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MANAGEMENT OF LOGISTICS DESIGN OF SECURE DEVELOPMENT OF INNOVATIVE INDUSTRIAL, AGRICULTURAL AND TOURIST ENTERPRISES IN THE CONDITIONS OF MARTIAL LAW

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Abstract

The current stage of the development of the national economy is characterized by the intensification of globalization processes and the growth of competition among business entities in both domestic and foreign markets. In these conditions, logistics plays a significant role in achieving a high level of competitiveness and ensuring the effective functioning of enterprises. Also, the escalation of crisis phenomena actualizes the solution of these problems, in particular, in the conditions of the military aggression of the Russian Federation against Ukraine, the design of an adequate logistics system becomes an important component of the company's management system, because it allows to achieve a reduction in the overall costs of the business entity and increase the effectiveness of the economic processes that take place at the enterprise. Based on the above, the purpose of the study is to develop a methodology for making managerial decisions regarding the modeling of the logistics system in the context of the security development of the enterprise.

The materials for this research were gathered from 14 Ukrainian innovative industrial, agricultural, and tourist enterprises. In order to achieve the purpose of the research, an analysis of the differences in logistics systems inherent in innovative industrial, tourist, and agricultural enterprises was carried out with the method of comparative analysis. An analysis of specific factors that influence the modeling of the logistics system of the economic entity in the conditions of martial law was also carried out with the expert method. The analytic hierarchy process was used as a tool for choosing the optimal management solution for the formation of the logistics system of the enterprise.

In the process of research, an analysis of logistics systems that are characteristic of tourist, agricultural and innovative industrial enterprises was carried out, and the sectoral differences of logistics systems that are characteristic of these enterprises were determined. So, for example, the reverse movement of flows is characteristic for the logistics systems of tourist

enterprises, because, unlike an industrial enterprise, in the tourism industry the consumer moves in the direction of the service producer. The conducted factor analysis made it possible to identify factors affecting the logistics of industrial, tourist and agricultural enterprises. For example, the mode of transport has a significant impact on the logistics processes of enterprises. The logistics design methodology was proposed, which involves the application of the method of analysis of hierarchies in the process of modeling logistics systems in order to determine the optimal alternative option.

In the conditions of martial law, the problem of ensuring effective management of national enterprises is becoming more urgent. In particular, an important component of the general management system of the enterprise is logistics management, which is aimed at performing management functions in order to achieve the goals of the logistics system. Industry differences are largely reflected in the logistics systems of individual enterprises. Also, modern conditions require the management of companies to quickly make non-standard decisions regarding the formation or reorganization of logistics systems. It is advisable to introduce the method of analyzing hierarchies in the process of finding the optimal solution. In order to obtain the optimal option, it is necessary to take into account the specifics of the industry and factors that affect the logistics processes of the enterprise in the conditions of martial law.

Key words: *Logistics design, Hierarchy analysis method, Tourist enterprise, Agribusiness, Martial law.*

1. Introduction

The modern world is characterized by an all-encompassing process of globalization, in particular, economic relations are implemented regardless of borders. The COVID-19 pandemic has highlighted the importance of the globalization process, which, like any other complex phenomenon, has both its advantages and disadvantages, but modern society cannot abandon globalization even in the face of the threat of the spread of a dangerous virus. It is consistent that for a modern business entity, the role of the logistics system is growing, the functional essence of which is to ensure the effective management of the entity due to the provision of a single duplex flow of material values and information along the entire «supplier-consumer» chain. The logistics system occupies a key place in the structure of the enterprise, because it allows the enterprise to optimize inventory, accelerate capital turnover, reduce cost, and improve the quality of goods and services. It is due to the formation of an effective logistics system that the business entity gets the opportunity to increase the efficiency of its functioning.

In the conditions of martial law, which was declared due to the military aggression of the Russian Federation against Ukraine, the formation of an adequate logistics system is a difficult, but critically important task for any business entity. Due to the military actions, many enterprises were forced to transform and adapt their logistics processes to new realities, because the old logistics systems lost their efficiency and were unable to implement their functions.

Material and technical support of the operation of the enterprise and the sale of finished products entirely depends on the efficiency of the enterprise's logistics system (Stolyarov *et al*., [1]). Under such conditions, quick adaptation of the company's logistics system becomes the key to increasing the chances of the company's survival.

The complexity and critical impact of logistics on the efficiency of economic activity is the cause of scientific interest. Many scientific works are devoted to the study of various aspects of logistics.

Thus, the article by Stareček *et al*., [2], is devoted to the problems of implementing innovative technologies in the field of automated logistics systems, the solution of which allows increasing the efficiency of industrial enterprises due to increased productivity. New trends in logistics are due to the introduction of the concept of Industry 4.0 and are characterized by the operation of autonomous transport systems, self-propelled transport systems (Automatic Guided Vehicle - AGV) and various hybrid modules for AGV. The authors also highlight the problem of a shortage of qualified labor both for direct work in the warehouse and for managerial employees who should be engaged in operational and strategic management of logistics processes.

Brigant *et al*., [3], investigate the modern problems of implementing smart technologies in the logistics processes taking place in the warehouse of an industrial enterprise. The authors offer automated vehicles and sorting robots for use. According to scientists, this will increase the competitiveness of the enterprise. Trends in the development of logistics in the period after the COVID-19 pandemic are investigated by Weihua *et al*., [4], on the example of the functioning of the logistics industry in the People's Republic of China. Analyzing the consequences of the COVID-19 pandemic, the authors note that the consequences of the pandemic for logistics were: a significant drop in the volume of logistics flows, lack of transport capacity, limitations of logistics networks, and changes in the service regime.

Scientists have identified the following main trends in logistics, namely: steady growth of domestic demand for logistics services, high degree of uncertainty regarding external demand, development of logistics hubs, development of urgent logistics, etc.

Logistics processes and their implementation, the formation of a logistics system largely depend on the industry in which economic activity is carried out. In their work, Mrnjavac and Ivanovic [5], investigated the functions of logistics in the tourism industry and the features of the logistics system and its elements. The authors emphasize the importance of optimizing logistics links and processes at the destination. Perkumienė *et al*., [6], analyze possible green logistics solutions for sustainable tourism, such as tourist mobility, bicycle tourism and others. Khan *et al*., [7], conduct an analysis of factors affecting tourism demand in a group of 21 tourism-oriented countries during 2006 - 2016. The authors claim that the logistics productivity index has a positive effect on international tourism demand, while financial and regulatory measures have a different effect on international tourism. According to the authors, an increase in the index of business opening increases tourist demand, while the cost of opening a business increases income from tourism goods. Khan *et al*., [7], emphasize the need to introduce an integrated economic and financial model, which involves the involvement of international tourism infrastructure and logistics activities to support sustainable economic growth. Separately, theoretical aspects of logistics processes in the tourism industry are investigated in their work by Ivanovic and Baldigara [8]. The authors emphasize the important role of logistics processes in determining a tourist destination. The offer of a tourist destination depends on the degree of optimization of logistic flows. The relationship between logistics phenomena and tourist flow is investigated by Jin *et al*., [9], and explain the process of logistics activities in the tourism industry. Researchers also identify the functions and objectives of the tourism logistics system and two types of logistics phenomena in the tourism industry.

