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Selecting an optimal model of cooperation in the vegetable industry in Russia: vertical integration, agrarian dies, clusters

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Abstract. The article gives a brief description of the existing problems of vegetable growing in the Russian Federation. It is shown that hierarchical (in the form of vertical integration) or network (in the form of agrarian fillers or clusters) models of the functioning of the vegetable industry can be used to solve them. A comparative analysis of these models is provided in the paper. It is shown that a rapid increase in production can be achieved on the basis of vertical integration. However, for ensuring the sustainable development of the industry, it is necessary to use network models. Thus, stable and efficient functioning of the vegetable industry in our country should be based on the balance of hierarchical and network models.

1. Introduction

Analyzing the attention that Russian researchers are paying to strategic sectors of agriculture (such as the production of grain, meat, milk), one could notice that vegetable production occupies a secondary place. Nevertheless, the presence of its own vegetable production is of great importance for Russia, since its products are extremely important for ensuring a balanced diet of the population. Also, the independent production of vegetables will allow sales organizations to minimize currency risks during their purchase. In addition, the food embargo imposed in 2014 against countries exerting sanctions pressure on Russia removed a number of traditional suppliers of vegetables from the Russian market, which raised the question of replacing them with their own production.

Vegetable production (especially protected ground vegetable farming) is characterized by a rather long investment cycle, which increases the risks of potential investors [1, 2] (including due to the short duration of the food embargo). For this reason, it is of great importance to develop recommendations for creating favorable conditions for the development of vegetable production, including recommendations for choosing the optimal models for organizing vegetable production.

In this article, we will perform a comparative analysis of the three possible models for the organization of vegetable growing: clusters, agrarian dies, and vertical integration (the first two models refer to the forms of network or hybrid cooperation).

Researchers have long been interested in networking forms [3], and Williamson's work [4] gave a new impetus to research in this area, introducing the notion of a hybrid as a compromise between market and hierarchical models of organization of transactions [5, 6]. However, the problem of comparative analysis of various network models of business organization in relation to the specifics of



agriculture, as far as we know, is much less popular with specialists (one of the few exceptions here is work where a comparison of agrarian dies and cooperatives is performed [7]). Generally speaking, almost the only kind of network (hybrid) structures, which is considered in research on the agricultural economy, are cooperatives [7]. There are some studies with a long history [9, 10, 11]).

Some attention is also paid to vertical coordinated structures (of which agrarian dies are a special case) [12, 13] and clusters, but the prospects for their use in vegetable production have not yet been studied in detail. That is why, we will carry out a comparative analysis of the feasibility of using such models of cooperation (and integration) as clusters, vertical coordinated structures (using the example of agricultural dies) and vertical integrated structures. We will not consider cooperatives due to the fact that, as mentioned above, there is a significant number of publications on them.

The term “agrarian die” (in contrast to the terms “vertical integrated structure” and “cluster”) has not yet gained widespread acceptance and therefore needs clarification. The agrarian die is understood to be a set of independent agribusiness enterprises that are at different stages of the value chain (and collectively covering it entirely) and coordinating their activities to achieve their goals. Agrarian die is usually formed around a large retailer (who acts as the coordinator of the die activity) and serves to provide this enterprise with the appropriate type of agricultural products [7, 12]. From the organizational and economic point of view, it can be considered as a special case of a meta-firm [14].

Before we proceed to the comparative analysis of network and hierarchical forms of organization of economic activity, we will give a brief description of the domestic vegetable subcomplex.

The vegetable sector is divided into two subsectors (protected ground and open ground), the development of which in Russia is still asymmetrically [1, 2]. Investments are actively going into the protected ground subsector, while in open ground among Russian producers dominate private farms (their share reaches 70% for the main types of vegetables) and peasant cooperatives. Their products are sold in markets or are recycled, while retail chains prefer to buy similar goods abroad [1, 2].

