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Transport Clusters in Domestic Agriculture System

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Transport Clusters in Domestic Agriculture System

P S Probin¹, A A Simdiankin¹

¹Russian State University of Physical Culture, Moscow, Serenevii bulvar 4, Russia

E-mail: probinpavel@mail.ru

Abstract. In order both to prevent imbalances in the development of domestic agriculture and to counter the monopolization of the market of agricultural products it's justified the need to develop a model of agricultural transport cluster. Particular attention is paid to the theoretical aspects of the feasibility study of this approach in the format of transport clusters. First-order relationship elasticity coefficient is introduced for description of effectively agricultural work carrying out in the external territory when using a certain amount of cluster equipment and second-order link coefficient is introduced for description for the number of vehicles and agricultural machinery provided from other cluster members to one who makes agricultural works. At the same time the emphasis is placed on the problem of harmonization of the system of financial and economic relations at the level of territories with high livestock and crop potential. Authors also propose a dependence of the evaluation of the business activity of the agricultural transport cluster and enter rating scale.

1. Introduction

The world experience of developed countries proves both the efficiency and the inevitable regularity of occurrence of different types of clusters [1]. Cluster approach has largely transformed the ineffective paradigm of relations between government agencies, businesses and end users in the context of the development of individual sectors of the economy [4,5].

Cluster could be defined as a geographical concentration of firms belonging to the same sector and other similar firms where a set of ties is established between those firms and public as well as private research and financial institutions, together with others which have as their main aim to provide business support [7].

On the contrary similar structural changes occur not so dynamically in the domestic agriculture. In general the analysis of clustering level shows that at this moment in Russia there are no grown agro-industrial clusters competitive at the international and global level [8]. In this regard there is an objective need to develop a cluster approach in the study area, especially in the context of solving the problems of transport and logistics areas with high agricultural potential. Now agricultural cluster is the trend of modern agricultural development [20].

The state of the agricultural sector of the economy affects the interests of everyone and largely determines the economic potential, economic and political situation [2]. There is a dynamic reduction in the number of agricultural organizations and farms during the period from 1996 to 2016. At the same time there are pronounced tendencies of mass consolidation of farms which, in turn, may become a key factor in the development of subsequent monopolization of markets, the emergence of oligopolies. The main reason for this situation is the active expansion of the sphere of influence of the



largest agricultural holdings. This fact is a result of the active spread of the phenomenon of globalization in both the real and financial sectors of the economy [12,13,15],

It is important to note that agricultural holdings are able to receive loans on more favorable terms than representatives of small and medium-sized businesses. In addition large business structures have more favorable conditions for access to state orders. The result of the expansion of the sphere of influence of agricultural holdings is also the bankruptcy of farms whose lands are subsequently withdrawn from circulation and transferred for construction needs. Thus the result of the development of large business structures is the risk of unemployment in rural areas, on the one hand, and the monopolization of prices for agricultural products, on the other hand.

2. Relevance

The problem of designing agricultural transport clusters should be considered in the context of the development of small and medium-sized businesses. This circumstance is due to the fact that the largest agricultural holdings (in contrast to the large agricultural organizations) capable of providing full cycle of production of agricultural products – from the preparation of land and sowing to the implementation of the trade organizations. No doubts this leads to the monopolization of the agricultural products market. That is why the problem of finding optimal solutions aimed at creating a system of financial and non-financial incentives for small and medium-sized agricultural enterprises comes to the fore. Cluster initiatives can provide the companies with numerous incentives for improving their competitive position [6].

It's known that soviet-era machine-tractor stations (MTS) provided technical and organizational support to producers of agricultural products [11]. At the present moment there is a significant need to create such structures taking into account the existing historical experience [19] and requirements imposed by the participants of the modern system of agriculture. We consider it expedient to implement this approach in practice in the format of agricultural transport clusters.

The development of this approach is accompanied by two key prerequisites.

1. Despite the availability of a wide range of services modern logistics companies can't fully meet all the current and future needs of agricultural producers in most cases. This is primarily due to the inability of logistics companies to take into account the specific maintaining of agricultural producers separate chains especially of small and medium size enterprises (SME). In some cases attempts to adapt to the SME requirements – especially in a limited time interval – do not allow companies to get the necessary level of profit. It connects with the fact that such adaptation requires additional time, transport and financial costs as well as increases the overall level of risk. That is why more cost-effective option for logistics companies is to service the large agricultural holdings.

2. As mentioned earlier we have many years of experience in developing and implementing MTS projects at the Soviet period. However since 1958 MTS began to be transformed into repair and technical stations and at the same time equipment was transferred to collective farms. As a result the MTS functionality was reduced to the required minimum while the agricultural machinery itself was distributed among the territories with high agricultural potential [3].

