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Innovative approaches to financial flow management in global value chains

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Abstract. In the context of growing international interdependence, the efficiency of financial resource management is determined by the ability of systems to ensure transparency, flexibility, and transaction speed. It requires the implementation of innovative approaches that integrate financial management, digital technologies, and data analytics. The **purpose of the study** is to provide a theoretical generalization and practical justification of mechanisms for innovative financial flow management under conditions of economic digital transformation. **Methods.** The research applies a systemic and structural-functional approach, comparative analysis of international digital indices, and logical generalization, which made it possible to identify the relationship between a country's digital readiness and the implementation of innovations in financial management. **Results.** The study found that digital readiness of the economy is a key prerequisite for innovation in the financial sphere. At the same time, its asymmetry – between high human capital and a weak level of business digitalization – creates the need for new approaches to financial flow coordination. Based on a comparative analysis of the



Network Readiness Index (NRI), DiGiX, and Cisco DRI, it was found that Ukraine possesses favorable human and technological conditions for FinTech development but remains constrained by institutional barriers and insufficient investment in digital infrastructure. The study develops an analytical approach to managing financial flows within global value chains (GVC), grounded in the integration of innovative technologies – blockchain, artificial intelligence, smart contracts, FinTech platforms, and cloud systems. The proposed framework of innovative solutions reflects their functional purpose and their impact on the efficiency of financial management in GVCs. The application of these technologies enhances financial monitoring accuracy, reduces transaction costs, accelerates capital circulation, and strengthens trust among participants in the global economic network. The practical significance of the results lies in the use of the proposed approach to improve financial flow management and to support the development of digital strategies for sustainable economic growth.

Keywords: digital readiness, financial coordination, FinTech tools, blockchain technologies, global value networks.

Інноваційні підходи до управління фінансовими потоками у глобальних ланцюгах створення вартості

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Анотація. У сучасних умовах зростання міжнародної взаємозалежності ефективність управління фінансовими ресурсами визначається здатністю систем забезпечувати прозорість, гнучкість і швидкість трансакцій, що потребує впровадження інноваційних підходів, орієнтованих на поєднання



фінансового менеджменту, цифрових технологій та аналітики даних. **Метою дослідження** є теоретичне узагальнення та практичне обґрунтування механізмів інноваційного управління фінансовими потоками в умовах цифрової трансформації економіки. **Методи.** Використано системний і структурно-функціональний підходи, порівняння міжнародних цифрових індексів та логічне узагальнення, що дозволило визначити зв'язок між цифровою готовністю країни та впровадженням інновацій у фінансове управління. У **результаті дослідження** встановлено, що цифрова готовність економіки є визначальною передумовою інноваційності у сфері фінансів, а її асиметрія – між високим людським потенціалом і слабким рівнем бізнес-цифровізації – зумовлює потребу у нових підходах до координації фінансових потоків. На основі порівняльного аналізу індексів Network Readiness Index (NRI), DiGiX та Cisco DRI виявлено, що Україна має сприятливі кадрові й технологічні умови для розвитку FinTech-напрямів, але обмежена інституційними бар'єрами та недостатнім рівнем інвестицій у цифрову інфраструктуру. У дослідженні сформовано аналітичний підхід до управління фінансовими потоками у глобальних ланцюгах створення вартості, який базується на поєднанні інноваційних технологій – блокчейну, штучного інтелекту, смарт-контрактів, FinTech-платформ і хмарних систем. **Висновки.** Розроблена система інноваційних рішень відображає їх функціональне призначення та вплив на ефективність фінансового управління у GVC. Застосування таких технологій підвищує точність фінансового моніторингу, знижує трансакційні витрати, прискорює обіг капіталу та зміцнює довіру між учасниками глобальної економічної взаємодії. Практична значущість результатів полягає у використанні запропонованого підходу для вдосконалення управління фінансовими потоками та формування цифрових стратегій сталого розвитку економіки.

Ключові слова: цифрова готовність, фінансова координація, FinTech-інструменти, блокчейн-технології, глобальні мережі вартості.