Also, many scientific works are devoted to the study of the branch specifics of the organization of logistics processes. Thus, Wang *et al*., [10], in their work analyze the functional structure of modern logistics of an agrarian enterprise and form a theory of twelve functions. Studying the functioning of supply chains, the authors built an innovative model of logistics of modern agribusiness. Higgins *et al*., [11], describe the TRANSIT model, which is a component of ArcGIS and uses the Network Analyst toolkit. The model allows to determine the transport costs of all movements between enterprises, taking into account road conditions, types of vehicles and regulatory restrictions. The authors, implementing research in the livestock sector of Australia, emphasize the model's ability to estimate the benefits of road modernization, new processing facilities and changes in biosecurity conditions. Investigating the peculiarities of logistics in the agricultural sector, Saddem-Yagoubi *et al*., [12], analyze the problems of agribusiness logistics and propose a model that allows for the development of trajectories of the harvesting machine to obtain a given amount of grapes of higher quality while minimizing working time. In his article, Shi [13], analyzes the peculiarities of optimizing logistics supply chains of an individual agricultural enterprise. The author offers an optimized scheme of the logistics process and an optimal design for managing the transportation and distribution of agricultural products. Shi also recommends changing the design of the main functional modules of the intelligent logistics information system in order to ensure the growth of the efficiency of the studied agro-enterprise. Luyao [14], examines the relationship between the level of development of the logistics industry and the development of agriculture in his work. The author emphasizes that the development of the logistics industry leads to the expansion of the scale of agriculture, which in turn leads to the development of agro-logistics, and the development of agro-logistics as a result has a stimulating effect on the development of agriculture. The author, using statistical data of the logistics industry and agriculture, investigates the correlation model of factors. Analysis of the model indicates that there is a certain relationship between the development of agriculture and the logistics industry, but its level is insignificant. Linkova and Lazarova [15], investigating the peculiarities of agribusiness in Bulgaria, draw attention to negative trends in the development of agribusiness - the priority export of unprocessed agricultural products, the presence of weak horizontal and vertical links in the logistics chain, weak investment and innovation activity, etc. The authors claim that the formation of logistics models and the formation of logistics chains in agriculture is a response of business in the conditions of a market economy, as well as a tool for the sustainable development of both agribusiness and rural areas.

Scientists also pay attention to the study of the implementation of innovative technologies in agrologistics. So, for example, Villalba and Abd Elkader [16], emphasize in their work that the implementation of innovative technologies faces barriers - the high cost of technologies and the high fluctuation of economic processes in the conditions of a market economy. The authors investigate the impact of the implementation of logistics 4.0 on agricultural systems.

Many authors emphasize the need to develop innovativeness in the process of interaction between enterprises and the formation of logistical connections (Khodakivska *et al*., [17], and Rossokha *et al*., [18]).

Despite the large number of scientific works dedicated to the study of logistics and its individual components, many questions remain unresolved. For example, many aspects of managing logistics systems remain unsettled. Therefore, the purpose of the study is to develop a methodology for making managerial decisions regarding the modeling of the logistics system in the context of the security development of the enterprise.

2. Materials and Methods

Making managerial decisions regarding the design of the enterprise's logistics system is a complex task. One of the methods that allows solving complex decision-making problems is the method of analyzing hierarchies. The method of analyzing hierarchies is built on the basis of three principles, namely: decomposition of the components of a complex problem, comparative analysis of characteristics to determine the level of influence, and synthesis, which involves the collection of information and the creation of a set of arguments.

The application of the method involves the implementation of the following stages:

1. Preliminary analysis of business processes to determine the limits of the task.
2. Decomposition of a complex task into separate key criteria.
3. Selection and classification of key criteria.
4. Building a hierarchy of solutions.
5. Formation of the survey matrix.
6. Formation of an experts group to conduct a survey.
7. Conducting a survey of a previously formed experts group.
8. Control of consistency of experts' answers.
9. Provided that the control of the consistency of the answers gave a negative result - redesigning the survey matrix and re-conducting the survey.
10. Searching for a hierarchy solution, including determination of relative weights.
11. Analysis of the obtained results and final selection of the decision option.

Particular attention should be paid to the following key elements of the implementation of the hierarchies analysis method: defining the goal, building a hierarchy of decisions, forming a group of experts and obtaining their evaluations.

Applying the method of analysis of hierarchies, it is necessary to clearly formulate the purpose of its implementation. The construction of the decision hierarchy takes place within the framework of the general scheme «Goal - Key criteria - Subcriteria - Alternative solutions», which is shown in Figure 1.

The implementation of the method assumes that the expert can choose an alternative solution from the pool of alternative solutions, which includes a comprehensive set of options, namely: the alternative solution Alt_1 is preferred over Alt_2; alternative solution Alt_2 is preferred over Alt_1; a person with no preference for Alt_2 or Alt_1. Where Alt_2 and Alt_1 are independent alternative solutions.

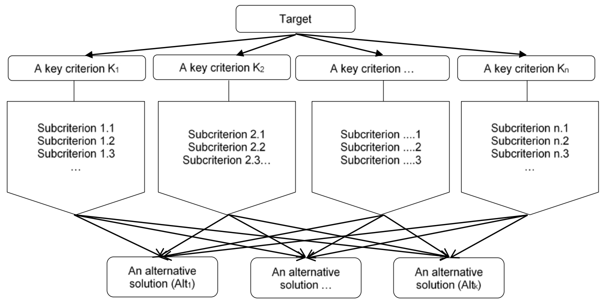

Figure 1. Design of a hierarchical model for the method of analyzing hierarchies
Source: author's development

It is important to note that the first level - the element of the goal and the second level - the set of key criteria are mandatory components of the hierarchical model. While the third level - groups of subcriteria are arbitrary elements of the model and may be absent. The fourth level - a set of alternative solutions is also a mandatory element of the model.

The survey matrix is formed by creating a matrix that includes the values obtained by comparing a particular model component from the previous layer with all the components associated with it at the current layer. For example, for any component of the second level Kn, there is a set A at the third level, which includes *k* alternative solutions Alt. Then the mathematical formula of the matrix of paired comparisons will have the following form (1):

$$R = \begin{bmatrix} 1 & q_1 \cdot q_2^{-1} & \cdots & q_1 \cdot q_k^{-1} \\ q_2 \cdot q_1^{-1} & 1 & \cdots & q_2 \cdot q_k^{-1} \\ \vdots & \vdots & \vdots & \vdots \\ q_k \cdot q_1^{-1} & q_k \cdot q_2^{-1} & \cdots & 1 \end{bmatrix} = \begin{bmatrix} c_{11} & c_{12} & \cdots & c_{1k} \\ c_{21} & c_{22} & \cdots & c_{2k} \\ \vdots & \vdots & \vdots & \vdots \\ c_{k1} & c_{k2} & \cdots & c_{kk} \end{bmatrix} \quad (1)$$

Matrix R represents a value c_{ij} element priority ratio i and element j key criterion K and takes into account the following conditions:

$$\begin{cases} c_{ij} = \dfrac{1}{c_{ij}}; \\ i = j; \\ c_{ij} = 1; \\ i, j \in \overline{1, k}. \end{cases}$$

Table 1. Saati's priority rating scale

Value	Equal priority	Moderate priority preference	Significant advantage of priority	Strong priority preference	Very strong priority preference	In appropriate intermediate cases
Rating	1	3	5	7	9	2, 4, 6, 8

Source: Saaty, [19].

