работки стратегии УИСОРЭ, а также формировании перечня приоритетов, определяющих систему целей в управлении УИСОРЭ; 2) системного анализа, комплексного, системного и междисциплинарного подходов – при разработке блок-схемы модели формирования и реализации УИСОРЭ Украины; 3) анализа иерархий и диалектического метода научного познания – при принятии решения по разработке программ и проектов УИСОРЭ Украины.

Результаты. Разработана и предложена блок-схема модели формирования и реализации стратегии УИСОРЭ Украины, основу которой составляют жизненно важные интересы (ЖВИ) человека, общества, государства. В контексте необходимости адекватной оценки инновационной политики страны как одного из этапов по формированию и реализации стратегии УИСОРЭ выделены показатели, характеризующие тип инновационной политики. Сформирован перечень приоритетов, определяющих систему целей в управлении УИСОРЭ. Позиционировано развитие отраслей горнодобывающей промышленности как драйверов УИСОРЭ, что способствует решению проблемы энергетической безопасности Украины. Разработаны и предложены программы УИСОРЭ согласно классификации ЖВИ по приоритетам и критерии их оценки.

Научная новизна. Разработана блок-схема модели формирования и реализации стратегии УИСОРЭ Украины, которая соответствует критериям оптимальности, эффективности и устойчивости развития динамических систем. При этом основным управляемым параметром выступает модернизированный индекс человеческого развития, который одновременно является индикатором достойного уровня жизни человека и благосостояния страны в целом. В контексте реализации этапов стратегии УИСОРЭ обоснованы показатели, которые позволяют выбрать подходящий тип инновационной политики, сформирован перечень приоритетов, определяющих систему целей, визуализированы программы УИСОРЭ и критерии их оценки.

Практическая значимость. Результаты исследования могут использоваться органами государственного управления для формирования и реализации концепций, стратегий и программ УИСОРЭ страны.

Ключевые слова: *стратегия развития экономики, критерий устойчивости, жизненно важные интересы, национальная экономика, энергетическая безопасность*

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THEORETICAL ASPECTS OF THE SYSTEM DECOMPOSITION OF THE LOGISTICS SYSTEM ELEMENTS

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ТЕОРЕТИЧНІ АСПЕКТИ СИСТЕМНОЇ ДЕКОМПОЗИЦІЇ ЕЛЕМЕНТІВ ЛОГІСТИЧНОЇ СИСТЕМИ

Purpose. Decomposition of the logistics system into the system elements is an important and necessary step in the theoretical studies, the results of which are used in establishing or improving the logistics system in order to increase the efficiency of the company and gain additional competitive advantages by forming unique competences.

Methodology. A systematic approach to defining the elements of the logistics system has been applied. The method of scientific abstraction has been used to reveal the properties of logistics systems which allow identifying the core features of the investigated categories.

Findings. Implementation of the system decomposition of the logistics system allows identifying its main components and revealing the relationships between its elements. Results of the study confirm that the system decomposition of the logistics system elements includes conditions, properties, features, goals, subjects and objects.

Originality. The scientific novelty of the research is a systematic approach to defining the elements of the logistics system and their properties (viz. integration, structuration, hierarchy, development, emergentity, goal orientation, synergy, and modeling) through the method of scientific abstraction.

Practical value. System decomposition of the logistics system elements, including the conditions, properties, features, goals, subjects and objects, allows for the unification of terminology and elimination of non-core logistics categories.

Keywords: *system decomposition, logistics system elements, logistics system conditions, logistics system properties, logistics system features, logistics system goals, logistics system subjects, logistics system objects*

Introduction. The formation of logistics as a science requires addressing numerous issues, with a focus on the standardization of the terminology. A system decomposition of the logistics system will identify its main constituent parts and demonstrate the interrelations between its elements.