Problem statement. A high level of interdependence, digitalization and the speed of value exchange between participants in international markets characterizes modern global economic processes. In such conditions, the management of financial flows becomes a determining factor in the effectiveness of the functioning of Global Value Chains (GVC) [1, p. 60]. Accordingly, not only is the structure of financial transactions changing, but also the very concept of financial management, which integrates information, logistics and technological components. The need to rethink the role of innovative technologies in financial management is due to deep transformations that occur under the influence of digitalization, automation, the development of FinTech ecosystems and the use of data analytics [2]. These factors radically change the mechanisms for coordinating cash flows, reduce transaction costs and increase the transparency of international settlements [3, p. 131]. At the same time, the results of international digital indices (NRI, DiGiX, DRI) demonstrate the unevenness of Ukraine's digital readiness: high human potential is not accompanied by proper institutional support for innovation. It necessitates the formation of an adaptive financial flow management system capable of ensuring the sustainability and competitiveness of enterprises within the GVC.

Analysis of recent research and publications. In modern scientific literature, the transformation of financial flows under the influence of digitalization, FinTech innovations and blockchain technologies in global value chains is actively studied. Thus, M. Böhmecke-Schwafert analyzed the application of blockchain technologies in international trade, identifying the main areas of their implementation – from electronic trade documents to the formation of sustainable global value chains [4]. Continuing this trend, W. Chen and colleagues, relying on the theory of transaction costs, proved that blockchain increases the transparency and efficiency of business processes in global financial systems [5, p. 75]. The study by I. Ioannou and G. Demirel summarizes approaches to the use of blockchain in supply chain financing, identifies its potential in reducing inefficiency and increasing mutual trust between trade participants [6, p. 83]. Additionally,



O. Korobkova and co-authors substantiated a model of interaction between customs and logistics service participants, which contributes to increasing the efficiency of flow regulation in international supplies [7]. FinTech tools attract considerable attention from scientists as a catalyst for innovations in financial management. M. Kumari proved that FinTech innovations reduce trade barriers and stimulate the growth of international trade [8], while Y. Guo and W. Wang showed that data analytics and FinTech platforms form flexible financial systems that increase the efficiency of supply chains [9]. In turn, S. Maryam and A. Ahmad proposed a conceptual model of FinTech integration into value chain financing in Islamic financial institutions, emphasizing the role of trust, information exchange, and ICT in ensuring financial flexibility [10, p. 597]. The issue of financial inclusion in the context of FinTech is revealed in the work of V. Kesavan and A. Polisetty, who prove that financial technologies act as a driving force for social and regional integration, contributing to the achievement of the Sustainable Development Goals [11]. A similar idea is supported by S. Ul-Durar and co-authors, who have proven that FinTech increases the economic preparedness of businesses to climate risks, and the quality of institutions enhances the effectiveness of financial innovations [12]. The development of new financial technologies is highlighted in the work of G. Kou and Y. Lu, who summarize the directions of evolution of artificial intelligence, machine learning, blockchain and quantum solutions that form the basis of future finance [13]. Similarly, V. Zalizniuk emphasizes the importance of innovation and digital strategies in strengthening the economic resilience of countries in conditions of global instability [14]. The digital dimension of economic development and its impact on financial flows are considered in a cross-country study by S. Nagy, who compared the level of digital maturity of Hungary and Ukraine, identifying positive trends in digital transformation [15, p. 174]. In the context of digital logistics, O. Korostin substantiated the possibilities of using artificial intelligence to optimize maritime transport routes, which directly affects the efficiency of global financial and commodity flows [16, p. 31]. In addition, M. Levchenko emphasized the



importance of adapting marketing strategies to local conditions when businesses enter new markets, which is consistent with the principles of innovation management in GVC [17]. Finally, V. Hrushko and R. Kovchar summarized modern approaches to the development of global value chains, outlining their advantages, risks and significance for the foreign economic security of states [18, p. 9].

Thus, modern research demonstrates that the combination of FinTech, blockchain technologies, data analytics and artificial intelligence forms a new paradigm for managing financial flows in global value chains. Their integration ensures transparency, speed and stability of financial transactions, which is a key condition for the effective functioning of the digital economy.

Identification of previously unresolved parts of the general problem.

