

Situation-oriented System of Technology Transfer Methods in the Agricultural Sector of the Economy

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Abstract

In the article, the authors schematically depict the process of functioning of a situation-oriented system of technology transfer methods in the agricultural sector of the economy. Indicators of domestic expenditures on research and development in Russia, as well as exports of high-tech goods from Russia, China, Japan, the United States, Germany and France are presented. As a set of methods of technology transfer proposed by us to create a situation-oriented system, we consider: the method of forming an intensive market interaction of economic entities based on information and telecommunications technologies, the method of introducing innovations based on the accumulation of additive technologies, the method of transforming information products and services into an autonomous component of the domestic agricultural economy. The scientific foundations of the development of situational modelling in relation to the formation of technology transfer are revealed. It is concluded that it is necessary to actively develop the mechanism of technology transfer in modern agriculture based on the consolidation of information resources of state structures, specialized organizations, innovation centers of cities and regions into a single network and its further integration into European networks.

Key-words: Agriculture, System of Methods, Technology Transfer, Efficiency, Development Economy, Innovation and Investment Mechanism, Agricultural Economy.

1. Introduction

The study of the prerequisites for the formation of a functional environment for technology transfer and the improvement of the regulatory regime, carried out by the adoption of new laws and bylaws or by making changes and additions to existing official documents, will ensure the creation of favourable social economic conditions for its existence. It is necessary to supplement the existing and

form new instruments of influence that will ensure the improvement of the legal, administrative, managerial and economic space for the functioning of technology transfer.

Building organizational links between formal and informal technology transfer institutions based on data structuring will allow monitoring the state of technology transfer and controlling the process of promoting high-tech products, as well as analyzing the consistent impact of external and internal factors on the adaptability of technology transfer in the agricultural economy in conjunction with the developed methods of technology transfer based on the regulation of the activities of its institutions and organizational - economic methods of activating the process of technology transfer in agriculture.

2. Methods

The conceptual basis of the research is the theory of innovative and technological development of the modern market economy, as well as a new innovation paradigm, consisting of a cascade structure of trajectories of technological development, creation and development of innovative products and the diffusion of innovations to the market, proposed by the Japanese scientist M. Hirooka[1], as well as the methodology for analyzing and predicting the development of technological innovations – the technology maturity cycle (Gartner Hype Cycles), created by the American analytical and consulting company Gartner, which is quite acceptable for use in the domestic economy [2].

