Business Processes Modelling of Crowdinvesting Platforms Based on Assets' Tokenization

E.V. Popov[a], A.Y. Veretennikova[b], S.A. Fedoreev[c]

[a] Ural Institute of Management of the Russian Presidential Academy of National Economy and Public Administration (RANEPA), Ekaterinburg, Russia;
[b] Institute of Economics of the Urals Branch of the Russian Academy of Sciences, Ekaterinburg, Russia;
[c] Sverdlovsk Regional Fund for Entrepreneurship Support in the Gornozavodsky Administrative District, Nizhny Tagil, Russia

ABSTRACT

The rapid development of digital platforms, the formation of new business models of interaction between the economics agents, as well as the problem of increasing the efficiency of resources have generated the need to develop new approaches to the exchange of resources using modern digitalization opportunities. The purpose of our study is to develop models of business processes for the exchange of financial resources on crowdinvesting platforms using tokenization. The research subject is the economic relations between transactions on crowdinvesting platforms participants. The authors proposed a typology of business processes of crowdinvesting platforms, taking into account the type of transaction scenario (credit (closed) and speculative (opened)), which allows grouping the processes of exchange of financial assets allocated by the Cambridge Center for Alternative Finance. In addition, traditional models of financial assets exchange on a crowdinvesting platform are described. We proposed models of the exchange of financial assets on a crowdinvesting platform considering the tokenization process. Also, we substantiated that the tokenization will significantly increase the liquidity of over-the-counter securities, shares of non-public joint-stock companies, investments in real estate construction projects. The theoretical significance of the results obtained lies in expanding the theoretical and methodological basis for the development of the sharing economy in the financial area. The practical relevance of the proposed model is in the possibility of its application in improving the processes of exchanging financial resources on crowdinvesting platforms.

Keywords: crowdinvesting; digital platform; token; digital financial assets; modelling processes; sharing economy

INTRODUCTION

The rapid development of digital technologies in modern society has created a powerful impetus for the expansion and growth of the diversity of economic relations. The changing landscape of credit and financial markets is a typical example of the extensive process of such transformation. The global expansion of digital devices, enhancing the role of civic initiatives and increasing their involvement in solving the problems of society as a whole and of individual groups, led to the establishment of new business models for collective investment based on the active interaction of small private investors and borrowers. [1, 2] Thus, the world financial system has embarked on a new round of infrastructural transformations, including the emergence of new types of market participants and new types of financial products, and also the emergence of new user scenarios in transactions of access to investment information and transactions.[1] Growing on the limits of traditional financial institutions, crowdinvesting platforms are rapidly forming their unique competitive position by creating new business models for customer service.

At the same time, the crowdfunding market in Russia is in its infancy.

The popularity of crowdfunding platforms is low on traditional credit and loan instruments, due to subjective high-risk assessment of potential investors, as well as a low level of confidence in the activities of investment platforms. This is due to the unavailability of full information on business projects on investment platforms, lower of awareness among potential investors and borrowers of the internal operation of investment platforms. [3] These issues are indeed common to some crowdinvesting platforms. Transparency in their operation would significantly reduce the risks identified.

The implementation of this process, in turn, is possible through the use of distributed registry technology (DLT). The use of this tool in relation to a wide range of assets is generally referred to as "asset tokenization", which implies the digital reflection of tangible and intangible assets in distributed registries as multiple digital units of accounting, i.e. tokens. [4] The possibility of splitting large and expensive (and therefore low-liquid) investment objects in the form of multiple low-cost tokens (tokenized assets, crypto assets) creates significant market infrastructure development potential for both borrowers and investors. [5, 6]

Applying the asset tokenization procedure to improve transactions on crowdinvesting platforms involves a preliminary modelling process. This transformation of business processes will allow investment platform operators to form a unique competitive position against the background of traditional financial institutions. In addition, the application of distributed registry technology unlocks the potential of technological solutions to create a new segment of the lending market, as well as contributing to the consumer value of collective investment. [7]

ASSET TOKENIZATION AS A TOOL FOR TRANSFORMING TRANSACTIONS ON A CROWDINVESTING PLATFORM

Tokenization — is the representation of traditional assets in the form of DLT-issued tokens. A token means a digital right to a resource. I. M. Konobeevskaya notes that "from a technological point of view, a token — is one of the miniature blocks in a blockchain system that can be used to

---

[1] The Global Alternative Finance Market Benchmarking Report. URL: https://www.jbs.cam.ac.uk/wp-content/uploads/2020/08/2020–04–22-ccaf-global-alternative-finance-market-benchmarking-report.pdf; The 2nd Global Alternative Finance Market Benchmarking Report. URL: https://www.jbs.cam.ac.uk/wp-content/uploads/2021/06/ccaf-2021–06-report-2nd-global-alternative-finance-benchmarking-study-report.pdf

secure various rights within the system". [8] D. A. Kornilov adds that "literally a token — is a key or access to identify its owner, secure remote access to information resources, etc." [9] However, the concepts of "token" and "tokenized assets" are not identical. If tokenized assets are real assets (for example, property in the form of buildings, structures, financial resources and property rights), the value of which is determined by their off-network economic turnover by blockchain, then cryptocurrency and ICO tokens — are the digital rights to the assets existing in the network of the blockchain, as their value is determined by their presence inside the network. [10] In the case of crowdinvesting, it is important to note that tokenization can be exercised with respect to any asset, and rights to it will be represented as a token, i. e. a link in a distributed registry. It follows from all of the above that tokenization as a technical innovation can significantly change the model of transaction implementation on the crowdinvesting platform, greatly minimizing the number of documents ensuring the security of the transaction.

The high potential of distributed registry technology to improve the performance of digital platforms is gradually forming the growth of interest in this topic, in both foreign and domestic literature. [11–14] J. Chod and E. Lyandres compare crowdfunding mechanism with venture financing. [15] In his work J. Li and W. Mann, and also Y. Bakos and H. Halaburda pay attention to the network effect and coordination of users of digital platforms P2P-investment. [16, 17] R. Fahlenbrach and M. Frattaroli research the behavior of ICO investors and show that they often sell their tokens in the secondary market, thus ensuring its attractiveness and liquidity. [18] A number of other papers are studied the determinants of ICO success and show a positive relationship with the amount of information disclosed to investors. [19, 20]

Practical mastering of opportunities to work with real assets and property rights in tokenized form, enables transactions to be arranged and property rights to be transferred and protected in more effective ways. In support of this thesis in the report for public consultations of the Central Bank of the Russian Federation "Development distributed ledger technologies" (December 2017) specified that the "selection of basic elements" (tokenization) ... will ensure the speed and ease of its (financial asset) transfer by owners or intermediaries". In addition, the report notes that "development of standards for distributed registry technology will help to reduce the costs of implementation and integration of different systems, ensure their compatibility and effective interoperability".[2]

On *Fig. 1* schematically presents the process of transferring property rights in traditional form (*fig. 1a*) and when using tokens (*fig. 1b*). Traditional procedure for verification of ownership of assets, documentary recording of changes, as well as verification and registration of ownership rights replaced by the process of tokenization of assets, which significantly simplifies the process of transferring property rights by reducing the number of intermediaries, increases the speed of transactions, and also makes the process more transparent.

