Machinery & Energetics. Journal of Rural Production Research. Kyiv. Ukraine. 2021, Vol. 12, No 4, 53-59
ISSN 2663-1334 (print), ISSN 2663-1342 (online), www.journals.nubip.edu.ua/index.php/Tekhnica

http://dx.doi.org/10.31548/machenergy2021.04.053

UDC [656.078.1+161.2]:664

FOOD SUPPLY TRANSPORT AND LOGISTICS SYSTEM ORGANIZATIONS

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Speciality of article: 275 – transport technologies (by road).

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Article History: Received – June 2021, Accepted – November 2021, Published – 17 December 2021.
Bibl. 24, fig. 1, tabl. 2.

Abstract. The logistics system for agricultural products distribution in the current global economy is the main topic for discussion in society and in the scientific literature, and food security is closely linked to the concept of sustainable economic development.

The article considers a number of factors influencing the efficiency of logistics systems for agricultural products distribution in the global economy and analyzes the problems that arise in the management of business processes in food supply chains. It is determined that in the agri-food chain the decisive factors for creating and maintaining competitive advantages are access to the best buyer at the appropriate level of quality, with the required shelf life and proper passage through the supply chain.

In the context of globalization, the competitive advantages of logistics services, based only on price and consumer properties, lose their leading importance, and in the first place are flexibility, limited lead time, reliable and high-quality supplies, choice, and so on. The complexity of the organization of transport and logistics systems for the supply of perishable food products is due to, on the one hand, the participation of a large number of links in the chain, and, on the other hand, the features of perishable goods.

Key words: agrologistics, efficiency, losses, transport and logistics system, food products.

Introduction

The need to feed the world's ever-growing population is prompting countries around the world to take measures to reduce the millions of tons of perishable waste that can be avoided throughout the supply chain. A significant part of these losses is due to suboptimal processes and the provision of transport and logistics systems for food supplies. In addition, the global coronavirus pandemic has significantly disrupted traditional supply chains and necessitated the preservation of much larger amounts of food, which further increases the likelihood of their loss.

Formulation of problem

It should be noted that the problem of food losses at all stages of the transport and logistics chain is inherent in most economies and needs to be addressed both at the national level to improve the efficiency of the agricultural sector and the welfare of the population and internationally for development, addressing the complex issues of global food security and preventing hunger. After all, modern global transport and logistics systems of food supply face a variety of social problems that are constantly deepening.

Analysis of recent research results

In most developed countries, corporate logistics costs and their share in gross national product are constantly growing. In this regard, all countries of the world develop national strategies for the development of logistics systems and conduct research on the feasibility of realizing the existing logistics potential in accordance with the strategic priorities of the national economy.

In recent years, issues and problems of organization of agrological activities have been raised in the works of V.A. Kulik, V.Ye. Marchuk, O.M. Garmash, A.P. Zakharchuk, Yu.O. Gradysky [2]; O.B. Mnykh and B.D. Grechyn [3]; R. Badia-Melis, U. Mc Carthy, L. Ruiz-Garcia, J. Garcia-Hierro, J.I. Robla Villalba [8]; A. Chaudhuri, I. Dukovska-Popovska, N. Subramanian, H. Chan, R. Bai [9]; J. Dai, W. Che, J.J. Lim, Y. Shou [10]; A. Ratul, F.Z. Megat, S. Nazmus [18]; Rachel A. Weim, John P. Reganold, David W. Crowder, Kevin M. Murphy, Lynn A. Carpenter-Boggs [19]; Zagurskiy, S. Rogach, L. Titova, I. Rogovskii, T. Pokusa [22] and other scientists.

However, despite the significant number of developments, it is not necessary to determine that a comprehensive approach to the effective organization of transport and logistics systems of food supply needs to be expanded and improved. And bearing in mind the fact that a significant part of logistics operations on the movement of material flow from the primary source of raw materials to the final consumer is carried out using different modes of transport, and the cost of these operations is up to 50% of total logistics costs, it should be emphasized the need to

consider the optimization of logistics costs in the transportation of food.

Purpose of research

The purpose of the article is to consider the factors influencing the efficiency of logistics systems for the distribution of agricultural products in the global economy and to analyze the problems that arise in the management of business processes in food supply chains.

Research results

The logistics system for agricultural products distribution in the current global economy is the main topic for discussion in society and in the scientific literature, and food security is closely linked to the concept of sustainable economic development. Logistics, as a science and practice of managing material and related flows of financial resources and information is becoming increasingly popular in the agricultural sector.