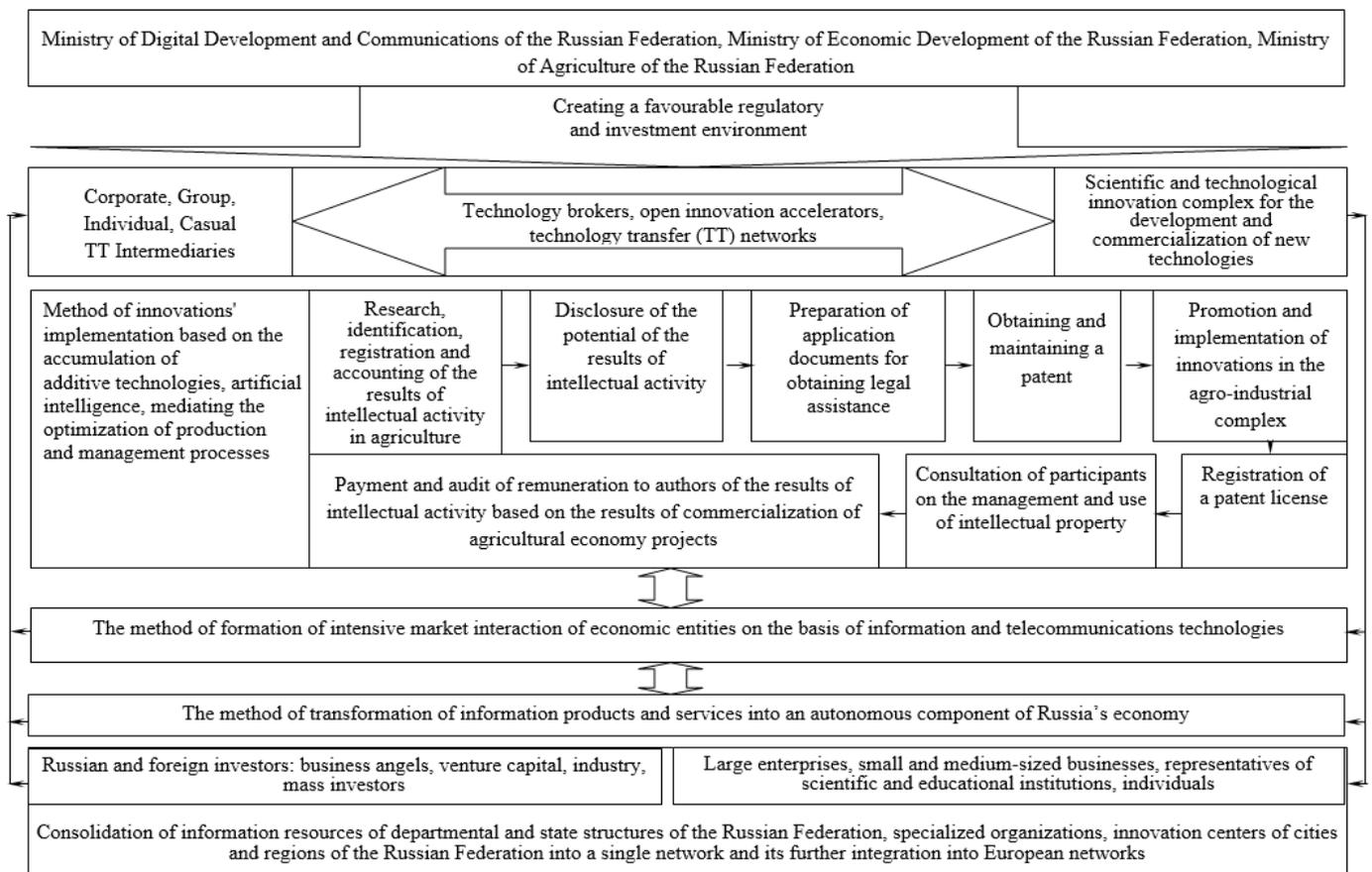
3. Results

The scheme of the process of functioning of the situation-oriented system of technology transfer methods in the agricultural sector of the economy is shown in Figure 1.

As the main means of developing a situation-oriented system of technology transfer methods in the agricultural sector of the economy, algorithm creating and scheme building of this process are used, which allow us to consider the order of interaction between institutions and subjects of technology transfer, as well as the use of administrative, legal, managerial, and economic tools of influence mediated by the use of the developed methods: the method of forming intensive market interaction of economic entities based on information and telecommunications technologies, the method of introducing innovations based on the accumulation of additive technologies, artificial intelligence, mediating the optimization of production and management processes, the method of

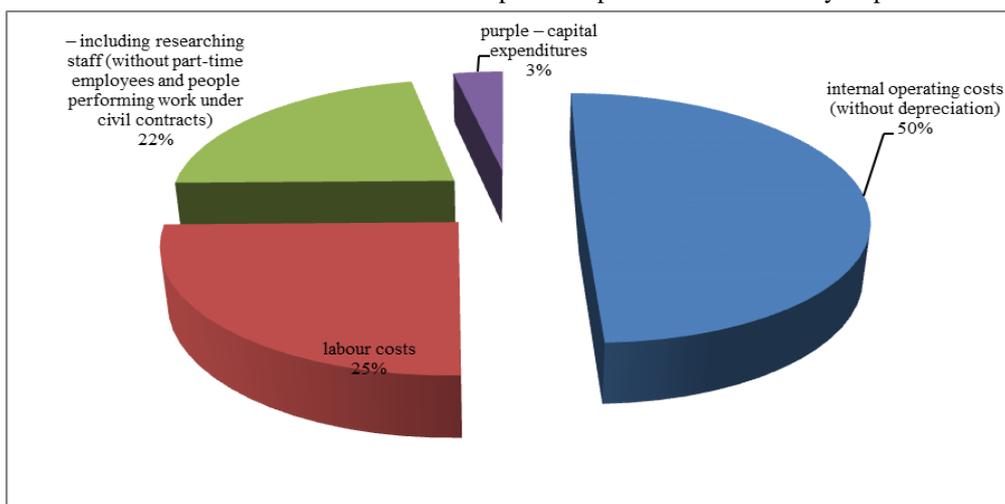
transforming information products and services into an autonomous component of the domestic economy, contributing to the consistent solution of important tasks for the formation of an effective innovation and investment mechanism.

Figure 1 - The process of functioning of the situation-oriented system of technology transfer methods in the agricultural sector of the economy



To diagnose the initial state of the system, consider some of its indicators. The chart of performance indicators of organizations performing research and development for January-September 2020 in the Russian Federation is shown in Figure 2, the chart of exports of high-tech goods in Russia, the United States, Europe and Asia is shown in Figure 3.