Despite significant scientific achievements in the digitalization of financial processes, the problems of integrating innovative financial technologies into the system of managing global value chains remain unresolved. The impact of a state's digital readiness and financial infrastructure on the effectiveness of managing financial flows in the context of financial integration remains insufficiently studied. Our research is aimed at systematizing the evolution of approaches to managing financial flows, determining the role of FinTech ecosystems, data analytics, artificial intelligence and blockchain in the modernization of international financial transactions, as well as identifying the relationship between digital indices (NRI, DiGiX, Cisco DRI) and the level of innovative management. The practical value of the results obtained lies in the formation of an analytical model of digital readiness as a prerequisite for effective management of financial flows in global value chains, which can be used to improve the state policy of digital transformation, increase investment attractiveness and develop the FinTech sector.

Formulation of the article's objectives. The purpose of this study is to substantiate the theoretical foundations and develop analytical approaches for innovative management of financial flows in global value chains, considering the economy's digital readiness level and the potential for integrating FinTech solutions



into the financial management system.

Presentation of the main material of the study. The concept of «financial flows» in international management has evolved from the classical idea of the movement of funds between business entities to a complex category that encompasses a multi-level system of transactions, information interconnections and digital transfers in global value chains [1, p. 65]. In modern conditions, financial flows are considered not only as a reflection of the results of economic activity, but as an integrated mechanism for coordinating resources that ensures the stability and continuity of international production and sales systems. It is through the management of financial flows that control over supply chains is implemented, capital allocation is optimized, liquidity is ensured, and the risks of cross-border operations are minimized [3, p. 136].

The evolution of global value chains is accompanied by the formation of the concept of «innovative management», which reflects the shift from administrative and accounting procedures to intellectual and analytical models of financial coordination. This approach is based on the principles of transparency, adaptability, data processing speed and digital integration of chain participants [19]. Within the framework of financial integration, this means that the management of capital flows, investments, settlements and monetary resources occurs through digital interfaces that provide real-time decision-making, interaction of financial and production subsystems, as well as increased financial flexibility of enterprises. The digitalization of business processes and the emergence of FinTech ecosystems have radically changed the structure of financial flow management. Traditional banking infrastructure is giving way to decentralized financial platforms that provide integration of payments, lending, investing, insurance and reporting in a single digital environment [8; 9; 10; 12]. The implementation of open banking technologies allows you to synchronize financial transactions with production and logistics processes, ensuring supply chain transparency and efficiency of settlements between counterparties.



At the same time, the key drivers of modernization are data analytics, artificial intelligence, blockchain, smart contracts and API platforms [8; 9; 10; 12]. Data analytics provides cash flow forecasting, risk assessment and formation of financial decision-making scenarios, and artificial intelligence (AI) allows you to automate operational processes, in particular, receivables management, determining the credit rating of counterparties and monitoring transactions in real time. In turn, blockchain creates trust between parties due to the immutability of records and the ability to verify each stage of the financial chain, which reduces transaction costs and fraud risks. Smart contracts today are becoming a tool for automatic fulfillment of obligations, ensuring, for example, the transfer of funds after delivery of goods or confirmation of service performance. The integration of various financial and corporate systems is entrusted to API platforms, which form a single ecosystem for managing data flows and capital.

As a result, innovative technologies form a new paradigm – intelligent management of financial flows, within which finance is transformed from a passive resource into a dynamic tool for strategic coordination in global value chains. Such a transformation contributes to a more efficient allocation of resources, reduction of transaction costs and increase of the sustainability of international business [2; 4]. At the same time, the level of digital readiness of the economy is a determining factor in the development of innovative approaches to financial flow management. It is digital maturity that forms the personnel, technological and institutional prerequisites for the implementation of FinTech solutions, creating an environment in which financial transactions are carried out quickly, transparently and without excessive costs [10; 12]. Within global value chains, digital readiness becomes the basis of competitiveness, ensuring the integration of information, logistics and financial flows into a single system of international interaction.

To assess the digital potential of a country, it is advisable to use international digital indices that reflect the level of technological, educational and regulatory readiness for the implementation of innovations. The most indicative are the



Network Readiness Index (NRI) [20], the Digitalization Index (DiGiX) [21] and the Cisco Global Digital Readiness Index (DRI) [22], which form an analytical basis for comparing countries by the level of digital integration. The summarized results for one of the key indicators – NRI – are given in table 1, which illustrates the current level of digital readiness of Ukraine and the directions for its further improvement.

