective implementation is clearly traced in the banking sector, such as in Ukraine. The introduction of a new system of organizing statistical reporting in standard XML format for reporting through the NBU web portal made it possible to finally abandon the collection of reports on paper and move to open channels for collecting and disseminating data through APIs with a high level of information protection. The use of paperless technologies in the provision of banking services allows to achieve a significant reduction in unproductive costs and increases the efficiency of - 9 - banking operations and the quality of customer service. Regulators of the financial sector and the Ministry of Finance are taking measures to implement a system of financial reporting in a single electronic format iXBRL. The introduction of this financial reporting system in the iXBRL format is a step toward raising the standards for information disclosure in the domestic financial market. Also, a single operational and information system for insolvent banks, an automated system of payments to depositors, a system of stress testing and early warning, and a full-fledged system of calculating regular fees in the form of differentiated fees based on bank risks are been implemented. The assets of insolvent banks are sold on transparent and competitive terms through electronic platforms.

Based on this, we can emphasize the importance of developing such an area as fintech products. Considering the components of the development potential of the ecosystem of fintech products it is considered that the functional definition of these components will be described by the power function.

To derive a general view of the model of forming the development potential of the ecosystem of fintech products of the country on the basis of components will have the following form:

$$y = \sum_{n=1}^6 ax^{a_1}, \quad (1)$$

where y - the development potential of the ecosystem of fintech products of the country; n - the number of components of the potential of technologies for the production of fintech products of the country; a , - a parameter whose value is taken to be greater than zero (typical for economic processes); a_1 - a parameter whose value is taken as a non-integer (considered only as a case); x - element of the development possibility of the fintech product ecosystem.

The general scheme of research of potential development of the country fintech products ecosystem on the basis of power function:

- establishing the reliance nature on the sign of the first derivative:
 - if $y' > 0$, procedure is growing;
 - if $y' < 0$, procedure is descending;
 - if $y' = 0$, procedure is constant.
- establishing the nature of the procedure change according to the sign of the second derivative:
 - if $y'' > 0$, procedure develops rapidly;
 - if $y'' < 0$, procedure develops slowly;
 - if $y'' = 0$, procedure develops evenly.
- establishing the interrelation between the dependent and independent parameters using the coefficient of elasticity.

To investigate the dependence of the used development potential of the fintech ecosystem of the country's products on its components, it is necessary to dwell in detail on their assessment.

Data-gathering tools: official statistics Readiness for the Future of Production Report. In the future it is proposed to study the dependence of the used potential of the ecosystem development of fintech products on its components by country.

Quantitative research of the impact of the ecosystem on the scale of production of fintech products involves the use of econometric models of degree (power) type, which are most used in the study of economic processes at the macro level. Econometric modeling is conducted in the following order: conceptual formulation of the problem, model specification, data collection and evaluation of model parameters, model testing for adequacy, model verification.

RESULTS

The study of the development potential of the ecosystem of fintech products involves the assessment of its separate parts and its combination. Accordingly, the study of the progress potential of the fintech product ecosystem is extremely important for determining the magnitude of the impact of each of its components in the conditions of the Covid crisis. And in terms of countries - it will provide an opportunity to understand the development of the ecosystem of fintech products in modern conditions (Table 1) [22].

Table 1. Structure of the development potential of the ecosystem of fintech products by country.							
Indictor	Potential of production drivers	Components of the potential:					
Country		Technologies and innovations	Human capital	Global trade and financing	Institutional structure	Steel resources	Demand environment
Ukraine	4,5	3,5	5,8	5,1	3,4	4,6	4,5
Turkey	4,9	4,2	4,5	5,1	4,8	6,3	5,8
Latvia	5,4	4,7	5,9	5	6,7	7,4	4
Bulgaria	5	4,8	5,1	5,4	5	6,9	4,3
Georgia	4,9	5	4,5	5,5	5,9	4,4	3,5
Poland	5,8	4,8	5,7	6,4	6,1	7,1	5,9

Based on the proposed method the potential for ecosystem development of fintech products in such countries as Ukraine, Turkey, Latvia, Georgia, Poland, and Bulgaria is analyzed. The choice of these countries was influenced by:

- differentiation by assessment categories (countries are in different groups according to the level of development of the fintech product ecosystem);
- territorial delimitation (neighboring countries, partners);
- historical development (the same initial stages of economic development, ecosystems of fintech products and in most countries during the period of independence), etc.