Analysis of the recent research and publications. Conditions for the logistics system existence were analised by N. B. Savina and N. O. Selezniova; the properties were studied by V. I. Amelkin, I. A. Gareev, T. Ye. Yevtodiyeva, I. A. Kabanets, V. A. Levchenko, V. V. Nikiforov and T. N. Skorobogatova. Characteristics inherent in a logistics system were investigated by V. A. Levchenko, T. Ye. Yevtodiyeva and N. B. Savina and the purpose of the logistics system was studied by V. O. Levchenko, N. B. Savina and A. V. Tkachova. Most of the above publications deal with the individual elements of the logistics system, with little focus on a system decomposition of the logistics system; the gap gave the impetus for this research.

Tkachova A. V. suggests that the decomposition of the logistics system should be performed by defining the following: firstly, the natural and material composition of the logistics system management objects by isolating such elements as material resources, inventory, warehouses, transportation vehicles, information, personnel, services; secondly, the functional composition of the elements of the logistic system, which implies identifying the blocks aimed at specific logistics functions within the logistics system (procurement, production, or marketing); thirdly, structural (object) composition of the logistics system through dividing the logistics system into subsystems, units (relationships) and elements [1].

Object hierarchy is of greatest interest from the standpoint of organizational forms of the logistics management. Structural decomposition enables clearly tracing both the interrelations between the component parts within the system (internal relationships) and between the components of different logistics systems that interact in the process of transferring logistics flows in the external market environment (external relationships). Thus, internal relationships form the internal chains, while external relationships account for the external chains [1].

The importance of the object-oriented structure of the logistics system is due to the flow processes in an organized aggregate of its units that consist of elements. This way of representation of the logistics system clearly demonstrates the integrity of its functional components, the subordination and dependences of its structural components on the selected type of logistics organization with its specific system-forming properties as well as material, information and other relationships.

Unsolved aspects of the problem. With a view to standardizing the terminology and eliminating the non-core logistics categories, there is urgent need for a system decomposition of the logistics system, which would include its conditions, properties, characteristics, purpose, subjects and objects.

Theoretical basis. The first stage of the study involves examining the conditions. For instance, according to N. A. Selezniova, the obligatory conditions for the existence of a logistics system are: integrity (the system is a holistic set of elements that interact with each other; the elements only exist within the system, while outside the system they are merely objects); presence of some characteristics of the purpose and some quality criteria that condition the existence of the object as a system (the system should have integrative qualities that are inherent in the system as a whole, but not in any of its individual elements); the system should be part of a larger system, and enter into some other system as a subsystem (the elements of the system are interrelated by logical relationships that necessitate the integrative character of the system); the object considered a system should be structurized, able to break into parts and consist of subsystems (there are system-forming factors that enable establishing the ordered relationships) [2].

Savina N. B. points out that the basic conditions for the existence of logistics systems are [3]: focus on the demand (logistics should address the needs of consumers); integritivity (transition to integrated structures that combine procurement, production, and distribution on the basis of a developed infrastructure); coordination (synchronization of material, information and financial flows, which provides high efficiency for all the parties).

Secondly, let us turn to the properties. According to I. A. Gareeva, to study a system comprehensively , it is necessary to identify the common and unique features of various type systems [4].

The common properties, in I. A. Gareeva's opinion, should include [4]: 1) integrity (which is determined by strong relationships between the elements that form the system as a single unit; the properties of the system are not the mere sum total of the constituent elements and they are not determined by simply adding the properties of the elements; the integrity of the system is manifested in its external and internal performance); 2) structure (elemental composition and relationships between the elements, which determine the internal structure and organization of the object as an integral system; internal strength, sustainability, a high degree of interrelation between all the components, the ability to withstand environmental factors); 3) hierarchy (each component can be viewed as a system, while the investigated system itself is a component of a larger and more complex system); 4) functionality (all the elements of the system function continuously and interact in a coordinative