Saati's priority rating scale is used to evaluate the priority. Under such conditions, the rating acquires a value from 1 to 9. The rating values are listed in Table 1.

The survey matrix is filled out by experts. The use of the method of analysis of hierarchies allows to realize the potential of the expert to a large extent by using his experience, knowledge and worldview in the process of pairwise comparisons.

It is important that according to the conditions of the method, the higher the priority level of an individual element, the more integer values it will receive in the corresponding row of the matrix and will have a greater value.

The next step is to determine the weight vector $Q = (\overline{q_1}, \overline{q_2}, \dots, \overline{q_k})^t$, for this purpose, it is advisable to use the geometric mean formula (2):

$$\overline{q_i} = \sqrt[k]{\prod_{j=1}^{k} c_{ij}}, i \in \overline{1,k} \quad (2)$$

Calculated weight vector Q allows you to determine the normalized values of the eigenvector $Q_{norm} = (q_1, q_2, \dots, q_k)^t$ using the following formula (3):

$$q_i = \overline{q_i} \cdot \frac{1}{\sum_{j=1}^{k} \overline{q_j}}, i \in \overline{1,k} \quad (3)$$

The next stage of the research is the control of consistency of experts' answers. The use of the method of expert evaluations has a drawback, namely, it is necessary to check whether the evaluations are consistent. The level of consistency of estimates directly affects the effectiveness of using the method. After all, if the level of agreement is low, then it is necessary to transform the survey matrix. Therefore, in order to determine the level of consistency of estimates, it is advisable to invent a ratio of consistency RC according to the following formula (4):

$$RC = IC \cdot CC^{-1} \quad (4)$$

Where: IC - the index of consistency of assessments, which allows you to determine the level of consistency of the survey matrix; CC - the index of random consistency of the matrix, which was determined by the author of the method of analysis of Saati hierarchies and is calculated for a square inverse-symmetric positive k -dimensional matrix, the values of which are determined by a generator of random numbers distributed according to the normal law and are listed in Table 2.

Table 2. The value of the random consistency index

k	2	3	4	5	6	7	8	9	10
CC	0	0.66	0.99	1.11	1.32	1.35	1.40	1.45	1.49

Source: Saaty, [19].

The consistency index of IC expert evaluations can be calculated using the formula (5):

$$IC = \frac{(\sigma_{max} - k)}{k - 1} \quad (5)$$

Where: k - the order of the square inverse-symmetric positive matrix of expert evaluations; σ_{max} - the maximum eigenvalue of the matrix of expert evaluations.

To calculate the maximum eigenvalue of the matrix of expert evaluations, it is advisable to use the formula (6):

$$\sigma_{max} = \frac{\sum_{i=1}^{k} q_i^{-1} \cdot (R \cdot Q_{norm})_i}{k} \quad (6)$$

Where: $(R \cdot Q_{norm})_i$ - i - th element of the vector V, $R \cdot Q_{norm}$ - vector V, which is defined as a matrix product R and vector Q_{norm} according to the formula (7):

$$V = R \cdot Q_{norm} = \begin{bmatrix} c_{11} & c_{12} & \cdots & c_{1k} \\ c_{21} & c_{22} & \cdots & c_{2k} \\ \vdots & \vdots & \vdots & \vdots \\ c_{k1} & c_{k2} & \cdots & c_{kk} \end{bmatrix} \cdot \begin{bmatrix} q_1 \\ q_2 \\ \vdots \\ q_k \end{bmatrix} = \begin{bmatrix} v_1 \\ v_2 \\ \vdots \\ v_k \end{bmatrix} \quad (7)$$

Provided there are no inconsistencies among experts' assessments, the IC consistency index is equal to 0, but in real conditions it is impossible to achieve such a level of consistency. Therefore, for real conditions, it is enough that this consistency index has as low a value as possible.

It is also advisable to analyze the value RC. Provided that this index is less than or equal to 0.1, the level of agreement is considered satisfactory, that is, the survey matrix is agreed, vector Q_{norm} is considered weighty, and each of its elements characterizes the fate of the corresponding alternative for the corresponding criterion.

However, if the RC takes a value that exceeds 0.1, then this indicates an unsatisfactory level of consistency of assessments and the need to make changes in the survey matrix in order to increase the level of consistency to a satisfactory level.

The next stage of the analysis is the determination of local and general relative weighting factors.

In order to calculate general weighting coefficients for each alternative solution, it is necessary to calculate the weight vector for all alternative solutions. Local weighting factors at different levels should be aggregated in order to determine general weighting factors for alternative decisions. Aggregation should be carried out according to the following formula (8). Each value of the vector indicates the fate of the corresponding alternative solution in achieving the set goal.

$$MS = \begin{bmatrix} q_{11} & q_{12} & \cdots & q_{1r} \\ q_{21} & q_{22} & \cdots & q_{2r} \\ \vdots & \vdots & \vdots & \vdots \\ q_{l1} & q_{l2} & \cdots & q_{lr} \end{bmatrix} = \begin{bmatrix} M_1 \\ M_2 \\ \vdots \\ M_r \end{bmatrix} \tag{8}$$

Where: MS - aggregate weight vector taking into account all alternative solutions at the third level to the criteria of the second level; l - the number of alternative solutions at the third level; r - the number of criteria at the second level; M - a weight vector that displays the fates of all alternative decisions at the third level for the corresponding criterion at the second level.

At the next stage of the analysis, it is necessary to calculate the weight vector $P = p_1, p_2, \ldots, p_r$ for all criteria at the second level to the first level objective. Vector of general weighting coefficients X, which displays the weights of all alternative decisions at the third level and is calculated as a vector product MS and vector P according to the formula (9):

$$\mathrm{X} = MS \cdot P = \begin{bmatrix} q_{11} & q_{12} & \cdots & q_{1r} \\ q_{21} & q_{22} & \cdots & q_{2r} \\ \vdots & \vdots & \vdots & \vdots \\ q_{l1} & q_{l2} & \cdots & q_{lr} \end{bmatrix} \cdot \begin{bmatrix} p_1 \\ p_2 \\ \vdots \\ p_r \end{bmatrix} = \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_l \end{bmatrix} \tag{9}$$

The final stage is the ranking of alternative solutions according to the values x_i. The alternative solution that has the highest value x, is the most priority option.

