Logistic approach to the production and processing of agricultural products

Z P Medelyaeva, I G Zharkovskaya and I E Erofeeva

Voronezh State Agrarian University named after Emperor Peter I, 1, Michurin, Voronezh, 394087, Russia

E-mail: medelaeva@mail.ru

Abstract. AIC is a complex system that includes several areas, a significant number of subcomplexes, a variety of industries, interconnected by logistics flows. It is important that the logistics flows are properly regulated, contribute to the full use of agricultural raw materials, by-products from the processing of raw materials, provide a synergistic effect for all participants in the supply chain. Under the conditions of the Central Black Earth Economic Region, the development of dairy and sugar beet subcomplexes, capable of developing integration ties, improving crop rotation, and providing jobs in the first and third sectors of the agricultural sector, is proposed as system-forming ones.

1. Introduction

By the number of connections, the variety of relationships, the agro-industrial complex is a socio-economic logistics system, the activity of which is interdependent on the effectiveness of individual subsystems, up to an enterprise. In determining the integration processes that are inevitable in the functioning of the agro-industrial complex at the present stage, an important place should be given to such an aspect as logistics. The position of the authors as applied to the agro-industrial complex as a logistics system is because, based on the principles of logistics, the authors apply its laws to such a complex system as the agro-industrial complex.

In the considered aspect of the agro-industrial complex, there are various complex-specific relations between its participants, which determine the effectiveness of each individual enterprise, a separate area of the agro-industrial complex (production of capital goods, agriculture, the processing industry) and the agro-industrial complex as a whole. Many problems in the agricultural sector arose in the 90s due to the inefficiency of existing production relations, especially between agricultural producers and the third sector of the agricultural sector. During the transition to market relations, the system of organizational and economic relations in the agro-industrial complex of Russia was not regulated, which at first could not improve the relations and relations that were developed under the administrative system.

The need to study agribusiness from the point of view of logistics is relevant in the sense that all three areas of agribusiness are interconnected, their activities are interdependent and the effectiveness of both the general system and individual enterprises is determined by the effectiveness of the relationships, the final amount of profit received from the sale of agribusiness products.
2. Discussion

Summarizing the statements of the authors about the logistics system in general and in relation to the agricultural sector [4; 8], we conclude that the communication system in the agro-industrial complex should not allow the existence of intermediaries who purchase products from commodity producers at minimum prices during the harvesting period, when the latter need money to resume production activities, and then supply raw materials to processing and procurement organizations at inflated prices, receiving a significant margin in the absence of sound production ties.

The activity of the agro-industrial complex is impossible without integration processes, and this implies a logistic approach to the formulation of the organizational and economic mechanism of its functioning. Logistics, as applied to agribusiness, is a system in which some elements of the system provide the necessary volume of raw materials for the activities of organizations involved in its processing. In this system, some are engaged in the production of raw materials, the second are engaged in its distribution, the third are engaged in the storage and supply of raw materials from producers to consumers, the fourth summarize information about producers, consumers of products, supplies of means of production, etc. Interactions in the logistics system are like a capital cycle.

Justifying the logistic approach to the functioning of the agro-industrial complex as a system where the flows for the production and processing of agricultural products are interconnected, the authors use the integrated logistics paradigm where it is necessary to determine the market place; interconnections in the system of organizational and economic relations, which are based on integration between logistics partners; when the produced agricultural products should go directly to the processing enterprises and organizations, it is advisable to use the waste from the processing industries both within the agricultural sector and in light industry (hides, fluff).

The logistics system of the agro-industrial complex, based on integration processes, suggests the idea of mutually beneficial cooperation in building economic relations between partners. The benefits of integration area as follows:

- **vertical integration** - partners interact at different levels of the supply chain. This type of integration involves reducing costs on both sides and, consequently, the manifestation of a synergistic effect from joint activities;
- **horizontal integration**, involving partnership between enterprises of the same industry;
- **diversification** based on the mutual expansion of the scope of activities.