Using tokenized assets as financial products carried out at crowdinvesting platforms, will contribute to the growth of their liquidity, the possibility of dividing the asset into separate tokens, transforming the pricing procedure, as well as reducing the cost and increasing the reliability of transactions.

---

[2] Report for public consultation "Development distributed ledger technologies". URL: https://cbr.ru/ Content/ Document/File/50678/ Consultation_Paper_171229(2).pdf
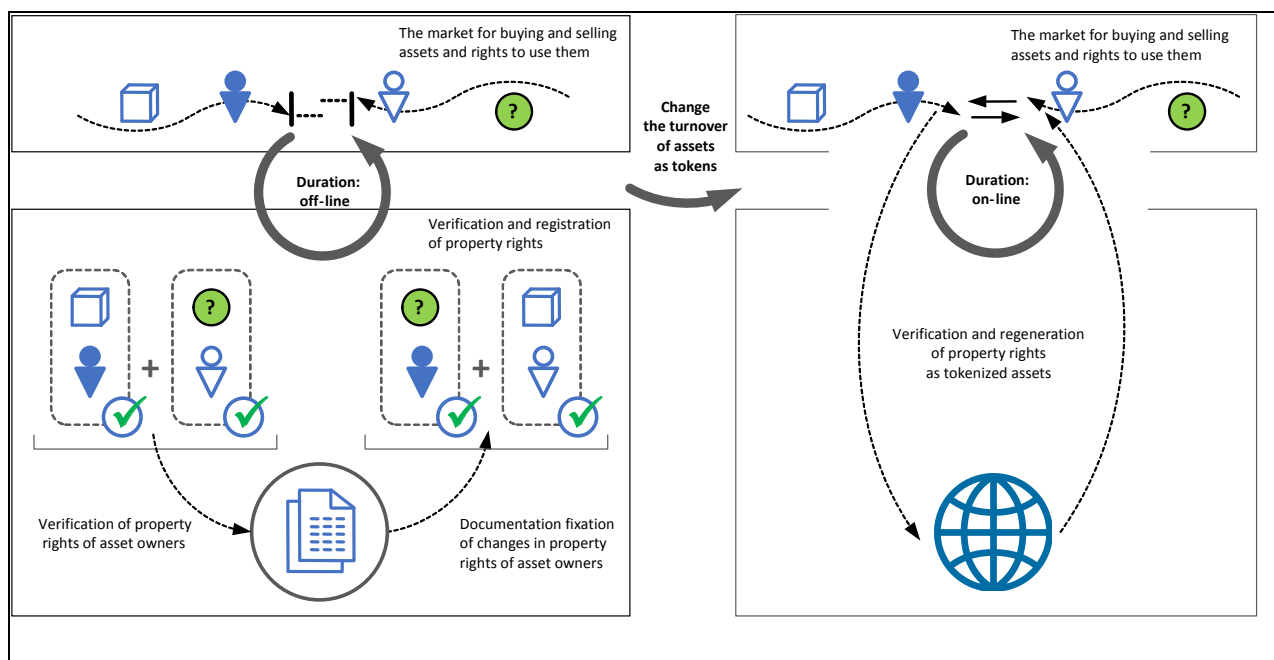
Fig. 1. **The scheme of purchase and sale of assets and the rights to use them in the traditional form and the form of tokenized assets**

Source: compiled by the authors.

CLASSIFICATION OF BUSINESS PROCESSES OF CROWDINVESTING PLATFORMS BASED ON ANALYSIS OF DIGITAL FINANCIAL ASSETS (DFA)

In the Federal Law of the Russian Federation from 31 July 2020 No. 259, regulatory framework for investment platforms, are used rather broad concepts such as "information system" and "information system operator", interpreted in values, defined by the Federal Law from 27 July 2006 No. 149 "On Information Technologies and Information Protection". The investment platform operator can only be a Russian legal entity and only after inclusion of its Bank of Russia in the "Register of Information Systems Operators" (par. 1 art. 5).

To analyze the diverse business practices of information system operators, where digital financial assets are produced and managed, it is advisable to pre-typologize the existing processes on crowdinvesting platforms and consider their implementation features, taking into account the tokenization of assets.

In the analytical documents of the Central Bank of Russia, crowdinvestment operations are classified according to the composition of their participants[3]: P2P — lending to individuals of other persons; P2B — lending by individuals to small and medium-sized companies; B 2B — lending of legal entities or individual entrepreneurs by legal entities or other individual entrepreneurs.

A more detailed typology of the business models used in collective investment is presented in the reports of the Cambridge Center for Alternative Finance 2020 and 2021 years.[4] This typology includes the

_____

[3] The crowdfunding market doubled in 2017. URL: http://www.cbr.ru/press/event/?id= 1902#highlight=краудфандинга

[4] The Global Alternative Finance Market Benchmarking Report. URL: https://www.jbs.cam.ac.uk/wp-content/uploads/2020/08/2020–04–22-ccaf-global-alternative-finance-market-benchmarking-report.pdf; The 2nd Global Alternative Finance Market Benchmarking Report. URL: https://www.jbs.cam.ac.uk/wp-content/uploads/2021/06/ccaf-2021–06-report-2nd-global-alternative-finance-benchmarking-study-report.pdf

allocation of all investment models into 6 groups and 9 types (*table 1*).

Criteria such as the type of assets to be invested, the type of investor and the degree of the platform's involvement in the investment process are used as a classification principle.

P2P-investment (Peer-to-peer) — is a way to attract investment in the form of a secured or unsecured loan from a group of private or institutional investors by an individual or business entity. Currently, this method is the most common in terms of attracting collective investment through investment (crowdinvesting) platforms, in which the risk of loan default is assumed by the investor. The investment platform does not accept the default risk of a loan, but can perform the functions of loan default risk assessment and work on arrears.

Within **balance sheet lending**, Unlike direct investment, a digital platform operator provides a loan directly to an individual or entrepreneur from funds held on the operator's own balance sheet, at the same time, the risks of loan default are borne by the platform operator himself.

Buyout of accounts receivable (invoice trading) is a type of alternative investment, which is used as a receivables management tool and is an alternative to traditional factoring.

Purchase of OTC securities (debt-based securities) — is the business of digital platforms, providing individuals and/or institutional investors with the opportunity to purchase debt securities, bonds or fixed interest rate debt. In the traditional sense, the over-the-counter market — is a tool for experienced investors who are dissatisfied with the terms of the deal or the set of instruments they can get on the stock exchange. In the over-the-counter market, investors can deal with various types of assets: from shares to all kinds of bonds, derivatives and structural products. Despite the low relative share of the global market,

statistics on crowdinvesting platforms show strong demand and growth for this type of financial assets. For example, platforms in the USA and Canada demonstrated a high rate of growth in institutional OTC funding in 2019 (74%) and 2020 (98%).