In order to achieve the goal of the study, 14 enterprises were examined, including five innovative industrial enterprises, five agricultural enterprises and four tourism firms. Accordingly, the data were grouped by industry. Group IN - innovative industrial enterprises, AG - agricultural enterprises, TU - tourist enterprises. The business processes of the enterprises were analyzed in order to identify the sectoral features of logistics systems and the factors of the formation of the structure of logistics systems.

3. Results and Discussion

The logistics system of any enterprise is a set of elements of an organizational, economic, legal, technological and technical nature, the main purpose of which is to optimize the material and technical flow, finished products, information, energy and people. Analyzing the functioning of enterprises belonging to different industries, it can be concluded that the logistics system has an open and dynamic nature, because it is in constant interaction with both internal divisions and the external environment, and also ensures the balance and adaptation of the enterprise to market fluctuations.

The analysis of the branch features of the functioning of logistics systems allowed us to highlight the following differences. The general structure of the logistics system of an industrial enterprise consists of the following functional components - subsystems:

- subsystem of material and technical support - a subsystem that incorporates two components, one of which ensures the selection of the most optimal suppliers and improvement of the management of the procurement process, and the other is aimed at managing stocks and ensuring the production process;
- warehousing support subsystem - a subsystem that ensures the improvement of all warehousing processes, the growth of the quality of warehousing services, etc.;
- transport support subsystem - a subsystem aimed at optimizing route schemes, loading transport, keeping track of transport, etc.;
- sales support subsystem - a subsystem that provides market research, order processing, and improvement of logistics service, etc.

In turn, the structure of the logistics system of an innovative industrial enterprise differs from the general structure by the presence of an innovation support subsystem. The specified subsystem aims to ensure effective innovative activity of the enterprise. This subsystem includes two components, namely: the logistics of the innovation process, which includes resource provision for the development and implementation of innovative products within the enterprise, as well as the logistics of innovation, which involves ensuring the promotion of finished innovative products to sales markets. Market research allows the enterprise to identify the needs of the consumer at the stage of developing an innovative product and to form the final product taking into account these wishes. The logistics system of an innovative industrial enterprise is a complex management concept that involves the integration of a logistics approach into management practices for the purpose of qualitative development and implementation of innovative projects.

The logistics system of an agrarian enterprise is characterized by the presence of significant seasonality in the operation of the logistics system, the leading role of transport and storage subsystems, these subsystems account for approximately 50-60% of the load. Also, in the structure of the logistics system of an agrarian enterprise, an ecological subsystem can be distinguished, the main function of which is the management of flows, which ensure not only the minimization of the negative impact on the environment, but also the reproduction of natural resources, in particular, water and land resources. It is important to note that large agricultural holdings have a significant resource base that allows implementing the latest logistics solutions in practical activities. The rapid development of information technologies finds its application in the economic activity of agricultural enterprises, for example, the use of geoinformation systems, navigation devices, automated vehicles, etc.

The most significant differences are the logistics system of the tourism industry enterprise. Tourism logistics aims to optimize tourist, information and material flows that arise in the process of providing tourist services. Thus, the logistics system of a tourist enterprise includes the following elements:

- subsystem of resource provision;
- information support subsystem;
- transportation subsystem;
- subsystem of excursion support and complementary services.

It is also important to note that the reverse movement of flows is characteristic of the logistics systems of tourist enterprises, because, unlike an industrial enterprise, in the tourism industry the consumer moves in the direction of the service producer. It is this feature that determines the fact that special managerial attention is paid to the tourist flow.

In the process of research, thanks to the expert method, factors were identified that affect the logistics systems of enterprises, in particular, in the conditions of martial law. Thus, among the identified factors, the following have the greatest influence:

- rising prices for new equipment;
- growing demand for maintenance and repair of car fleets instead of purchasing new equipment;
- implementation of innovative information technologies;
- development of logistics outsourcing;
- reorientation from road transport to railway transport;
- growing popularity of logistics collaboration, cooperation and unification of logistics services;
- spread of remote working conditions;
- growing requirements for sanitary standards;
- increasing the volume of online orders;
- uneven territorial location of warehouse hubs.

Some factors are due to the military actions taking place in Ukraine. Such factors include the following:

- refusal to accumulate and store both finished products and resources due to the risk of losing them during an attack;
- destruction of logistics infrastructure as a result of military operations;
- loss of access to the occupied territories, including ports and other logistics infrastructure;
- reduction of suppliers and limited assortment;
- complication of highway logistics due to the introduction of roadblocks and curfews;
- complication of designing routes;
- deficit and rising prices for fuel and lubricants;
- lack of air travel.

Taking into account the above factors, enterprise management gets the opportunity to adapt the logistics system of the enterprise in accordance with the influence of the factors in order to increase the efficiency of the enterprise's functioning.

In order to find the optimal options for management decisions regarding the adaptation of the enterprise's logistics system to modern challenges, it is proposed to use the method of analyzing hierarchies. A three-level hierarchical model was chosen for three separate industry groups. At the first level of the model is the goal. For all enterprises, the goal is to increase the efficiency of the logistics system. The second level includes criteria and the third level includes alternative solutions. For each group, separate criteria and alternative solutions were selected in accordance with the features of the functional environment and industry specifics. Structural components of hierarchical models differ by group (Table 3).

Next step was to construct a survey matrix, which contains paired comparative assessments obtained from experts. This matrix reflects the impact of individual criteria on achieving the goal. The following matrix was obtained for the IN group R_1^{IN}:

$$R_1^{\mathrm{IN}} = \begin{bmatrix} 1 & 3 & 1 & 3 & 5 & 6 \\ 0.33 & 1 & 2 & 4 & 5 & 6 \\ 1 & 0.50 & 1 & 2 & 4 & 5 \\ 0.33 & 0.25 & 0.50 & 1 & 4 & 5 \\ 0.20 & 0.20 & 0.25 & 0.25 & 1 & 2 \\ 0.17 & 0.17 & 0.20 & 0.20 & 0.50 & 1 \end{bmatrix}$$

Survey matrix R_1^{IN} has dimension $k = 6$. The matrix contains expert assessments of pairwise comparison of the criteria significance. The weight vector of the matrix is calculated on the basis of the given pairwise evaluations $Q = (2.54, 2.08, 1.65, 0.97, 0.41, 0.29)^t$. The next step is to calculate the normalized value of the eigenvector $Q_{norm} = (0.32, 0.26, 0.21, 0.12, 0.05, 0.04)^t$. In order to calculate the consistency ratio RC, the maximum eigenvalue of the matrix is calculated σ_{max1} and is equal to $\sigma_{max1} = 6.534$. The consistency index is calculated for the same purpose IC, which is equal to $IC = (6.534 - 6) \cdot (6 - 1)^{-1} = 0.107$. According to the Table 2 for $k = 6$ we determine the value of the random consistency index $CC = 1.32$.

The next step is to calculate the RC, which is equal to 0.081. Based on the fact that the RC value is less than the standard value of 0.1, it can be concluded that the matrix has passed the consistency check.

Then there is to calculate the survey matrices for the second level - criteria, in which pairwise comparisons of significance are given and the level of consistency of the matrix is checked for each criterion (Table 4).

