Multi-Agent Model for Financing Innovative Projects in Agriculture

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Abstract: The paper considers an effective mechanism for the development of agro-industrial complex of Kazakhstan and Russia based on the introduction of multi-agent model for financing of innovative projects. The emphasis is made on the investment R&D-active projects providing necessary changes in the development of agriculture of both countries aiming at its translation to a modern technological base. Using the method of comparative analysis the advantages and disadvantages of different models of financing of innovative projects have been studied and the criteria of their expedience for different types of projects and the conditions of their implementation have been formulated. Statistical analysis of the innovation activity of the enterprises processing agricultural products in the Republic of Kazakhstan allowed justifying a conclusion about the need to change the system of financing of innovative projects from the single-investor system to a multi-agent one. The contemporary approaches to financing of innovative projects in the agro-industrial complex of Russia have been analyzed. The importance of integrated innovative agricultural projects has been evaluated in terms of the development of agricultural industries and the economy as a whole.

Key words: Innovative projects · State support · Bank financing · Venture capital financing · Multi-agent model

INTRODUCTION

An important issue currently faced by the governments of most countries of the world is the development of basic industries and sectors of the national economy and sustainable economic growth on this basis [1-3]. The solution of this problem occurs in the conditions of the new technological order, focusing on innovative projects and on this basis, implying the transition of traditional industries to the category of high-tech industries with a significant level of research and innovation (R&D) activities.

The agro-industrial complex is no exception. Moreover, it is agriculture that because of the historical technological backwardness, both in Russia and in Kazakhstan, requires additional attention to the introduction of innovative projects in the enterprises and the formation of modern technological basis. Lack of interest from foreign investors existing yet raises the problem of finding additional sources of financing for innovative agricultural projects to build the required highly competitive production.

This problem may be solved by introducing the multi-agent system of financing in the practice of innovative projects investment.

Key Part: The introduction of modern forms and models of innovative process management suggests changes in the conceptual approaches to financing. According to theoretical and empirical studies, the behavior of investors, including banks and institutional investors in the financing of various kinds of innovative projects in modern conditions has a significant effect on the rate of economic growth in some industries and the economy as a whole [4].

First, during the modern economy formation the role of investor in the innovation process has changed.

In the traditional scheme, the role of the investor is to select and fund the most profitable and low-risk projects, i.e. the main function of investors in the traditional funding scheme is to provide the investment process with funds.

In the case of funding of the complex innovative project the situation is different. Such projects, first,
require much larger investments than traditional; and secondly, have a greater degree of uncertainty and a higher risk; and thirdly, are long-term (up to several tens of years) and multistage; and fourthly, are characterized by a complex and less reliable scheme of exchange of information between the lender and the borrower, when the creditor does not have all the necessary information on the impact of the project and the extent of its implementation, etc. [5].

Second, the studied models of financing of innovative projects have shown that now there are two different systems of financing of innovative projects: a single and a coalition (multi-agent). The economic system with the dominated system of project financing by single investor has a "soft" budget constraint, while the economy with dominating financing of R&D projects by several investors has a "hard" budget constraint. The terms "soft" and "hard" characterize the level of severity of the requirements of the lender to the performance indicators (profitability) of the project. Detailed theoretical justification of the features of "soft" and "hard" budget constraints were given by H. Huang and Ch. Xu from the London Business School [6-8].

According to practice, the specific feature of the implementation of large-scale investment and innovation projects is the need to consider the presence of three kinds of interests: the private utility (benefit) of entrepreneur from the project implementation (borrower), a private utility (profit) of the creditor (bank, another financial institution and other investor) from investment of funds (the investor) and public benefit (in the form of increased sectoral and national competitiveness of products, increase in exports, increase in economic growth, etc.). The optimal is the situation when all three groups of interests are realized. However, it does not frequently happen in practice.

One of the drawbacks of a single-agent model of the innovative project lending is the possibility of infringement of the interests of the lender. The latter is due to the fact that in real life, there is the problem of the exchange of information between the lender and the borrower. Moreover, since there is a private interest of the borrower, then he would be interested in the continuation and completion of the project by any means. As for investors, he gets private benefit from the project implementation as a whole. This means that if an investor discontinues funding for the project in the first phase, he will not receive benefits. Thus, even when the borrower learns about the real poor performance of the project at an early stage (it usually happens at the end of the first stage), he is still interested in the continued funding of the project and gives the investor a reorganization plan after the beginning of the project financing at the second phase. As a result, the investor (lender) learns about the poor performance of the project only at the second stage and the decision to stop funding or reorganization of the project therefore may be taken only at the third stage. However, fearing the loss of already made investments, the investor (lender) usually decides on the completion of the project, even with lower returns. Examples of inefficient schemes of innovative projects financing were demonstrated in summer 2002 by the situation between large corporations and banks in the U.S.

The model for financing the large-scale investment projects by several investors works in a different way. In case of a coalition mechanism at low or questionable effectiveness of the project, funding ceases already after the first stage. As a result, low-efficiency projects do not receive the support and thereby do not divert financial resources from more profitable or viable projects.