Purchase of shares of non-public joint stock companies (equity-based crowdfunding) is the type of equity investment, off-exchange, or securities issued by young start-up companies. From the point of view of risky investments, the purchase of shares of companies that are not yet on the stock exchange is profitable. This is due to the fact that the growth of private companies exceeds the growth of public. In particular, the growth rate of transactions for this type of investment in 2019 was 27%, or 1.09 billion USD; and 2020 was — 35%, or 1,52 billion USD,[5] which indicates a growing interest in this group of financial assets.

Investment in real estate projects (real estate crowdfunding) — operation of digital platforms that enable individuals and/or institutional investors to buy a stake in a real estate project. Placement of equity investment offers gives potential investors a more convenient and liquid instrument for investments than with the expensive purchase of a separate property and certainly has significant growth potential. [24] In recent years, real estate crowdfunding has shown a 71% growth rate of 2.87 billion USD, in 2019 and by 63%, or 2.77 billion USD in 2020.[6]

The data presented in the analytical reports of the Cambridge Center for Alternative Finance in 2020 and 2021 also allow to assess the degree of popularity of different business models of crowdinvestment (*fig. 2*).

---

[5] The 2nd Global Alternative Finance Market Benchmarking Report, Cambridge, UK, Cambridge Centre for Alternative Finance. URL: https://www.jbs.cam.ac.uk/wp-content/uploads/2021/06/ccaf-2021–06-report-2nd-global-alternative-finance-benchmarking-study-report.pdf

[6] See ibid.

Typology of crowdinvesting models and related processes

Classification of crowdfunding models	Essence business process actor interactions	World market volume in 2018, bln USD	World market volume in 2020, bln USD
1. P2P- investment 1.1. P2P- personal loans 1.2. P2P- business entity loans 1.3. P2P- loans to individuals or business entities secured by real estate	1.1. Private and/or institutional investors provide loans to individuals	195	34.740
	1.2. Private and/or institutional investors provide loans to business entities	50	15.374
	1.3. Private and/or institutional investors provide loans secured by real estate to individuals or business entities	6	3.1
2. Lending from the digital platform balance account (Balance Sheet Lending) 2.1. Personal loans 2.2. Business entity loans 2.3. Loans to individuals or business entities secured by real estate	2.1. Digital platform operator provides loans to individuals from funds attracted from private and institutional investors	10	13.025
	2.2. Digital platform operator provides loans to business entities funds attracted from private and institutional investors	21	28.018
	2.3. Digital platform operator provides loans secured by real estate to individuals or business entities from funds attracted from private and institutional investors	11	1.808
3. Buyout of accounts receivable (Invoice Trading)	3. Private and/or institutional investors buyout accounts receivable from an entrepreneur at a discount	3.2	3.882
4. Purchase of OTC securities (Debt-based Securities) 4.1. Debt securities 4.2. Corporate bonds (Mini Bonds)	4.1. Private and/or institutional investors buy debt securities from an entrepreneur, generally bonds with a fixed interest rate	0.852	0.384
	4.2. Private and/or institutional investors buy debt securities from an entrepreneur, generally corporate bonds, with a fixed interest rate	1.333	0.043
5. Purchase of shares of non-public joint stock companies (Equity-based Crowdfunding) [21, 22]	5. Private and/or institutional investors buy shares of an entrepreneur	1.515	1.52
6. Collective investment in the construction of real estate (Real Estate Crowdfunding) [23]	6. Private and/or institutional investors provide loans to business entities	2.959	2.777
Total		302.859	104.671

Source: compiled by the authors based on The 2nd Global Alternative Finance Market Benchmarking Report.

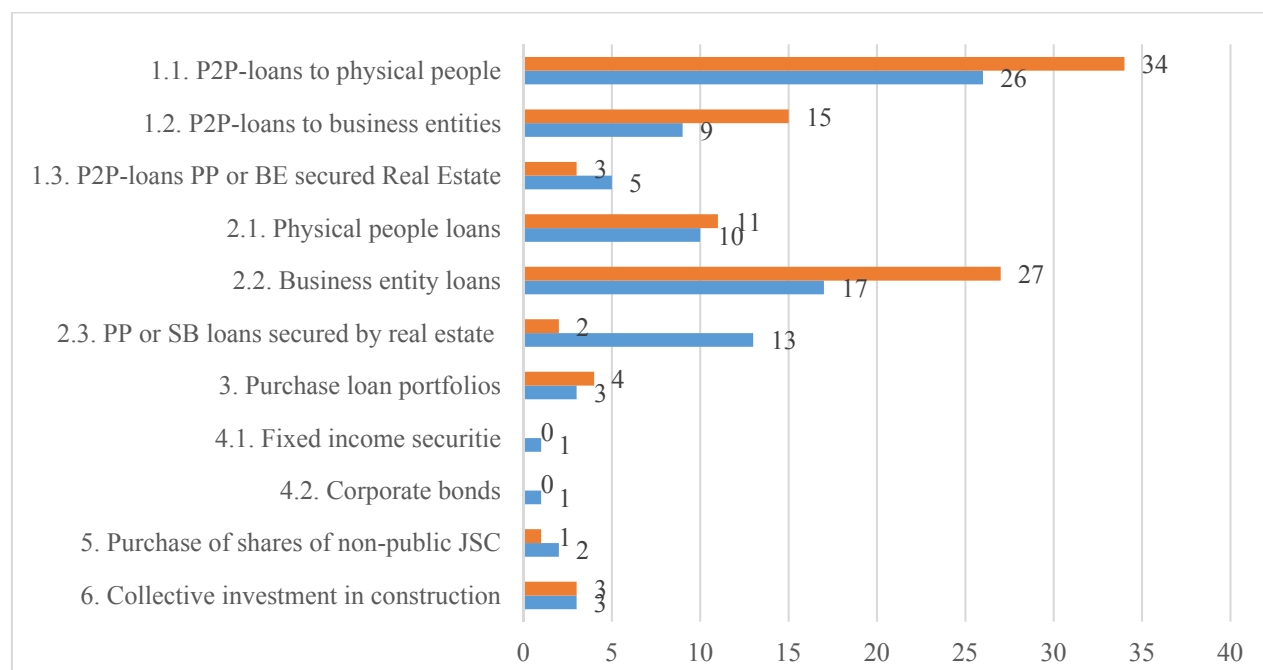*Fig. 2.* **Dynamics of the shares of the global crowd investment market
for different business models, 2018 and 2020**

Source: The Global Alternative Finance Market Benchmarking Report.

From the analysis of *fig. 2* it follows that the business model of consumer P2P-lending has remained the largest financing model ever since 2013, although it faced a significant fall in absolute volume in 2019 and 2020. In considering at the dynamics of the 2018 and 2020 market shares between individual business models (see *fig. 2*), there are two different trends. Largest share change — this is the downward trend in turnover in the business model "loans provided by the crowdlending platform under the mortgage of real estate" (2.3). The growth trend can be seen in models of lending to business entities (1.2. и 2.2), which indicates an increase in the use of crowdfunding in business practices.

Different investor remuneration principles are used as a criterion for different business models in different crowdfunding projects: as a share in an investment project or return financing, similar to a bank loan. [25]

However, from our point of view, considering the issue of modeling business processes of crowdinvesting platforms, it is advisable to use as a typological feature the difference in types of tokenized assets or DFA, which is much closer to the terminology of the Federal Act from 31 July 2020 No. 259. Such a focus would directly address, how the internal working mechanisms of the crowdinvesting platform are being transformed in the organization of DFA turnover.