The next step is to determine the aggregated weight vector taking into account all alternative solutions at the third level to the criteria of the second level.

After that it should be calculated the combined weight vector taking into account all elements of the level of alternatives to the level of criteria:

$$MS = \begin{bmatrix} 0.089 & 0.183 & 0.586 & 0.645 & 0.413 & 0.297 \\ 0.588 & 0.075 & 0.061 & 0.058 & 0.327 & 0.645 \\ 0.323 & 0.742 & 0.353 & 0.297 & 0.260 & 0.058 \end{bmatrix}$$

Weight vector $P = Q_{norm} = (0.32, 0.26, 0.21, 0.12, 0.05, 0.04)$.

Table 3. Structure of the second level of the hierarchical model

Group	Content	Designation of the model component
IN	implementation of the logistics information system	K_1^{IN}
	organization of transport collaboration	K_2^{IN}
	organization of a warehouse cooperative	K_3^{IN}
	creation of a reserve pool of suppliers	K_4^{IN}
	formation of reserves of fuel and lubricants	K_5^{IN}
	optimization of warehouse stocks	K_6^{IN}
	optimization of the warehousing subsystem	Alt_1^{IN}
	optimization of the transportation subsystem	Alt_2^{IN}
	increasing the level of security of logistics processes	Alt_3^{IN}
AG	implementation of the logistics information system	K_1^{AG}
	organization of transport collaboration	K_2^{AG}
	organization of a warehouse cooperative	K_3^{AG}
	creation of a reserve transport pool	K_4^{AG}
	formation of reserves of fuel and lubricants	K_5^{AG}
	optimization of warehouse stocks	K_6^{AG}
	formation of a pool of alternative warehouses	K_7^{AG}
	transition to rail transport	K_8^{AG}
	optimization of the warehousing subsystem	Alt_1^{AG}
	optimization of the transportation subsystem	Alt_2^{AG}
	increasing the level of logistics processes security	Alt_3^{AG}
TU	relocation of business to a safer place	K_1^{TU}
	development of movement routes taking into account security aspects	K_2^{TU}
	organization of logistic collaboration	K_3^{TU}
	formation of alternative routes focused on domestic tourism	K_4^{TU}
	optimization of the excursion support subsystem and complementary services	Alt_1^{TU}
	optimization of the transportation subsystem	Alt_2^{TU}
	increasing the level of security of logistics processes	Alt_3^{TU}

Source: author's development.

Table 4. The results of the calculation of the survey matrices and their level of agreement for the innovative industrial enterprises

$R_{K1}^{IN} = \begin{bmatrix} 1 & 0.17 & 0.25 \\ 6 & 1 & 2 \\ 4 & 0.50 & 1 \end{bmatrix}$	The survey matrix R_{K1}^{IN} has dimension $k = 3$. The matrix contains expert assessments of pairwise comparison of the significance of the criteria. Based on the above estimates, the following is calculated: matrix weight vector $Q = (0.347, 2.289, 1.26)^t$; normalized value of the eigenvector $Q_{norm} = (0.089, 0.588, 0.323)^t$. the maximum eigenvalue of the matrix $\sigma_{max1} = 3.01$; consistency index $IC = (3.01 - 3) \cdot (3 - 1)^{-1} = 0.005$. According to Table 2, for $k = 3$, we determine the value of the random consistency index $CC = 0.66$. The next step is to calculate the consistency ratio $RC = 0.007$. Based on the fact that the RC value is less than the standard value of 0.1, it can be concluded that the matrix has passed the consistency check.
$R_{K2}^{IN} = \begin{bmatrix} 1 & 3 & 0.2 \\ 0.33 & 1 & 0.13 \\ 5 & 8 & 1 \end{bmatrix}$	The matrix R_{K2}^{IN} has dimension $k = 3$. Weight vector of matrix $Q = (0.843, 0.347, 3.42)^t$; The normalized value of the eigenvector $Q_{norm} = (0.183, 0.075, 0.742)^t$. The maximum eigenvalue of the matrix $\sigma_{max1} = 3.044$; Consistency index $IC = (3.044 - 3) \cdot (3 - 1)^{-1} = 0.022$. For $k = 3$, we determine the value of the random consistency index $CC = 0.66$. Concordance ratio $RC = 0.033$. Based on the fact that the RC value is less than the standard value of 0.1, it can be concluded that the matrix has passed the consistency check.
$R_{K3}^{IN} = \begin{bmatrix} 1 & 8 & 2 \\ 0.13 & 1 & 0.14 \\ 0.5 & 7 & 1 \end{bmatrix}$	The matrix R_{K3}^{IN} has dimension $k = 3$. Weight vector of matrix $Q = (2.52, 0.261, 1.518)^t$; The normalized value of the eigenvector $Q_{norm} = (0.586, 0.061, 0{,}353)^t$. The maximum eigenvalue of the matrix $\sigma_{max1} = 3.035$; Consistency index $IC = (3.035 - 3) \cdot (3 - 1)^{-1} = 0.017$. For $k = 3$, we determine the value of the random consistency index $CC = 0.66$. Concordance ratio $RC = 0.026$. Based on the fact that the RC value is less than the standard value of 0.1, it can be concluded that the matrix has passed the consistency check.
$R_{K4}^{IN} = \begin{bmatrix} 1 & 8 & 3 \\ 0.13 & 1 & 0.14 \\ 0.33 & 7 & 1 \end{bmatrix}$	The matrix R_{K4}^{IN} has dimension $k = 3$. Weight vector of matrix $Q = (2.884, 0.261, 1.326)^t$; The normalized value of the eigenvector $Q_{norm} = (0.645, 0{,}058, 0{,}297)^t$. The maximum eigenvalue of the matrix $\sigma_{max1} = 3.104$; Consistency index $IC = (3.104 - 3) \cdot (3 - 1)^{-1} = 0.052$. For $k = 3$, we determine the value of the random consistency index $CC = 0.66$. Concordance ratio $RC = 0.079$. Based on the fact that the RC value is less than the standard value of 0.1, it can be concluded that the matrix has passed the consistency check.
$R_{K5}^{IN} = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 1 & 1 \\ 0.5 & 1 & 1 \end{bmatrix}$	The matrix R_{K5}^{IN} has dimension $k = 3$. Weight vector of matrix $Q = (1.26, 1, 0.794)^t$; The normalized value of the eigenvector $Q_{norm} = (0{,}413, 0{,}327, 0{,}26)^t$. The maximum eigenvalue of the matrix $\sigma_{max1} = 3.054$; Consistency index $IC = (3.054 - 3) \cdot (3 - 1)^{-1} = 0.027$. For $k = 3$, we determine the value of the random consistency index $CC = 0.66$. Concordance ratio $RC = 0.041$. Based on the fact that the RC value is less than the standard value of 0.1, it can be concluded that the matrix has passed the consistency check.
$R_{K6}^{IN} = \begin{bmatrix} 1 & 0.33 & 7 \\ 3 & 1 & 8 \\ 0.14 & 0.13 & 1 \end{bmatrix}$	The matrix R_{K6}^{IN} has dimension $k = 3$. Weight vector of matrix $Q = (1.326, 2.884, 0.261)^t$; The normalized value of the eigenvector $Q_{norm} = (0.297, 0{,}645, 0{,}058)^t$. The maximum eigenvalue of the matrix $\sigma_{max1} = 3.104$; Consistency index $IC = (3.104 - 3) \cdot (3 - 1)^{-1} = 0.052$. For $k = 3$, we determine the value of the random consistency index $CC = 0.66$. Concordance ratio $RC = 0.079$. Based on the fact that the RC value is less than the standard value of 0.1, it can be concluded that the matrix has passed the consistency check.