Today a one of the most important factors of survival in the market is the effective solution of a problem of expenses minimization especially for agricultural SME (AGSME). In this regard there is an objective need to develop a project to support business processes for these participants.

We propose a conception of a transport agricultural cluster (TAC) on the one hand having all the necessary tools for building an effective system of interaction with AGSME on a flexible basis (in accordance with the seasonality of work, their scale, etc.). And on the other hand this conception takes into account the positive MTS experience could adapted to the current economic realities. In addition to the services of rental and maintenance of equipment and vehicles this TAC can support the participants with a full range of insurance, financial and legal services and can form some kind of effective market mechanism to support small businesses.

Both sides of this proposal radically distinguish TAC from the work of existing outsourcing transport companies.

Transport agricultural clusters allow to transform the modern vision of approaches how to organize the agriculture at the level of small and medium-size businesses [9]. As an alternative to sector-wide projects it is proposed to solve the most important problems with creating a whole new model of an agricultural cluster that can effectively solve the problems of transport support and formation of supply chains for agricultural producers.

Transport agricultural cluster will reduce the time and financial costs of agricultural producers with transferring of certain elements of the agricultural production chain to the outsourcing companies. It is allow small and medium-sized farms to maintain their competitive positions in the market. As a result a system of financial and non-financial incentives will be formed to prevent the emergence of imbalances in the development of agriculture and the monopolization of its sales market as a whole. No doubt these conditions will create new jobs. Finally the conflict of economic interests of the largest agricultural holdings, on the one hand, and the administrations of agricultural areas, on the other hand, will be resolved. The creation of clusters will promote the involvement of abandoned land (and settlements) in the circulation and as well as development of rural areas [14]. Organizing clusters (in addition to the Soviet and Russian practice of agriculture) it is also necessary to rely on the experience of Western countries – it will help to avoid or reduce the number of mistakes and form their strategies adapted to the distinctive characteristics of the agro-industrial sector of the territory [18].

3. Theoretical part

Most of the proposed reasonable approaches [10] do not aim at a detailed consideration of the transport and logistics of agricultural territories but it is one of the fundamental problems. In addition to that the existing researches practically ignore the issues of pricing and market monopolization as well as the problem of formation of an effective mechanism to counter the capitalist approach in the agriculture development. Moreover in some cases the proposed clustering solutions only create additional favorable conditions exclusively for the work of major agricultural holdings.

It is important to note that today there is no common understanding of the essence of the agricultural transport cluster. That is why authors introduce the following definition: agricultural transport cluster is a set of transport companies, financial institutions, service stations, storage areas, processing lines of agricultural products as well as other economic entities united in a single system on a territorial basis with the purpose to reduce the interaction of transport, time and financial costs of agricultural producers throughout the production cycle and the sale of products by providing customers with appropriate equipment for lease, the provision of related services. Suggested model of TAC is shown on Fig.1. Cluster approaches recognize that all the actors in the agricultural value chain are often more innovative and successful when they interact with supporting institutions and other actors in the supply chain [16]. The impact of a region's geographical location on its economic performance has always been a source of debate in growth literature [17].

Cluster model includes first and second order relationships (see Fig.2). First-order relationships are formed directly between the cluster participants and external users. Second-order links are exclusively formed between external users of cluster services in order to minimize transportation costs. For example agricultural and cargo equipment after works completion on an external site can be redirected to other site of works bypassing thus the territory of a transport agricultural cluster.

There is an objective need to introduce tools to assess the relevant links.

First-order relationship elasticity coefficient ("external user – cluster") for one member is

$$K_1 = (n \cdot k) / f \cdot 100\%, \quad (1)$$

where n – the percentage of equipment available in the cluster for external using, %; f – efficiency/completion of external stakeholders such as planting or harvesting, %; k – correction coefficient.

This coefficient K_1 means how effectively agricultural work is carried out in the external territory when using a certain amount of cluster equipment. For example if 20% of the equipment is available to the external user and the effectiveness of the on-site harvesting is 80% than the coefficient is 0.25.

The recommended value of n is defined as quotient of 100% by the number of cluster members. So if we have 3 cluster members than n equals 33%, for 8 cluster members $n = 12.5\%$, etc.

At the same time this value can be adjusted with the value of the correction coefficient which depends on the demand for each individual territory of the cluster services. For example for areas with high agricultural potential k can be equal 1.2...2 while for the remaining territories its value can be reduced to 0.2...0.5. At the same time the total value of nk for all cluster members must be constant and equals to 100%.

