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MANAGEMENT OF BUSINESS PROCESSES IN LOGISTICAL NETWORKS OF THE FOOD SUPPLY CHAIN

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УПРАВЛІННЯ БІЗНЕС-ПРОЦЕСАМИ У ЛОГІСТИЧНИХ МЕРЕЖАХ ПРОДОВОЛЬЧОГО ЛАНЦЮГА ПОСТАЧАННЯ

The logistics strategy of building business processes is an essential component of efficient management in the food supply chain under contemporary conditions. It is to provide appropriate availability of the goods while transporting them to the sales market. Owing to the sales intermediaries, it is possible to reduce the number of direct contacts of producers with consumers of the produce. The features of management in operational process within the sales logistics system have been considered. The method of the research is the development of logistic networks and designing decisions aimed at their optimization under the conditions of the trade -intermediary activity at the foodstuffs market. The methodological component of the research is focused on the integrated application of rationalistic and providing logistics concepts, criteria analysis, linear programming and logistical modeling. The material of the research was chosen a set of trade-intermediary organizations, which work at the market of foodstuffs in Central and Eastern areas of Ukraine. Transformation of the known information from the operational management to new

objects in the system of trade foodstuffs logistics had further development. Integrated methodical approaches to projecting rational decisions in the area of managing logistics of distribution have been grounded. The ways of optimizing the supply process and transportation at goods distribution by distribution channels have been grounded. Preconditions to efficient management over supply chain in the system of trade logistics have been generalized. Application of the method of the transportation task while projecting the managerial decision on the optimal plan of foodstuffs transportation makes possible to determine the content and the quantity of the goods which can reasonable be supplied to residential areas of the city. The suggested logistical model additionally provides optimal distribution of goods by distribution channels considering the main factors which influence the efficiency of food supply chain management. The value of the obtained research results can be seen as the development of possibilities for efficient management over the logistics networks in the system of the trade logistics. The developed recommendations can be used by trade-intermediary organizations for managing food supply chain.

У сучасних умовах логістична стратегія побудови бізнес-процесів є важливою складовою ефективного управління продовольчим ланцюгом постачання. Вона має забезпечувати належну доступність товару при прямуванні його до ринку збуту. За допомогою торговельних посередників можна скоротити кількість прямих контактів виробників із споживачами продукції. У статті розглянуто особливості менеджменту операційних процесів в системі торговельної логістики. Метою дослідження є розвиток логістичних мереж та проектування рішень щодо їх оптимізації в умовах торговельно-посередницької діяльності на ринку продовольчих товарів. Методологічна складова дослідження зорієнтована на інтегроване використання положень концепції раціоналістичної та забезпечувальної логістики, критеріального аналізу, лінійного програмування, а також логістичного моделювання. Матеріалами для досліджень було обрано низку торговельно-посередницьких організацій, які працюють на ринку продовольчих товарів у Центральному та Східному регіонах України. Дістало подальшого розвитку перенесення відомих знань із операційного менеджменту на нові об'єкти в системі торговельної логістики продовольчих товарів. Обгрунтовано інтегровані методичні підходи до проектування раціональних рішень в середовищі управління логістикою дистрибуції. Запропоновано шляхи оптимізації процесу управління постачанням та транспортними перевезеннями при розподілі продукції за каналами реалізації. Узагальнено передумови ефективності управління ланцюгом постачання в системі торговельної логістики. Застосування методу транспортної задачі при проектуванні управлінського рішення щодо оптимального плану перевезень продовольчої продукції дозволяє встановити із якого складу і яку кількість продукції найбільш доцільно транспортувати у житловий район міста. До того ж часу запропонована логістична модель додатково забезпечує оптимальний розподіл продукції за каналами реалізації із урахуванням основних чинників впливу на ефективність управління продовольчим ланцюгом постачання. Цінність одержаних результатів дослідження полягає у розвитку можливостей для ефективного управління логістичними мережами в системі торговельної логістики. Розроблені рекомендації можуть бути використані торговельно-посередницькими організаціями в управлінні продовольчим ланцюгом постачання.

Keywords: *logistics; management; trade; optimization; operations; distribution; supply; transportation; food.*

Ключові слова: *логістика; менеджмент; торгівля; оптимізація; операції; дистрибуція; постачання; транспортування; продовольство.*

Setting a task.