Source: Calculated by the authors.

Then, the next step is to calculate the vector of general weighting coefficients x:

$$X = \begin{bmatrix} 0.089 & 0.183 & 0.586 & 0.645 & 0.413 & 0.297 \\ 0.588 & 0.075 & 0.061 & 0.058 & 0.327 & 0.645 \\ 0.323 & 0.742 & 0.353 & 0.297 & 0.260 & 0.058 \end{bmatrix} \cdot \begin{bmatrix} 0.32 \\ 0.26 \\ 0.21 \\ 0.12 \\ 0.05 \\ 0.04 \end{bmatrix} = (0.309, 0.268, 0.423)$$

The vector of general weighting coefficients X allows choosing the most optimal alternative solution for the adaptation of the logistics system for the IN group. The most optimal solution is Alt_3^{IN}, the general weight factor of which is equal to 0.423. Chosen alternative solution involves increasing the level of security, which is extremely relevant in the conditions of martial law.

Following R_1^{AG} matrix was obtained for the AG group:

$$R_1^{AG} = \begin{bmatrix} 1 & 4 & 1 & 3 & 4 & 5 & 6 & 7 \\ 0.25 & 1 & 2 & 4 & 2 & 5 & 7 & 8 \\ 1 & 0.50 & 1 & 2 & 3 & 5 & 6 & 7 \\ 0.33 & 0.25 & 0.50 & 1 & 2 & 5 & 6 & 8 \\ 0.25 & 0.5 & 0.33 & 0.5 & 1 & 2 & 3 & 6 \\ 0.2 & 0.2 & 0.20 & 0.20 & 0.50 & 1 & 1 & 2 \\ 0.17 & 0.14 & 0.17 & 0.17 & 0.33 & 1 & 1 & 2 \\ 0.14 & 0.125 & 0.14 & 0.125 & 0.17 & 0.5 & 0.5 & 1 \end{bmatrix}$$

Survey matrix R_1^{AG} has dimension $k = 8$. Matrix contains expert assessments of pairwise comparison of the significance of the criteria. The weight vector of the matrix $Q = (3.17, 2.41, 2.24, 1.45, 0.96, 0.45, 0.38, 0.25)^t$ is calculated on the basis of the given pairwise estimates. The next step is to calculate the normalized value of the eigenvector $Q_{norm} = (0.28, 0.21, 0.2, 0.13, 0.09, 0.04, 0.03, 0.02)^t$. In order to calculate the consistency ratio RC, the maximum eigenvalue of the matrix σ_max1 is calculated and is equal to $\sigma_{max1} = 8.836$. For the same purpose, the consistency index IC is calculated, which is equal to $IC = (8.836 - 8) \cdot (8 - 1)^{-1} = 0.119$. According to Table 2, for $k = 6$, we determine the value of the random consistency index $CC = 1.485$.

The next step is to calculate the RC, which is 0.08. Based on the fact that the RC value is less than the standard value of 0.1, it can be concluded that the matrix has passed the consistency check.

Then there is to calculate the survey matrices for the second level - criteria, in which pairwise comparisons of significance are given and the level of consistency of the matrix is checked for each criterion (Table 5).

Next step is to determine the aggregated weight vector taking into account all alternative solutions at the third level to the criteria of the second level.

Calculating the combined weight vector taking into account all elements of the level of alternatives to the level of criteria is as follows:

$$MS = \begin{bmatrix} 0.097 & 0.229 & 0.574 & 0.645 & 0.333 & 0.297 & 0.287 & 0.559 \\ 0.570 & 0.075 & 0.065 & 0.058 & 0.333 & 0.645 & 0.635 & 0.352 \\ 0.333 & 0.696 & 0.361 & 0.297 & 0.333 & 0.058 & 0.078 & 0.089 \end{bmatrix}$$

Weight vector

$P = Q_{norm} = (0.28, 0.21, 0.20, 0.13, 0.09, 0.04, 0.03, 0.02)$

Then, in the next step, we calculate the vector of general weighting coefficients X:

$$X = \begin{bmatrix} 0.097 & 0.229 & 0.574 & 0.645 & 0.333 & 0.297 & 0.287 & 0.559 \\ 0.570 & 0.075 & 0.065 & 0.058 & 0.333 & 0.645 & 0.635 & 0.352 \\ 0.333 & 0.696 & 0.361 & 0.297 & 0.333 & 0.058 & 0.078 & 0.089 \end{bmatrix} \cdot$$

$$\cdot \begin{bmatrix} 0.28 \\ 0.21 \\ 0.20 \\ 0.13 \\ 0.09 \\ 0.04 \\ 0.03 \\ 0.02 \end{bmatrix} = (0.335, 0.279, 0.386)$$

Vector of general weighting coefficients X allows choosing the most optimal alternative solution for the adaptation of the logistics system for the AG group. The most optimal solution is Alt_3^{AG}, the general weighting factor of which is equal to 0.386. As in the previous group, the selected alternative solution concerns ensuring a certain level of security of logistics processes.

Following R_1^{TU} matrix was obtained for the TU group:

$$R_1^{TU} = \begin{bmatrix} 1 & 4 & 5 & 4 \\ 0.25 & 1 & 3 & 4 \\ 0.2 & 0.33 & 1 & 2 \\ 0.25 & 0.25 & 0.50 & 1 \end{bmatrix}$$

The survey matrix R_1^{TU} has dimension $k = 4$. Matrix contains expert assessments of pairwise comparison of the significance of the criteria. Weight vector of the matrix $Q = (2.99, 1.32, 0.6, 0.42)^t$ is calculated on the basis of the given pairwise estimates. The next step is to calculate the normalized value of the eigenvector $Q_{norm} = (0.56, 0.25, 0.11, 0.08)^t$. In order to calculate the consistency ratio RC, the maximum eigenvalue of the σ_{max1} is calculated and is equal to $\sigma_{max1} = 4.276$. For the same purpose, the consistency index IC is calculated, which is equal to $IC = (4.276 - 4) \cdot (4 - 1)^{-1} = 0.092$. According to Table 2, for $k = 4$, we determine the value of the random consistency index $CC = 0.99$.

Next step is to calculate the RC, which is equal to 0.093. Based on the fact that the RC value is less than the standard value of 0.1, it can be concluded that the matrix has passed the consistency check.