Table 1

Key digital indicators of Ukraine, 2024

Indicator	Rank	Score	Analytical interpretation
Overall Index	43 / 133	55.32	Average level of global digital readiness; positive dynamics of ICT development
Technology pillar	44	48.96	Potential for development of technological infrastructure and future technologies
People pillar	28	51.83	High human capital and a sufficient level of digital skills of the population
Governance pillar	56	63.14	Moderate regulatory stability and trust in digital governance
Impact pillar	51	57.34	Limited impact of digitalization on economic results
Individuals sub-pillar	4	77.28	High digital activity of the population
Businesses sub-pillar	69	34.67	Low level of business digitalization, weak integration of FinTech solutions
Governments sub-pillar	57	43.53	Average level of development of electronic government services
Economy sub-pillar	16	52.82	Export of ICT products as a driver of the digital economy

Source: constructed according to [20]

The results of NRI 2024 indicate that Ukraine's digital ecosystem has high human potential and a fairly developed ICT sector, but remains structurally unbalanced.

High indicators for the People pillar component and the Individuals sub-indicator demonstrate the population's ability to quickly master technologies, which creates a favorable basis for the development of FinTech and automated financial management. At the same time, the low level of business digitalization and mediocre results of the governance pillar indicate institutional and organizational barriers that



inhibit innovation processes in the financial sector.

Thus, Ukraine's digital readiness is asymmetrical: a high level of human capital is combined with an underdeveloped business infrastructure and limited institutional support for digital investments.

Such an imbalance in the digital ecosystem slows down the integration of innovative financial instruments. It requires the formation of new approaches to managing financial flows based on automation, flexibility and transparency of processes.

To comprehensively assess Ukraine's digital readiness and identify its development's structural aspects, the 2024 results of the international indices NRI and DiGiX were analyzed (table 2).

Table 2

Assessment of Ukraine's positions in international digital development indices,
2024

Index	Year	Position of Ukraine	Score	Analytical characteristics
Network Readiness Index (NRI)	2024	43 / 133	55.32	Average level of global digital readiness; high indicators of human capital and ICT exports, but a low level of business digitalization
Digitalization Index (DiGiX)	2024	67 / ~160	0.45	Moderate level of digitalization; balanced development of infrastructure and skills, requires strengthening of the institutional environment

Source: constructed according to [20; 21]

The results obtained indicate that Ukraine is characterized by an average level of digital readiness, which is characterized by an asymmetry of development: a high level of human capital and digital competencies is combined with an underdeveloped business infrastructure and limited investment in digital technologies. High indicators in the field of access to ICT, digital education and export of IT services create the potential for further scaling of the FinTech sector. In contrast, institutional barriers and the low integration of business into digital processes remain factors that slow down the transformation of the financial environment. To ensure the



completeness of the analytical review, DRI data for 2021 were also used, which covered 146 countries and assessed the structural prerequisites for digital transformation [22]. Despite the lack of updates to this index in subsequent years, its results remain a valuable benchmark for comparison, as they record Ukraine's starting positions in the process of forming a digital economy. In particular, in 2021, Ukraine ranked 79th with an integral score of -0.13 , corresponding to the Accelerate-Low level. A positive factor was high human potential (0.51), while investment activity (-0.84) and the business environment (-0.71) remained weak components of digital maturity.

A comparison of the results of 2021 and 2024 shows that Ukraine's digital readiness has a progressive but uneven development: significant progress has been made in the field of digital infrastructure and human capital, while the institutional and business components still need modernization.

The obtained results indicate that Ukraine remains at the stage of forming a digital ecosystem, but already has significant potential for developing technological and financial infrastructure (table 2). The high level of digital skills of the population, developed ICT education and expanded access to the Internet create a favorable environment for the development of innovative financial instruments.

In this context, digital readiness assumes a functional dimension, serving not only as a statistical indicator but also as a key prerequisite for the financial integration of global value chains. It is digital competencies, payment automation and the speed of information exchange that form the basis for a new model of financial flow management – Smart Financial Flows, which combines analytics, transparency and self-regulation of financial processes in a global environment.

Within the framework of the proposed Smart Financial Flows model, financial management in global value chains acquires innovative content (table 3). Its concept is based on the integration of digital technologies, analytical systems and platform solutions that ensure continuity, transparency and self-regulation of financial processes.



