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EMPIRICAL MODEL OF LOGISTIC SUPPLY OF INTERNATIONAL INTEGRATION OF GRAIN PRODUCERS OF UKRAINE

EMPIRYCZNY MODEL ZABEZPIECZENIA LOGISTYCZNEGO MIĘDZYNARODOWEJ INTEGRACJI PRODUCENTÓW ZBÓŻ UKRAINY

Introduction

Cereal production and their export are a stable source of currency inflows that can provide Ukraine with positive GDP due to the large export potential of grain crops. However, it is necessary to adopt the relevant rules of the game and introduce modern effective trade mechanisms that will allow Ukraine to fully integrate into the world grain market and hope for a dominant position in the near future.

The grain market in Ukraine is significantly regulated by the authorities, what is objectively explained by the necessity of provision of food security as the essential part of the national security of the state. The complexity of the management system and the constant changes in its structural configuration contribute to the corresponding misuse of the grain product subcomplex of the agro-industrial complex, which, taking into account its scale, is particularly attractive in the field of such "public interests". Therefore, ensuring the transparency of the functioning of the grain market and creating an equal level playing field for all its participants is a fundamental principle of the efficient development of the logistics system in the grain-product subcomplex of the Ukrainian agro-industrial complex. Getting decent financial results

that ensure the process of expanded reproduction of production involves the free access of grain producers to market mechanisms of mutual relations with buyers, and no monopoly obligations to price dictates of intermediary monopolies. This can be achieved through the access of farmers and other grain producers in the regions of Ukraine to stock exchange pricing and sales mechanisms, as well as the use of progressive schemes of independent access to the international grain market.

1. Purpose, materials and method of research

The purpose of the article is to present main results of investigation of possibility of an empirical model of logistic support for the export operations of grain producers in Ukraine on the basis of existing and proposed institutional elements creation. To achieve this goal, we solved the following tasks: on the basis of the dialectical method of cognition of objective reality and using the general scientific method of simulation to form an integrated model of the effective development of grain logistics in Ukraine, which covers the whole logistical chain in the grain product subcomplex of the agroindustrial complex from field to linear or port elevator on the scale of all Ukraine with the possibility of entering the world grain market. On the basis of the monographic method the structure and directions of the Association of Agrarian Carriers of Ukraine and the Derhprodspozhywsluzhba (State Food Consumer Service) on the functional correspondence of the empirical model were investigated. The study used available statistical data from official statistical sources, as well as materials from the scientific literature devoted to the presentation of research results on the development of the process of adaptation of Ukrainian grain producers to the conditions of the global market and increasing the efficiency of export operations with Ukrainian grain.

2. Main results of the study

Material flows, which are the basis of the functioning of the logistics system, transforming from a dynamic state into a static, are forming material stocks. If all the complexity of the logistics system can be elimitized and the elements of storage of grain masses separated from it, then the primitive nature of the activity of the Ukrainian elevator enterprises consists in limiting their functional to the level "took the grain to the warehouse – gave the grain", that is, the seller and the buyer of grain, which, being in different regions of Ukraine, provide inter-boundary movement of a certain batch of grain from the place of its storage to the place of its consumption.

The proposed by us[1] conceptually new approach to the organization of the functioning of logistical systems in the grain product subcomplex of the agroindustrial complex[2] will contribute to the maximum reduction of the transport component

[1] V. Kolodiychuk, *Conceptual model of optimization of the logistic system in the grain-product subcomplex of agrarian and industrial complex of Ukraine,* „Economy of agroindustrial complex", 2016, nr. 5, p. 60–65.