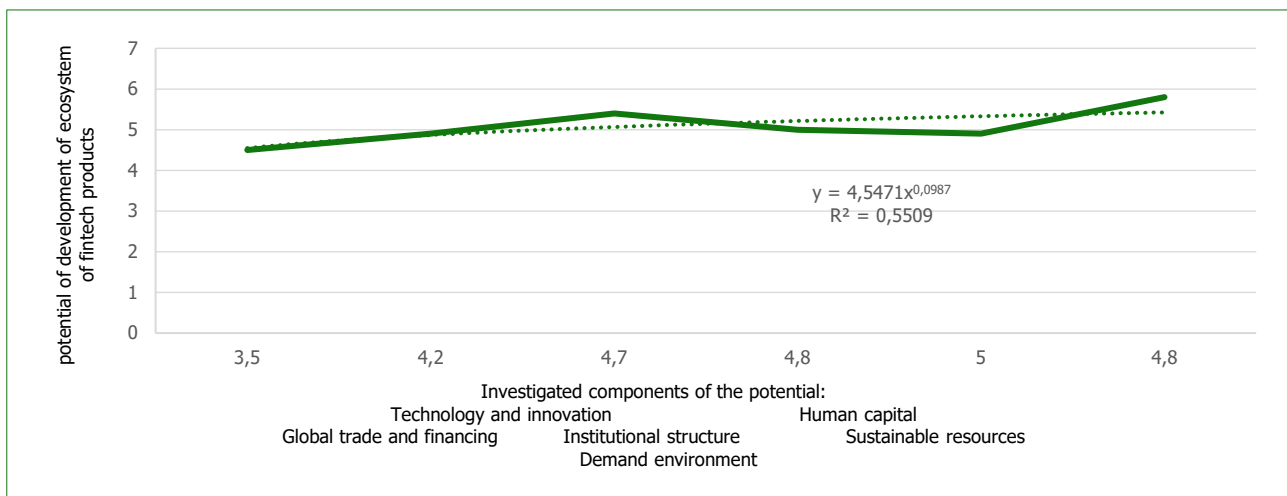


Figure 1. Dependence of the development potential of the fintech product ecosystem on the components of its potential.

The dependence (Figure 1), which describes the components of the development potential of the fintech products ecosystem will look like this. This dependence is described by a function:

$$y = 4,5471x^{0,0987} \quad (2)$$

- establish the subordination character on the sign of the first derivative:

$$y' = (y') = (4.5471x^{0.0987})' = (4.5471 \times 0.0987)x^{0.0987-1} = 0.45 \frac{1}{x^{0.9013}} \quad (3)$$

The subordination character on the sign of the first derivative specifies the appearance of a growing procedure of development possibility of the ecosystem of fintech products, that is $y' > 0$.

- establish the character of the procedure change according to the sign of the second derivative:

$$y' = (y')' = \left(0.45 \frac{1}{x^{0.9013}}\right)' = -(0.45 \times 0.9013)x^{-0.9013-1} = -0.41 \frac{1}{x^{1.9013}} \quad (4)$$

The interrelation character on the sign of the second derivative specifies the availability of a slow procedure of development possibility of the ecosystem of fintech products, that is $y'' < 0$.

- signify a relationship between dependent and independent variables using the coefficient of elasticity:

$$E = \frac{x}{y} \frac{dy}{dx} = \frac{x}{4,5471x^{0,0987}} \times \frac{0,45}{x^{0,9013}} = \frac{1}{4,5471} \times \frac{x}{x^{0,0987}} \times \frac{0,45}{x^{0,9013}} = \frac{1}{4,5471} \times x^{0,9013} \times \frac{0,45}{x^{0,9013}} = 0,099 \quad (5)$$

With a change (growth) of the constituents of the ability by 1 point, the development potential of the ecosystem of fintech products will increase by 0.099 points.