Table 3

Innovative technologies for managing financial flows in global value chains

Technology/tool	Functional purpose	Effect of GVC financing
Big Data analytics	Processing large amounts of financial information to forecast cash flows, assess risks and support management decisions	Increase planning accuracy, reduce cash gaps, optimize capital allocation
Artificial intelligence (AI)	Automatic detection of patterns and trends, build forecasts, and manage receivables	Formation of counterparty behavior models, increases the speed and validity of financial decisions
Blockchain	Decentralized transaction accounting and verification of contract execution	Ensuring supply chain transparency, reducing transaction costs, and increasing the level of trust between partners
Smart contracts	Automatic fulfillment of financial obligations after the occurrence of certain conditions	Reducing settlement time, minimizing administrative costs, and eliminating intermediaries
FinTech platforms	Integration of payment services, lending, investment and analytics into a single digital environment	Ensuring continuity of financial flows between GVC participants, increasing financing efficiency
API solutions and open banking	Interaction of banking, corporate and government systems through standardized digital interfaces	Unification of financial data, efficiency of control, and reducing the risk of information gaps
Cloud Computing	Storage, processing and analytics of financial data in remote environments	Scalability of processes, availability of financial analytics in real time
ESG-oriented financial instruments	Taking into account environmental, social and governance criteria in financial decisions	Increasing the reputational value of GVC, access to «green» financing and global capital markets

Source: developed by the author

The key elements of this model are digital platforms, big data analytics, blockchain, smart contracts, and API solutions in an open banking format. Their combination provides real-time monitoring of cash flows, financial risk forecasting, automation of obligation fulfillment, and synchronization between financial, production, and logistics processes. As a result, an innovative financial process management ecosystem is formed, built on the principles of automation,



adaptability, and transparency. It helps reduce transaction costs, accelerate capital turnover, and strengthen the integration of enterprises into global value chains. The synergy of these technologies forms the basis of an innovative financial ecosystem capable of ensuring full traceability and control of flows within global value chains. In such a system, financial processes do not operate in isolation, but are integrated with production, logistics, and information flows, forming a single digital management architecture. Innovative financial solutions – from AI analytics to blockchain contracts – ensure transparency of capital flows at all stages of GVC, increase the efficiency of transnational settlements and minimize time delays between supply chains.

Thus, innovative management of financial flows becomes a catalyst for financial sustainability and competitiveness of global value chains, contributing not only to the acceleration of operations but also to the strategic transformation of business models towards sustainable development.

Conclusions. The generalization of the results of the conducted research shows that the management of financial flows in the context of globalization has undergone a qualitative transformation, the substantive content of which is determined by the growing role of digital technologies and analytical solutions. Within global value chains, financial flows are transformed from a purely accounting category into a strategic coordination tool that ensures continuity of supplies, consistency of actions of counterparties and efficient allocation of resources. They become a key element in the integration of production, logistics and information processes, forming a new logic for creating added value on a global scale.

Research on international digital indices – Network Readiness Index, DiGiX and Cisco Global Digital Readiness Index – has revealed that Ukraine's digital readiness is developing unevenly: substantial human capital and high digital competences of the population contrast with a low level of business digitalization and institutional support for innovation. Such asymmetry necessitates a rethinking



of financial flow management mechanisms focused on technological integration, transparency and adaptability. It is digital readiness that determines the potential of the state and enterprises to implement innovative financial practices that ensure the speed, accuracy and security of international transactions.

Innovative approaches based on the use of artificial intelligence, blockchain, smart contracts, API platforms and FinTech solutions are forming a new architecture for managing financial flows. Their application makes it possible to create a single financial monitoring system in global value chains, in which the flow of funds becomes manageable, transparent and predictable. As a result, there is a transition to the concept of Smart Financial Flows, which ensures the synchronization of financial and operational processes in international cooperation networks. Innovative management of financial flows is gaining strategic importance as a factor of financial stability, competitiveness and integration of the economy into global production systems. It forms a new development paradigm, within which technologies serve not only as a tool for automation, but also as a means of strengthening financial trust, optimizing value distribution and increasing the efficiency of capital management. This approach contributes to the transition to a digital model of economic growth, in which innovations are the basis for sustainability and long-term effectiveness of global value chains.

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