Efficient business-process management and optimal use of produce distribution channels are of a great importance in the supply chain management. To achieve maximal economic effect in the supply and distribution policy

of an enterprise it is reasonable to optimize amounts of produce sales. Such rationalization of business processes is essential for distribution channels at different time periods. Moreover it is necessary to consider various limiting factors. Among them special attention should be paid to the forecast demand, storage facilities, fixed orders and so on. Besides, there are also produce distribution limitations connected with stakeholders. At that the widespread availability of goods should be provided for while moving them directly to the sales market. With the help of trading intermediaries it is possible to decrease the number of direct contacts of producers with consumers of products. Such a role can be successfully performed by supply-selling organizations, wholesale traders, stock exchange structures and others.

All these business processes are important objects for the logistics management. And such management at the same time is focused on both rationalistic and providing logistics of the enterprising organization. Nowadays the logistical strategy of building business-processes is important and for the food supply chain hence it is a necessary condition of strengthening the food security, development of the competitive national economy, strengthening of food industry positions at the world market and so on. Nowadays an important task is the implementation of the grounded approaches to logistics management of business development with the purpose of providing stable competitive conditions in a strategic perspective. A modern enterprise in the system of food industry has to not only outperform competitors in more efficient use of the internal potential, but also to have a more flexible, adaptive reaction to external possibilities and threats.

However those issues have not been sufficiently studied in modern economic publications. Further development of strategic innovative approaches to formation and usage of the resource potential of trade intermediary organizations in the field industry is required. Therefore in modern conditions there is an objective need for further profound research in the process of developing food supply chains under the conditions of institutional changes.

Analysis of the latest publications.

The issue of managing business processes in the food supply chain is the topic of the researches carried out by many contemporary scientists. In particular, B. Devin and C. Richards consider the socially responsible behavior of trade intermediary organizations as an essential condition of the efficient food supply chain [4]. Researchers Ye.V. Krykav's'kyj et. al. [1] pay attention to the actuality of such behavior.

Moreover M.M. Aung and Y.S. Chang have studied the importance of the efficient tracking of the chain with the aim of further prospect and safety. At that the researchers pay much attention to the fact that the food industry becomes more and more consumer-focused and it requires quick actions to solve the problems connected with food incidents. Effective tracking systems help to minimize the production and spread of dangerous and low-quality produce [2]. In addition F. Tian notes that in the past few years food security has become a significant problem in China. It is determined by the fact that the traditional model of food logistics cannot match market needs, and the consumer system of tracking chains of agricultural produce becomes more and more vital [10]. Whereas C. Göbel et. al. describe similar problems in the food logistics of Germany [5], and J.M. Soon et. al. – in several Islamic countries [9].

General coordination of the supply chain in the food industry has been profoundly studied by K. Govindan. The attention is focused on the institutional theory, theory of dynamic possibilities and stakeholder theory. Moreover the researcher has developed a conceptual frame by determining indicators, factors and barriers. It is based on the stakeholder theory for achieving a high level of coordination in the food supply chain. Different limitations and futuristic amount of the produce supply are also considered in the research [6].

With the help of the interpretive structural model (ISM) A. Haleem et. al. developed the structural-hierarchical model of the determined barriers in the food supply chain. Key objects in management here are logistical operations [7]. Similar studies were carried out by J. Havenga et. al. regarding costs in the area of trade logistics [8].

At that D. Chu et. al. has suggested the new base for achieving the optimal trading route in the logistical network. After thorough examination of the features of the logistics network, the issue of optimizing the route is divided into several subprograms, which are modeled into the hierarchical graph. But the traditional problem of routing is solved by scientists by conducting the combinatorial optimization in the determined transport network [3].

Meanwhile, regardless numerous examinations of the issue of managing material flows from different chains and participants, the food supply chain, a number of issues remain insufficiently studied. Moreover many issues have no corresponding answers from the point of view of efficiency mechanisms and conditions of applying those mechanisms. In particular it concerns the need to profound study of management in logistics systems in the area of trade intermediary activity, as well as development of notions on methods of rationalistic and provisional logistics in the system of the material flow of the foodstuffs. The further search for the efficient selection and application of the complex methodical approaches to planning rational decisions of trade companies in distribution logistics is required. Besides, further ways of optimizing the process of management over the supply and transportation costs at allocation of foodstuffs by distribution channels are actual. That is why the main tasks of the scientific research have been set.