METHODOLOGY
OF THE RESEARCH

As described earlier, there are several different approaches to classifying the business processes of crowdinvesting platforms in scientific literature and practice: taking into account the participants of transactions [2], the objects of investments, as well as multi-level and multi-criteria systems, combining several classification principles (differentiating participants, objects of investment and roles of different participants of investment transactions).

Models' classification according to basic transaction scenarios

Scenario type	Business processes for crowdinvesting platforms that match this scenario
Credit (closed) investment scenario	1. Direct investment (P2P/Marketplace Lending) 2. Credit from the digital platform balance account (Balance Sheet Lending) 3. Buyout of accounts receivable (Invoice Trading)
Speculative (open) investment scenario	4. Purchase of OTC securities (Debt-based Securities) 5. Purchase of shares of non-public JSC (Equity-based Crowdfunding) 6. Collective investment in the construction of real estate (Real Estate Crowdfunding)

Source: compiled by the authors.

In the framework of this research, it is proposed to apply the synthesis method, combining the identified processes of crowdinvesting platforms in two groups. This is because tokenization unifies and impersonates the nature of the underlying asset to the level of monetary claims and the ability to exercise economic rights. It is important to note that this is how the classification of digital rights in the Federal Law from 31 July 2020 No. 259. In accordance with this synthesis, it is proposed to consider the classification of business processes of turnover of tokenized assets with differentiation of two base scenarios of transactions:

Credit investment scenario — closed transaction scenario between lender and borrower by trajectory "loan granting — loan repayment". It is close to classical lending, where the economic interest of the lender is based on the expectation of gain loan income.

Speculative investment scenario — open multiple transaction scenario between multiple buyers and sellers. It is close to speculation and the use of an asset as a means of accumulation, when the economic interest of the buyer of the asset is based on the expectation of a speculative return from the resale.

Accordingly, the crowdfunding business model scenarios were divided into two groups (*table 2*).

Since tokenization unifies and depersonalizes the nature of the underlying asset, conditions are created to organize liquidity turnover of tokenized assets in the secondary market. In other words, part of the transactions in the closed or credit investment scenario may migrate to the public speculative cash flow of claims through resale of claims rights in the secondary market. This possibility, however, does not eliminate the differences in the typology presented, because the economic interest in obtaining a loan or speculative income will in any event be realized at one stage of resale of the asset.

To address the challenge of designing a mechanism for crowdinvesting platforms based on the turnover of tokenized assets was applied business process and notation BPMN-2 (Business Process Model and Notation). Notation BPMN-2 currently used to describe lower-level processes using diagrams illustrating the process execution algorithm. The diagrams schematically identify events, performers, material and documentary flows accompanying the process. The business process description language is based on the following basic
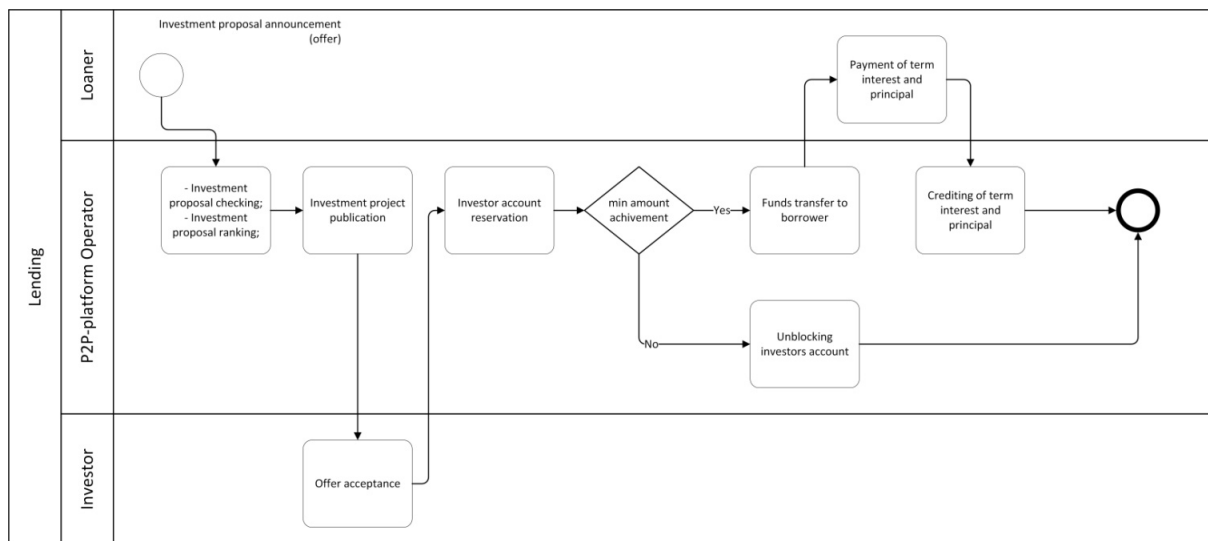
Fig. 3. **The traditional business model of a loan on a crowdinvesting platform**

Source: compiled by the authors.

objects: event; activity; gateway; flow; date; artefact; swimline; pool.

The choice of description and design method in favor of BPMN is based on the universality and prevalence of this approach. To date it is one of the widely used approaches to business process description both among business users and as a basis for business model software products. Schematics of this notation is a standard language of description also for creation of executable algorithms in the sphere of business management. The key factor in choosing BPMN-2 for this article was the opportunity to visualize how the roles are being transformed roles and specific actions of participants in the crowdinvesting platform in the organization of movement of tokenized assets or DFA.

The actual procedure of the research included two main stages. In the first phase, after the preliminary systematization of the processes mentioned above, the existing models of transactions on crowdinvesting platforms were described (the so-called "as is"). In the second phase, transaction processes were described with regard to tokenization within each group.

BUSINESS PROCESS MODEL DEVELOPMENT BASED ON ASSET TOKENIZATION

Modeling business processes of crowdinvesting platforms closed investment scenario

