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Credit in the Model of the Infrastructure Industry Ecosystem of the Agro-Industrial Complex

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ABSTRACT

The development of the FinTech, AgTech and GovTech industries and the digital ecosystems that are emerging around them, the prospects for their convergence and the emergence of hybrid architectural solutions based on them are the subject of active scientific discussion. The purpose of the study is to develop the concept of a hybrid solution for the agro-industrial complex, incorporating industry value chains and public administration functions in a single digital platform, as well as the subsequent development of an ecosystem model of the functioning of agricultural credit. The methodology of this work is based on the hypothetico-deductive approach, and the hypothetical design of the study is formed by assumptions about the feasibility of developing ecosystem forms of government functions implementation in the agro-industrial complex. These include the need to integrate elements of the credit mechanism within the agro-industrial industry into the value chains that form the business models of industry ecosystems, as well as the possibility of creating a digital infrastructure ecosystem that combines commercial and government services on a single platform. Based on cases existing in the agro-industrial complex and financial sphere of digital ecosystems, we have developed a model of an infrastructure industry ecosystem. The model is structured into object, environmental, process, and project subsystems. Organizationally, the ecosystem will have a modular structure, and the Russian Ministry of Agriculture will act as its coordinator and IT integrator. Within the proposed model, we outline directions for incorporating elements of the industry credit mechanism into the ecosystem value chains, and for preferential loans, government support measures will become an element of a new ecosystem form of implementing public administration functions in the agro-industrial complex. The credit segment of the infrastructure industry ecosystem is implemented as a client-centered system based on digital technologies and FinTech, elements of the environmental subsystem and credit infrastructure. This system ensures seamless interaction between all participants and cost savings through the automation of transactions and the exchange of information.

Keywords: digital economy; ecosystems; platforms; ecosystem business models; agricultural credit; agro-industrial complex; preferential loan; digital state

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INTRODUCTION

Digital business ecosystems are becoming a “new systemic actor” [1] in the economy and social life of modern society, especially in the field of e-commerce and in the financial industry, where three basic models have developed: American-Chinese, Russian and European. In the former, bigtech prevails, with a secondary role for financial services and institutions. In Russia, the core of ecosystem business is mainly traditional financial institutions (banks and neobanks). The European model is characterized by the niching of services, the active role of customers and fintech startups. Despite these differences, credit is an integral part of all business models in the ecosystem, which

makes research into changes in the form and content of credit relationships relevant.

In the agro-industrial sector, ecosystem formation occurs through the creation of private industry ecosystems by major players and banks in order to promote their own services, product markets, and logistics solutions. This includes the formation of industry databases and the development of online consulting services. At the same time, the specific features of loan operations are determined by the operational characteristics of the industry and by preferential measures provided by the government.

The ecosystem concept has also penetrated the field of public administration, which is associated

with the growth of GovTech industries developing technological solutions for the state. Government information systems and services form a digital ecosystem that provides citizens and businesses with remote access to public services, but its architecture is “patchwork” in nature, where each agency invests in its own GIS, data centers, software and staff, which complicates interdepartmental interaction and creates a trend towards creating interdepartmental platforms. Within the framework of the state program “Information Society”, a single state cloud platform GosOblako, the national data management system GosData, and the GOSTECH platform have been created, allowing the transfer of disparate IT solutions into a single cloud infrastructure.

The development of AgTech, FinTech, and GovTech technologies and the ecosystems emerging around them make it possible for them to converge with the advent of hybrid ecosystem solutions. Therefore, the hypothesis of the study is formed by a number of interrelated assumptions: firstly, about the expediency of an ecosystem model for the implementation of government functions in the field of support and regulation of the agro-industrial complex, in particular, in the field of preferential bank loans and other preferential elements of the credit mechanism.; Secondly, about the need to incorporate elements of the credit mechanism of the agro-industrial complex and complementary functions of state support into industry ecosystem business models; thirdly, about the possibility of forming an infrastructural industry ecosystem (IOE), providing access to industrial services (including credit) for industry actors within value chains, proactively complemented by government support measures.