Then there is to calculate the survey matrices for the second level - criteria, in which pairwise comparisons of significance are given and the level of consistency of the matrix is checked for each criterion (Table 6).

Table 5. The results of the calculation of the survey matrices and their level of agreement for the agricultural enterprises

$R^{AG}_{K1} = \begin{bmatrix} 1 & 0.2 & 0.25 \\ 5 & 1 & 2 \\ 4 & 0.50 & 1 \end{bmatrix}$	The survey matrix R^{AG}_{K1} has dimension $k = 3$. The matrix contains expert assessments of pairwise comparison of the criteria significance. Based on the above estimates, the following is calculated: weight vector of the matrix $Q = (0.368, 2.154, 1.26)^t$; normalized value of the eigenvector $Q_{norm} = (0.097, 0.57, 0.333)^t$. the maximum eigenvalue of the matrix $\sigma_{max1} = 3.025$; coherence index $IC = (3.025 - 3) \cdot (3 - 1)^{-1} = 0.01$. According to Table 2, for $k = 3$, we determine the value of the random consistency index $CC = 0.66$. The next step is to calculate the consistency ratio $RC = 0.0186$. Based on the fact that the RC value is less than the standard value of 0.1, it can be concluded that the matrix has passed the consistency check.
$R^{AG}_{K2} = \begin{bmatrix} 1 & 4 & 0.25 \\ 0.25 & 1 & 0.14 \\ 4 & 7 & 1 \end{bmatrix}$	The survey matrix R^{AG}_{K2} has dimension $k = 3$. The weight vector of the matrix $Q = (1, 0.329, 3.037)^t$; The normalized value of the eigenvector $Q_{norm} = (0.229, 0.075, 0.696)^t$. The maximum eigenvalue of the matrix $\sigma_{max1} = 3.076$; Consistency index $IC = (3.076 - 3) \cdot (3 - 1)^{-1} = 0.038$. For $k = 3$, we determine the value of the random consistency index $CC = 0.66$. Consistency relation $RC = 0.058$. Based on the fact that the RC value is less than the standard value of 0.1, it can be concluded that the matrix has passed the consistency check.
$R^{AG}_{K3} = \begin{bmatrix} 1 & 7 & 2 \\ 0.14 & 1 & 0.14 \\ 0.5 & 7 & 1 \end{bmatrix}$	The survey matrix R^{AG}_{K3} has dimension $k = 3$. The weight vector of the matrix $Q = (2.41, 0.273, 1.518)^t$; The normalized value of the eigenvector $Q_{norm} = (0.574, 0.065, 0.361)^t$. The maximum eigenvalue of the matrix $\sigma_{max1} = 3.054$; Consistency index $IC = (3.054 - 3) \cdot (3 - 1)^{-1} = 0.027$. For $k = 3$, we determine the value of the random consistency index $CC = 0.66$. Consistency relation $RC = 0.041$. Based on the fact that the RC value is less than the standard value of 0.1, it can be concluded that the matrix has passed the consistency check.
$R^{AG}_{K4} = \begin{bmatrix} 1 & 8 & 3 \\ 0.13 & 1 & 0.14 \\ 0.33 & 7 & 1 \end{bmatrix}$	The survey matrix R^{AG}_{K4} has dimension $k = 3$. The weight vector of the matrix $Q = (2.884, 0.261, 1.326)^t$; The normalized value of the eigenvector $Q_{norm} = (0.645, 0.058, 0.297)^t$. The maximum eigenvalue of the matrix $\sigma_{max1} = 3.104$; Consistency index $IC = (3.104 - 3) \cdot (3 - 1)^{-1} = 0.052$. For $k = 3$, we determine the value of the random consistency index $CC = 0.66$. Consistency relation $RC = 0.079$. Based on the fact that the RC value is less than the standard value of 0.1, it can be concluded that the matrix has passed the consistency check.
$R^{AG}_{K5} = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 1 & 1 \\ 0.5 & 1 & 1 \end{bmatrix}$	The survey matrix R^{AG}_{K5} has dimension $k = 3$. The weight vector of the matrix $Q = (1, 1, 1)^t$; The normalized value of the eigenvector $Q_{norm} = (0.33, 0.33, 0.33)^t$. The maximum eigenvalue of the matrix $\sigma_{max1} = 3.0$; Consistency index $IC = (3.0 - 3) \cdot (3 - 1)^{-1} = 0.0$. For $k = 3$, we determine the value of the random consistency index $CC = 0.66$. Consistency relation $RC = 0.0$. Based on the fact that the RC value is less than the standard value of 0.1, it can be concluded that the matrix has passed the consistency check.
$R^{AG}_{K6} = \begin{bmatrix} 1 & 0.33 & 7 \\ 3 & 1 & 8 \\ 0.14 & 0.13 & 1 \end{bmatrix}$	The survey matrix R^{AG}_{K6} has dimension $k = 3$. The weight vector of the matrix $Q = (1.326, 2.884, 0.261)^t$; The normalized value of the eigenvector $Q_{norm} = (0.297, 0.645, 0.058)^t$. The maximum eigenvalue of the matrix $\sigma_{max1} = 3.104$; Consistency index $IC = (3.104 - 3) \cdot (3 - 1)^{-1} = 0.052$. For $k = 3$, we determine the value of the random consistency index $CC = 0.66$. Consistency relation $RC = 0.079$. Based on the fact that the RC value is less than the standard value of 0.1, it can be concluded that the matrix has passed the consistency check.
$R^{AG}_{K7} = \begin{bmatrix} 1 & 0.33 & 5 \\ 3 & 1 & 6 \\ 0.2 & 0.17 & 1 \end{bmatrix}$	The survey matrix R^{AG}_{K7} has dimension $k = 3$. The weight vector of the matrix $Q = (1.186, 2.621, 0.322)^t$; The normalized value of the eigenvector $Q_{norm} = (0.287, 0.635, 0.78)^t$. The maximum eigenvalue of the matrix $\sigma_{max1} = 3.094$; Consistency index $IC = (3.104 - 3) \cdot (3 - 1)^{-1} = 0.047$. For $k = 3$, we determine the value of the random consistency index $CC = 0.66$. Consistency relation $RC = 0.071$. Based on the fact that the RC value is less than the standard value of 0.1, it can be concluded that the matrix has passed the consistency check.
$R^{AG}_{K8} = \begin{bmatrix} 1 & 2 & 5 \\ 0.5 & 1 & 5 \\ 0.2 & 0.2 & 1 \end{bmatrix}$	The survey matrix R^{AG}_{K8} has dimension $k = 3$. The weight vector of the matrix $Q = (2.154, 1.357, 0.342)^t$; The normalized value of the eigenvector $Q_{norm} = (0.559, 0.352, 0.089)^t$. The maximum eigenvalue of the matrix $\sigma_{max1} = 3.054$; Consistency index $IC = (3.054 - 3) \cdot (3 - 1)^{-1} = 0.027$. For $k = 3$, we determine the value of the random consistency index $CC = 0.66$. Consistency relation $RC = 0.041$. Based on the fact that the RC value is less than the standard value of 0.1, it can be concluded that the matrix has passed the consistency check.