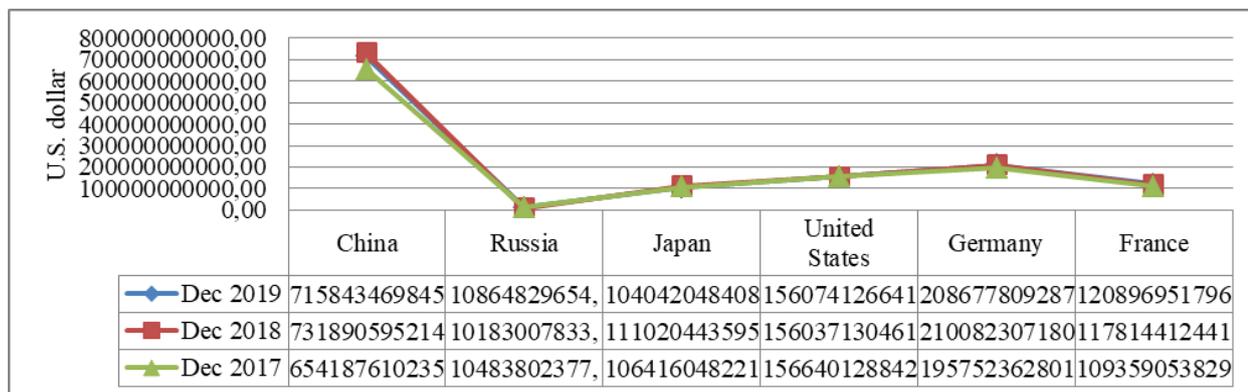
Figure 2 - Structure of internal research and development expenditures for January-September 2020 [3].



Green – including researching staff (without part-time employees and people performing work under civil contracts) 22%, red – labour costs 25%, purple – capital expenditures 3%, blue - internal operating costs (without depreciation) 50%.

a) share of internal operating costs of research and development (without depreciation) in the Russian Federation

Figure 3 - Graph of exports of high-tech goods in Russia (column 2), the United States(4), Europe (Germany(5), France(6)) and Asia (China(1), Japan(3)), US dollars for 2017-2019 [4].



The initial information mediating the functioning of the state of the technology transfer system in the Russian economy, which depends on the share of internal current research costs, is formed under the influence of the factors considered earlier: organizational-administrative, financial-economic, technological-environmental, innovative, and social [5].

Analyzing the data shown in Figure 2, we can conclude that the structure of internal costs for research and development in the Russian Federation as a whole is relatively stable. Analyzing the

data in Figure 3, we note the priority place of China in the export of high-tech products, the country accounts for up to 54% of exported goods in 2019. The share of the Russian Federation is consistently low and is 1%, among the countries selected as competitors. The indicators of Germany, France, and Japan are static and make up 16%, 9%, and 8%, respectively. Slight decline by 2019 (about 2%) was recorded for the export of high-tech goods by the United States of America, but the indicator remains high – 4th place in the ranking after China, Hong Kong and Germany.

The process of functioning of a situation-oriented system of technology transfer methods in the agricultural sector of the economy, using dynamic characteristics, improving the institutional environment, taking into account the identified external and internal, economic, institutional and social factors, will allow state authorities to use in practice tools to influence the transfer mechanism.

The developed methods of technology transfer, which altogether are situation-oriented, provide for improving the quality of existing formal and informal institutions, involving new institutions in the ongoing process of digitalization of the agricultural economy in order to activate the process of creating and implementing high-tech products and increase the efficiency of using the digital space.

In the process of developing a situation-oriented system of technology transfer methods in the agricultural sector of the economy, the indicators of the current situation are studied. Thus, having considered the category "situation" and the interpretation of the methods of situational modeling in relation to technology transfer in the agricultural economy, defined as the directions of influence on the set of elements of the innovation and investment mechanism under consideration and mediating its functioning at the moment, it is established that the dynamic state of the system under consideration mediates its evolutionary development. Diagnostics of the initial state of the system necessary for the development of a situation-oriented system of technology transfer methods in the agricultural economy conducted on the basis of a comparative analysis of data for the Russian Federation, the Volga Federal District and the Saratov region provided for the structuring of internal costs for research and development for the period under study and to allocate in their part internal costs compensated by the federal budget.

As a set of methods of technology transfer proposed by us to create a situation-oriented system, the following are considered. The method of forming intensive market interaction of economic entities on the basis of information and telecommunications technologies-involves building relationships between technology transfer entities, taking into account the capabilities of the created and planned technological platforms, which will ensure effective interaction of participants online,

with the allocation of their functions, and access to up-to-date information that characterizes the situation of the innovation market in the agricultural economy.