Purposes of the research.

The purpose of the research is development of logistical networks and projecting decisions on optimization under conditions of trade intermediary activity at the market of foodstuffs. The research is based on the idea of applying the known information from the operational management to new objects in the system of trade logistics of foodstuffs. The methodological component of the research is focused on the integrated application of the provision of the concept on rationalistic [11] and providing [12] logistics, criteria analysis, linear programming as well as logistical modeling.

The object of the research is the process of managing the food supply chain in the system of trade logistics.

The object of the research is theoretical-methodological and practical aspects in management of business processes of logistical networks.

The materials of the research were chosen a number of trade-intermediary organizations which work on food markets of Central and Eastern regions of Ukraine. In particular, the research was based on materials provided by three companies in the area of distributing candy goods LLC “Dakort”, LLC “Avangard Grand” and TH “Login”.

At that general scientific and special examination methods were used in the research. Among the latter are monographic, calculating-constructive, comparison, graphic methods, linear programming, criteria analysis and so on.

Results of the research.

To assess the consumers and their further selection, multi-criteria approach with the author’s development have been used in the research. In particular, for the Trading House “Login” it was necessary to carry out the selection of one of the four possible consumers (“Velyka Lozhka”, “Billa-Ukraine”, “ATB” and “Silpo”), which was the most important and which should be focused on. With this purpose by the qualitative analysis we form the system of possible criteria for assessing each consumer: K_1 – price of the goods; K_2 – distance to the end-user; K_3 – types and conditions of transportation; K_4 – delivery at the exact time; K_5 – rates of changes in consumer requirements; K_6 – insistence to improving goods; K_7 – activity in sales support; K_8 – possibility of uniting informational systems.

For further application of these criteria with the purpose of forming the non-conflict system we carried out its test to logical freedom from contradictions and relative dependence. Then the half-matrix was built to determine the importance of each criterion (table 1).

Table 1. Half-matrix of determining the importance of each criterion

Criterion	K1	K2	K3	K4	K5	K6	K7	K8	Numbers of advantages	Importance, %	Sequence
K1		K2	K3	K4	K5	K1	K7	K1	2	7.1	4
K2			K3	K2	K5	K6	K7	K8	2	7.1	4
K3				K3	K3	K6	K3	K3	6	21.5	1
K4					K5	K5	K4	K4	3	10.7	3
K5						K6	K5	K5	6	21.5	1
K6							K7	K6	4	14.3	2
K7								K8	3	10.7	3
K8									2	7.1	4
Total									28	100	-

Source: developed by the third author

Assessment of importance of each criterion was made by forming the half-matrix, in numbers of which there are the numbers of those criteria which are important in the pairwise comparison with the others. The obtained number of advantages for each criterion is normalized which determines the importance of each criterion. The last graph of the table forms the sequence of criteria considering their importance for the overall rating customer suitability. Thus the first place is taken by the types and conditions of transportation (K_3) and rate of changes in customer demands (K_5), whereas the price of the good (K_1) is only on the fourth place. The estimation of each consumer by the selected criteria is carried out by the expert method. Expert assessments are provided in the ten-point scale (table 2).

Table 2. Evaluation matrix for choosing the consumer

Criterion	Importance of the criterion (norm)	Estimation of the criteria for each consumer							
		“Velyke Lozhka”		“ATB”		“Silpo”		“Billa-Ukraine”	
		expert	weighted	expert	weighted	expert	weighted	expert	weighted
K3	21.5	3	0.6	7	1.5	10	2.2	8	1.7
K5	21.5	5	1.1	6	1.3	4	0.9	5	1.1
K6	14.3	7	1.0	4	0.6	5	0.7	6	0.9
K4	10.7	10	1.1	8	0.9	9	1.0	8	0.9
K7	10.7	2	0.2	3	0.3	1	0.1	2	0.2
K1	7.1	8	0.6	7	0.5	7	0.5	9	0.6
K2	7.1	3	0.2	2	0.1	2	0.1	4	0.3
K8	7.1	9	0.6	2	0.1	4	0.3	3	0.2
Total	100.0	56	5.4	48	5.3	50	5.8	54	5.9