It is clear that the need to use the tools of logistics in the process of logistics of agricultural production and marketing, i.e. in the field of agro-industrial complex and the creation of a new direction in logistics - agro-logistics. After all, the organization of resource provision of agricultural producers and the promotion of their products on the market on the principles of logistics gives significant economic, social and environmental effects. O. M. Sumets defines "agrologistics" as a scientific and practical direction in the management system of agricultural entities, which allows to increase the economic efficiency of their activities by reducing intra-firm costs associated with the implementation of logistics operations and processes in the production, storage and movement of agricultural products and information about it at a certain logistics site within the established time limits, and ensuring timely and quality customer service [4].

However, if we consider the logistics system of agriculture from a functional approach, we can give the following definition: agrologistics is the interaction of cyclical forecasting and planning of agricultural production, obtaining loans or funds, purchase or preparation for the season of machinery and equipment, procurement of materials, production, processing, delivery of finished products to consumers, receipt of proceeds to the accounts of enterprises.

From the process approach agrologistics is a form of optimal organization of flows of material and technical products between suppliers and consumers of this product in a market economy, as well as rational planning, regulation and management of financial, information, service and other flows in agriculture.

Agrologistics is directly related to the distribution of agricultural products, and in a broader sense - with the creation of the most optimal system of movement of all types of agricultural products in the distribution network with high standards of service in the field of consumption. Accordingly, the management of transport and logistics systems for the supply of agricultural products should be aimed primarily at transforming the supply chain into a single, efficient system of customer service - the population.

Table 1. List of the main problems of creating an effective transport and logistics system for agricultural products distribution and ways to solve them.

Problematic issues	Solutions
Infrastructure	Investing in joint logistics centers that will create a scale effect that will increase logistics efficiency by reducing routes, distances and transportation times
Information Technology	The implementation of information technology will help reduce losses and increase competitiveness.
Integrated logistics systems	Improving the efficiency of agri-food supply chain management is aimed at uniting all participants in the supply chain into a single, efficient system
Qualified personnel	Training of specialists in the field of logistics management and employees specializing in the finishing of products with a limited shelf life.
Specialized vehicles	Involvement of refrigeration equipment in the supply chain of agricultural products increases its quality and freshness and extends the shelf life.
Services of logistics companies	Involvement of logistics service operators.
Packaging	Improving packaging technologies that minimize losses and ensure appropriate product quality.
Monitoring and traceability	Improving monitoring of product identification and taking measures to maintain its proper quality

Source: compiled by the authors on the basis of literary sources

Analysis of literature sources [13, 21] allows to form the main problems on the way to the formation of an effective transport and logistics system of agricultural products distribution and possible solutions (Table 1).

Despite all the problems and shortcomings of the agro-industrial complex, the World Bank estimates that GDP growth, which is due to agricultural growth, is at least twice as effective in reducing poverty as GDP growth in other industries, and it is the innovative development of this industry provides a large reduction of rural poverty in recent years in many countries around the world. In addition, the calculations of scientists show that one percent of additional products produced in the agricultural sector, provides an increase in production of industrial infrastructure by 2.5%, respectively, manufacturing by 1.4%, transport services – by 0.33%, adequate trade – by 2.7% [20].

Therefore, accelerating the growth rate of agricultural production on the basis of increasing its competitiveness is a

priority of economic policy [5]. If we add to this that the reduction of logistics costs by about 1% is equal to an increase in sales by 10%, it becomes clear that a well-built transport and logistics system at an agricultural enterprise can provide more income than the traditional extensive business development scheme.

Modern development of agro-industrial complex with application of agrologistics will allow:

- reduce stocks along the entire path of material flow by 30-50%;
- reduce the time of movement of goods along the logistics chain 25-45% (according to scientists of the Institute of Agrarian Economics UAAS transportation of products by field roads, which are typical for most domestic transportation at grain producers, accompanied by annual losses of 1-2% of gross grain harvest) [6];
- reduce transportation costs;
- reduce the cost of manual labor.

The above indicates the need to adapt the transport and logistics systems of the agro-industrial complex to the market model of management. The development of logistics in the agro-industrial complex will soon become more and more popular. Its colossal efficiency in business development is proved by the results of application of the logistics approach in the economy of developed countries and large agrarian vertically integrated firms.