The method of innovation implementation, based on the accumulation of additive technologies, artificial intelligence, mediating the optimization of production and management processes, proposed by us as the basis for the formation of the situation-oriented system under consideration, involves the use of the developed step-by-step methodology for analyzing and predicting the development of technological innovations. The functional state of the system is formed by the current regulatory regime and the use of digital economy tools that regulate the agar market conditions.

The method of transformation of information products and services into an autonomous component of the domestic economy proposed by us as an element combining the situation-oriented system developed by us ensures the effective use of the results of digitalization of the agricultural economy for the formation of a transfer mechanism and their availability to potential users.

4. Discussion

Frederick Winslow Taylor (1856-1915) wrote that "the scientific organization of government does not presuppose, as its necessary prerequisite, any major invention or discovery of new and startling facts. It presupposes a certain new combination of elements that did not exist before, namely, such a collection, analysis, grouping, classification of previously known data into new laws and rules, that these former disparate knowledge is organized into a new coherent science" [6].

Mary Parker Follet in the early 1920s (1868-1933) is considered one of the founders of the situational approach to management. In her work, she constantly focused on taking into account the "requirements of the situation" in the management. In her opinion, each situation has its own internal logic that determines the order that participants should follow. She argued that the effectiveness of managing a situation depends on the availability of the necessary information, which is formed under the influence of the actual conditions of the existence of the management process [7].

One of the first Russian researchers of situational modelling was Yu. I. Klykov, who in 1974 identified the concept of "situation" with the concept of "state". In contrast to simulation modeling, where states describe the values of the characteristics of objects at a given moment, in situational modeling, the concept of "state" includes a complex of relationships between the elements of an object and their values. In other words, the situational approach operates with systems and their subsystems, not objects [8].

The development of methods of situational modeling was proposed by D. A. Pospelov, interpreting the concept of "situation" as follows: "We will further call a discrete set (situation) a set of operational elements located at certain points of the system." Later, the author defined the current situation as the totality of all information about the structure of the object and its functioning at a given time [9].

The undeveloped institutional environment of technology transfer and, as a result, the unfavorable functional state is the result of the low-efficiency work of existing institutions and their functional interaction. The determination of the causes of this situation is due to an objective assessment of the factors that have a direct impact on this process. The innovation and investment mechanism should be considered as a dynamic system defined in the generally accepted form "source information-functional state-output information". Since the state of the technology transfer system is in dynamics, it is necessary to study the set of current characteristics, represented by the following elements: information and analytical properties; diagnostics of the problem; input effects (controlling and disturbing), set for the current and future time points [10]. We can say that the dynamic state of the technology transfer system mediates the evolutionary development of the situation.

5. Conclusions

In conclusion of the study, it is necessary to draw the following conclusions:

The process of functioning of the situation-oriented system of technology transfer methods in the agricultural sector of the economy, considered in conjunction with the developed methods, involves the functioning of an innovation and investment mechanism, taking into account the strategy of information development of society in the Russian Federation until 2030 and according to the domestic program for the introduction of the digital economy with the assistance of relevant ministries (federal and regional), namely, the Ministry of Digital Development and Communications, the Ministry of Economic Development and the Ministry of Agriculture. The information field of the model is formed taking into account the analysis of regulatory legal acts, the use of tactical program-target documents and involves amendments to certain laws and bylaws, regulatory legal acts, as well as the development of recommendations for changing legislation, expanding and delegating the powers of technology transfer entities. The proposed model provides for the use of state targeted financing, the creation of a favorable investment climate, the use of a rational pricing mechanism in the transfer market, the promotion of effective demand, the application of a tax policy that does not infringe on the interests of market participants while stimulating capital inflows into the agricultural

sector of the economy. When describing the process of functioning of the situation-oriented system of technology transfer methods in the agricultural economy, the interaction of its subjects is schematically depicted: corporate, group, individual, random intermediaries of technology transfer, technology brokers, open innovation accelerators, scientific and technological innovation complexes for the development and commercialization of new technologies, domestic and foreign investors, large enterprises, small and medium-sized businesses, representatives of scientific and educational institutions and individuals.

The result of the operation of the developed situation-oriented system of technology transfer methods in the agricultural economy is the consolidation of information resources of departmental and state structures of the Russian Federation, specialized organizations, innovation centers of cities and regions of the Russian Federation into a single network and its further integration into European networks.

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