Analyzing the development potential of the fintech product ecosystem, it is worth considering the example of Ukraine. The development of technology, e-commerce, the use of smartphones, and digital currencies have led to the transition of traditional banking and financial instruments to cyberspace. Improving the regulation of Ukraine's payment market infrastructure in accordance with EU standards has contributed to the development and reduction in the price of non-cash payments and the creation of a large number of FinTech companies in Ukraine. The NBU has created a Sandbox to stimulate the development of FinTech companies. Regulation of crowdfunding and virtual asset operations has also been introduced. Due to the rapid change in the needs of financial market participants in Ukraine, traditional payment activities have been restructured into digital format, non-cash payments have increased (ratio of non-cash transactions to total transactions - 75%), and financial services became available 24/7 regardless of customer location, use various methods of remote identification, increased the competition in the financial market by FinTech companies and the emergence of new IT solutions and tools in the financial sector, including regulatory and supervisory technologies. One of the priority activities of the regulators of the financial sector of Ukraine is to ensure the cybersecurity of payment, depository, and exchange infrastructure. Digitalization in the financial sector stimulates the development of the digital society in Ukraine. Public confidence in the financial sector has been restored, financial literacy has been increased, and people are actively and consciously using modern financial instruments to improve their own well-being. The use of digital technologies has made it possible to increase the number of citizens who have a basic current account in the bank and carry out transactions with financial instruments (number of active accounts/number of adults - 80% in 2025). Financial market regulators have introduced regulation of new and modern areas of FinTech - Insur Tech, WealthTech, and lending platforms, and introduced the regulation of crowdfunding. Due to this, modern international trends in Machine Learning and Artificial Intelligence technologies are presented and directly used in FinTech areas. EU standards on the PSD2 directive, the ISO 20022 standard, and instant payments have been implemented, which has made it possible to increase competitiveness in the financial market and ensure the expansion of the range of financial services. The concept of using the e-hryvnia (CBDC - Central Bank Digital Currency) at the national level has been developed. SupTech and RegTech have introduced easier, faster, or more efficient compliance with regulatory requirements by financial market participants. The regulator identifies development vectors and uses innovative tools to collect, process and visualize data received from reporting entities. Open and consolidated registers have been created and are functioning, combining information from different sources. Such registers are widely used by financial market players to identify customers, automate business processes. At the legislative level, the rules for the use of open APIs have been established and the use strategy for all financial market participants has been approved. The legal framework for the development of BigTech has been created, the activities of such players are regulated and ensure proper protection of confidential consumer data and cybersecurity.

Public authorities of the studied countries are most active in promoting the development of innovative fintech products. They cooperate with the community of entrepreneurs and are willing to invest in the development of financial technology centers in their territories. The main goal of the initiatives is not to limit the industry, but to develop the ecosystem of fintech products.

Taking into account some facts, conducted research shows the impact of the ecosystem on the scale of fintech production due to the Covid pandemic. It is noticed the importance of state stimulation of the ecosystem of financial technologies and further assess trends in change.

Thus, the process of impact of the ecosystem on the scale involves solving problems such as:

1. Establishing a relationship between the most important components of the ecosystem and the level of scale of production;
2. Establishing a relationship between national influence and the level of scale of production with taking into account the time factor.

Consider the process of econometric modeling of each of the tasks.

1. The impact of the ecosystem of fintech products on the level of scale of production can be conditionally recorded using an econometric model of functional communication of general form:

$$V = f(Ic), \quad (6)$$

where V - the scale of production of fintech products, score; Ic - ecosystem of financial technologies, score.