In closed investment case business models was included direct investment (P2P/ marketplace lending), credit from the digital platform balance account (balance sheet lending) and buyout of accounts receivable (invoice trading). In the practice of crowdfunding platforms 1–3 types (P2P/ Marketplace Lending, Balance Sheet Lending and Invoice Trading) the basic business process functions according to the logic of the loan (*fig. 3*), which leads to the need to conclude a contractual relationship between the parties. Due to the fact that borrowing is not carried out in a bank, and on a crowdinvesting platform, the scheme is typical for a credit (closed) investment scenario. Platform functionality allows investors to independently determine the size of the buyout "share" in the project, and thus, even without the use of tokens, provides a pseudo-discrete representation of the asset to many small investors.
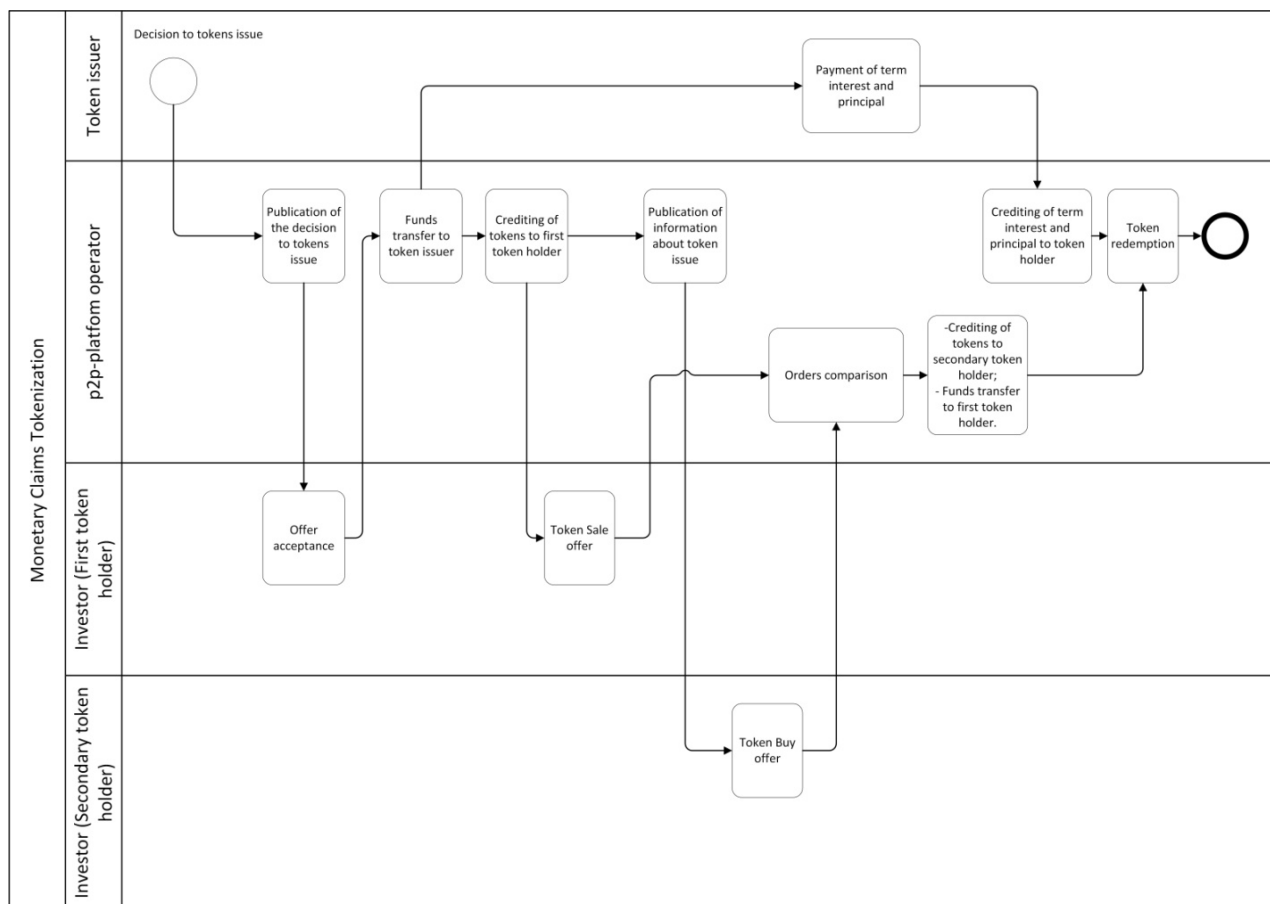
Fig. 4. **Transformation of the business model of a loan on a crowdinvesting platform in the form of placement of digital financial assets**

Source: compiled by the authors.

The benefits of asset tokenization include the simplicity, speed and security of token transactions on the DLT network, where there is an unhindered possibility of debt moving beyond the closed investment scenario. In other words, it is the possibility of trading monetary claims in the form of digital rights in the secondary market.

In the traditional business model of a loan on a crowdfunding platform, in case of an investor need to sell existing liabilities, the borrower will require a new contract while waiting for a refund and appropriate registration by platform and government regulators. These restrictions hinder the formation of a mass secondary market in relation to concluded loan transactions. This limitation can be neutralized by placing investment offers from borrowers in the form of digital financial assets, i.e. by tokenizing assets (*fig. 4*).

Digital platforms move to transactions in the form of tokenized or digital financial assets (DFA) will realize a number of advantages essential for the growth of market size and liquidity. Increased transparency and reduced risk in the exchange of financial assets on crowdlending platforms as a result of the tokenization process will increase the growth of both borrowers and lenders, will also contribute to the spread of various business models of crowdfunding. All this will result in a balance between supply and demand and an improved pricing mechanism.

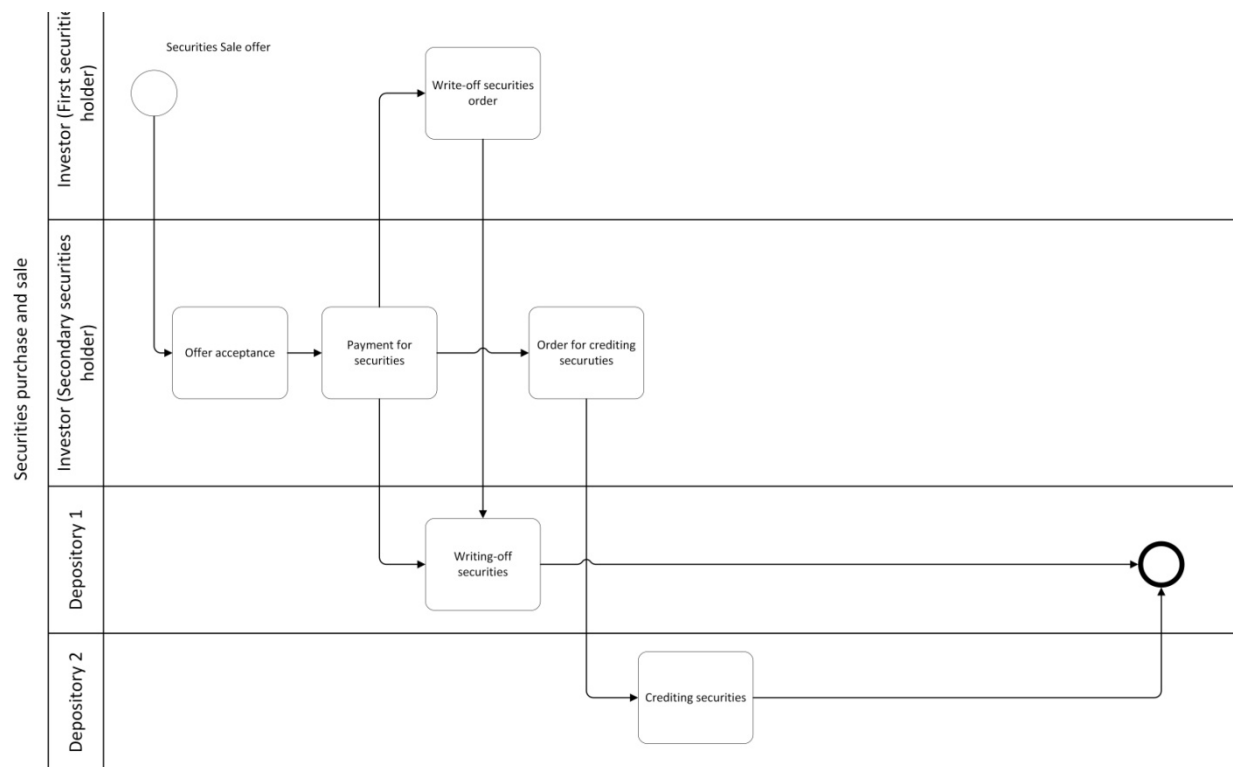Simplicity and absence of time delays will allow the formation of a secondary market,

Fig. 5. **The traditional business model of buying and selling securities**

Source: compiled by the authors.

which, in turn, will make the DFA market accessible to more investors and speculators who invest for a short period.