It is in the open ground that the problems of the Russian agro-industrial complex are especially pronounced:

- A large number of small producers, the production volumes of which do not correspond to the demands of the network retail, which forces this retail to purchase goods from foreign suppliers, and the Russian producers themselves to use alternative sales channels;
- Acute shortage of vegetable storage capacity, which is why producers have to immediately sell their crops. This reduces the profitability of their activities (since at the moment large amounts of products enter the market, prices for it fall) and do not allow for rhythmic supplies (that's why in the winter, after selling the domestic crop, the market is occupied by foreign suppliers). In addition, the existing capacity for storing fruit and vegetable products do not meet modern requirements, since they lead to large crop losses.

As mentioned above, the food sanctions imposed gave a chance to the Russian agro-industrial complex, including the domestic vegetable production. However, at present there is an acute question of how national production of vegetables will develop: along the way of embedding existing small-scale producers into large value chains (which can be realized on the basis of network models — agrarian fillers or clusters) or along the way of crowding out of these small producers by large integrated structures (based on vertical integration). The model of formation of the necessary transport and logistics infrastructure depends on which path is chosen: whether it is created by vertical integrated structures for its needs, or it exists as independent logistic enterprises that serve the needs of an agricultural die or cluster. In addition, it is possible to combine these models, when each of them will occupy its niche in the market. To answer this question, it is necessary to perform a comparative analysis of network and hierarchical models of business organization.

A short list of the differences listed above forms of organization of agricultural production is presented in Table 1.

Table 1. Comparative analysis of vertical integrated structures, agrarian spinnerets and clusters.

Matching Criterion	Vertical integrated structure	Agricultural die	Cluster
Transaction Organization Model	Hierarchical	Combined (for various participants can be used both hierarchical and hybrid tools)	Hybrid
Coordination center	Yes	Yes	No
Regional binding	Not required	Not required	Yes

As Table 1 shows, the vertical integrated structure is a set of dependent subdivisions, the agrarian die can be viewed as a number of independent enterprises which activities are coordinated by the central core to achieve joint benefits, and finally the cluster is a set of independent but interrelated enterprises of several related industries activities in the same region.

Immediately it should be noted that for domestic agricultural production (and, more broadly, for agriculture in the CIS countries), the most characteristic model is the “vertical integration,” which implies strict owner and managerial control over all parts of the value chain included in that structure [12]. The popularity of this model is probably due to the owners’ desire to ensure complete control over production and to minimize the risks of extraneous influence on economic activity (for example, due to overpricing of raw materials or lower prices for final products). For Russia, this can also be explained by the weak institution of trust, which is why it is easier and more familiar for business owners to retain full control over the assets and business processes of enterprises.

It is large vertically integrated agribusiness companies that play a key role in the implementation of the policy of agricultural import substitution in Russia [15].

The advantages and disadvantages of this model are presented in Table 2.

Table 2. Advantages and disadvantages of the vertical integrated structure as a way of organizing agro-industrial production.

Advantages	Disadvantages
<ul style="list-style-type: none"> - Full control over all links in the supply chain (as a result, control over costs and quality of products); - The ability to manage the profitability of the vertical structure due to the redistribution of profits between the various links; - The possibility of optimizing taxation (due to the redistribution of profits between the various links); - Guaranteed sales of products for intermediate links; - Provision of own resources for intermediate stages of production (reduction of dependence on external supplies); - The best opportunities for attracting external financing for the implementation of projects (since banks and investors understand the mechanism of interaction within the integrated structure, as well as the composition of its assets). 	<ul style="list-style-type: none"> - High costs of formation (because of the need to pay for the purchase of elements of the value chain or to invest in their creation); - High management costs (associated with cumbersome structure); - High fixed costs (the need to pay for the maintenance of fixed assets, regardless of the actual value of demand); - Standardized production.

Analysis of the data presented in Table 2 allowed us to conclude that an important advantage of the vertical integration model is minimization of internal and external risks due to maintaining control

over assets and business processes. However, the use of vertical integration is associated with significant time and financial costs for the formation of an integrated structure and for ensuring its current operation. In addition, the management of such a structure (and control of the activities of line managers) leads to high transaction costs [16].

However, this drawback is largely leveled by the fact that, due to the comparative transparency of the activities of such a structure and low risks, it can attract external financing. As a result, it can afford to invest in large and relatively long-term projects (including those related to the formation of elements of the value chain that are not yet present in such a structure, such as, for example, the capacity for storing fruits and vegetables). Moreover, due to the ability to independently distribute profits between various parts of the value chain that are part of its structure, such a structure can accumulate significant resources and also optimize its taxes. In addition, as shown in [14], such a structure minimizes its costs of external profitability. But, unfortunately, such a structure cannot reduce the time spent on its formation.