This effect can be specified using a model $V(Ic)$ that looks like this:

$$V = e^{\alpha_0} \times Ic^{\alpha_1}, \quad (7)$$

where α_0 - a parameter that characterizes the influence of all other factors; α_1 - parameter that characterizes the ecosystem of financial technologies on the scale of production of fintech products.

Consider in more detail the relationship between the scale of production of fintech products and the ecosystem of public administration using the coefficient of elasticity (E):

$$E = \frac{Ic}{V} \times \frac{dIc}{dV} = \frac{Ic}{e^{\alpha_0} \times Ic^{\alpha_1}} \times e^{\alpha_0} \times \alpha_1 \times Ic^{\alpha_1 - 1} = \alpha_1 \quad (8)$$

Thus, the coefficient of elasticity is equal to the parameter (α_1), on the basis of which it will be possible to reflect the change in the scale of production of fintech products based on the ecosystem of fintech products.

The impact of the ecosystem on the scale of production (V) taking into account the most important components of the ecosystem (Ici) will be reflected using the power function of the following type:

$$V = V(Ici) = e^{\alpha_0} \times Ic1^{\alpha_1} \times Ic2^{\alpha_2} \times Ic3^{\alpha_3} \times Ic4^{\alpha_4}, \quad (9)$$

where $Ic1$ - regulation efficiency; $Ic2$ - corruption; $Ic3$ - future orientation of the government; $Ic4$ - rule of law. $\alpha_0, \alpha_1, \alpha_2, \alpha_3, \alpha_4$ - required parameters of the multifactor model.

The model $V(Ici)$ of dependence of scales of production of fintech products on separate components of ecosystem of fintech products taking into account reduction of power function to a linear-logarithmic kind will get such look:

$$\ln V = 0,29 + 0,16 \times \ln Ic1 - 0,72 \times \ln Ic2 + 0,75 \times \ln Ic3 + 2,31 \times \ln Ic4, \quad (10)$$

$$R^2 = 0.91$$

In the power form the econometric model (4) takes the form:

$$V = e^{0,29} \times Ic1^{0,16} \times Ic2^{-0,72} \times Ic3^{0,75} \times Ic4^{2,31}. \quad (11)$$

The constructed multifactor model $V(Ici)$ is adequate, the value of Fisher's F-criterion calculated by the value of the coefficient of determination (0.91) exceeds the critical value. The calculations allow us to draw certain conclusions based on the economic content of the parameters of growth of the ecosystem of fintech products by 1%, with the sustainability of all other components of the ecosystem of fintech products will increase the production of fintech products by 0.29%. An increase in the efficiency of regulation by 1% causes a change in the scale of production by 0.16%, provided that Ic_2, Ic_3, Ic_4 -steel. In turn, if there is a decrease in corruption by 1% with a constant value of other components the scale of production will increase by 0.72%. The growth of the indicator as a future orientation of the government by 1% will be accompanied by an increase in the scale of production of fintech products by 0.75%. And an increase in the rule of law by 1% will increase the scale of production by 2.31%. It is safe to say that the rule of law is an important indicator of the development of fintech products.

The influence of the time factor (t) and the institutional structure (Ici) on the scale of production of fintech products (V) can be reflected using a model that contains as independent variables the time factor (t) of regulatory efficiency (Ic_1), corruption (Ic_2), future government orientation (Ic_3), rule of law (Ic_4).

We represent such dependence by means of model $V(t, Ici)$:

$$V = (t, Ici) = e^{\alpha_0 + \beta \times t} \times Ic_1^{\alpha_1} \times Ic_2^{\alpha_2} \times Ic_3^{\alpha_3} \times Ic_4^{\alpha_4}, \tag{12}$$

where t - time factor.

As a result of calculating the parameters of model (10) of the impact of the ecosystem of fintech products on the scale of production of fintech products using the time factor (t) (Appendix A) we obtain the following model:

$$\ln V = 0,32 + 0,09 \times t + 0,59 \times \ln Ic_1 - 1,05 \times \ln Ic_2 + 0,14 \times \ln Ic_3 + 3,83 \times \ln Ic_4, \tag{13}$$

$$R^2 = 0,99,$$

Or in power form:

$$V = e^{0,32 + 0,09 \times t} \times Ic_1^{0,59} \times Ic_2^{-1,05} \times Ic_3^{0,14} \times Ic_4^{3,83}. \tag{14}$$

The calculated values of the coefficient of determination (0.9999) and Fisher's F-test indicate its adequacy (Table 2).