The hypothesis put forward: a) corresponds to the general trends towards the modernization of traditional business models in the agro-industrial complex based on ecosystem solutions integrating financial and non-financial services; b) is characterized by a variety of applied implementation options; c) provides an opportunity to extend the practice of proactive provision of public services to agricultural support programs and, in particular, to the mechanism of preferential lending; d) assumes obtaining a synergistic effect

as a result of synchronization of the functions of the credit and economic mechanism, as well as public administration within the framework of a single organizational and managerial solution. In addition, certain elements of the proposed ecosystem are already being implemented in practice. In particular, the Agribusiness Digital Services Information System, integrated with the Unified Identification and Authentication System, the Gosuslugi portal and other industry GIS, will start operating in 2025. By 2028 the service will ensure a 100% transition to remote, targeted and proactive provision of state support measures and reporting on subsidies received. It is logical to assume that after the unification of all public services into a single industry information system, its development will continue towards convergence and interaction with private platforms, and the IOE model describes the likely scenario of these processes.

The detailed description of research tasks in accordance with the hypothesis suggests:

1) development of a model of an infrastructural industry ecosystem that integrates tools and mechanisms for interaction between industry business structures in value chains into a single platform solution and proactive implementation of government management and industry support functions (potentially such an ecosystem may become the largest, but obviously not the only ecosystem solution in the agro-industrial complex);

2) determining the location of a preferential loan and other elements of the credit mechanism of the agro-industrial complex in terms of their integration into the object, environment and process subsystems of the digital ecosystem of the industry.

Within the framework of the study, the application of the hypothetical-deductive method will have features related to the impossibility of a complete empirical verification of the consequences deduced from the hypotheses put forward, since the model of the agro-industrial complex infrastructure ecosystem is conceptual and implemented only in fragments. The application of the analogy method will partially solve this problem by identifying similar structures in existing ecosystems and policy documents of the industry department.

A MODEL OF THE DIGITAL INFRASTRUCTURE INDUSTRY ECOSYSTEM OF THE AGRO-INDUSTRIAL COMPLEX

The relative novelty and applicability of the term “ecosystem” to a wide range of phenomena, as well as the variability of organizational models associated with it, lead to a variety of interpretations of this concept. L. Thomas and E. Autio classify ecosystems into innovative, entrepreneurial, and knowledge ecosystems by product type, and business ecosystems, modular ecosystems, and platform ecosystems are distinguished within innovation [2]. I. M. Stepanov and Yu. A. Kovalchuk identifies industrial and service ecosystems [3] (the latter, according to the authors, dominate in Russia — Sber, Yandex, VK, MTS), but a more common option is to identify three basic areas of research in this area [4]: 1) business ecosystems, focusing on the environment in which it operates a firm; 2) innovative ecosystems focused on a specific innovation and a value proposition based on it; 3) platform ecosystems that consider the organization of participants around the platform.

In accordance with the initial concept of J. Moore [5], a business ecosystem is understood as a network of interconnected economic entities formed around the main technology [6] or platform [7]. Subsequently, as scientific interest in the problems of business ecosystems grew, a multiplicity of research approaches developed. Today, business ecosystems are considered as:

- “cooperation mechanisms that allow firms to combine individual proposals into a single customer-oriented solution” (author — the value of which is higher than the sum of the usefulness of individual proposals) [8];
- “a group of firms ... that have mutual joint specialization at the group level and are not unilaterally hierarchically managed” [9];
- “a spatially localized complex of hierarchically uncontrolled organizations, business processes, innovative projects and infrastructural systems interacting with each other during the creation and circulation of material and symbolic goods and values” [10];
- “an interdependent set of entities that are regulated in such a way that they allow taking actions” [11];

- “a set of interrelated business entities, business organizations, institutions, and business processes that formally and informally come together to communicate” [12];

- “based on modularity rather than hierarchical management ... a set of organizations producing complementary components of value that form a specific structure of relationships and coordination without the need for vertical integration” [13].

In the second area, the focus is on the central role of innovation in ecosystems [14], more precisely, “systemic innovations created and commercialized through ecosystems ... whose value proposition is supported and expanded through continuous innovation” [15]. Ecosystems themselves are considered as the “main organizational consequence of digital innovation” generated by the “digital technological revolution” and best adapted to new ways of creating and preserving value” [16]. At the same time, unlike cluster formations, the center of innovative ecosystems can be a digital platform that reduces the transaction costs of interacting actors [17], which actually blurs the boundaries between innovative and platform ecosystems.

Ecosystems formed around platforms (platform ecosystems) are considered as “multilateral markets” that enable transactions between different user groups [18], and interaction and transaction management between related parties are provided by a special type of technology — the platform (in fact, the result of innovation, produced and controlled by its owner or “sponsor”) [19].

Another theoretical concept that often appears in research on ecosystems is “digital ecosystems”, considered as “a set of economic entities that are closely connected to a key company based on a digital platform or digital infrastructure and interact with it and with each other based on a hybrid transaction management mechanism” [19]. That is, in this context, “digital ecosystems” are considered as “digital in terms of the infrastructure on which they are built”, while retaining all the features of ecosystems “in terms of how they are organized” [20].

