

Optimization of agricultural products storage and marketing on the basis of logistics

Optimización del almacenamiento y comercialización de productos agropecuarios sobre la base de la logística

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ABSTRACT:

In order to establish a network of distribution centers methodological approaches taking into account the optimal placement and territorial specialization of the processing enterprises have been developed. Based on the given methodological approaches a mechanism of agricultural market regulation is proposed. It allows establishing the optimal balance of supply and demand for agricultural products. In order to justify the selection of an efficient logistics system of storage optimization and agricultural products market a measure in the form of the objective function is proposed. It takes into account the factors of costs reducing and agricultural products quality characteristics optimizing. Particular attention in the storage and marketing system of agricultural products is paid to stock trading, reducing the number of middlemen in the chain a manufacturer – a buyer, enhancing transparency and information availability of transactions, as well as setting a fair price for the products.

Keywords: storage; marketing; agricultural products,

RESUMEN:

Para establecer una red de centros de distribución se han desarrollado enfoques metodológicos teniendo en cuenta la colocación óptima y la especialización territorial de las empresas de transformación. Basándose en los enfoques metodológicos dados, se propone un mecanismo de regulación del mercado agrícola. Permite establecer el equilibrio óptimo de la oferta y la demanda de productos agropecuarios. Para justificar la selección de un sistema logístico eficiente de optimización del almacenamiento y del mercado de productos agropecuarios se propone una medida en forma de función objetiva. Se tienen en cuenta los factores de reducción de costes y la optimización de las características de calidad de los productos agropecuarios. En el sistema de almacenamiento y comercialización de productos agropecuarios se presta especial atención al comercio de valores, reduciendo el número de intermediarios de la cadena un fabricante – un comprador, mejorando la transparencia y la disponibilidad de información de las transacciones, así

1. Introduction

Solving agricultural problems is possible only with the use of modern trends, providing innovative approaches, taking into account the improvement of the organizational-economic mechanism. It is obvious that these trends must meet the principles of the systems, and take into account existing restrictions. In our opinion one of the most effective tools is logistics, which is very effective in different sectors of economics.

An integrated approach used in logistics provides through-flows management. These flows are associated with each link in the logistics system. Being an integrated part of logistics system, storage facilities should take into account the accumulation, processing and distribution of material flows. As a result, it will be possible to achieve high performance in AIC systems.

2. Brief Literature Review

The authors think that environmental aspect of efficiency is also very important while using logistic approach in AIC (Gebresenbet and Ljungberg 2001). In particular, the globalization of the agricultural sector leads to an increase in distances of agricultural products transportation, and as a result, to additional emissions, polluting the environment, including greenhouse gases and waste. In this regard, during the construction of logistics stocker system in agriculture it is necessary to pay special attention to such elements as centers of agricultural production collection, the supply chain in the distribution channels. It should also consist of monitoring of producers and supply point, as well as products collection and distribution based on geographical location.

After the analysis of numerous scientific studies on the use of the logistical approach in agriculture F. Bulitta, Bosona, Gebresenbet (2011) conclude that the logistics is aimed at the study of economic models, taking into account time factors and location of material flows in agriculture (Federico 2011; Bulitta, Bosona and Gebresenbet 2011).

Considering the significance of transport operations in the agriculture and food chain, from economic as well as environmental perspectives, and the rapid structural transitions from small-scale to large-scale in primary production and processing industries, there is a need for research in agricultural logistics (Gebresenbet and Bosona 2012).

3. Purpose

In view of the fact, it is necessary to establish an effective regional system of storage and distribution of vegetables on the basis of logistical tools. This system will provide maximum safety of products and the reduction of transportation costs, and will increase the investment attractiveness of this sphere of activity.