Therefore, if we consider the transport and logistics systems of agro-industrial complex or agri-food supply chains, it should be noted that these are self-organized systems that depend on the internal and external environment. Over time, some factors determine the evolutionary direction of the entire system. The self-organizing system has the initiative to adapt and choose parameters, which means that key enterprises can negotiate and actively cooperate, weakening and assimilating negative parameters, and vice versa, increasing and developing positive parameters.

As a result, synergies between key enterprises and synergies between supply chains and the environment can be created, and supply chain efficiencies can be improved. Under certain conditions, supply chain subsystems can form self-organized structures and create new ordered connections through nonlinear interaction [12].

In the agri-food chain, the decisive factors for creating and maintaining a competitive advantage are access to the best buyer (the one who provides the highest income) at the appropriate level of quality, with the required shelf life and proper passage through the supply chain [7].

However, these requirements need to be expanded when we talk about sustainable development issues in strategic decision making. Since the ultimate goal of a sustainable agri-food chain is to meet the needs of consumers, it will be most appropriate to take into account the impact of operating activities on the environment and society. In his research, O. P. Velichko [1] and M. P. Butko emphasize that in the conditions of transformation the concept of socially responsible business is gradually spreading. In their opinion, socially responsible companies get a positive result from their social activities aimed at both external and internal environment, which is manifested in increased productivity, increasing product quality, reducing the duration of the production cycle, as well as increasing the company's reputation, increasing volume sales and a positive attitude of the population to the company, which they propose to perceive as a long-term unique competitive advantage of the firm.

At the same time, food products are special and so far irreplaceable goods of daily consumption. Their availability, quality and accessibility are the main conditions of human life and ability to work. However, despite the stable demand for food, the current market situation is characterized by certain difficulties:

1. Increasing customer requirements for product quality.
2. The importance of maintaining consistent results.
3. Unpredictable changes in the market.
4. Rising logistics costs [9].

Given this, companies in the food and processing industries, to ensure the competitiveness of their products, it is necessary to maintain a balance in the supply chain by providing optimal solutions that provide value to the company, namely:

- support of logistics costs at a reasonable level;
- efficiency of use of production equipment;
- differentiation of markets;
- providing opportunities for production growth;
- ensuring the reliability and sustainability of supplies of their products [14].

Along with the difficulties in managing business processes in food supply chains, there are also a number of problems in the development of the market for such products in general:

1. Constant changes in the formats of retail trade - the growth of forms of sales channels. Retailers seek to reach customers in different geographical locations, they create different store formats, which in turn requires an understanding of the business model for each store format and the orientation of logistics to this format;
2. Expansion and specialization of the range. Retailers use customer segmentation to more accurately identify their needs. However, most of them are unable to support the growth of the range, which affects the availability of goods on the shelf. Compliance with this requirement requires a reduction in the supply of individual items and a corresponding increase in logistics costs in general;
3. The growing importance of individual products. Trademarks are a source of differentiation for retailers. Providing these items with stocks requires significant support for demand, which is difficult to obtain without sales statistics, which leads to both an increase in the level of stocks and additional transportation costs. Accordingly, improving the quality of the forecast will increase the quality of forecasting parameters, and this will affect the level of stocks in the supply chain. Reducing inventories in the supply chain will reduce the share of urgent supplies and, as a result, reduce logistics costs.

The presence of internal difficulties in managing food supplies and external externalities in this market encourages the analysis of the supply chain and the technologies used in it. If we consider in detail the process structure of the food supply chain, it usually contains all types of activities for growing and preparing raw materials, direct production of the final product and all post-production activities, such as storage, transportation, sale (wholesale and retail) of finished products, its export and imports.

It should be noted that these activities have a number of specific characteristics such as the duration of the finished

product, seasonality in production, limited shelf life, the need for air conditioning during transportation and storage.

In this regard, food supply chains are subject to increased requirements related to their safety. The rigidity of food safety rules and the growing awareness of consumers about food safety are encouraging businesses to take steps to improve and modernize agri-food chains and are attracting increasing attention from researchers in food science, technology and supply chain management.

To ensure food safety, their quality must be carefully and continuously monitored and controlled at every stage of the supply chain. The International Organization for

actor contributing to such a high level of waste is the inability to control/monitor the temperature in global food logistics systems [8].

The problem of food losses at all stages of the transport and logistics chain is inherent in most economies and needs to be addressed both at the national level to improve the efficiency of the agricultural sector and the welfare of the population and internationally to solve complex problems. related to global food security and hunger prevention.