Table 2. Results of the effectiveness study of the fintech products ecosystem formation of the countries.		
Content of dependence	Impact of the ecosystem of fintech products (Ici) on the scale of production of fintech products (V)	Influence of time factor (t) and ecosystem of fintech products (Ic) on the scale of production of fintech products (V)
Type of dependence	Model $V(Ici)$ $V = e^{0,29} \times Ic_1^{0,16} \times Ic_2^{-0,72} \times Ic_3^{0,75} \times Ic_4^{2,31}$	Model $V(t, Ici)$ $V = e^{0,32 + 0,09 \times t} \times Ic_1^{0,59} \times Ic_2^{-1,05} \times Ic_3^{0,14} \times Ic_4^{3,83}$
Assessment of the adequacy of the model	$R^2 = 0,91$ F settlement = 200,2 F critical. = 5,99 The model is adequate	$R^2 = 0,99$ F settlement = 390,8 F critical = 4,39 The model is adequate

A study of the model of the ecosystem of fintech products impact on the scale of production with taking into account the time factor allows us to draw the following conclusions: with increasing efficiency of regulation (Ic_1) by 1% and the consistency of values, corruption (Ic_2), future government orientation (Ic_3), rule of law (Ic_4), the level of scale will increase by 0.59%; with an increase in corruption (Ic_2) by 1%, and the constancy of all other factor features, the scale will decrease by 1.05%; in turn, the growth of the future orientation of the government (Ic_3) by 1% with a constant value of other components will increase the scale of production of fintech products by 0.14%; if the rule of law (Ic_4) increases by 1% with the constancy of all other factors, the scale of production of fintech products will increase by 3.83%. The most important is the factor Ic_4 , then the factors Ic_1, t, Ic_2, Ic_3 . Summary results of the study of the dependence of the ecosystem of fintech products on the institutional structure are given in table 2.

Application of economic and mathematical modeling of the ecosystem on the scale of fintech products production, which can be used to predict the pace of ecosystem development and determine the impact of the most important components on the scale of fintech product production, national impact on the scale of fintech product production is allowed to confirm the hypothesis.

The calculations showed that based on the economic content of the parameters of growth of the ecosystem of fintech products by 1% with the sustainability of all other components of the ecosystem will increase the production of fintech products by 0.29%.

An increase in the efficiency of regulation by 1% causes a change in the scale of production by 0.16%, provided that I_{c2}, I_{c3}, I_{c4} - steel. In turn, if there is a decrease in corruption by 1% with a constant value of other components, the scale of production will increase by 0.72%. The growth of the indicator as a future orientation of the government by 1% will be accompanied by an increase in the scale of production of fintech products by 0.75%. And an increase in the rule of law by 1% will increase the scale of production by 2.31%. It is safe to say that the rule of law is an important indicator of the development of fintech products.

The influence of the time factor (t) and the institutional structure (I_{ci}) on the scale of production of fintech products (V) are reflected in a model that contains as independent time factors (t) variables regulatory efficiency (I_{c1}), corruption (I_{c2}), future government orientation (I_{c3}), rule of law (I_{c4}). The study of the model of the ecosystem of fintech products impact on the scale of production taking into account the time factor allowed to draw the following conclusions: with increasing regulatory efficiency (I_{c1}) by 1% and stability of values, corruption (I_{c2}), future government orientation (I_{c3}), rule of law (I_{c4}), the scale will increase by 0.59%; with an increase in corruption (I_{c2}) by 1%, and the constancy of all other factor features, the scale will decrease by 1.05%; in turn, the growth of the future orientation of the government (I_{c3}) by 1% with a constant value of other components will increase the scale of production of fintech products by 0.14%; if the rule of law increases (I_{c4}) by 1% with the constancy of all other factors, the scale of production of fintech products will increase by 3.83%. The most important is the factor I_{c4} , then the factors $I_{c1}, t, I_{c2}, I_{c3}$.