Thus, the results of even a brief theoretical review indicate the absence of generally accepted definitions and classifications of existing ecosystems, therefore, in the framework of further research, we will talk about them in line with the subject area united by

the term “digital platform ecosystems”, considering them as multilateral markets implemented on a digital platform infrastructure that go beyond the traditional understanding of the market, industry or a vertical hierarchy based on the complementarity of actors in the process of creating the final value.

In this context, J. Rietveld, J. N. Ploog, D. B. Nieborg note the critical dependence of multilateral platforms on complementary parties and user support on both sides of the market [21], which highlights the complementarity of platform ecosystems, which affects their ability to dominate the market. Complementarity is one of the key properties of platform ecosystems, often mentioned in the context of additions, components, modularity, interdependence and synergy [22], which is understood as dynamic combinations of resources, processes and participants that are beyond the hierarchical control of the platform owner, but complement each other in the process of creating value on the platform [23], and being a source of network effects [24].

An important aspect of research on ecosystems is the assessment of the role of the state, which is often limited to “regulating and supporting competition” [25], but there are often studies where the role of the state is interpreted more broadly, for example, in the context of heterogeneity of participants, manifested not only in “covering several industries, but also in attempts to overcome the boundaries between the public and private sectors” [2]. As a result, ecosystems can be interpreted subjectively more broadly than just a set of interconnected business structures, and include government agencies and financial authorities as ecosystem participants [12], considered as “the basis for public-private partnership in the digitalization of various sectors of the economy” [26] or “forms and environments of partnership of organizations, authorities and citizens who ensure the constant interaction of their digital platforms” [27]. That is, allowing for any form of government involvement in ecosystems of various kinds.

The considered approaches to defining ecosystems as a new organizational entity of the digital economy reveal their main properties — the network nature of interaction around a value proposition, the interconnectedness and interdependence of a large group of participants, the emergence of a proposal

(the value of a complex product exceeds the value of the sum of individual proposals), the lack of a clear hierarchy in organization and management, the modularity of architecture, the asymmetry of the position of actors relative to the central the participant (the owner of the platform). These theoretical provisions, taking into account the cases of actually functioning ecosystems, form the basis for further research related to modeling promising options for convergence of elements of the credit mechanism and industry ecosystem solutions in the agro-industrial complex.

Noting the trend towards the dominance of digital ecosystems in many markets (network effects and economies of scale lead to monopolization or oligopolization according to the winner-takes-all principle), M. Treiber, T. Theunissen, S. Grebner, J. Witting, H. Bernhardt conclude that such dominant solutions are not yet available in the agricultural market, being replaced by a multitude of digital solutions inside its segments [28]. There are many digital platforms of different scales and ecosystems formed around them in the industry, which determines the tendency towards convergence and integration of platform and ecosystem solutions implemented in practice [29, 30].

At the same time, one should agree with the opinion that “the tasks of industry digitalization are too big for one company... Therefore, we should not talk about disparate systems and services, but about a platform that provides the opportunity for disparate systems and organizations to work together” [26], that is, a single ecosystem solution implemented across the industry, including with government participation. In relation to the agro-industrial complex, such ideas about the need to “form a unified digital ecosystem of the agro-industrial complex” based on the integration of “scientific and industrial information resources ... and systems” are still of Soviet origin [31].

We will outline approaches to the formation of an infrastructural industry ecosystem and the development of business models based on it, integrating business processes and government support mechanisms in the agro-industrial complex. *IOE can be defined as a digital community of independent actors offering complementary components of value linked by a common industry*

chain of its creation, forming a modular, client-centered organizational structure devoid of hierarchy and coordinated by the owner of the digital platform (the Ministry of Agriculture of Russia) for effective interaction of technological platforms, Internet services and information systems of the state, business and rural population.

The proposed concept of an infrastructural industry ecosystem is a new type of platform ecosystem that has common features with traditional business ecosystems. It is distinguished from existing practices by:

- the absence of the asymmetry of participants characteristic of private ecosystems, since its technological core is formed by the state digital platform, and the central actor is the Ministry of Agriculture of Russia.;
- proactive provision of state support measures through the convergence of government and commercial (including financial) platforms in a single digital shell, which is especially important in the agro-industrial complex, where the role of the state in creating added value is traditionally high;
- the value proposition goes beyond the boundaries of the traditional understanding of the industry (for example, seamless interaction with financial platforms) and its formation around industry value chains (production, financial and information needs of industry manufacturers).