Thus, tokenization of assets in closed investment scenario business models should produce the following effects. First, increase the number and volume of market transactions by reducing transaction costs online. Second, to provide opportunities to transform a closed investment scenario into an open. That is, tokenization is a technological solution to increase the liquidity of assets through the ability to resell digital rights of cash claims in the secondary market.

Modeling business processes of open investment scenario crowdinvesting platforms
On the business model of over-the-counter securities purchase (Debt-based Securities), purchase of shares of non-public joint-stock companies (Equity-based Crowdfunding), investment in real estate projects (Real Estate Crowdfunding) account for 8% of the

global market turnover of crowdinvesting platforms 2018 and 2020.

In the proposed typology of crowdinvesting processes, we attribute these models to a speculative or open investment scenario, where the closest analogy from the usual practice of investing is the purchase of shares of public companies. The low turnover of these crowdinvesting models indirectly indicates a lack of attractiveness of its internal structure, small interest of market participants, thus forming a request to increase liquidity and transparency of its functioning. In other words, this investment scenario requires open access to a broad secondary market, which implies strong growth within individual business models.

The general logic of the platforms in these business models is described as the purchase and sale of securities and the rights to receive income from securities in the form of dividends or other type of investment remuneration (*fig. 5*). At the same time, traditional securities turnover
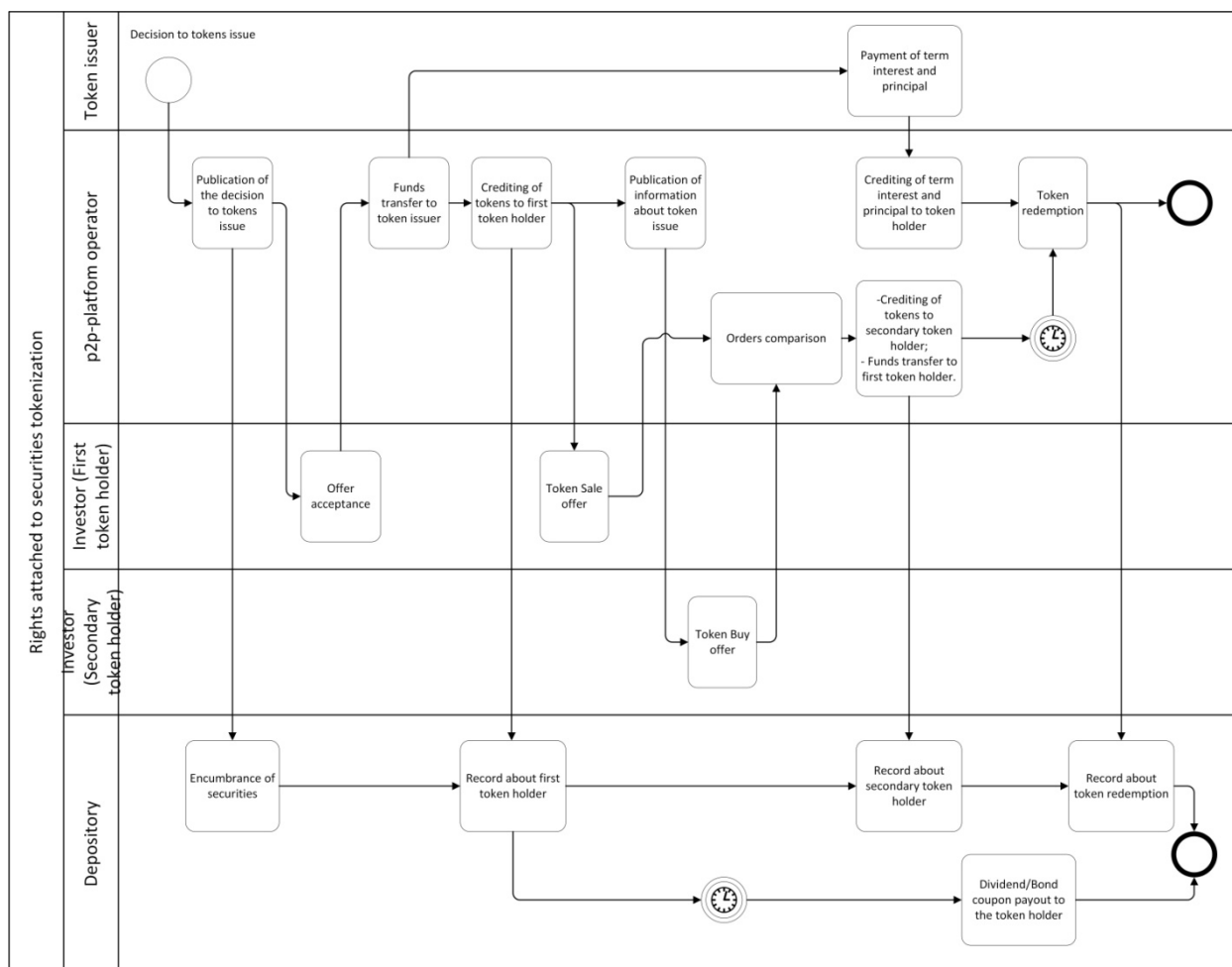
Fig. 6. **The business model of tokenization of rights, including the possibility of exercising rights under securities**
Source: compiled by the author.

formats demonstrate the dependence on the speed of performing the functions of the depository, especially in the case of the purchase of over-the-counter securities or shares of non-public joint-stock companies.

Accommodation digital financial assets on the crowdinvesting platform will increase the turnover rate and put transaction in online mode. In this format, the DFA market for business models of over-the-counter securities purchases. In this format, the DFA market for business models of over-the-counter securities purchases (Debt-based Securities), shares of non-public joint-stock companies (Equity-based Crowdfunding) and investments in real estate projects will approach the stock and currency market (*fig. 6, 7*).