Today the Russian market of logistics services is not effective enough. According to experts, its potential is estimated at USD 120 billion. Share of the sector of transport and freight forwarding by all modes of transport is 55%, the sector of warehouse services – 13% and the sector of services for the integration and supply chain management - 32%. Nowadays, the efficiency of the goods supply chain is an essential condition to ensure the competitiveness of enterprises. Manufacturers-competitors cannot reduce the direct costs associated with the production, without the risk to reduce the quality. The only way to save money is to reduce the time of products sales throughout the supply chain. Experience of both developed countries and Russia proves that only specialized companies are able to implement current requirements for logistics. In Russia there is a number of logistics service providers, such as the National Logistics Company (NLC), FM Logistic, Tablogix et al., providing services on a world-wide basis

(Liping, 2009) .

In modern vegetable stores built on innovative technologies, the loss will be 5%. It corresponds to international standards. Moreover, the creation of capacities for the effective products storage will significantly reduce the share of imports and slow the rise in prices in the winter-spring period.

4. Results

In our opinion, the logistics system in agriculture should include a network of regional logistics centers located in view of production and climatic characteristics of the regions, created by modern technology, with the necessary engineering and transport infrastructure and operation of automated information logistics systems.

High efficiency of control of logistics flows in the EU is determined by the high technology of vegetables cultivation, developed network of modern storages, postharvest handling system, perfect means of transport. Russian vegetables are of high-quality only in the field.

Wholesale markets play a significant role in the development of fresh vegetables logistics. In Europe, these markets are an essential link in the chain of vegetables' promotion from the field to the consumer.

In the management of agricultural production flows significant problems are associated with losses. Due to deficiencies during harvesting and processing in the process of promotion up to 35% of vegetable production is lost. It leads to significant economic and material losses.

After harvesting the logistics of fresh vegetables has two schemes - intrafarm and external. Harvest is carried in the packaging department, where it is post-harvested on assembly lines. Finished products are supplied to the consumer through logistics schemes.

Post-harvesting can be carried out by two organizational schemes - directly in the field during harvesting and on special facilities. To do this special mobile sweepers are used.

According to another scheme, harvested vegetables are delivered to the stationary packing plants, where the four basic operations are carried out:

- disposal of non-market fraction;
- sorting and calibration according to the degree of maturity and size;
- rinse;
- packaging and subsequent cooling of the finished product.

The study showed that at the regional level it is necessary to create an effective mechanism of regulation of agricultural products market, which will balance the supply agricultural producers and demand for their products (Ślusarczyk, 2014, pp. 97).

In this connection it is necessary to form an effective system of goods movement from producer to consumer (the most satisfying food needs for domestic agricultural raw materials and the population needs for the main types of food with minimal transaction costs) (Van der Vorst JGAJ, Tromp S-O and Zee D-Jvd. 2009).

In order to justify the proposed logistic scheme of agricultural product distribution an objective function is proposed. It takes into account such factors as loss of agricultural product quality, loss of time and transportation costs. The result of the objective function can be expressed in monetary units and should reflect the cost-effectiveness of the proposed logistic scheme of agricultural product distribution taking into account alternative variants of product distribution.

Thus, the objective function of the logistic function will be as follows:

$$P = \left[\sum_{t=0}^T (R_t - Z_t) \times (1 - P_k) \times (1 - P_c) - Z_{tr} - E_{in} \times K \right] \times (1 + E)^{-t} \quad (1)$$

where T is planning horizon; R_t is achieved result, \$; Z_t is operation cost, \$; P_k is loss of quality characteristics of agricultural products, per cent; P_c is loss of time during agricultural product delivery, per cent; Z_{tr} is shipping cost, \$; K is investments in running project, \$; E_{in} is coefficient of efficiency of capital investments in the exploring options; E_{is} is discount rate.

Table 1 shows the rate of vegetables loss, depending on the period and delivery distance. Based on these data, it is possible to calculate the efficiency of products distribution within the logistics system.