The effect of properly constructed logistic flows in the economic system, which is the agro-industrial complex, is manifested in increased profits and increased cash flows. Efficiency growth is manifested due to increased profits both due to increased production volumes and due to diversification of activities, use of domestic prices, additional investments to expand production due to overflow of capital, optimization of taxation.

3. Materials and methods

Considering the agro-industrial complex and all the product sub-complexes included in it from the point of view of logistics, it can be represented as an open system where there is an exchange of products and information. Being an open system, the activity of the agro-industrial complex as a whole depends on the external environment: at the entrance it receives a public order for the production of certain finished products, and at the output, it consumes the finished product produced in the agricultural sector for consumers. The formation of the order, and therefore the volume of production, is determined by economic, social and political environmental factors, such as society, the market and the state. The logistic system can be represented by a global hierarchical structure, including mini-meso-meta-systems (Figure 1).

The external environment of the agro-industrial complex, which determines the needs of the meta-system of the agro-industrial complex, is society, the market and the state, which form the order to produce finished products. The relationship of mini-systems in the structure of the agro-industrial complex have or do not have organizational design. If there is organizational design, then integration, as a rule, has inherent features of combination with a closer and longer-term nature of relationships,
which have distributional features. If a compromise is not reached with participants in the supply chain on which economic relations are based, they seek new partners for themselves. At the same time, the logistics flow resumes, the raw materials come from other partners with whom contracts are concluded. Moreover, the requirements of logistics meet the conditions of adaptability of the agro-industrial complex as a system.

The partner partners of the supply chain can be both legal entities and individuals, whose interests are similar in their production activities.

For strategic partnership in the logistical socio-economic system, it is necessary that the relationship provides mutually beneficial cooperation. If this requirement is not observed, for any position of the relationship, mutually beneficial partnership is terminated, the relationship goes to the level of disparity, and ultimately ends.

Successful activity or, conversely, failure of an individual participant in the logistics system at the previous stage in the relationship chain, as a rule, affects the subsequent stages of the production process. In view of this, the strategy defined by the logistic paradigm should prevent problems, conflicts, disparity of relations and provide the possibility of obtaining a synergistic effect from joint activities. Mutually beneficial cooperation of all elements in the agricultural sector provides not only the efficiency of the agricultural sector, but also rural areas [1].

The products produced in the region, first, should be processed at processing enterprises located in the region. The efficiency of the use of raw materials with this option is increased due to lower transportation costs, the use of transfer prices in the calculations, which is confirmed by the practice of functioning of the oil-product sub-complex of the Central Black Earth Economic Region [2]. Moreover, the forms of interaction can be different, the main thing is that they provide mutually beneficial cooperation [5].
4. Results

Processing of agricultural raw materials should be deep, using by-products, which is not yet available in many regions. Completeness does not always occur in the aforementioned logistics system, which is why the region’s agribusiness does not receive huge amounts of profit. Not always the relationships included in the agro-industrial complex of subjects create a synergistic effect, as it should be. Certain types of agricultural raw materials produced by agricultural producers do not find further use. Agricultural producers, on the one hand, should engage in diversification of production, expanding the types of products manufactured, and on the other, forecast the channels for using new products [3].

Such waste from the industry for processing agricultural raw materials as oil cake, meal, bard, etc., is not fully utilized at the regional level.

Logistic approach is not always shown at the level of agricultural organizations. Many agricultural organizations are not currently involved in animal husbandry, which often leads to a disruption in the structure of sown areas. Sown areas of grain and industrial crops at such enterprises often exceed established agricultural requirements, which leads to land depletion, the introduction of large amounts of mineral fertilizers and protective equipment. Without a livestock of animals, agricultural enterprises do not have the most valuable organic fertilizer - manure, which is necessary in crop production and is not always replaced by expensive mineral fertilizers [6].

For the full use of pastures, which are owned by most agricultural organizations, it is advisable to engage in sheep or meat cattle breeding. Without beekeeping, which in recent years has been suffering from the introduction of large amounts of various protective means onto the fields, the productivity of sunflower, orchards, annual and perennial herbs is significantly reduced.