Source: developed by the third author

All consumers for TH “Login” are important but there are the most attractive ones. The most important consumer according to the table is “Billa-Ukraine” ($K_a=5.9$ % $B=54$), in the second place of importance is “Silpo” ($K_a=5.8$; $B=50$), in the third place is “Velyka Lozhka” ($K_a=5.4$; $B=56$), and in the last place of importance is “ATB” ($K_a=5.3$; $B=48$). The consumer research, their consumer behavior is a difficult, complex process connected with the estimation by them of the received goods and services, their actions and intentions, connected with the selection of the

most preferable goods or services, making decisions by consumers on purchasing, determination of their satisfaction and dissatisfaction by purchasing of services. Similar logistical tasks are actual for LLC “Avangard Grand”.

Another company-distributor LLC “Dakort” is one of the modern leaders of the Ukrainian trade-intermediary market of foodstuffs. For recent years the company has been selling products of famous brands “ABK”, “Mars”, “Wrigley”, “Zolote Runo”, “Chumak” and others. The company distributes its goods via a chain of own shop and via the chain of biggest shops which are located in the city of Dnipro as well as through distributors. In the structure of the commercial products of the limited liability company “Dakort”, the goods of trademark (TM) “ABK” take the highest position – 78.2 %. Most consumers know the distributor exclusively by this trademark. The biggest specific gravity in the sale of goods by TM “ABK” is taken by chocolate, packaged sweets, bars and weight sweets which represent 18%, 15.3 %, 14.3% and 13.8 % respectively (table 3).

Table 3. Structure of the goods distributed by the limited liability company in 2017-2019, %

Goods	2017	2018	2019
Trademark “ABK”			
Chocolate	17.1	17.1	19.9
Packaged sweets	15.2	13.0	12.8
Bars	9.0	10.6	10.3
Weight sweets	2.8	2.5	2.0
Packet sweets	1.8	2.2	1.4
Weight flour products	2.3	3.0	1.6
Ground coffee	15.4	15.5	14.3
Instant coffee	14.2	13.2	13.3
Total	77.8	77.1	75.6
Trademark “Mars”			
Total	8.2	9.2	8.6
Trademark “Zolote Runo”			
Total	14.0	13.7	15.8
Total on the enterprise	100	100	100

Source: developed by the third author

Goods by trademarks such as “Mars” and “Zolote Runo” has recently appeared at the market. Therefore it explains the fact that the goods by those trademarks have insignificant specific gravity in the structure of the commercial products. On average the gross income from selling the goods of the company-distributor has increased by 7908.5 ths UAH per year.

For LLC “Dakort” it is necessary to solve the issue of minimizing transportation costs in the sphere of supplying materials inside the enterprise. Such a need is conditioned first of all by spatial different location of secondary subdivisions as well as the scale of the business. The reason of the significant costs on transporting materials to subgroups is the presence of only one central warehouse, from which the allocation and distribution of materials take place. Hence, in this case the distribution area and the area of procurement influence each other to a great extent.

Construction of the chain of distributing centers and its efficient use will positively influence the costs and via costs the price of the produced goods. The distribution center is a warehouse complex which receives materials from the supplier and distributes them by smaller installments to subdivisions.

Thus the solution to the task of minimizing transportation costs in the area of procurement will be made by stages. At first we will carry out the research for coordinates of an additional distribution center by considering the center of the mass of the cargo transportation. It is based on the assumption that transportation costs are exclusively the distance function. Thus it is assumed that it is worth minimizing the total distance of transportation and we will get the optimal place for the warehouse by costs. On our model the distance from the point of consumption of the material flow to the location of the distribution center was calculated by the line which requires from the modeled area the presence of the developed network of roads. Otherwise the main principle will be broken – the principle of similarity of the modeled area. After that the optimization of the cargo transportation was carried out using the logistical modeling by creating and solving the transportation task.

There are 5 subdivisions in LLC “Dakort”: Subdivision # 1, Subdivision # 2, Subdivision # 3, Subdivision # 4 and Subdivision # 5. In 2018 the general flow of goods was 7459 tons, from which 4662 tons (62.5%) – chocolate, 1655 t (22.2%) - candies, and 1142 tons (15.3%) – ground and instant coffee.