But, despite the ease in attracting resources, there is a risk that a vertically integrated company from an economic point of view will not be sufficiently effective due to the high level of its costs (including transaction costs [16]). In other words, attracted and independently formed financial resources will be used not so much to improve the efficiency of such a structure, as to mask its inefficiency.

The advantages and disadvantages of the model of agrarian dies are presented in Table 3.

Table 3. Advantages and disadvantages of agrarian dies as a model for the organization of agro-industrial production.

Advantages	Disadvantages
<ul style="list-style-type: none"> - Easily established (since the agrarian dies arise on the basis of the already existing enterprises); - Independence of intermediate and final links from external deliveries; - Guaranteed product sales for intermediate links; - The presence of intermediate levels of possessive motivation among management, which increases the efficiency of their managerial decisions and partially eliminates the need to control their activities; - Promotion of small and medium business development. 	<ul style="list-style-type: none"> - Greater difficulty in attracting external financing compared to a vertically integrated structure (since financing may not attract the entire agrarian dies, but only the enterprises included in it); - The risk of a conflict of interest between enterprises belonging to different stages of the value chain; - The impossibility of direct management of individual enterprises of the filler by the coordinating core (coordination of activities is carried out on the basis of the coordination of interests); - Lower growth topics (compared to vertical integrated structure).

Table 3 shows that it is easier to form an agrarian die than a vertical integrated structure. At the same time, its resource security is lower than that of a vertical structure, and the risks of management conflicts are higher, as a result. This means that the die will be able to function effectively only if its coordinator has great negotiating power (and can achieve the interests with its help). Also, a die should have a high level of resource endowment (sufficient to be able to independently build the missing parts of the value chain; in addition, the coordinator of the spinneret may be required to make investments to ensure that existing enterprises meet the requirements [7]). Otherwise, the die could be scattered into separate independent enterprises, pursuing only own goals.

Would also like to note such a paradox as lower growth rates of the die compared to vertical integrated structures. As shown in the Table 3, the die can be formed faster and easier than the vertical structure, which allows us to expect that the growth rates of the die will also be higher. However, this is not the case: the vertical integrated structure makes centralized development decisions and invests in key areas of activity (moreover, it is relatively easy to attract these funds), which allows it to achieve

high growth rates with favorable economic conditions. In the case of an agrarian die, such centralization is absent, and the coordinator faces more stringent resource constraints (in fact, the amount of external funding is not tied to the scale of the entire business, but to the scale of activities of individual enterprises that are recipients of external funding). This can cause slower growth.

An important advantage of the die is its social significance. The die does not lead to the displacement of small producers by global integrated enterprises, it helps these manufacturers to integrate into an effective value chain [7, 12]. This is beneficial for the motivation of participants (which remain the owners of their businesses) and the social situation in rural areas [21].

The advantages and disadvantages of the cluster are presented in Table 4.

Table 4. Advantages and disadvantages of the cluster as a model for the organization of agricultural production.

Advantages	Disadvantages
<ul style="list-style-type: none"> - Comprehensive coverage of the regional economy; - Creating a system of mutual incentives and guarantees; - Building multiple parallel value chains; - Effective innovation transfer mechanism; - Involvement of non-profit organizations (scientific and educational institutions, authorities, etc.); - Creating conditions for the development of small and medium businesses; - A wide range of products (thanks to the participation of a large number of enterprises). 	<ul style="list-style-type: none"> - Lack of a single organizational vertical; - Spontaneous nature of formation and functioning.

As was shown in the article [17], an important advantage of a cluster is its potential as a tool for regional development. Within the cluster, many value chains are built, with each individual enterprise participating in several chains. Due to this, the cluster covers a significant part of the regional economy and contributes to the transfer of efficient product, organizational, and technological solutions between the enterprises involved in it. As a result, the efficiency of the branches included in the cluster increases.