[2] V. Kolodiychuk, *Branch positioning of the grain-product subcomplex of agroindustrial complex of Ukraine,* „Economic Journal-XXI: Sciences. Magazine", 2014, nr. 9–10 (1), p. 45–48.

in the cost structure due to certain "virtualization" of material flows between the certified elevator facilities. As of 01.06.18 in Ukraine, there are 761 enterprises with the simultaneous implementation of the monitoring system and provision of interregional grain balances (Logistics Monitoring Center). Since grain grown in all regions of Ukraine is a standardized product, which places it on the list of features as stock commodity, we have proposed the maximum reduction of the tension between interregional cereal flows through the interchange of already impersonal grain lots. That is, the seller transfers the right of ownership to the buyer in the form of the corresponding document (warehouse certificate) in the case of sale, and the buyer receives the grain with the corresponding quantitative and qualitative parameters on the certified grain stock in his area.

The advantages of the proposed scheme for optimizing the logistics system are:

- implementation of the objective function of the logistic system in the grain -product subcomplex of the AIC and increase of the synergistic effect from the interaction of its constituent elements;
- facilitation of solving the problem of non-compliance of the existing capacity of certified grain elevators with grain supply parameters in Ukraine due to the priority export of Black Sea grain from the southern regions without its storage during peak load periods on port elevators;
- reduction of transport costs for the invariability or increase of the volume of commercial transactions due to the cancellation of stochastic transport of small batches of grain due to the replacement of their centralized movement of consolidated lots (routing of rail transportation instead of wagonloads);
- institutional support for the operation of information flows (Monitoring Center for the logistics system) will facilitate the reduction of transaction costs for all logistics chain participants without exception;
- simplification of the system of state monitoring of the state of grain balance and the efficiency of state interventions and the implementation of social programs for the provision of Ukrainian regions;
- facilitating the development of the stock market in Ukraine, especially as regards the conclusion of spot transactions;
- stimulation of grain-preserving enterprises for the certification of capacities that will enable them to take advantage of the "virtualization" of grain flows;
- increase the investment attractiveness of the grain-product subcomplex of the agroindustrial complex and create organizational preconditions for the efficient functioning of the financial flows of the logistics system.

For the effectiveness of the proposed mechanism, it is necessary to ensure:

- legislative regulation of qualitatively new relations through the adoption and implementation of offensive laws on logistics activities, grain product subcomplex of the AIC and other legislative acts regulating the whole range of legal relations between participants in the logistics chain;
- bringing of the quality characteristics of the grain mass to the international standards in line with the objective laboratory quality control of grain,

eliminating of the manipulation of qualitative and price characteristics between the elements of the specified system;
- participation of all certified grain storage facilities in the "virtualization" of grain flows and a single system for monitoring and ensuring interregional grain balances;
- the appropriate level of protection of the forms of documents for ownership of the grain;
- unification of requirements and rules of work with clients and corresponding documents;
- the equality of all participants in the distribution of the synergistic effect from the introduction of the conceptual model of the mechanism of optimization of the logistics system.

Of course, material flow is the basis of the functioning of the logistics system, and informational and financial flows are positioned as security flows. However, the movement and modification of the material flow is the most costly component of the logistics system, and our proposals for partial virtualization of grain flows implement the idea of a partial replacement of expendable physical functions with cheaper information flows in relation to manipulations with grain. At the same time, the logistic system in the grain-product subcomplex of the AIC implements its target function, since the buyer physically removes the grain with the corresponding quantitative and qualitative parameters at the nearest elevator, and the seller – the corresponding amount of funds for realization of products. For the effectiveness of the proposed model space-time synchronization of grain, information and financial flows is required, and we propose to solve this problem by involving an additional structural unit – the Center for monitoring logistics system. The proposed institutional structure assumes the functions of synchronizing logistic flows, maximally replacing the stochastic transport of grain of individual traders by centralized routing to achieve interregional grain balances in Ukraine.

The empirical level of our research requires the verification of the proposed model of the mechanism of logistics of grain flows into the system of branch relations in the grain market of Ukraine. If the proposed mechanism, which is an element of a multicomponent environment, will fit into the existing system organically, this will mean its new quality and the prospect of further development.