Chocolate is bought and transported to each subdivision, since each of them has a warehouse for storing inventory items. Moreover it is necessary to consider that a part of chocolate is stored at secondary warehouses of the enterprise and the rest is bought and stored at the central warehouse. The method of determining the center of the weight is applied for determining the location of one distribution center. The task of the logistical optimization has been solved using the coordinate overlay method on the map of the places of the positioned subdivisions (Figure 1).

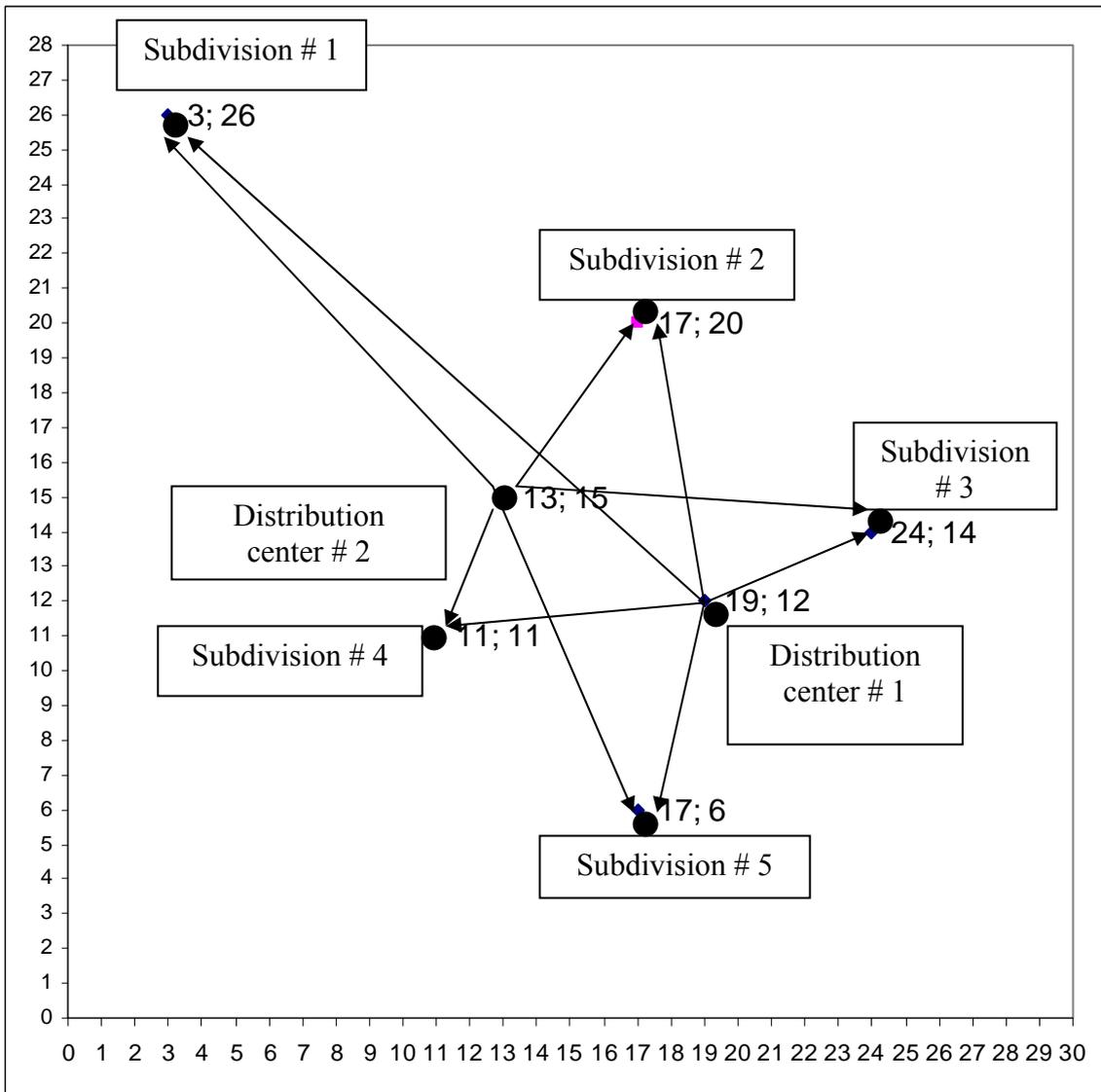


Figure 1. Location of distributing centers of company

Source: developed by the third author

Work of the distributing centers has been optimized using the linear programming through creating and solving the transportation task. At that it was necessary to create such a plan of transporting chocolate by subdivisions which corresponds to possible amounts of chocolate at warehouses and minimal need for subdivisions in it, it also provides minimal cost of transportation.