Functionally and organizationally, IOE will combine the capabilities of existing digital platforms and ecosystem solutions in the agro-industrial complex at the technological, information and legislative levels, but at the same time its development should be based on the “one of many” principle. In other words, it will not replace existing ecosystem and platform solutions in the industry, but will function in parallel, competing with other market participants, on the one hand, and forming a public infrastructure for their interaction, on the other hand.

Ecosystem architecture is understood as “a set of fundamental principles of an organization, which are embodied in a set of its components, the relationships of components with each other and with the external environment, as well as the principles of design and development” [27]. A distinctive feature of ecosystem architecture is “its modular and interdependent system of basic and

additional components interconnected by design rules and a common value proposition.” At the same time, in organizational terms, ecosystems are “less formal and less hierarchical structures than firms, but more closely related than traditional markets” [32]. With regard to the proposed digital IOE model, its architectural solution is based on the actual cases of existing ecosystems in the agro-industrial complex, but differs from them organizationally – the state will become the founder and system actor, which will determine its functional and elemental differences [33].

The development of the digital IOE architecture was carried out within the framework of the methodology proposed by G.B. Kleiner [10], according to which a “full-fledged” ecosystem combines the features of the main types of economic systems – objects, environments, processes and projects that form its subsystems: 1) an object subsystem (or an organizational component) in the form of a cluster; 2) an environmental subsystem (or an infrastructure component) in the form of a digital platform that implements interaction; 3) a process subsystem (or a communication and logistics component) that provides network communications; 4) the design subsystem (or the innovation component) as a mechanism for implementing innovations (Fig. 1). Systemic economic theory considers the balance of the internal structure of economic entities (proportionality of the named subsystems) as a prerequisite for their sustainable functioning, and the “consolidation of the interests of participants” as a mechanism for overcoming the asymmetry “causing systemic deformations” [34], which determines the essence of economic ecosystems and the relevance of a systematic approach to their study.

1. The object subsystem is an association of financial and non-financial businesses that implement separate business processes within the ecosystem, the distinctive features of the component will be: the participation of the state represented by the Ministry of Agriculture as a system actor and IT integrator, the extraterritoriality of the interaction of business structures, clustering based on the industry community of value chains, proactive complementation of business requests of industry customers complementary measures of state support, access of the rural population to

a remote channel for the implementation of social policy in rural areas. The ecosystem will have a modular organizational structure based not on hierarchy, but on coordination carried out within the framework of the implementation of the functions of public administration of the Ministry of Agriculture of Russia, with full economic independence of the actors in the process of interaction. The Agency, as the leader of the ecosystem, will determine its final architecture, establishing common rules and methods of interaction, standards and interfaces for coordinating the activities of participants. The formation of an ecosystem on a public platform, equidistant from all business actors, will avoid the main ecosystem problems that arise around private digital platforms – “economic dominance”, “abuse of economic power”, “consolidation of control and ... value” in the hands of the platform owner [16]. In other words, IOE will provide common and equal access to the multilateral market for all industry participants, while private platforms and the ecosystems formed around them primarily serve the economic interests of their owners.

2. The environmental subsystem is a digital technology platform (marketplace) on which the

services of the participants are available. Technically, the digital technology platform of the Russian Ministry of Agriculture will be “a set of technological reusable components at each level of architecture (infrastructure, data storage, technology services, business logic, application solutions, channel applications) ... development and operation tools, integration tools, analytics tools, security tools to increase speed.”¹ The distinctive features of the component will be a combination of functions: user interface, aggregator site, accumulation and processing of financial and non-financial information, marketplace and payment system, implementation of budget subsidy mechanisms in the form of smart contacts, online access to government services, an open database of best practices and online consulting.

As a distributed information system, technically the platform will also have a hybrid architecture combining the principles of centralization and decentralization. Centralized, managed segment of the platform (decision-making, data storage and processing, transaction management, security) The

¹ The concept of general regulation of the activities of groups of companies developing various digital services based on a single ecosystem (approved on 14.04.2021 No. 3760p–P10).