The growth of the fintech market in Ukraine in comparison with world practice has a number of specific features: the activity of banks in promoting technological financial services; most Ukrainian fintechs are in the early evolution stages; underdevelopment of the formal and informal venture investment system; fintech market volatility; decline in interest from fintech companies in blockchain technology; highly segmented distribution of fintech companies by spheres of activity and concentrated mainly on two areas – payment services and the introduction of innovative technologies and infrastructure; fintech companies are mainly financed by the founders' savings.

The introduction of the institution of banks that can be authorized to store banknotes and coins (authorized banks) is aimed at providing cash to banks and other participants in cash circulation. The new model of cash circulation will allow for expansion of the list of participants of cash circulation (SIT companies), will help to improve the liquidity of banks, and reduce the use of cash. Further expansion of the list of authorized banks together with the strengthening of control over their activities will serve as an important tool for providing quality cash to consumers of financial services. For more active use of electronic means of payment, further development of infrastructure should be ensured, as well as the development of financial literacy. Developing innovative technologies to meet the preferences of financial services consumers, expanding virtual service channels, personalized financial services, mobile solutions, developing open banking, and expanding cooperation between traditional financial institutions and FinTech companies will better meet customer needs and require regulators to be a more flexible and proactive approach to the regulation and supervision by a wider range of financial market participants. The adoption of comprehensive amendments to regulations on depository activities, securities trading, and the operation of stock exchanges will contribute to the expansion of opportunities for innovation in the provision of financial services by professional stock market participants. The above changes will enable the use of the latest mobile IT technologies in the case of establishing business relationships and providing professional stock market participants services to their clients to open and maintain a securities account, conduct transactions with securities and other financial instruments, including stock exchanges, which will allow investors to gain simplified and prompt access to the services of depository institutions and securities traders. At the same time, equal conditions of competition must be ensured for all financial market participants, the possibility of using regulatory arbitrage must be eliminated, and compliance with international financial monitoring standards must be ensured.

DISCUSSION

The aim of this study was to justify the importance of transforming the model of development for the ecosystem of fintech products and further assessing trends in the conditions of pandemic Covid. It is proved that the application of multifactor

econometric models of the ecosystem of fintech products on the scale of production allows us to predict the pace of development of the scale of production and assess the impact of each component of the ecosystem of fintech products on its change.

The study can serve as a theoretical model for determining the magnitude of the impact of each component of the ecosystem of fintech products and the potential of its development in countries. Based on the proposed method, the potential for ecosystem development of fintech products in such countries as Ukraine, Turkey, Latvia, Georgia, Poland, and Bulgaria has been analyzed. Data collection tools: official statistics of the Report on Readiness for the Future of Production.

The crucial agents affecting the progress of the fintech ecosystem in the conditions of COVID-19, in particular in the banking sector are:

- the worldwide growth of digitization processes, covering almost all spheres of human activities, especially during a pandemic COVID-19, including the financial sector. Digitalization improves customer satisfaction with financial services; develops the chances of the economic entity capital controlling; reduces the costs of all participants in the financial market; speeds up financial transactions; increases territorial coverage of financial services and ensures clarity of relations in the financial market. The development of fintech segments such as blockchain, P2P lending, online scoring, algorithmic trading, etc. was determined by the development of information processing technologies;
- the active growth of the Internet (geography has been expanding and the speed of the Internet has been improving) that allows a person to be in cyberspace all the time. This process is also accompanied by an increase in the incidence of COVID-19. Social networks and messengers are developing rapidly. The growing popularity of social networks has contributed to the emergence of fundamentally new types of financial services based on the exchange of information among users (crowdfunding, P2P transfers, financing, social trading, etc.);
- the desire for innovation, increased requirements for the convenience of using services, the quality and speed of obtaining information inherent in the most numerous generation Millennials in world history. This generation already depends on automated, faster, and more efficient technologies and services. As a result, demand for digital payment systems will see rapid growth soon;
- the success of technology companies in other sectors of the economy (retail, entertainment industry, etc.). The emergence of successful companies that have largely changed their markets and offered more competitive products and services has aroused the interest of entrepreneurs, including the financial sector;
- the growth of e-commerce stimulates the growth of services in the payment and transfer segment, as well as in the financing segment, especially during a pandemic COVID-19. The increasing turnover of online trading is a driver of the payment services development (including e-wallets, internal payments using applications, and instant payments), as well as services in the field of lending to customers.