Source: Calculated by the authors.

Table 6. The results of the calculation of the survey matrices and their level of agreement for the tourism enterprises

$R_{K1}^{TU} = \begin{bmatrix} 1 & 0.25 & 0.33 \\ 4 & 1 & 2 \\ 3 & 0.50 & 1 \end{bmatrix}$	The survey matrix R_{K1}^{TU} has dimension $k = 3$. The matrix contains expert assessments of pairwise comparison of the significance of the criteria. Based on the above estimates, the following is calculated: weight vector of the matrix $Q = (0.437, 2, 1.145)^t$; normalized value of the eigenvector $Q_{norm} = (0.122, 0.558, 0.32)^t$. the maximum eigenvalue of the matrix $\sigma_{max1} = 3.02$; coherence index $IC = (3.02 - 3) \cdot (3 - 1)^{-1} = 0.01$. According to Table 2, for $k = 3$, we determine the value of the random consistency index $CC = 0.66$. The next step is to calculate the consistency ratio $RC = 0.0139$. Based on the fact that the RC value is less than the standard value of 0.1, it can be concluded that the matrix has passed the consistency check.
$R_{K2}^{TU} = \begin{bmatrix} 1 & 4 & 0.33 \\ 0.25 & 1 & 0.17 \\ 3 & 6 & 1 \end{bmatrix}$	The survey matrix R_{K2}^{TU} has dimension $k = 3$. The weight vector of the matrix $Q = (1.101, 0.347, 2.621)^t$; The normalized value of the eigenvector $Q_{norm} = (0.271, 0.085, 0.644)^t$. The maximum eigenvalue of the matrix $\sigma_{max1} = 3.054$; Consistency index $IC = (3.054 - 3) \cdot (3 - 1)^{-1} = 0.027$. For $k = 3$, we determine the value of the random consistency index $CC = 0.66$. Concordance ratio $RC = 0.041$. Based on the fact that the RC value is less than the standard value of 0.1, it can be concluded that the matrix has passed the consistency check.
$R_{K3}^{TU} = \begin{bmatrix} 1 & 5 & 2 \\ 0.2 & 1 & 0.2 \\ 0.5 & 5 & 1 \end{bmatrix}$	The survey matrix R_{K3}^{TU} has dimension $k = 3$. The weight vector of the matrix $Q = (2.154, 0.342, 1.357)^t$; The normalized value of the eigenvector $Q_{norm} = (0.559, 0.089, 0.352)^t$. The maximum eigenvalue of the matrix $\sigma_{max1} = 3.054$; Consistency index $IC = (3.054 - 3) \cdot (3 - 1)^{-1} = 0.027$. For $k = 3$, we determine the value of the random consistency index $CC = 0.66$. Concordance ratio $RC = 0.041$. Based on the fact that the RC value is less than the standard value of 0.1, it can be concluded that the matrix has passed the consistency check.
$R_{K4}^{TU} = \begin{bmatrix} 1 & 6 & 2 \\ 0.17 & 1 & 0.2 \\ 0.5 & 5 & 1 \end{bmatrix}$	The survey matrix R_{K4}^{TU} has dimension $k = 3$. The weight vector of the matrix $Q = (2.289, 0.322, 1.357)^t$; The normalized value of the eigenvector $Q_{norm} = (0.577, 0.081, 0.342)^t$. The maximum eigenvalue of the matrix $\sigma_{max1} = 3.029$; Consistency index $IC = (3.29 - 3) \cdot (3 - 1)^{-1} = 0.015$. For $k = 3$, we determine the value of the random consistency index $CC = 0.66$. Concordance ratio $RC = 0.022$. Based on the fact that the RC value is less than the standard value of 0.1, it can be concluded that the matrix has passed the consistency check.

Source: Calculated by the authors.

After that, it should be determined the aggregated weight vector taking into account all alternative solutions at the third level to the criteria of the second level.

Next step is to calculate the combined weight vector taking into account all elements of the level of alternatives to the level of criteria:

$$MS = \begin{bmatrix} 0.122 & 0.271 & 0.559 & 0.577 \\ 0.558 & 0.085 & 0.089 & 0.081 \\ 0.320 & 0.644 & 0.352 & 0.342 \end{bmatrix}$$

Weight vector $P = Q_{norm} = (0.56, 0.25, 0.11, 0.08)$. Following this, we are calculating the vector of general weights X:

$$X = \begin{bmatrix} 0.122 & 0.271 & 0.559 & 0.577 \\ 0.558 & 0.085 & 0.089 & 0.081 \\ 0.320 & 0.644 & 0.352 & 0.342 \end{bmatrix} \cdot \begin{bmatrix} 0.56 \\ 0.25 \\ 0.11 \\ 0.08 \end{bmatrix} = (0.244, 0.351, 0.405)$$

The vector of general weighting coefficients X allows choosing the most optimal alternative solution for the adaptation of the logistics system for the TU group. Most optimal solution is Alt_3^{TU}, the general weighting factor is 0.405. Chosen alternative solution is naturally related to ensuring a certain level of security of logistics processes.

Conducted analysis indicates that despite the industry differences, in the conditions of martial law, any enterprise faces challenges that are primarily related to the danger and unpredictability of military operations, which explains the need to transform the logistics system in order to ensure the safety of logistics processes.

4. Conclusions

- Modern logistics involves the involvement of the latest information and management technologies, which allow to ensure the high efficiency of the business entity's functioning, subject to compliance with environmental and social norms.

- The application of logistics approaches in the management of Ukrainian enterprises is a fairly new management practice, and at many enterprises such approaches to logistics management are in the process of formation. The introduction of martial law in the country also forces the management of enterprises to find possible ways of adapting the logistics system to the requirements of the time.
- In order to achieve the goal of the study, fourteen enterprises were examined. The results of the survey were grouped into three groups according to the industries, namely: innovation-industrial group, agricultural and tourism. The analysis made it possible to identify the factors that affect the formation and functioning of the logistics system of the enterprise, namely: the increase in prices for equipment, the increase in the popularity of logistics collaboration and cooperation, the increase in the volume of online orders, the uneven territorial location of warehouse hubs, reorientation from road transport to rail, development of logistics outsourcing, etc. Factors caused by military actions include the following: a decrease in the amount of stocks due to the risk of losing them during an attack, the destruction of the logistics infrastructure, shortages and rising prices for fuel and lubricants, complications in highway logistics, etc. The obtained factors made it possible to form the criteria that were used in the hierarchical analysis.
- In the process of research, a hierarchical analysis was carried out in order to find optimal solutions for the adaptation of logistics systems separately for each group. As a result, for each individual group, the most optimal solution was the chosen alternative, which involves increasing the level of security of logistics processes at the enterprise. Such a result indicates that, despite industry differences, the most urgent task for any enterprise in the conditions of martial law is to ensure a certain level of security of business processes, in particular, logistics processes.
- The application of the expert method of criteria selection for the method of hierarchies' analysis can become a subject for further research.

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