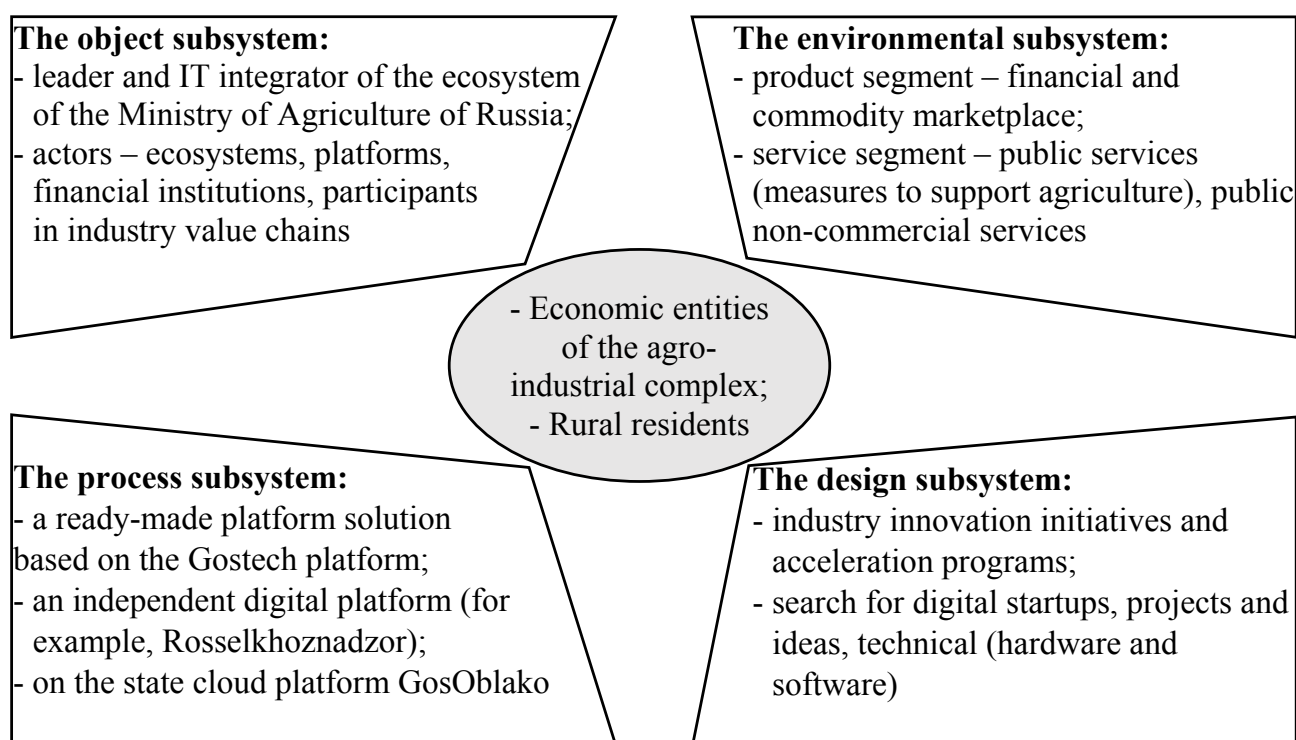


Fig. 1. A Model of the Digital Infrastructure Ecosystem in the Agro-Industrial Sector

Source: Author's development.

Ministry of Agriculture of Russia, will be a virtual platform for participants to communicate through secure interfaces. It will house a closed part of the ecosystem's service segment, designed to provide public services to agribusiness (G2B) and rural populations (G2C), as well as other segments of the ecosystem at the initial stage of its development. In the future, the product and service segments of the ecosystem that ensure the interaction of business participants (B 2B) will move to a decentralized segment of the platform, operating on the basis of peer-to-peer networks and blockchain. The main advantages of decentralization are associated with a higher level of information security and the ability to automate transactions.

3. The process subsystem is a stable network structure for the interaction of ecosystem members, supported by an IT integrator. The distinctive features of the component will be: the simultaneous implementation of technological solutions underlying the functioning of digital platforms and e-government, the variability of technological options for applied implementation, and the need for regulatory changes. The development of digital technologies, software and hardware complexes, regulation and unification of approaches to the formation of state digital platforms make it possible to implement this component: a) on the Gostex platform; b) on the existing digital platform of the Rosselkhoznadzor (in this case, it is difficult to ensure equidistance for all actors); c) on the cloud platform of GosOblako (in fact, in GIS Ministry of Agriculture of Russia in the cloud infrastructure).

4) The project subsystem is a set of innovative initiatives and acceleration programs. The distinctive features of the component will be: the involvement of departmental universities and research institutes in the search for startups, projects and ideas, the creation of business incubators and a competence center in the field of scaling industry innovations.