Table 1. The rate of vegetables and potato loss during motor movement, per cent of cargo weight

Year season	Way of conveyance	Distance of conveyance, km	Potato	Cabbage	Root vegetables	Common onion, garlic	green onion	Dill, lettuce and other green vegetables
Autumn and winter period (1 October- 31 March)	in-container	10- 25	0.3	0.4	0.4	0.2	0.3	1.3
		26 - 50	0.4	0.6	0.4	0.4	0.6	2.5
		51 - 75	0.5	0.9	0.5	0.5	-	-
		76 - 100	0.6	1.1	0.7	0.6	-	-
	inbulk	10- 25	0.3	0.4	0.3	-	-	-
		26 - 50	0.5	0.7	0.5	-	-	-
		51 - 75	0.7	1.1	0.7	-	-	-
		76 - 100	0.8	1.5	0.8	-	-	-
Spring and summer period (1 April – 30 September)	in-container	1- 09	0.3	0.4	0.3	0.2	0.2	1
		10- 25	0.4	0.4	0.4	0.3	0.3	1.3
		26 - 50	0.6	0.8	0.6	0.4	0.6	2.5
		51 - 75	0.7	1	0.7	0.5	-	-
		76 - 100	0.8	1.2	0.8	0.6	-	-

Source: European Union, 2013; Order of the Ministry of Agriculture of Russian Federation No. 3, the Ministry of Transport of the Russian Federation No. 2 of January 14, 2008 "On approval of rules of natural loss of potatoes, vegetables and cucurbits crops during segmental transport"

Particular attention should be paid to the formation of inter-regional logistics system, the operation of which will achieve the following objectives: ensuring transparency of trade and financial transactions by creating unified distribution centers, the establishment of independent quality services for the protection of consumer market from counterfeit products, as well as from products of poor quality, reducing transport costs and commodity losses.

Inter-regional logistics system in the agricultural products market, which includes a network of regional logistics centers (industry centers of collective use of high-tech equipment, municipal centers and the use of modern information techniques), will create new and improve the actors of the market infrastructure, develop exchange trade, including email, hold fairs, exhibitions, make new contacts.

Such system is the most relevant for small and medium-sized business that do not have the financial ability to create their own equipped centers for goods' sales, specialized transport companies, electronic communication systems.

Inter-regional logistics system can be created with funds of the wholesale and retail level and with funds of manufacturers, and take the form of open joint stock company (figure).