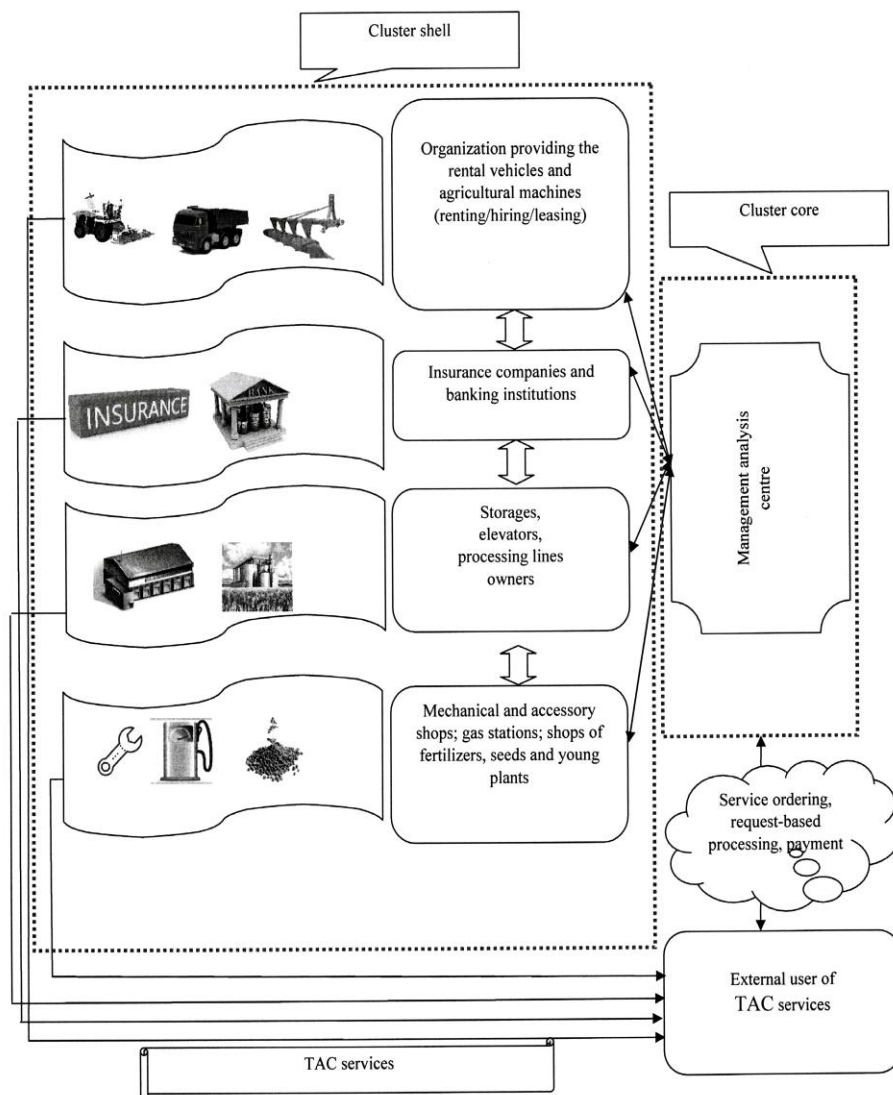


Figure 1. Transport agricultural cluster conception.

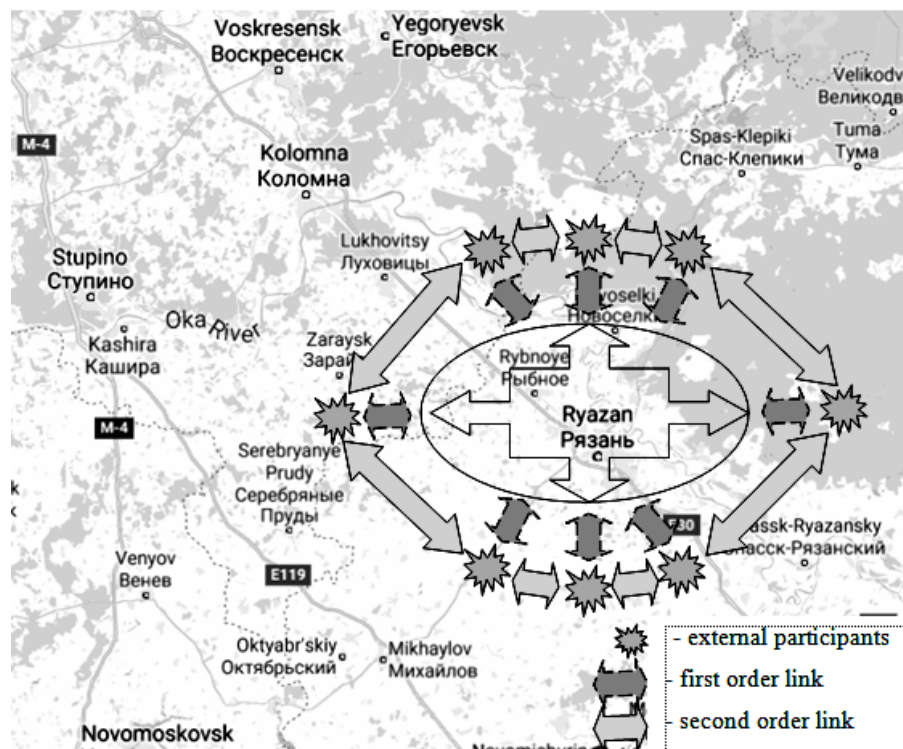


Figure 2. Scheme of interaction of external participants of Ryazan region.