THE CREDIT SEGMENT OF THE INFRASTRUCTURE INDUSTRY ECOSYSTEM

Since the proposed ecosystem's functionality is broader than that of existing financial platforms, it is essential to determine the role and scope of

concessional loans and other components of the credit system for the agro-industrial sector in terms of their potential integration into the ecosystem's object, environment, and process subsystems. Additionally, it is crucial to explore new technological possibilities underlying the ecosystem model for non-financial and financial transactions between industrial borrowers, banks, and the Ministry of Agriculture of Russia.

Within the framework of the proposed IOE creation model, *elements of the industry's credit mechanism and credit system are incorporated into value chains that form the ecosystem's business model. And in terms of preferential bank loans, government support and regulatory measures are becoming an element of a new ecosystem model for implementing public administration functions in the agro-industrial complex. Accordingly, the ecosystem model of agricultural credit functioning can be defined as a form of implementation of credit relations within the framework of ecosystem (platform) business models, which is characterized by participation in the intermediation of information and financial flows of a new type of intermediaries — financial ecosystems (platforms), with varying degrees of variability involved in the conclusion and implementation of a loan transaction and creating for its participants additional competitive advantages as a result of network, information and other ecosystem effects.*

Due to the customer-centricity of digital ecosystems, the organizational, infrastructural and service elements of the IOE, interacting with elements of the credit system and the credit mechanism of the agro-industrial complex, subordinated to the needs of different groups of industry borrowers, essentially form a model of the credit segment of the ecosystem, or more broadly, an ecosystem model of the functioning of industry credit, focusing the loan offer on borrowers (Fig. 2).

The possibilities of embedding elements of the credit mechanism of the agro-industrial complex into the environmental and process subsystems of the ecosystem are due to the development of end-to-end digital and FinTech technologies that allow maintaining a stable network structure of interaction between actors (lenders and borrowers) and the functioning of a digital platform (marketplace) that

ensures the availability of loans and related services. Therefore, the main technological components of the IOE credit segment model can be attributed:

- End-to-end digital and FinTech technologies. Their development, along with the improvement of hardware, creates the necessary technological conditions for the creation of an infrastructural industry ecosystem, as well as the incorporation and

functioning of elements of the credit mechanism of the agroindustrial complex in its structure.

- User interface. As an element of the organization of credit relations, it solves the following tasks: 1) search for and compare credit products for the needs of a specific user (the ecosystem platform operates in the credit marketplace mode); 2) communications, including through closed channels, providing