At the same time these factors cause more complex changes which are the foundation for the development of the ecosystem of fintech products [23]:

- improving product quality through innovative capabilities of digital quality management IT systems, improved business process control, statistical control of business processes;
- improving efficiency and safety of work through innovative capabilities of IT systems for the robotization of production processes, remote monitoring, and control, digital management of labour efficiency, automation of intellectual and physical labour;
- increasing the capacity of production equipment through innovative capabilities of IT systems of predictive maintenance, additional reality in maintenance, flexible routing and use of equipment, remote monitoring, and control;
- improvement of the operation mode of technological equipment through innovative capabilities of IT systems of energy-saving, informatization of products, optimization of the technological capacity of production equipment;
- improvement of post warranty technologies through innovative capabilities of IT self-service systems using virtual technologies, remote after-sales and predictive service;
- speeding up the entry period of products to the market through innovative capabilities of IT systems of rapid modeling and experimentation, parallel design, open information, and communication environment between the manufacturer and the client based on IT innovations;
- ensuring the accuracy and manufacture of products following the data obtained through the innovative capabilities of IT systems;
- improvement of logistics processes through innovative capabilities of IT systems for optimizing the batch size and real-time sales chains, etc.

CONCLUSIONS

Fintech-based systems help to create inclusive integrated networks quickly. They also stimulate innovation and create entirely new markets and jobs that have new work principles in accordance with the post-covid period. In addition, the task of public authorities is to create proper mechanisms for promoting such a process.

It is necessary to implement coordinated measures to maintain a balanced approach in the field of state regulation of the financial technology market to ensure the effective functioning of the ecosystem of fintech products, especially during a pandemic COVID - 19 for any financial system. On the one hand, the task of the state is to create a favorable environment for the state to develop innovations, and on the other – to control and minimize the risks associated with the functioning of the fintech market.

Such mechanisms can be: increasing the level of financial literacy among the population, based on the simplicity and availability of information, ergonomic and design solutions, implementation of elements of artificial intelligence, development of robotic consulting and machine learning in the financial sphere; formation of human potential that can provide access to specialists with competencies key to the fintech industry in the future, creation of an attractive education system, as well as the implementation of a favorable immigration policy.

Therefore, it is necessary to provide labor resources for the fintech ecosystem development with a set of general and special (professional) competencies to perform successfully professional tasks in the field of finance, banking, and insurance [24]. Actually, it is vital to create labor potential aimed at the fintech ecosystem development, to educate highly qualified professionals. They have to gain theoretical knowledge and skills in fintech development, its use, and adaptation and should be able to solve research, management and financial issues of different hierarchy levels. Effective mechanisms in this direction can be:

- systematic interdisciplinary training of modern specialists;
- purposeful, expert knowledge in financial technologies;
- economic, statistical and computer modeling; use of special software platforms of the digital economy;
- participation in the innovative development of financial resources and cash flow management.

In practice, certain indicators and measurements can help financial technology market participants to be aware of the activation of the necessary areas that will contribute to the development of the ecosystem of fintech products. It is substantiated that an important prerequisite for the implementation of professional tasks in various fields with the use of innovative financial instruments and technologies (FinTech) is a human potential. It can be said with confidence that the effectiveness of public administration, in particular the formation of interdisciplinary competencies is an important indicator of the development of fintech products. The next stage of the study should be the formation and improvement of the necessary general and special (professional) competencies of the subjects of fintech creation and use.