In the process of structuring the agro-industrial complex, first, in the region, it is necessary to identify the most important sectors that are more able to determine the benefits of integration. Such industries in the Central Black Earth Economic Region are dairy farming and beet farming with a powerful base of dairy and sugar factories. Beet sugar and milk production are distinguished using proper crop rotation, including, in addition to grain crops, sugar beets and fodder crops, i.e. those crops that are good predecessors and enrich the soil require good tillage (row crops). It is important to determine the vectors of natural flows in the integration system of beet and sugar and dairy subcomplexes, since they belong to the main ones in the Central Chechen Republic, with access to other industries for the use of conjugated and by-products. Figure 2 shows the diversity and multidirectionality of the flows of integration links in the considered subcomplexes.

The strategy defined by the authors, based on an integrated logistics paradigm, should turn problems, disparity of relations into the possibility of equal cooperation along the entire supply chain within the agro-industrial complex. When proportionality in the development of industries is achieved, the logistic approach to the production, processing and sale of products will improve not only the economic indicators in the agricultural sector, but also the state of the social sphere in the countryside, which is currently in an unsatisfactory condition.

The logistic approach requires the early conclusion of contracts of agricultural producers with procurement and processing enterprises. And if for the latter the volumes of production that the producers can supply are important, then for the producers the purchase prices are significant. Practice shows that the volumes of supplies of products are specified in contracts before the start of the planned year, and sales prices at that time are not put down in contracts and become known only before the start of supply of products when signing additional agreements to the contracts. This circumstance does not allow producers to fully navigate when planning production volumes of a product. In our opinion, it is necessary to establish minimum sales prices, or use the methods of setting prices for agricultural raw materials, which allow us to determine a single level of profitability for agricultural producers and processing enterprises [7].
5. Conclusion
The problems considered must be addressed at all levels, including in scientific, research institutions. It is important to determine the volume of production, which, on the one hand, will ensure the loading of production capacities of processing enterprises, and on the other hand, the sown area will correspond to agrotechnical requirements. We offer the supply of mineral fertilizers, herbicides, equipment to agricultural enterprises in accordance with the established standards at fixed prices, as
well as the purchase of agricultural products in state funds in order to determine the minimum contractual sale prices.

A more rational construction of logistics flows is possible using digital technologies, which are widely used in the country’s economy [9]. It is important that all participants in the supply chain benefit from cooperation.

References

[1] Agibalov A V, Tkacheva Y V and Zaporozhtseva L A 2018 Improvement of the financial management strategy for agricultural enterprises International Journal of Economic Perspective 11 (3) 1686-1696
[2] Bunchikov O N, Kurennaya V V, Aydinova A T, Ternovykh K S and Plyakina A A 2018 Investigation of development trends of fat-and-oil subcomplex in the regions of the southern Russia Espacios 39(45)
[3] Derkanosova N M, Ponomareva I N, Shurshikova G V and Vasilenko O A 2018 Application of fuzzy set theory for integral assessment of agricultural products quality (Mathematical simulation and data processing No. 032026) Journal of Physics: Conference Series 1015(3)
[4] Gasiński L, O'Regan D and Papageorgiou N S 2015 A variational approach to nonlinear logistic equations Communications in Contemporary Mathematics 17(3) 1450021
[5] Makarevich L O, Ulezko A V and Reimer B V 2019 Forms of interaction of subjects of agro-industrial integration Agricultural Economics of Russia 7 53-59
[6] Medelyaeva Z P 2007 Logistics of non-waste production in the agricultural sector Logistics 3 14-15
[7] Medelyaeva Z P 2008 Economic relations in the agricultural sector: theory, methodology, practice: monograph (Voronezh: VGAU).
[8] Tian Y and Chiu Y-C 2011 Anisotropic mesoscopic traffic simulation approach to support large-scale traffic and logistic modeling and analysis Proceedings - Winter Simulation Conference Ser. "Proceedings of the 2011 Winter Simulation Conference, WSC 2011" 1495-1507
[9] Ulezko A V, Reimer V V and Ulezko O V 2019 Theoretical and methodological aspects of digitalization in agriculture IOP Conference Series: Earth and Environmental Science 274 012062 - doi: 10.1088/1755-1315/274/1/012062