Investigating the tendencies of logistics development in Ukraine and forecasting the situation in the short and medium term, we drew attention to the perspectives of the Unified Agrarian Logistic System of Ukraine (UALS), which in early 2014 was presented by the Association of Agrarian Carriers of Ukraine (AACU)[3]. The said project, which contains innovative solutions in the field of road transport, supported by the Ministry of Agrarian Policy and Food of Ukraine, the Ministry of Infrastructure of Ukraine and the Ministry of Economy of Ukraine, has raised interest in the

[3] II All-Ukrainian Congress of the AACU *„Unified Agrarian System as the Basis of Economic Efficiency"*. Access mode: http://aapu.com.ua/ii-vseukrainskij-kongress-associacii-apu/(accessed 25.01.2018).

direct participants in the agrarian market. Partial testing of such a system, over which the domestic and foreign experts worked, was conducted during the 2014 harvest in a testing regime in individual agroholdings, which made it possible to identify and take into account certain disadvantages. Taking as a basis the CALS[4*] and the mechanism proposed by us for optimizing the logistics system in the grain-product subcomplex of the agroindustrial complex and combining them, we show in Fig. 1 integrated empirical model of effective grain logistics development in Ukraine.

CALS of Ukraine is created to unite all the participants of the agrarian market – customers (agroholdings), carriers and elevators – in order to establish effective interaction on the basis of direct contracts. Providing a direct operational relationship between agroholdings and carriers of agricultural products will obviously contribute to a reduction in the cost of transportation and a corresponding reduction in tariffs, as well as to the improvement of the quality of transport services for agricultural producers. The only agro-logistic system of Ukraine is in fact the first stage in the creation of a project for dispatching logistics of agroholdings.

There are operators in the analytical center on the constant communication with both agroholdings and carriers. Information from the customer about the need to transport the grain enters the analytical center, the operator through the relevant software analyzes the request and sends information to the target carriers through SMS-billing connected to the system. The carrier, who is interested in the order, connects to the operator and confirms the readiness for carriage. Once the cargo is accepted for carriage, the operator records the status of the car in the system – „busy", which eliminates the possibility of simultaneous car ordering by other agroholdings and facilitates the work of logisticians. Upon completion of transportation, the operator changes the status of the car to the status "free", which allows other agroholdings to attract the exempted vehicle for transportation. Upon completion, the agrohold-ing may put forward to the carrier an evaluation that forms the rating of the latter and stimulates it to improve the quality of transport services. Such a system allows to automate the process and to minimize the time of presentation of the truck to the place of loading, since the established algorithm for solving the transport problem helps to separate all agricultural areas into technical zones and provides first-hand delivery of the vehicle that is currently in the immediate vicinity. As the vehicle is occupied, the system finds free vehicles away from the place of loading until it chooses the best option. This allows to reduce the mileage distance of the empty vehicle and to reduce both the cost of transportation and the tariff.

The undeniable advantage of CALS is the ability to maintain continuous automated communication between the driver and the customer. For agroholdings, it is important to forecast costs before the harvest is commenced and the CALS allows financial conditions to be agreed with the transport services providers in advance, since the proposed agro-logistic system solves the tasks of the transit pricing in transport and, accordingly, the tariffing of transportation.

[4] * Consolidated Agrilogistic System.

Among the innovative capabilities of the CALS, it should be noted that the planned project implementation of the electronic signature module for users of the CALS, which accelerates the work processes and automates the decision-making process for the participants of the transport process. In addition, due to the specifics of the agrarian market, it is technologically impossible to provide paper document circulation from the driver's cab, therefore, there is a need for a transport forwarding company to be involved, which increases the transportation tariff for the agroholding without creating added value.