ADDITIONAL INFORMATION

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REFERENCES

1. Sorensena, J., Bengleb, T., Xiangc, W.-N. (2018). Ecological wisdom inspired practice research for building resilient communities in socio-ecological systems. *Journal of Urban Management*, 7(3): 121-123. <https://doi.org/10.1016/j.jum.2018.12.006>
2. D'yakonova, I., Nikitina, A., Gurvits, N. (2018). Improvement of the enterprise economic security management in global environment. *Geopolitics under Globalization*, 2(1): 19-26. [https://doi.org/10.21511/gg.02\(1\).2018.03](https://doi.org/10.21511/gg.02(1).2018.03)

[10/2018-fintech-100-the-worlds-leading-fintech-innovators-fs.html](https://www.semanticscholar.org/paper/10/2018-fintech-100-the-worlds-leading-fintech-innovators-fs.html)

23. Jaworski, N., Andrushchak, N., Dziurakh, Y. (2021). Features of Porous Composites Dispersion Relations Simulation based on Voxel-like Microlevel Models and Supercell Approach in COMSOL. System International Conference on Perspective Technologies and Methods in MEMS Design, 2021-May, 90-93. <https://ieeexplore.ieee.org/document/9467924>
24. Wasilczuk, J., Chukhray, N., Karyy, O., Halkiv, L. (2021). Entrepreneurial competencies and intentions among students of technical universities. Problems and Perspectives in Management, 19(3): 10-21. <https://www.semanticscholar.org/paper/Entrepreneurial-competencies-and-intentions-among-Wasilczuk-Chukhray/71cefdabc4335d57b65672e63dd6421f3ec82bee>

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ВИКЛИКИ ТРАНСФОРМАЦІЇ ЕКОСИСТЕМИ ФІНТЕХ-ПРОДУКТІВ В УКРАЇНІ В УМОВАХ COVID-19

Стаття присвячена особливостям розвитку фінтеху та актуалізації створення інноваційних продуктів і послуг, оскільки пандемія COVID-19 суттєво вплинула на визначення векторів формування фінансових технологій та інноваційних продуктів і сприяла їхній трансформації. Установлено, що з розвитком нових технологій зростає конкуренція й у банківському, і в небанківському сегментах фінансового ринку. Акцентовано, що головною метою ключових гравців фінансової екосистеми є задоволення потреб кінцевих користувачів, їхня діяльність вимагає використання різноманітних фінансових інструментів для досягнення власних цілей. На основі визначення впливу компонентів екосистеми фінтех-продуктів встановлено важливість кожного з них для розвитку екосистеми фінтех-продуктів, особливо в умовах пандемії Covid. Досліджено залежність використаного потенціалу розвитку екосистеми фінтех-продуктів від її складових за країнами.

За результатами дослідження встановлено, що, виходячи з економічного змісту параметрів зростання екосистеми фінтех-продуктів на 1 %, за стабільності всіх інших складових виробництво фінтех-продуктів зростає на 0.29 %. Підвищення ефективності регулювання на 1 % дозволить збільшити масштаби виробництва на 0.16 %. У свою чергу, масштаб виробництва збільшиться на 0.72 % за рахунок зниження корупції на 1 % при незмінному значенні інших складових. А підвищення ефективності нормативно-правового забезпечення на 1 % сприятиме збільшенню масштабів виробництва на 2.31 %. Отже, успіх усієї екосистеми залежить від злагодженої, взаємовигідної роботи учасників, яка ґрунтується на відкритості та повазі до інтересів учасників. Потреби всіх суб'єктів господарської діяльності мають задовольнятися шляхом надання належних фінансових послуг усіма учасниками фінансової екосистеми.

Ключові слова: екосистема, фінтех-продукти, стартап, публічне управління, потенціал, технології, фінансовий сектор

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