Thus, in the United States, Canada, Australia and New Zealand (in total) in 2011 (according to the Food and Agriculture Organization of the United Nations - FAO) there were the following losses:

Standardization (ISO) provides the most popular definition of food quality "A set of properties and characteristics of products and services related to the ability to meet the established requirements or needs of the consumer" [17].

Therefore, in order to preserve the value and quality of food products and meet customer requirements, the freshness and safety of these products must be ensured at every stage of the logistics chain. However, modern global transport and logistics food supply systems face a variety of social problems that are constantly deepening. As a result, many of them work "below ideal", with the result that about one-third of the food produced for human consumption is lost. A key f

- grain products: 38% lost vs 62% consumed;
- seafood: 50% lost vs 50% consumed;
- fruits and vegetables: 52% lost vs 48% consumed;
- meat: 22% lost vs 78% consumed;
- milk: 20% lost vs 80% consumed [15].

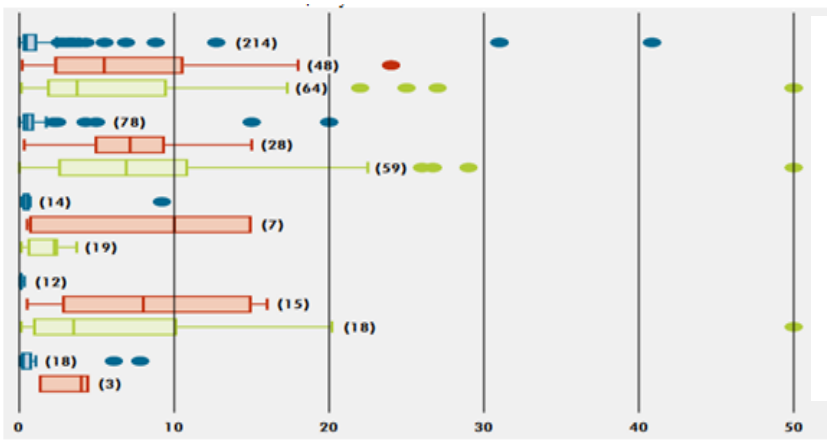
Moreover, food losses occur along the entire food production and distribution chain. Thus, the data of the Regional Office for Europe and Central Asia of the Food and Agriculture Organization of the United Nations - FAO show that the aver age loss of basic perishable foods (cereals, potatoes, fruits and vegetables, meat, milk) is almost evenly distributed between supply chain operations (Table 2).

Table 2. Average level of losses of agricultural products along the supply chain, %.

Product	Supply chain operations				
	Production	Storage	Processing and packaging	Distribution	Consumption
Crops	10-40	5-10	5-10	4-10	5-15
Potatoes	10-20	10-30	2-5	2-10	2-15
Fruits and vegetables	2-10	10-40	2-5	5-15	5-10
Meat	5-15	5-20	5-15	5-20	2-5
Milk	10-30	2-5	10-30	10-20	10-15

Source: Themen D. Food losses and waste in Ukraine [Electronic resource]. Regional Office for Europe and Central Asia Food and Agriculture Organization of the UN. 2013. URL: http://www.fao.org/europe/agrarian-structures-initiative/en

If we consider in more detail the places of origin and scale of losses and spoilage of food products at all stages of the food supply chain, for example for cereals and legumes (Fig. 1), then according to FAO studies in 2000-2017, conducted for countries in Asia and Africa, they were as follows.



NOTE: the number of observations is given in parentheses. Dates (2000-2017) refer to the time of the measurements, but in cases where the survey dates were unknown or known inaccurately, the dates of their publication were used.

Fig. 1. Places of loss and spoilage of cereals and legumes in Asia and Africa in 2000-2017- (%)

Source: FAO research data for 2000-2017.

Such losses led to the fact that in 2010 the total volume of unsold goods increased by 3-5 billion US dollars compared to 2008 [16].

In our opinion, the reasons for such deterioration can be divided into three categories. Firstly, the reduction of consumer tolerance regarding to the level of food quality. Secondly, it is the potential lack or lack of control over the cargo, which can lead to the supply to the market of unmarketable goods, which, in turn, can pose a threat to consumer health. Product spoilage during distribution is a serious problem. About one-third of the world's food production is spoiled or lost, with a total loss of 1.3 billion tons per year. Food losses in the United States alone are estimated at about 10% of the country's total food supply at the retail level [15]. Thirdly, the difficulty is the urgent need to reduce high operating costs in transport and logistics systems and at the same time increase the efficiency of their work.