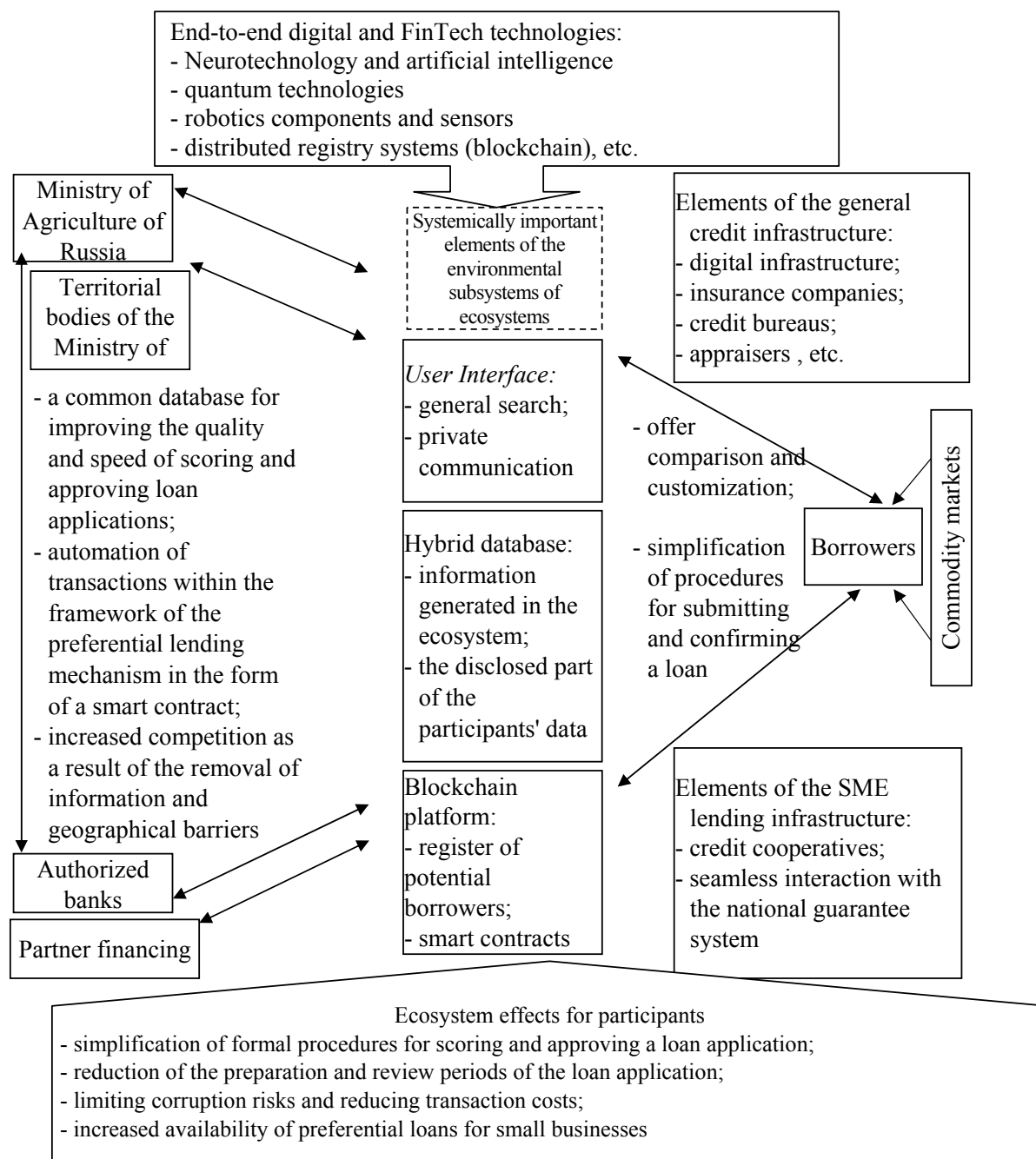


Fig. 2. The Model of the Credit Segment of the Infrastructure Industry Ecosystem

Source: Author's development.

financial transactions in different variants (B 2B, B 2G, B 2C, G2C). The formation of multiple product and service segments of the ecosystem, the absence of restrictions on the number of participants in each segment, the development of interdepartmental electronic interaction and the functioning of the platform in aggregator mode will expand the list and ensure the convenience of choosing and receiving digital credit products and services, including those accompanied by a complementary list of government services and subsidy (co-financing) programs. In terms of communications between subjects of credit relations, the functionality of users' personal accounts on the ecosystem platform should ensure seamless, remote interaction and payments between borrowers, lenders, credit infrastructure and the state.

- Hybrid database. Digital IOE will generate large amounts of data that can be used not only to realize the economic interests of actors, but also in the interests of society and the state for the integrated development of rural areas. Of particular value to lenders will be data on search queries, transactions, payments, and other information about potential customers accumulated and disclosed by the ecosystem in compliance with legal requirements. An additional information advantage of the ecosystem model may be the partial access of creditors to the information resources of the Federal Tax Service and the Ministry of Agriculture of Russia for automatic confirmation of constituent and accounting data used to assess creditworthiness.

- A blockchain platform. As part of the IOE, it can be implemented as an independent technological solution (in the longer term) or in collaboration (which is more likely in the short term) with existing or under development blockchain platforms (for example, Masterchain, developed by the Fintech Association or the digital ruble platform being developed by the Bank of Russia). Regardless of the implementation option, blockchain technology will allow automating various forms of credit relations in the form of smart contracts.

In terms of embedding elements of the credit mechanism of the agro-industrial complex into the IOE object subsystem, its credit segment is a collaboration of various groups of actors — direct and indirect participants in credit relations, building communications using the technological capabilities

created by the ecosystem. The following groups of actors are identified within the framework of the proposed model:

- The state is the Ministry of Agriculture of Russia and its territorial bodies. The preferential nature of agricultural loans is ensured by subsidizing bank loans, recapitalizing development institutions, creating a national guarantee system, and other measures. Consequently, the ecosystem model of implementing the mechanism of preferential lending to the agro-industrial complex assumes active government participation. In this group of actors, the main role is assigned to the branch agency that performs the functions of: 1) defining and legislating areas and measures of support, setting limits on budget expenditures and target parameters for their effectiveness; 2) working out the conditions and procedures for legally significant actions and transactions that constitute the content of specific support mechanisms and form the basis for their algorithmization and automatic execution in the digital shell of the ecosystem (in the form of smart contracts); 3) transfers of subsidies to creditors; 4) control of target parameters and effectiveness of budget expenditures.