Comparative characteristics of the main criteria for selection of innovative projects for funding under the single-investor and multi-agent investment model is shown in Table 1.

As it can be seen from Table 1, both single-subject and multi-agent models of innovative projects financing have advantages and disadvantages. The main problem of single-subject model is inability to distribute the investment risk, low levels of resources for financing and possible violations of the payment schedule for the financing of individual stages of the innovation project related to the lack of investor’s funds at a particular stage. However, these shortcomings are not so important in the case of the small-scale and short-term projects, as well as when it is important to restructure the project during its implementation due to various situational conditions, rather than because of its ultimate inexpediency [9-10].

If there is a need in funding of complex innovative projects designed to significant investment and long implementation period, the more advantageous is the multi-agent model of project financing.

General analysis of the advantages and disadvantages of these models of innovative projects investment has shown that the mechanism of multi-agent financing of complex investment projects has more advantages compared with financing by individual investor. Even such drawbacks of the interaction between different actors as the conflict of private interests of creditors in the exchange of information and the high cost of information exchange shall be treated as certain
Table 1: Comparative characteristics of the main criteria for selection of innovative projects for funding under different investment models

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Single-subject model</th>
<th>Multi-agent model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristic of an approach to project funding</td>
<td>Flexible. Even funding of low-efficient projects is possible</td>
<td>Hard. Funding of only highly efficient projects</td>
</tr>
<tr>
<td>Degree of severity of ex-ante selection of projects by investors</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Possibility of project restructuring</td>
<td>Yes, at any stage</td>
<td>No, funding stops whenever the project efficiency decreases, including at early stages</td>
</tr>
<tr>
<td>Investment risk distribution</td>
<td>Individual risk</td>
<td>Risk diversification</td>
</tr>
<tr>
<td>Volumes of resources for funding</td>
<td>Small</td>
<td>Possibility to accumulate significant resources</td>
</tr>
<tr>
<td>Efficiency of payments for funding</td>
<td>There may be problems with mobilization of resources for funding of individual stages of the project</td>
<td>No delay in funding at every next stage due to diversification of funding sources</td>
</tr>
<tr>
<td>Efficient exchange of information on the project</td>
<td>Lack of qualitative exchange of information between the lender and the borrower</td>
<td>High costs of information exchange</td>
</tr>
<tr>
<td>Conflict of interests</td>
<td>Conflict of private interests of lender and borrower</td>
<td>Conflict of private interests of lenders at information exchange</td>
</tr>
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Table 2: Indicators of contribution of the enterprises engaged in processing of agricultural products to the innovative development of Kazakhstan (in % for 2012)

<table>
<thead>
<tr>
<th>Industry Processing sector</th>
<th>All enterprise of processing sector being innovatively active</th>
<th>All innovative enterprises of RK economy</th>
<th>All enterprises of processing industry</th>
<th>All enterprises of RK economy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
<tr>
<td>Food production</td>
<td>21.97309</td>
<td>10.98655</td>
<td>2.752036</td>
<td>1.375825</td>
</tr>
<tr>
<td>Beverage production</td>
<td>5.829596</td>
<td>2.914798</td>
<td>0.730132</td>
<td>0.365015</td>
</tr>
<tr>
<td>Tobacco goods production</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Textile goods production</td>
<td>1.793722</td>
<td>0.896861</td>
<td>0.224656</td>
<td>0.112312</td>
</tr>
<tr>
<td>Leather and accessories production</td>
<td>0.224215</td>
<td>0.112108</td>
<td>0.028082</td>
<td>0.014039</td>
</tr>
<tr>
<td>Total on the industries of agricultural products processing</td>
<td>29.82063</td>
<td>14.91031</td>
<td>3.734906</td>
<td>1.867191</td>
</tr>
</tbody>
</table>

advantage, because they serve an obstacle to the continuation of the doubtful projects (due to lack of "transparency" of information, low performance after the first stage, etc.). This fully applies to the problem of forming high-tech production in agriculture through the introduction of innovative projects.

Analysis of the practice of financing of large-scale investment and innovative projects in the agro-industrial complex of Russia and Kazakhstan has shown that a single-subject model currently prevails in both countries and the most often the lender (investor) is the state (in the form of central or regional governments), sometimes it is banks and less often - the private investors.

However, the almost universal application of this model of financing has led in recent years (in conjunction with other problems of the financial sector after the financial crisis of 2008) to reduction of the amount of investment and innovation lending in agriculture of both countries.

Innovative development of agro-industrial complex of Kazakhstan

Thus, according to expert estimates, the level of investment in the Kazakhstan agriculture of the total investment in fixed assets in 2012 amounted to only 2.32% and much of this investment was provided by the governmental financial investments [11].