Conclusions

1. In the context of globalization, the competitive advantages of logistics services, based only on price and consumer properties, lose their leading importance, and in the first place are flexibility, limited lead time, reliable and high-quality supplies, choice, and so on. In the context of globalization, effective management of logistics and trade flows have become a central element of the competitiveness of almost any company that plans to operate internationally. And the global trend of logistics of the modern economy is "7R" rule whose main slogan is: the right product - the right quality - in the right quantity - must be delivered - at the right time - and in the right place - the right consumer - with the right level of costs.

2. The complexity of the organization of transport and logistics systems for the supply of perishable food products is due to, on the one hand, the participation of a large number of links in the chain, and, on the other hand, the features of perishable goods, namely: scattering of perishable food production points; seasonality of freight flows; the complexity of coordination of loading and unloading processes on interacting modes of transport; indeterminate arrival of rolling stock to transshipment points (transport hubs); non-deterministic mode of transportation of perishable goods to wholesale collection points; forced the need for reverse empty run of rolling stock; the need to pass phytosanitary and veterinary control when crossing state borders, which delays cargo at terminals of departure and destination, often not adapted for storage of perishable products.

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ОРГАНІЗАЦІЇ ТРАНСПОРТНО-ЛОГІСТИЧНИХ СИСТЕМ ПОСТАЧАНЬ ХАРЧОВИХ ПРОДУКТІВ

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Анотація. Логістична система розподілу сільськогосподарської продукції в нинішній, глобальній економіці є основним предметом дискусії як в суспільстві так і в науковій літературі, а продовольча безпека розглядається у тісному взаємозв'язку з концепцією сталого розвитку економіки країни.

В статті розглянуто низку факторів, що впливають на ефективність логістичних систем розподілу сільськогосподарської продукції в глобальній економіці та аналіз проблем, що виникають в управлінні бізнес-процесами в ланцюгах постачань харчових продуктів. Визначено, що в агропродовольчому ланцюгу вирішальними факторами для створення та підтримки конкурентних переваг є доступ до найкращого покупця за належного рівня якості, з необхідним терміном придатності та належним проходженням по ланцюгу постачання.

В умовах глобалізації конкурентні переваги логістичних послуг, засновані тільки на цінових і споживчих властивостях, втрачають провідне значення, а на перше місце виходять гнучкість, обмежені терміни виконання замовлення, надійні та якісні постачання, можливість вибору тощо. Складність організації транспортно-логістичних систем постачань швидкопсувних харчових продуктів обумовлена, з одного боку, – участю великої кількості ланок у ланцюзі, а з іншого боку, – особливостями швидкопсувних вантажів.

Ключові слова: агрологістика, ефективність, втрати, транспортно-логістична система, харчові продукти.

ОРГАНИЗАЦИИ ТРАНСПОРТНО-ЛОГИСТИЧЕСКИХ СИСТЕМ ПОСТАВОК ПИЩЕВЫХ ПРОДУКТОВ

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Аннотация. Логистическая система распределения сельскохозяйственной продукции в нынешней, глобальной экономике является основным предметом дискуссии, как в обществе, так и в научной литературе, а продовольственная безопасность рассматривается в тесной взаимосвязи с концепцией устойчивого развития экономики страны. В статье рассмотрен ряд факторов, влияющих на эффективность логистических систем распределения сельскохозяйственной продукции в глобальной экономике и анализ проблем, возникающих в управлении бизнес-процессами в цепях поставок пищевых продуктов. Определено, что в агропродовольственной цепи решающими факторами для создания и поддержания конкурентных преимуществ есть доступ к лучшему покупателя при надлежащем уровне качества, с необходимым сроком годности и должном прохождением по цепи поставки.

В условиях глобализации конкурентные преимущества логистических услуг, основанные только на ценовых и потребительских свойствах, теряют ведущее значение, а на первое место выходят гибкость, ограниченные сроки выполнения заказа, надежные и качественные поставки, возможность выбора и т. п. Сложность организации транспортно-логистических систем поставок скоропортящихся пищевых продуктов обусловлена, с одной стороны, - участием большого количества звеньев в цепи, а с другой - особенностями скоропортящихся грузов.

Ключевые слова: агрологистика, эффективность, потери, транспортно-логистическая система, пищевые продукты.

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