However, an important disadvantage of a cluster is that it is formed spontaneously, by itself. It cannot be created by anyone's decision; it is only possible to provide conditions for its emergence and functioning. As a result, the process of its formation can take a long time, but, if successful, the presence of a cluster in the region will be the key to the sustainable development of the relevant industries.

Note that the cluster, the agrarian die and the vertical integration do not exclude each other. In particular, the vertical integrated structure can cooperate with individual enterprises of the cluster, as well as build dies around itself to increase the efficiency of its activities (in particular, for long-term cooperation with non-core enterprises). Similarly, an agrarian die (or, at a minimum, its individual links) can create a vertical integrated structure.

Nevertheless, it is important for us to find the answer to the following question: which of the above models of the organization of agro-industrial production will be optimal for solving the problem of the development of domestic vegetable farming.

The answer will be somewhat paradoxical – all three, but for different situations.

As was shown above, the vertical integrated structure allows making centralized decisions and attracting resources to finance its activities, which provides it with higher growth rates. Thus, it is the vertical integrated structures that will solve the problem of ensuring a rapid breakthrough in vegetable growing. [16]. They will make it possible to relatively quickly increase the production of vegetables, stabilize the supply of fruits and vegetables to the market by creating the necessary transport and

logistics infrastructure, and achieve partial import substitution by saturating mass demand. The first steps in this direction are already being taken.

Agrarian dies are likely to play a supporting role and act either as a superstructure for vertical integrated structures, or serve to supply agricultural products to those structures for which agro-industrial production is not a core business [7, 12]. Their important role is to involve small and medium-sized producers in national supply chains. This will contribute to the social development of the village and simplify the task of import substitution. In other words, agrarian dies will complement vertical structures.

Clusters, in turn, are necessary to ensure the sustainable development of vegetable production. They will not give a quick breakthrough in production, but as they grow, they will contribute to improving the efficiency of domestic vegetable production through building horizontal and vertical links between companies.

In fact, this means that vertical integrated structures and, possibly, dies (in which, under public-private partnership conditions, state structures may also be involved) must create the primary infrastructure necessary for the efficient functioning of vegetable production (such as logistics centers, seed farms, and etc.), around which, on the basis of network interaction, new links of agrarian dies can be built, as well as clusters. This will provide a synergistic effect to all stakeholders of the vegetable industry:

- Vertical integrated structures and agrarian dies can increase the economic efficiency of the infrastructure they have formed by charging fees for its use from external customers;
- Small and medium enterprises of the agro-industry will be able to increase their profitability due to the use of external infrastructure (due to partial elimination of the factor of seasonality of supplies and the ability to integrate into the supply chains of retail networks);
- Network retail will receive guarantees of stable supply from domestic producers and be able to minimize the share of the currency component in its purchases;
- The state will increase the level of its food security [18] and, at the same time, ensure a high level of social stability in the countryside thanks to the preservation of small and medium-sized producers;
- The population will be satisfied of both mass demand (due to the increase in output by vertical integrated structures) and the specific needs of certain categories of clients (due to the development of small and medium-sized manufacturers and their integration into the distribution system).

The findings of the study:

- The forms of organization of agricultural and agro-industrial production analyzed by us separately are not a universal panacea, but serve to solve their own problems. At present, the development of domestic vegetable production will, in our opinion, be increased due to the increase in production of large vertical integrated structures (as is the case in other sectors of the agricultural industry [16]). However, the long-term sustainable development of the industry will be ensured on the basis of the coexistence of these structures with network models of production organization (namely, with clusters and agrarian dies). They will create a system of sustainable production and marketing links in vegetable growing and create conditions for social development of the village;
- When developing state or regional programs of import substitution in the field of vegetable production, one of the three listed models of organization of economic activity cannot be given with an absolute priority. It is necessary to seek a balance between these models (perhaps giving one of them temporary priority), and creating conditions for the functioning of all the organizational forms of agricultural production described in this paper;
- The development of vegetable production should take into account not only economic efficiency, but also the social component. It is necessary to ensure a decent life for village

workers, give them guarantees of long-term employment, and create conditions for their full self-realization on their land. This can also be achieved through the parallel development of network forms (clusters and agrarian spinnerets) and vertical integrated structures [19, 20].

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