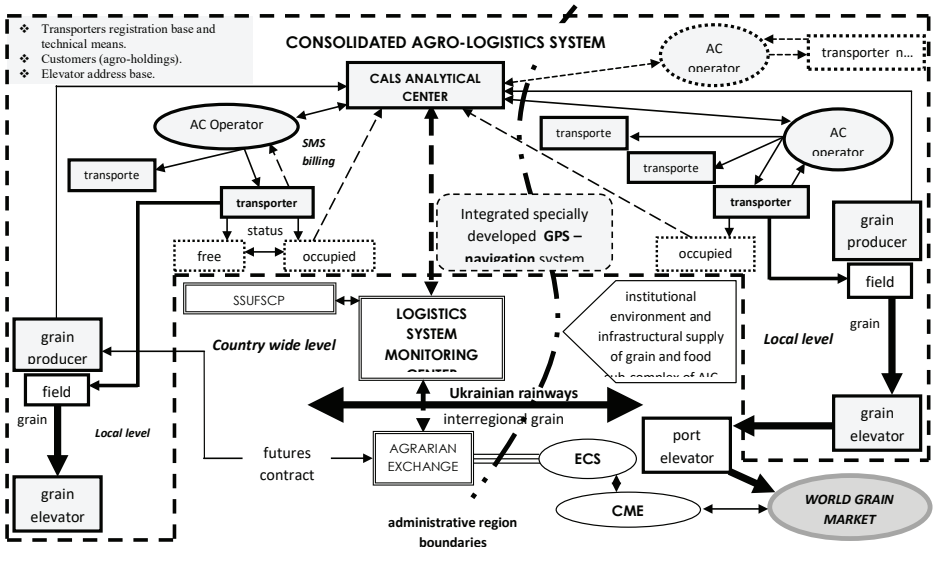

Figure 1. Scheme of integrated empirical model of effective development of grain logistics in Ukraine

By integrating our proposed model of the mechanism of the logistics system's functioning and the model CALS of the Association of Agrarian Carriers, we actually cover the whole logistics chain in the grain-product subcomplex of the agro-industrial complex. Since logistics involves improving of low management from the primary source of raw material to the consumer of the final product, we can state that the integrated model covers almost the whole logistics system (in the processing sector), since the CALS proposals relate to the logistics of intra-regional grain flows in the "field-elevator" system, but proposed by us model – "elevator – elevator" or "elevator-port" in a scale of Ukraine.

The material flow, that is the basis of the logistics management, has a consistent relationship with the Consolidated Agrilogistic System and the model proposed by us and can be subject to independent manipulation in both models. Moreover, the seasonal tension of the material flow in the CALS is noticeable, as the system generates grain flows between the field and the elevator only during the harvest period, and the model proposed by us – in the period of export and internal consumption

of grain with less noticeable seasonal fluctuations. Another warning of the CALS model is its targeted focus on agroholdings servicing, which account for almost a third of the total supply of grain in Ukraine, and other businesses actually turned out to be outside this service. In our opinion, the functionalities of the CALS need to be expanded to serve the medium-sized scale of production of farms and individual small producers. If large-scale enterprises have all the prerequisites for engaging in the scale-effect by reducing the constant costs per unit grain mass and maintaining appropriate competitive positions, then small-scale producers, having harvested, are faced with a complex logistical problem. In practice, they are forced to immediately sell grain to agricultural traders at a lower price, which is naturally formed in the post-harvest period, because the lack of own grain-saving capacities, lack of vehicles and the high cost of elevator services does not leave them alternatives.

By solving the complexity of the problem of the efficiency of the logistics systems functioning in the grain subcomplex of the agriindustrial complex of Ukraine, we could not overcome this problem and proposed appropriate tools for integrating small-scale producers into the world grain market (see Fig. 1). We are talking about a complete market of commodity derivatives (futures and forward contracts, etc.) in Ukraine, which will enable Ukrainian producers to use world experience in managing price risks and independently carry out operations on the world grain market.

Financial flows that ensure the functioning of the integrated model of efficient grain logistics development are also sufficiently structured, so there should be no problems arising from the integration of the CALS and the model proposed by us. Financial settlements between carriers and agroholdings in the "field-elevator" system are carried out in accordance with the tariffs, settlements between the CALS and its users are carried out by means of SMS billing and corresponding membership fees, and further mutual settlements between the elements of the logistic chain in the model proposed by us are an integral part of the commodity-monetary relations of a market economy.