The first block of limitations includes the limitations to transporting amounts of goods from distribution centers to subdivisions. Since the capacity of the central warehouse is 3,000 tons, the distribution center #2 receives 1662 tons of chocolate. The second block of limitations includes limitations to satisfying the need of the subdivision in material from each distribution center. The optimal criterion is the minimal cost of transportation. To solve the transportation task we will use the functions of the table processor software Microsoft Excel. At that the matrix with the cost of transporting one ton of materials from distributing centers to subdivisions has been built. Furthermore the matrix of the needed variables including the amount of the produce in each distributing center and needs of each subdivision in goods has been created.

Calculation of the optimal transportation plan showed that the produces from the first warehouse will be supplied to such residential areas as “Topol”, “Sokil”, “Parus” and on Slobozhanskiy avenue; from the second warehouse – to “Berezynsky”, “Livoberezhnuy”, “Lomivskuy”, “Pokrovskuy” and Raboch street; from the third warehouse – to residential areas “Topol”, “Peremoha” and “Pokrovskuy”. The results of solving the transportation task show that with two limitations the minimal costs on transportation of chocolate is 14814.63 UAH. It happens under the condition of supplying the chocolate from the distribution center #1 to producing subgroups. Subgroup # 2, Subgroup # 3, Subgroup # 4, Subgroup # 5 in the amounts 466.2 t, 202.8 t, 933 t, 1398 t respectively; from the distribution center #2 to production subgroups Subgroup # 1 and Subgroup # 3 in the amounts of 1165.5 t and 496.5 t respectively.

With the purpose of maximal efficiency of using the distribution channels the method of economic-mathematical modeling was used. LLC “Dakort” deals with distribution of chocolate which is sold in particular in the chain of shops “Silpo” and “Billa-Ukraine” in the city of Dnipro.

The output data for creating the model was the information on available capacities for selling chocolate and forecast demand for chocolate in different months (table 4).

Table 4. Forecast demand for chocolate in different months

Month	Amount, c	
	Silpo	Billa-Ukraine
1	2000	1000
2	1800	800
3	1900	900
4	2200	700
5	2000	1000
6	2000	1200
7	1500	1400
8	2300	900
9	2800	1000
10	1100	1100
11	1700	600
12	2000	750

Source: developed by the third author

As a result, the following was determined: 1) min the chain of shops “Silpo” it is reasonable to sell 2000 c, 1800 c, 1550 c, 1490 c, 2000 c, 1400 c, 1500 c, 1750 c, 1980 c, 675 c, 1540 c, 1350 c respectively to months starting with January; 2) chains of shops “Billa-Ukraine”– 250 c, 300 c, 900 c, 700 c, 190 c, 1200 c, 650 c, 900 c, in September it is not reasonable to focus on significant amounts of sales, 1100 c in October, in November it is worth selling small amounts and 750 c in December, considering the average factual monthly profit from the sales of the chocolate.

Conclusions. Considering the dynamics of the commodity markets, the selection of the prospective consumer is a necessary task of rationalizing the process of trade logistics. It is especially essential, if trade-intermediary organization distributes its products via own shops and via distributors. Under these conditions the multi-criteria logistical approach can be acceptable for estimating consumers and their further selection.

Application of the method of the transportation task while projecting the managerial decision on optimal plan for transporting foodstuffs makes possible to determine from which warehouse and what amount of goods are most reasonable to be transported into the residential area of the city. Moreover, the suggested logistical model additionally provides the optimal distribution of goods by distribution channels and consideration of main factors which influence the food supply chain management efficiency.

The logistical analysis made possible to determine the most attractive consumers of foodstuffs. And the estimation of the prospective competitive status confirmed that the trade-intermediary organization often takes the middle competitive position at the market. However the situation may change for better and the organization has all possibilities to take a much stronger position in future. To achieve it, more attention should be spent on modernization of production, load of capacities, widening market segments and advertising of the new products. The developed recommendations can be used by trade-intermediaries organizations in management of the logistical food supply chain networks.

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