manner within their functional purposes, thus playing a system-forming role and limiting the decision space, the number of cases, and the number of interactions); 5) purposefulness (a measure of order, organization, probability of the steady state of the system and the consideration of alternative choices); 6) controllability (choice of behavior, prediction of the mode of action); 7) predictability (analysis, prediction of the system's interactions with the environment, taking in consideration the environmental influence upon the purposeful functioning of the system and qualitative transformation of its properties under the impact of external factors); 8) conditionality (environmental feedback in the system); 9) self-organization (self-organization and self-improvement is manifested and enhanced through the targeted managerial social activities); 10) sustainability (maintaining the integrity and intended quality of functioning, adaptability to changes in the environment; search for interrelations or relationships between the elements that allow the system to maintain its existence and vital parameters at a desired level; differentiation and lability, which are the basic elements of self-organization to ensure the stability of a system); 11) modeling (presentation of a system through the final set of models that addresses certain properties of a complex system and is always more simple than the system itself).

Table 1 shows the above properties as identified in the current publications. As we can see, the researchers have distinguished the following properties:

1) integrity and divisibility [2, 5–8];

2) interrelations of the elements (relationships) [2, 5–7, 9];

3) organization and structuredness of the set of elements [2, 5–10];

4) complexity [5–8];

5) hierarchy [6–8, 10];

6) functionality [7, 10];

7) ability to develop [7, 8];

8) situationality [7, 9];

9) sustainability [7, 9];

10) integrative properties [2, 5–8];

11) purposefulness, efficiency, effectiveness, equifinality [7, 10];

12) synergy [7].

However, in our opinion, the above list needs systematization, since a number of the listed properties duplicate each other and, moreover, there are properties that have not been listed by the authors, though their existence is unequivocally proven.

Using the method of abstraction, we will define the properties of the logistics system, which, in the author's opinion, may highlight the most characteristic features of the category under study.

Since the concept "integrity and divisibility" refers to the uniting of the separated elements into a single unit, it makes sense to describe this property as "integrativity", which characterizes the integration process that unites the elements into a single system.

The situation is a little more difficult when referring to the following three properties: "interrelations of elements (relationships)", "organization and structuredness of the set of elements" and "complexity".

The definitions, suggested by the today's researchers, show that each of these properties provides the relationships that form a structure, which, in turn, is influenced by environmental factors. We consider it appropriate to combine these properties under a single denomination "structuredness", which describes an aggregate of elements, their interrelations, relationships with internal and external environment as well as organizational, technological and production relationships / processes that are united in a structure with its object, subject, input, output, feedback and constraints and ensures strength, sustainability, cohesion, and ability to withstand the environmental factors.

It should be added that in our opinion, structuredness of a system includes a property defined as "conditionality" that accounts for the purpose-directed feedback from the environment.

We suggest that the denominations "hierarchy" and "functionality" should be left unchanged, since they comply with the commonly accepted terminology referring to systems and systems analysis.

Unfortunately, very few scientists distinguish the "ability to develop", "situationality" and "sustainability" as properties inherent in the logistics system [8]. In our opinion, they should be united with a generally known concept "predictability". The turbulent times of today require consideration of the status in every given time period to maintain the intended properties of the system and predict its further development, which might enable its adaptation, expansion, cutting off the unnecessary, outsourcing or upgrading. We suggest considering this property as inherent in the logistics system and refer to it as "sophistication".

We doubt the formulation "integrative qualities" accepted by all the researchers listed in Table; they interpret it as the overall quality of the system, which is manifested by the combination of all its elements, but is not typical of any of its elements in isolation. However, it is this property that has been referred to as "emergence" and is a kind of the dialectical law of the transformation of quantity into quality. Therefore, it is not quite clear why the contemporary scholars so vividly supported the new term "integrative qualities" and abandoned the classical and well-known, justifiable term "emergence".

The concepts "purposefulness" and "synergy", in our view, fully meet the definitions given in Table 1 and do not require any changes.

Synergy is the property that requires additional attention of the researchers. For instance, T. N. Skorobogatova argues that the synergistic effect is reached by the interaction of the subjects (or objects, i.e. logistics flows) that can operate independently, but the result of synergy is not the arithmetic sum of their results [7]. The synergistic effect is obtained by coordinating the efforts of the manufacturers, suppliers and consumers and can be exhibited through the functioning or upgrading.