As for the innovation activity of the enterprises of the agro-industrial complex of Kazakhstan, the figures are even more modest. Analysis of innovation activity of RK enterprises among the branches of the manufacturing sector engaged in processing of agricultural products has shown rather low innovativeness (Table 2) (calculated on [12]).
So, as it can be seen from Table 2, despite rather optimistic data on the total share of innovation enterprises of agricultural products processing on a group of innovative companies as a whole (column 2, the total value of almost 30%), the larger groups - "all innovation active enterprises of the economy of the Republic of Kazakhstan" (column 3), "all manufacturing enterprises of the Republic of Kazakhstan" (column 4) and "all the enterprises of the Republic of Kazakhstan" (column 5), show a sharp deterioration in the figures - first 2 times (up to 15%), then 3.5 times more (to 3.7%) and the last group is less than 2%.

Thus, it indicates the apparent lack of innovation activity of agricultural enterprises of the Republic of Kazakhstan and requires the development of programs to support innovative projects in agriculture, including through the introduction of innovative multi-agent models for projects financing.

As for the other important component of the agricultural sector, Kazakhstan has already done a lot in terms of its innovative development. For example, according to the JSC "KazAgroInnovation", today the republic is implementing the large-scale project for the introduction of resource-saving technologies in agriculture, first of all, water saving. Effectiveness of these technologies is tested in 12 regions of Kazakhstan. As a result in 2012, the area of application of water and resource saving technologies was more than 12 million hectares, which increased wheat production by about 720,000 tons (in terms of money - about 220 million USD) [13].

Other promising innovative projects awaiting implementation in the Kazakhstan agriculture, according to experts, are research on diversification in crop production, the introduction of genomic cattle breeding, the development of biological methods of plant protection, as well as innovative technology of cultivation of agricultural crops [13]. However, the existing scheme of investment projects funding prevents from their development in full. Therefore, to encourage the innovative development of Kazakhstan's agro-industrial complex, a broader introduction of the multi-agent model of innovative projects financing is necessary.

**Innovative Development of Russian Agriculture:** In Russia, the multi-agent scheme of innovative projects financing has already become applicable in the agro-industrial complex. An example is a project for the development of agro-industrial cluster in the Rostov region within the frameworks of the program "PARK: Industrial and agricultural regional clusters." Agreement on the establishment of such a cluster in the framework of cooperation between the NP "Innovation Centre" and the administration of the Rostov region was signed in 2013 at the St. Petersburg Economic Forum. Main investors in the cluster will be the member companies of the "Center of Innovation", the Administration of Rostov region, Russian and foreign banks, as well as large companies in southern Russia. Under the "PARK" project in the Rostov region, it is planned to build a plant for deep processing of crops with an annual capacity of up to 1,000,000 tons, formula-feed plant with production capacity of 100-250 thousand tons, pig farm for 100,000 heads, poultry complex for 1.25 million heads and meat processing plant with capacity up to 40,000 tons of meat and sausage products. The total attracted investment is 20 billion rubles. The project will result in creation of at least 2.8 thousand new jobs. The primary site for cluster placement was predefined to be Belokalitvenskiy district, where about 40 hectares will be allocated for project implementation.

Later the agri-industrial cluster in the Rostov region may become the basis of the largest agro-industrial biocluster of Russia [14].

In addition to the project "PARK", currently two major projects in the field of agriculture have been launched in the Rostov region. The first is the project of "Russian agro-industrial trust", involving the construction of two pig farms with capacity of 212,000 heads per year and formula-feed plant for 80,000 tonnes. The second is the project of "Evrodon," which includes the construction of a complex for growing turkeys with capacity of 60,000 tons per year (the cost-17.9 billion rubles).

Among other modern and innovative projects for the development of enterprises of agricultural processing in Russian regions there is the beginning of construction of Volgodonsk joint Russian-German enterprise for deep processing of grain to produce lysine, starch, gluten and animal feed. The volume of grain processing will be 250,000 tons per year with the prospect of doubling capacity. The investors are the Russian company "RosBioTech" and the German industrial group Evonik Industries.

In the Stavropol region, "RusProdImport" LLC started construction of biotechnological complex for the production of lysine and deep processing of wheat for gluten (the stated annual processing capacity - 240,000 tons of feed wheat, the cost of the project - 6,000,000,000 rubles).
In addition, in autumn 2010 an application for the construction of the plant for deep processing of grain with planned production capacity of up to 100,000 tons of wheat a year in Novonikolayevsky district of Volgograd region and in the spring of 2013, the application for the project of sugar beet production in Dagestan for USD 700 million (about 19.5 billion Rubles) were submitted [14].

Assessing the significance of these and other innovative investment projects in the Russian agribusiness, experts note their importance to the related industries. An integrated approach to doing business in the AIC is to give a multiplier effect for all industries included in the value chain. First of all, this will positively affect the development of agricultural production, as the farmer will be included in the overall production cycle and the products will always be in demand.

CONCLUSION

Thus, according to the results of theoretical analysis and comparative studies of the innovative practices in funding of agricultural projects in Russia and Kazakhstan, to promote the necessary changes in the innovative development of agriculture in both countries there is an objective necessity to form a new mentality in lending to innovative projects and create multi-agent coalitions (unions) for financing major innovation and investment projects. At that, however, we should not abandon the single-investor system of financing, especially since in many cases it is this credit scheme that provides a more rapid introduction of innovative projects and higher rates of economic growth compared with the multi-agent lending.

REFERENCES