The first-order link is elastic if the coefficient is not more than 0.2 (1% of a machinery park provides 5% of works in progress). The lower the coefficient values the more the link elastic. If the link is elastic it is reasonable to consider the transferring of a part of agricultural and transport machines from one user to another external member of the cluster. If the coefficient values is more than 0.2 that the level of tension increases and there is a possibility of a reduction of total synergetic effect of the "participant – cluster" system. These critical and normal values of the coefficient have approximate and recommendatory character and can be changed on the base of reduction or increasing of the certain factors of the external and internal business environment.

The second-order link coefficient is defined as quotient of the number of vehicles and agricultural machinery provided from other cluster members by the total number of all machinery provided to the cluster participant for temporary use:

$$K_2 = V_{\text{external}}/V_{\text{total}}. \quad (2)$$

So if cluster member has taken to the use of 20 trucks where 5 trucks were transferred from the other (neighboring) members of the cluster that the coefficient value equals to $5/20=0.25$ or 25 %. The maximum value of the coefficient is 50% and it indicates a high degree of dependence of the cluster member on other (neighboring) members. However if this situation does not violate to the overall progress of the cluster it should not be perceived as an exclusively negative factor.

The implementation of the TAC conception for the areas having high agricultural potential and nearby could create optimal conditions not only for the transportation and storage of agricultural products but also for the time-sensitive supply of vehicles and agricultural machinery, components and consumables to the AGSME in accordance with their current and future needs.

The agricultural transport cluster consists of a core and a shell (see Fig.1). The cluster shell is formed with insurance companies; financial institutions; companies providing vehicles and agricultural machinery for temporary using of farmers; repair shops and filling stations; warehouses for storage of agricultural products and processing lines; suppliers of fertilizers, feed, seedlings, etc. The cluster core is represented with a management analysis (control and processing) center which is

monitoring the efficiency of the cluster work. This center distributes and redistributes the orders from external users and resolves the problem of using information technology effectively in agricultural logistics. So at any time the entrepreneurs, small and medium-sized farms can receive transport and logistics assistance including without limitation at the place of harvest.

Authors also propose a dependence of the evaluation of the business activity of the agricultural transport cluster:

$$Q = 0,01 \cdot X_1 + 0,09 \cdot X_2 + 0,1 \cdot X_3 + 0,2 \cdot X_4 + 0,2 \cdot X_5 + 0,2 \cdot X_6 + 0,2 \cdot X_7, \quad (3)$$

where X_1 – a fraction of financial and insurance companies actively supporting the cluster operation process, %; X_2 – level of maintenance companies workload, %; X_3 – level of supply companies workload, %; X_4 – level of storages workload, %; X_5 – level of grain storages workload, %; X_6 – percentage of the total fleet of vehicles involved in the works, %; X_7 – percentage of the total fleet of agricultural machinery involved in the work, %.

$Q = 1$ indicates the full workload of the cluster and – in some cases – that it will not be able to cover the full range of needs of its external users in the future.

$0.6 \leq Q \leq 0.9$ indicates effective work of a cluster and existence of a certain safety margin under expansion of a range of orders from external users.

$0.3 \leq Q \leq 0.5$ indicates that the cluster is underutilized.

$Q \leq 0.3$ evidences low productiveness of cluster.

4. Conclusions

Over the past few years the agriculture clustering has gained ground what is reflected both in scientific papers and in practice-oriented professional publications. However despite of the existing interest of representatives of the scientific community and farmers as well as the system of financial and nonfinancial incentives implemented by the state towards agricultural producers there is no dynamic development of the agriculture clusters. In order to prevent imbalances in the development of domestic agriculture, on the one hand, and to counter the monopolization of the market of agricultural products, on the other hand, the authors justified the need to develop a model of agricultural transport cluster including a shell (service companies – warehouses, financial institutions, owners of vehicles and agricultural machinery) and a core (management analysis, control and processing center). Besides authors offer to introduce first-order relationship elasticity coefficient and second-order link coefficient as well as an analytic dependence for assessing the business activity of the agricultural and transport cluster.

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