By specifying the status of the proposed Logistics Monitoring Centre, we are inclined to think about the expediency of its state subordination in view of the strategic importance of the agricultural product subcomplex of the agro-industrial complex in ensuring of food security of Ukraine. This status will determine the budgetary sources of investment in this specified institutional structure.

Synchronization of information flows in the integrated model (see. Fig. 1) should be ensured between the Logistics Monitoring Center and the CALS Analytical Center. It is advisable to exchange information with regard to the base of elevators, as well as operational control and provision of grain balances in adjacent areas, where there is rational use of road transport. In fact, the model proposed by us can act as a customer of short distance transport (up to 300 km) to provide interregional grain balances. Since the peaks of the traffic intensity in the CALS model and in the scheme proposed for providing inter-elevator grain movements have a time lag, this, of course, will be of interest not only in the Association of Agrarian Carriers of Ukraine as a coordinating structure of the CALS, but also directly to the forwarding agent companies that lose their income from seasonal intensity.

In order to provide analytical research and market forecasts on the domestic grain market between the Monitoring Center of the logistics system and the Agrarian Exchange (see Figure 1), it is necessary to establish an informational relationship that will enable the integrated model of effective development of the grain and agricultural complex of the agro-industrial complex to establish communication with the global stock market of grain. Improving and launching of the E-Commerce System (ECS) at the Agrarian Stock Exchange for a full-fledged commodity derivatives market in Ukraine will help national producers to use world-wide experience in price risks managing and to do some more predictable production activities.

Along with the implementation of educational programs working with the mechanisms of electronic exchange trading, we offer to ensure the compatibility of the ECS with the electronic trading platform CME GLOBEX and other virtual trading platforms, since the openness of the ECS will enable the Ukrainian food industry to effectively integrate into the world food market and ensure the compliance of domestic and world prices for grain.

Conclusions

The process of management of material, informational and financial flows involves their spatial-temporal synchronization with the goal of maximizing the systemic effect. The formed empirical model of the effective development of grain logistics in Ukraine on the basis of integration of the model of the Consolidated Agrilogistic System of Ukraine of the Association of Agrarian Carriers and the author's conceptual model of the mechanism of optimization of the logistics system in the grain product subcomplex of the Agriindustrial Complex allows to cover the entire logistical chain in the grain product subcomplex of the agriindustrial complex from field to linear or port elevators on the whole of Ukraine. Information relationship between the Logistics Monitoring Center and the Agrarian Stock Exchange will help the integrated model of the effective development of grain products of the AIC complex to establish communication with the global stock market of grain.

Summary

The article presents the results of the elaboration of an empirical logistic ensuring model for the efficiency of export operations of cereal producers in Ukraine on the basis of existing and proposed institutional elements. It was examined that the process of material, information and financial flows management provides for their spatiotemporal synchronization in order to maximize the systemic effect. Based on the integration of the Consolidated Agrilogistic System (CALS) of the Association of Agrarian Carriers of Ukraine (AACU) and the original conceptual model of the transformation mechanism of the logistics system of the Ukrainian food industry, an empirical model for the effective development of national grain logistics has been proposed.

Keywords: empirical model, logistics, international integration, grain.

Streszczenie

W artykule przedstawiono rezultaty opracowania empirycznego modelu zabezpieczenia logistycznego efektywności operacji eksportowych producentów zbóż na Ukrainie na podstawie istniejących i proponowanych elementów instytucjonalnych. Zbadano, że proces zarządzania przepływami materiałowymi, informacyjnymi i finansowymi przewiduje ich synchronizację czasoprzestrzenną w celu maksymalizacji efektu systemowego. W oparciu o integrację Zunifikowanego Systemu Agrologistycznego (ZSAL) Stowarzyszenia Przewoźników Agrarnych Ukrainy i autorskiego koncepcyjnego modelu mechanizmu transformacji systemu logistycznego sektora zbożowego gospodarki żywnościowej Ukrainy, zaproponowano empiryczny model efektywnego rozwoju krajowej logistyki zboża.

Słowa kluczowe: model empiryczny, logistyka, integracja międzynarodowa, zboże.

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