It is also necessary to emphasize that unfortunately, the contemporary authors do not distinguish the property of "modeling", which allows, firstly, a quantitative

Table

Systematization of logistics system properties [2, 5–10]

Suggested Description	Author's Definition of the Property	Description as Used in Publications	V.V. Nikiforov [5]	V.I. Amelkin [6]	T.Ye. Yevtodiyeva [10]	N.O. Selezniova [2]	T.N. Skorobogatova [7]	I.A. Kabanets [9]	V.O .Levchenko [8]
Integritivity	combining the parts into a whole and their compatibility to achieve common goals through the coordination of economic norms, values, stereotypes of the economic behavior of the logistics system elements to realize the potential and stabilize each component	integrity and divisibility	+	+		+	+		+
Structuredness	ordering a set of elements, which are united by sustainable interconnections and interrelations, according to their joint activities and spatio-temporal existence, to form a logistics system that regulates, controls and directs the behavior, and deternines renewable steady state of these elements	interrelations of elements (relationships)	+	+		+	+	+	
		organization and structuredness of the sets of elements	+	+	+	+	+	+	+
		complexity	+	+			+		+
Hierarchy	uniting the various-scale elements in a single logistics system, distribution of functions, specifying the rights and levels of subordination, recognizing that these elements are unequal	hierarchy	+	+			+		+
Functionality	the ability of elements to perform a sequence of actions to achieve the purpose of the logistics system through the ability of fulfilling special tasks, coordination of results, robustness and reliability	functionality			+		+		
Sophistication	the knowledge, technologies and competencies necessary to solve situational problems that ensure a sustained development, and the search for innovative approaches to solving them	ability to develop					+		+
		situationality					+	+	
		sustainability					+	+	
Emergency	interrelations between the elements of the logistics system that allow the emergence of new properties not inherent to each element	integrative qualities	+	+	+	+	+	+	
Purposefulness	subordination of the purpose-directed actions of the system elements, which provides for high performance, efficiency and equifinality, i.e. the ability of the logistics system to reach states, independent of the initial conditions and only determined by the parameters of the system	purposefulness, efficiency, effectiveness, equifinality			+		+		
Synergy	a single focus, a combined effect of the elements of the logistics system, whose overall outcome is greater than the individual outcome of each individual element	synergy					+		
Modeling	studying the logistics system by making a model that describes the operation, development, structure, relationships and trends to assess the current state, predict the future state and make proper management decisions								

description of the system objects through the specified units of measurement; secondly, modeling forms the basis for applications of the results obtained on a model to the original logistics system. Therefore, the possibility to represent a system as a model should by all means be included in the above properties.

Thus, we recommend integritivity, structuredness, hierarchy, sophistication, emergence, purposefulness, synergy, modeling to be distinguished as the properties inherent in the logistics system.

Thirdly, in our study of a system decomposition of the logistic system, we will define the characteristics that the logistics system should exhibit.

According to N. B. Savina, the logistics system should be complex, dynamic, and stochastic and composed of many interrelated elements to harmonize the interests of all participants in the logistics process [3]. Levchenko V. A., in turn, identifies systemic, integrated and complex nature of the logistics system [8].

Yevtodiyeva T. Ye. examines a systemic form of the organization and identifies the following features of the logistics system [10]:

- it provides a hierarchical structure, strict assignments of functions to the structural elements, compromise or sole discretion in addressing all disagreements that occur at lower levels;
- it allows each structural element (subsystem, unit) to use its own optimality criterion, which reflects its internal interests;
- the nodular structure of the organizational structure provides for both centralized and decentralized management;
- organizational structures of functional type dominate;
- it suggests both object and function orientation;
- it uses two models of management structure: administrative and contract management.

Distinguishing the properties according to [10] is the basis for a clear distinction between a system and network organization of logistics: "... firstly, the network involves at least three counterparties; secondly, the participants agree, but do not integrate their functions and establish long-term interrelations; thirdly, the counterparties perform operations under a contract concluded between them".