Implementation of a business model for the purchase and sale of securities in the form of tokenization of rights, including the enforceability of securities rights (see *fig. 6*) and tokenization of rights to transfer securities (see *fig. 7*) leads to increased complexity of the digital platform due to additional functions, which, in the traditional business model, are implemented by the registrar and depository. Within this functionality, the digital platform implements securities depository accounting, including information on first and subsequent owners, dividends and coupon income, and DFA repayment data. At the same time, from the point of view of users (investors), performing registration functions and tokenized assets on the DLT
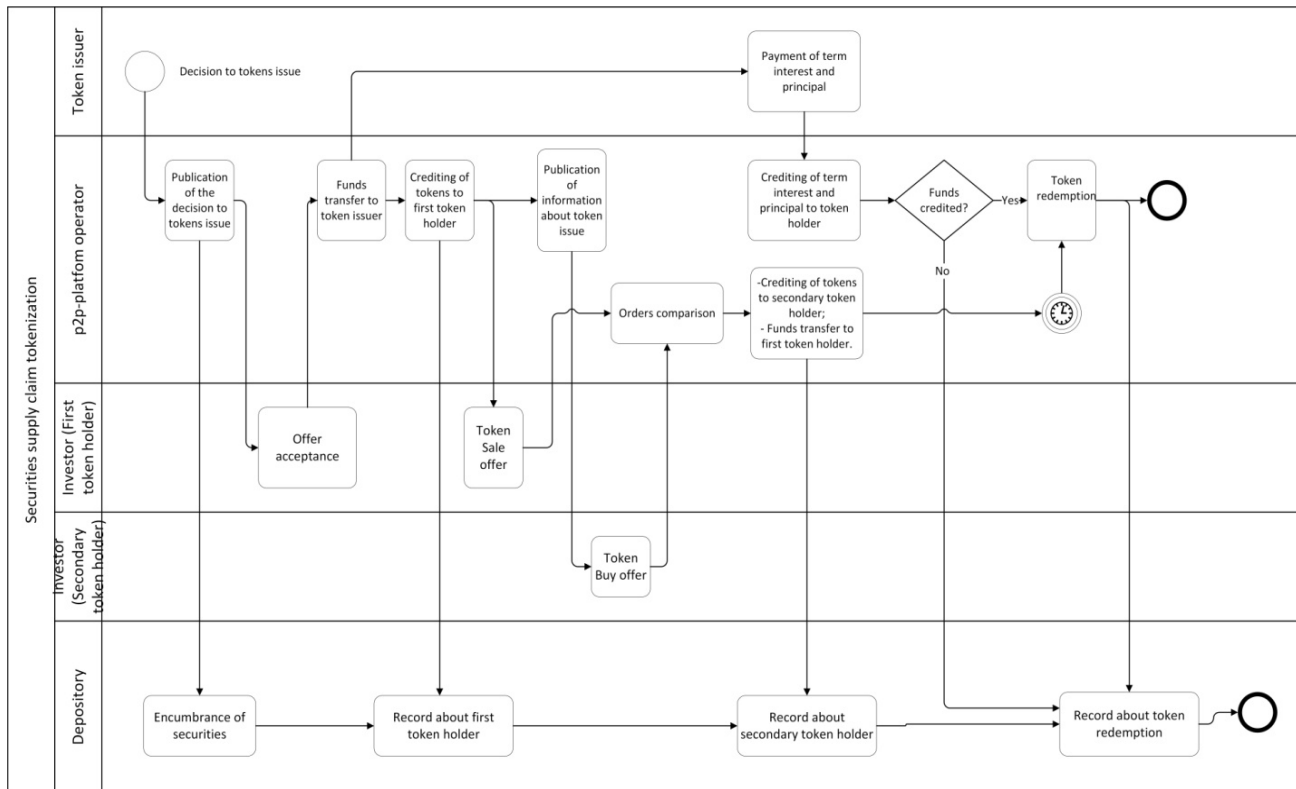
Fig. 7. **The business model of tokenization of rights of the claim for transfer of securities**

Source: compiled by the authors.

network have a significant advantage as distributed registry data cannot be deleted or edited. Thus, turnover of tokenized assets for open investment scenario business models provides real access of the asset to the secondary market and a significant reduction in transaction costs when the crowdinvesting platform performs the functions of registrar and depository.

DISCUSSION OF THE RESULTS

With regard to forecasts and prospects for business processes based on asset tokenization it can be assumed, that the use of digital financial assets in the future will lead to the abandonment of the classic IPO (Initial Public Offering) on the exchange. The issuance of tokenized shares and other DFA will allow the business to attract the necessary financing, and investors will have at their disposal a security that allows to receive investment and dividend income with the possibility of realization in the secondary market. Analyzing practical aspects of the activity on the basis of the business models presented above, it is possible to highlight a number of advantages and disadvantages of the turnover of tokenized assets.

The main contradiction of the implementation of asset tokenization on crowdlanding platforms is that, on the one hand, this technology improves the liquidity of financial assets, on the other hand,— the limitation of trade in tokenized assets constrains the development of this technology with collective investment. However, it will unlock significant amounts of money that are illiquid and not available to the broad market. Development of primary and secondary markets for such assets, increasing transparency in the exchange of financial assets through digitalization of the process will help build confidence in crowdfunding platforms, which will provide a cash flow, more

transparent pricing, and increase the growth of the collective investment market.

However, the realization of such effects requires both regular demand and supply. Level of readiness of potential investors and asset owners to interact on the crowdinvesting platform, as well as the appropriate market infrastructure, are crucial factors in the development of the crypto market. It follows that business models of digital platforms on the turnover of tokenized assets can be complementary, rather than an evolutionary substitute for existing traditional markets.

It is important to note that the proposed models of business processes of collective investment using tokenized assets can be implemented in different variations, depending on whether or not the loan is secured, how the investor's remuneration is calculated and paid, and the manner and duration of the loan repayment. Of high potential interest are the possibilities of development of these models when the users of crowdinvesting platforms interact through the organization of the secondary market. It is especially worth noting the prospects for the development of a liquid and investor-accessible DFA market for such low-liquid assets, as real estate, art objects, shares of non-public companies, over-the-counter securities and debt obligations.

Application of DLT technology creates opportunities for the regulator in terms of transaction monitoring, identification of participants and parameters of transactions with tokenized assets. In the long run, one can consider extending the use of cryptocurrencies (on par with fiat currencies) to purchase DFA. The absence of such barriers will provide opportunities for private investors and speculators at the level of institutional investors and professional traders. The presented models of business processes can be used for development of existing and future crowdinvesting platforms of local and global investment markets.

The theoretical significance of the obtained results lies in the formation of the basis for the development of the economy of common use in relation to financial resources. The practical significance of the proposed model consists in the possibility of its application in improving the processes of exchange of financial resources on crowdlanding platforms.

ACKNOWLEDGEMENTS

REFERENCES

1. Hesse M., Dann D., Braesemann F., Teubner T. Understanding the platform economy: Signals, trust, and social interaction. In: Proc.53rd Hawaii Int. conf. on system sciences (HICSS). (Maui, HI, January 7–10, 2020). Honolulu, HI: HICSS; 2020:5139–5148. URL: https://scholarspace.manoa.hawaii.edu/bitstream/10125/64373/0508.pdf

2. Dann D., Hawlitschek F., Peukert C., Martin C., Weinhardt C. Blockchain and trust in the platform economy: The case of peer-to-peer sharing. In: Proc. 15th Int. conf. on Wirtschaftsinformatik (Potsdam, March 08–11, 2020). Karlsruhe: Institut für Wirtschaftsinformatik und Marketing; 2020:1459–1473. URL: https://library.gito.de/wp-content/uploads/2021/08/N 2_manuscript_camera_ready.pdf

3. Fedulova E., Emokhonova Yu. Organizational forms of collective investment of direct investments: Problems and prospects of development. *Sibirskaya finansovaya shkola = Siberian Financial School.* 2015;(4):81–84. (In Russ.).