- Lenders are banks and partner financing institutions. This group of actors forms the offer of credit products for industry borrowers. At the same time, along with banks, innovative digital partner financing services can be involved in the credit and financial contour of the industry ecosystem, actively developing under the influence of FinTech technologies and forming a loan offer outside the traditional loan capital markets. In particular, in its forecasts,² the Bank of Russia expects to strengthen the role of partner financing in such areas as gratuitous loans (a pilot of Islamic banking was launched in Chechnya and Dagestan in 2023), financial leasing, factoring, installment payments under purchase and sale agreements, loan guarantees, and equity participation programs on partnership terms, microfinance. Online P2P services (crowdfunding — online platforms for direct communication between lenders and borrowers without the participation of a financial intermediary)

² The draft dated 28.11.2022 of the main directions of development of the financial market of the Russian Federation for 2023 and the period 2024 and 2025.

and P2B lending (crowdfunding — investment platforms that accumulate and provide small amounts of financing) are developing.

The potential for the development of these debt financing channels is largely attributed by the Bank of Russia to “the entry into the financial market of large e-commerce companies (in fact, they have been building an ecosystem business model for a long time) that have the necessary information about the activities of enterprises, on the basis of which assessment systems (rankings) of their investment and debt attractiveness can be created.”.³ Such ratings will significantly simplify the assessment of the creditworthiness of small and medium-sized enterprises, reduce transaction costs associated with its implementation, and create conditions for automating procedures that constitute the content of credit relations in the form of smart contracts.

The equidistance of the ecosystem platform from any group of actors will remove information and administrative barriers for new entrants to the industry credit market, including in the concessional lending segment, and the remote nature of credit operations will remove geographical barriers due to the lack of the need for the physical presence of structural divisions of banks and other lenders in regions and rural areas. As a result, a qualitative and quantitative increase in the supply of loan capital is possible with the formation of a full-fledged financial marketplace on the one hand, and an increase in the competitiveness of the industry credit market on the other.

The incentives for lenders to participate in the ecosystem will be related to the simplification of admission to concessional lending programs involving budget subsidies, as well as the previously mentioned information capabilities of the ecosystem to increase the efficiency and reduce the cost of credit scoring and marketing procedures, and to customize the offer.

- The credit infrastructure of the modern credit market primarily performs informational functions, forming an institutional, organizational, technological and legal environment for the development of credit relations to minimize credit

risks and transaction costs. The main infrastructure elements of the IOE credit segment can be insurance, auditing and consulting companies, credit bureaus, rating and collection agencies, credit brokers, appraisers, IT companies, banking associations, law firms, notaries, services for state registration of rights and real estate transactions, etc. Along with traditional institutions, a digital credit infrastructure is being actively developed. In particular, projects of the Bank of Russia, such as the Digital Profile and the Unified Biometric System, can be noted as examples.

Simultaneously with the incorporation of elements of the general credit infrastructure, specialized institutions are needed as part of the IOE, focused on meeting the growing demand for loan capital in the segment of small and medium-sized enterprises. In this area, the prospects for the development of the credit segment of the industry ecosystem may be related: a) with the involvement of credit cooperatives, which initially evolved as a microcredit institution and are able to function not only as an independent type of financial intermediaries, but also as a consolidated borrower (on behalf of its shareholders) in relations with banks; b) with ensuring seamless interaction of borrowers belonging to the category of SMEs in the agricultural sector through a personal account on the platform of the industry ecosystem with the institutions of the national guarantee system.

CONCLUSIONS

The study contributes to the theory of ecosystems by developing a model for a new type of platform ecosystem, which is based on a state-owned digital platform. This platform aggregates public services and private platforms within a single industry, providing a single IP address for automating the distribution of government support measures. It also ensures equal access for all actors, eliminating asymmetries and supporting competition in various segments of the agricultural market. Additionally, it forms a supply chain around the production, financial, and other needs of agricultural producers, increasing their value by complexity and coordination with government support programs.

At the same time, the proposed model contributes to the theory of credit by studying ecosystem forms

³ The draft dated 28.11.2022 of the main directions of development of the financial market of the Russian Federation for 2023 and the period 2024 and 2025.

of credit relations and considering the possibilities of their transformation, primarily in the field of preferential lending to industry. This is based on the new technological and communication opportunities created by ecosystem forms of commercial and government interest in the agro-industrial complex.

Among the possible ecosystem forms of credit relations, the infrastructure industry ecosystem will provide the longest seamless customer path

possible between financial and commodity markets, commercial services that allow actors to realize various economic interests, and government services that proactively provide government support measures available to industry entrepreneurs. In other words, it will maximize the potential of this ecosystem form of credit by absorbing and expanding the functionality of both government and financial digital platforms.

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