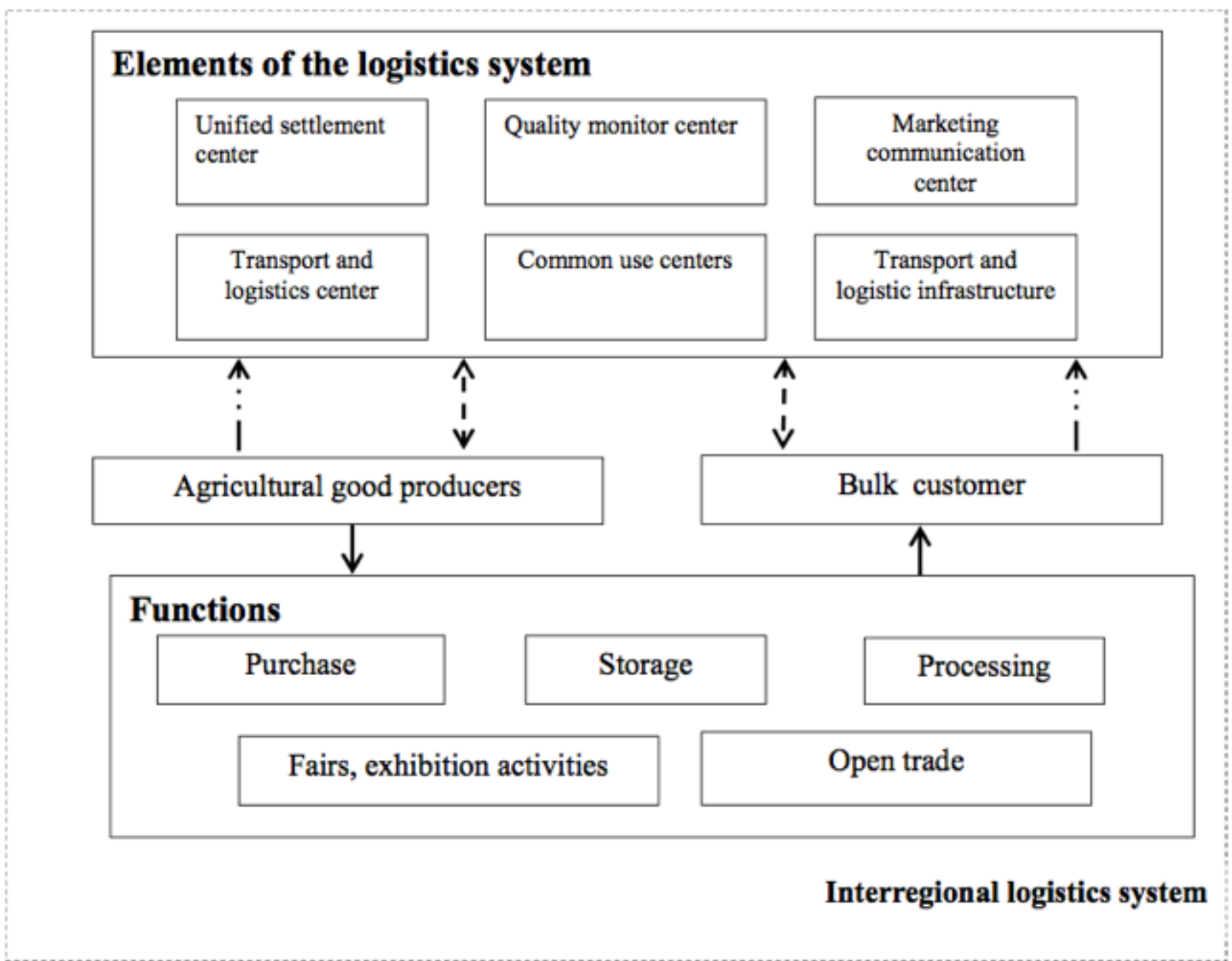
5. Discussion

It is necessary to set up distribution centers, the purpose of which is the formation and concentration of the range of products coming from manufacturers to wholesale and retail trade link. Distribution center operations can be carried out on the basis of contracts between wholesalers and regional wholesale food market. Distribution center is a specially designed storage room, specializing in the procurement, storage, supply and delivery of various types of agricultural products on a contract basis.

Distribution center is also a place where one can receive domestic products, catering on the basis of forward contract, negotiating by tender.

After logistic approaches it becomes possible to sign contracts for the supply of small parties of agricultural products at different times; to register buyers bid for the purchase of certain production batches; to transact on the basis of monthly auctions; to implement measures to control pricing.

Figure 1. Logistic scheme of optimization and storage of agricultural products



siglum:
 material flow \longrightarrow financial flow $\cdots \longrightarrow$ information flow $\leftarrow \cdots \rightarrow$

Source: Own research

Products entering to open trade will be strictly controlled in order to ensure their safety management pricing.

6. Conclusion

As a result, logistics system elements given in the figure 1 may be included in the interregional infrastructure logistics system of agricultural product distribution. They are as follows: distribution centers (wholesale regional food markets); a unified settlement center (an authorized bank); interregional exchange; marketing communication center; product quality control center; arbitration commission; objects of transport and logistics infrastructure.

In order to substantiate the effectiveness of the proposed logistics system for storage and sale of agricultural products calculations for the Saratov region were made (total length of the region's borders is 3500 kilometers, climate is temperate continental, population is 2,500 thousand people) (Table 2).

Table 2. The effectiveness of the creation of a network of logistics centers

Indicator	Calculated values
The total cost of the project, thousand \$	2500
Payback period, year	6
Profit ability of investments %	13,9
Cost of a unified settlement center, thousand \$	225
Performance indicators P at a discount rate (15 %), thousand \$	4325,525

Source: Own research

Thus, optimization of agricultural products distribution on the basis of the logistical approach will reduce the delivery time, improve product quality by losses reducing. It will lead to a significant reduction of costs, to increase in cost-effectiveness of this scope and will make this agricultural industry more investment attractive.

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