4. Volokitina V.M., Gedich T.G. The current state and development of the Russian coal industry: Analysis of investment component. *Ekonomicheskii analiz: teoriya i praktika = Economic Analysis: Theory and Practice.* 2017;16(7):1260–1268. (In Russ.). DOI: 10.24891/ea.16.7.1260

5. Kumar R., Sharma A.K., Tewari P.C. Thermal performance and economic analysis of 210 MWe coal-fired power plant. *Journal of Thermodynamics.* 2014:52018. DOI: 10.1155/2014/520183

6. Sidorenko E.L., Shaydullina V.K., Kirakosyan S.A. Tokenization of coal industry: Economic and criminological risks. *Ugol'.* 2018;(12):54–58. (In Russ.). DOI: 10.18796/0041–5790–2018–12–54–58

7. Pshenichnikov V.V. Formation of a new model of banking business in the context of digitalization of the economy: Prospects and threats, In: Babkin A.V., ed. Shaping the digital economy and industry: New challenges. St. Petersburg: Peter the Great St. Petersburg Polytechnic University; 2018:249–272. (In Russ.).

8. Konobeevskaya I.M. Digital rights as a new object of civil rights, *Izvestiya Saratovskogo universiteta. Novaya Seriya. Seriya: Ekonomika. Upravlenie. Pravo = Izvestiya of Saratov University. New Series. Series: Economics. Management. Law.* 2019;19(3):330–334. (In Russ.). DOI: 10.18500/1994–2540–2019–19–3–330–334

9. Kornilov D.A., Zaitsev D.A., Kornilova E.V. Modern forms of crowdfunding and crowdselling, the analysis of the market of ICO. *ITportal.* 2017;(3):6. URL: https://cyberleninka.ru/article/n/sovremennye-formy-kraudfandinga-i-kraudselinga-analitika-rynka-ico (In Russ.).

10. Ageev V.N., Vlasov A.V. Potential applications of digital financial assets. *Finansovyi zhurnal = Financial Journal.* 2020;12(6):100–112. (In Russ.). DOI: 10.31107/2075–1990–2020–6–100–112

11. Chod J., Trichakis N., Tsoukalas G., Aspegren H., Weber M. On the financing benefits of supply chain transparency and blockchain adoption. *Management Science.* 2020;66(10):4378–4396. DOI: 10.1287/mnsc.2019.3434

12. Cong L., Li Y., Wang N. Tokenomics: Dynamic adoption and valuation. *The Review of Financial Studies.* 2021;34(3):1105–1155. DOI: 10.1093/rfs/hhaa089

13. Fatehi S., Wagner M.R. Crowdfunding via revenue-sharing contracts. *Foundations and Trends in Technology, Information and Operations Management.* 2017;10(3–4):407–424. DOI: 10.1561/0200000071

14. Malinova K., Park A. Tokenomics: When tokens beat equity. *SSRN Electronic Journal.* 2018. DOI: 10.2139/ssrn.3286825

15. Chod J., Lyandres E. A theory of ICOs: Diversification, agency, and information asymmetry. *Management Science.* 2021;67(10):5969–5989. DOI: 10.1287/mnsc.2020.3754

16. Li J., Mann W. Initial coin offering and platform building. *SSRN Electronic Journal.* 2018. DOI: 10.2139/ssrn.3088726

17. Bakos Y., Hałaburda H. The role of cryptographic tokens and ICOs in fostering platform adoption. *SSRN Electronic Journal.* 2018. DOI: 10.2139/ssrn.3207777

18. Fahlenbrach R., Frattaroli M. ICO investors. *Financial Markets and Portfolio Management*. 2021;35(1):1–59. DOI: 10.1007/s11408–020–00366–0

19. de Jong A., Roosenboom P., van der Kolk T. What determines success in initial coin offerings? *SSRN Electronic Journal*. 2018. DOI: 10.2139/ssrn.3250035

20. Howell S. T., Niessner M., Yermack D. Initial coin offerings: Financing growth with cryptocurrency token sales. *The Review of Financial Studies*. 2020;33(9):3925–3974. DOI: 10.1093/rfs/hhz131

21. Cicchiello A., Leone D. Encouraging investment in SMEs through equity-based crowdfunding. *International Journal of Globalisation and Small Business*. 2020;11(3):258–278. DOI: 10.1504/IJGSB.2020.10031681

22. Kuti M., Bedo Z., Geiszl D. Equity-based crowdfunding. *Financial and Economic Review*. 2017;16(4):187–200. DOI: 10.25201/FER.16.4.187200

23. Cinelli S. Real estate crowdfunding: 2015 and beyond. In: Start-Ups and SMEs: Concepts, methodologies, tools, and applications. Hershey, PA: IGI Global; 2020:927–954. DOI: 10.4018/978–1–7998–1760–4.ch048

24. Garcia-Teruel R.-M., Simón-Moreno H. The digital tokenization of property rights. A comparative perspective. *Computer Law & Security Review*. 2021;41:105543. DOI: 10.1016/j.clsr.2021.105543

25. Sokolov I. N., Solokhin A. A., Fiyaksel E. A. Comparative analysis of the Russian equity crowdfunding platforms. *Innovatsii = Innovations*. 2017;(9):48–56. (In Russ.).

ABOUT THE AUTHORS

Evgeny V. Popov — D. Sc. (Econ.), Corresponding Member of the Russian Academy of Sciences, The chief of the Center for Social and Economic Research and Expertise, Ural Institute of Management of the Russian Presidential Academy of National Economy and Public Administration, Ekaterinburg, Russia
https://orcid.org/0000-0002-5513-5020
epopov@mail.ru

Anna Y. Veretennikova — Cand. Sci. (Econ.), Senior Researcher, Institute of Economics of the Urals Branch of the Russian Academy of Sciences, Ekaterinburg, Russia
https://orcid.org/0000-0003-1808-7856
vay_uiec@mail.ru

Sergey A. Fedoreev — Cand. Sci. (Technical Sciences), Head of the Representative Office of the Sverdlovsk Regional Fund for Entrepreneurship Support in the Gornozavodsky Administrative District, Nizhny Tagil, Russia
https://orcid.org/0000-0003-2307-8014
saf@sofp.ru

Authors' Declared Contributions
E. V. Popov — development of the general concept of the article.
A. Yu. Veretennikov — preparation of a literature review, article design.
S. A. Fedoreev — development of the author's typology of business processes of crowdinvesting platforms; design and description of graphic diagrams of business models of processes implemented on crowdinvesting platforms.

Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was received on 10.11.2021; revised on 25.12.2021 and accepted for publication on 12.01.2022.
The authors read and approved the final version of the manuscript.