With regard to the above research results, the following should be added: firstly, the characteristics suggested by N. B. Savina and V. O. Levchenko relate to the properties; secondly, the characteristic features indicated by T. Ye. Yevtodiyeva cannot be considered characteristics merely inherent in a logistics system.

In our view, the characteristics of the logistics system should include firstly, harmony: these are the interrelationships between the elements of the logistics system, which provide for their interconnection and make them ordered, expedient, logical, informative and free of conflicts; secondly, coordination, which is a kind of subordinate relationship between the key and dependent elements of the logistics system; and, thirdly, synchronization, which is the order of flows that prevents their competition or mutual deadlock, due to a consistent shift relative to each other.

Fourthly, a system decomposition of the logistics system involves identifying its purpose.

The most common purposes of the logistics activity are supplying the best prepared goods and products for personal or business consumption at the lowest cost; minimizing costs or maximizing profits; obtaining a synergistic effect; reducing the logistics cycle; achieving long-term strategic advantages.

Tkachova A. V. and Levchenko V. O. indicate that the purpose of the logistics systems is to deliver logistics flows with specified quantitative and qualitative characteristics and most prepared for production or personal use at optimal cost levels [1, 8]. According to V. A. Levchenko, the tasks are the formation of complex integrated logistics systems; strategic coordination, planning and control of the use of logistics flows in the company; achieving high system flexibility [8].

According to N. B. Savina, the result of the logistics system is the creation of a logistics product or service [3].

We claim that the logistics system should be aimed at sustainability (preserving and maintaining the status achieved), development (acquisition of a new status) and accumulation of core competencies.

Fifthly, in our opinion, the subjects of the logistics system are logisticians, logistics centers, logistics operators, counterparties, intermediateries, owners, and investors; the objects of the logistics system are phase processes, logistics operations, flow processes, logistic functions, functional processes, and logistics units.

Savina N. B. argues that the object of the logistics and, accordingly, the factors affecting it undergo changes depending on the level of an economic system. For instance, at the macro level these include the components of direct (tax policy, the behavior of suppliers and consumers) or indirect (the political, economic situation) influence. At the meso level, the logistics object undergoes a major impact from social and psychological components (the satisfaction of physiological, social and spiritual needs, the moral and psychological climate in the team). As for the micro level, the object of logistics is affected by typical dynamic factors such as the proportion of competitiveness of industrial products, trends in foreign trade, inflation, etc. [3].

In our view, all the company's relationships are formed under the influence of the meso logistics environment which, in turn, depends on the macro logistics environment, which is influenced by the domestic environment that is subject to the impacts from the international environment (Fig. 1). In turn, these relationships directly affect the logistics system.

The international economic environment undoubtedly influences the logistics system of an industrial enterprise and is characterized by the level of economic development in the country as a whole; by the state of economies in the leading countries of the world; by the state of their markets and, as a consequence, by trends in economic integration of the countries in question.

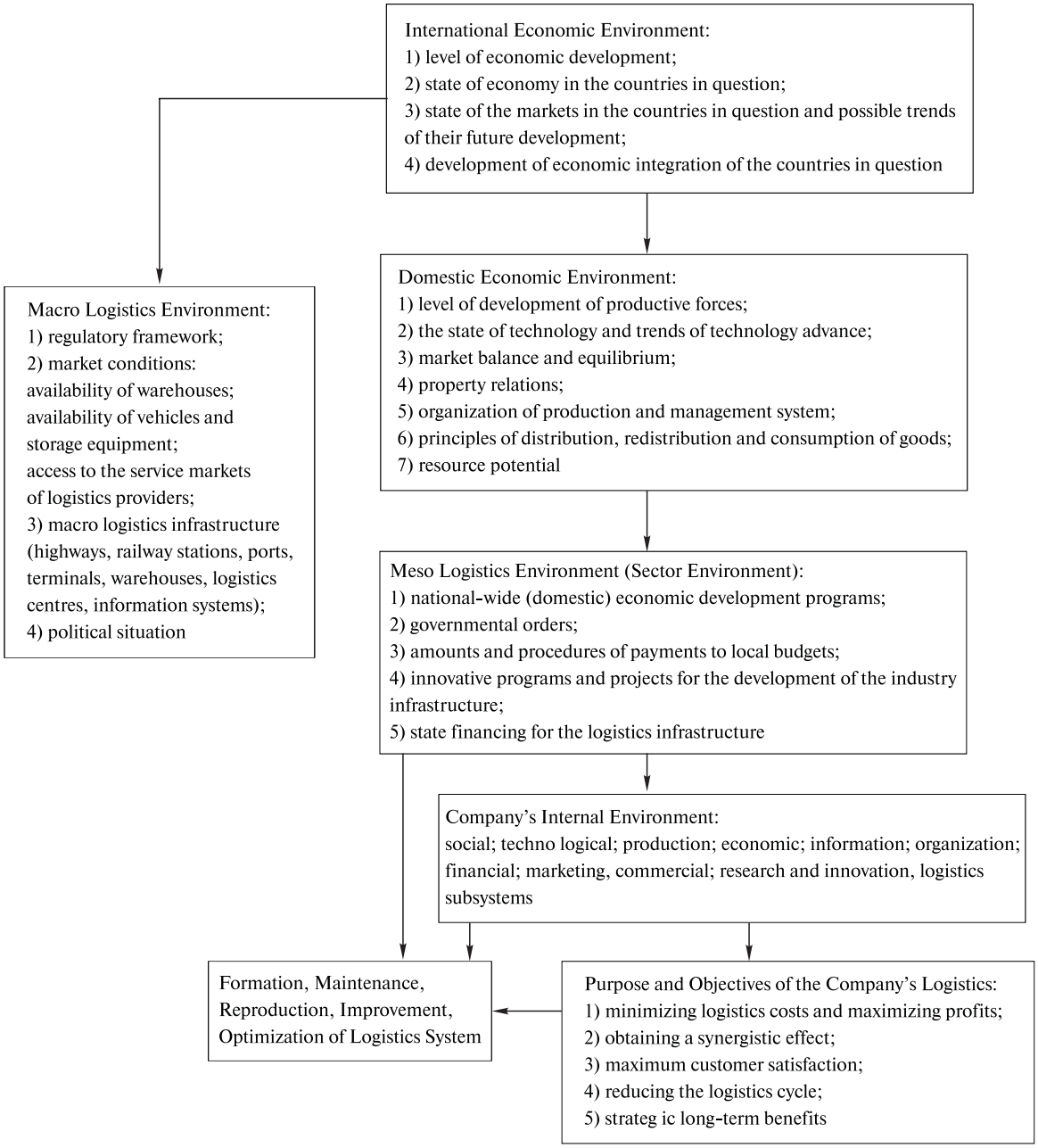

Fig. 1. Influence of the internal and external environments on a company's logistics system

The level of the development of productive forces; the state of technology and prospects of technological advances; balance and equilibrium in the market; property relations; production organization and management system; principles of distribution, redistribution and consumption of goods, and the resource potential are the factors that affect domestic economic environment.

As mentioned above, in addition to the domestic economic environment, the international economic environment also affects the macro logistics environment that can be characterized through the regulatory framework, market conditions, macro logistics infrastructure and political situation.

The meso logistics environment (sector environment) is formed under the influence of macro and domestic environments and includes national-wide (domestic) economic development programs; governmental orders; amounts and procedures for payments to local budgets; innovative programs and projects for the development of the industry logistics; state financing for the logistics infrastructure.

Based on the characteristic features of the influence of environmental factors, it is possible to describe the logistics system objects. They are phase, flow, and functional processes and operations, which are characterized by a change in size, forms of existence, and location, and which are influenced by the management functions through the proper methods, in order to obtain close to the desired processes and (or) values of the performance criteria.

Author's approach to a system decomposition of the logistics system elements is shown in Fig. 2.

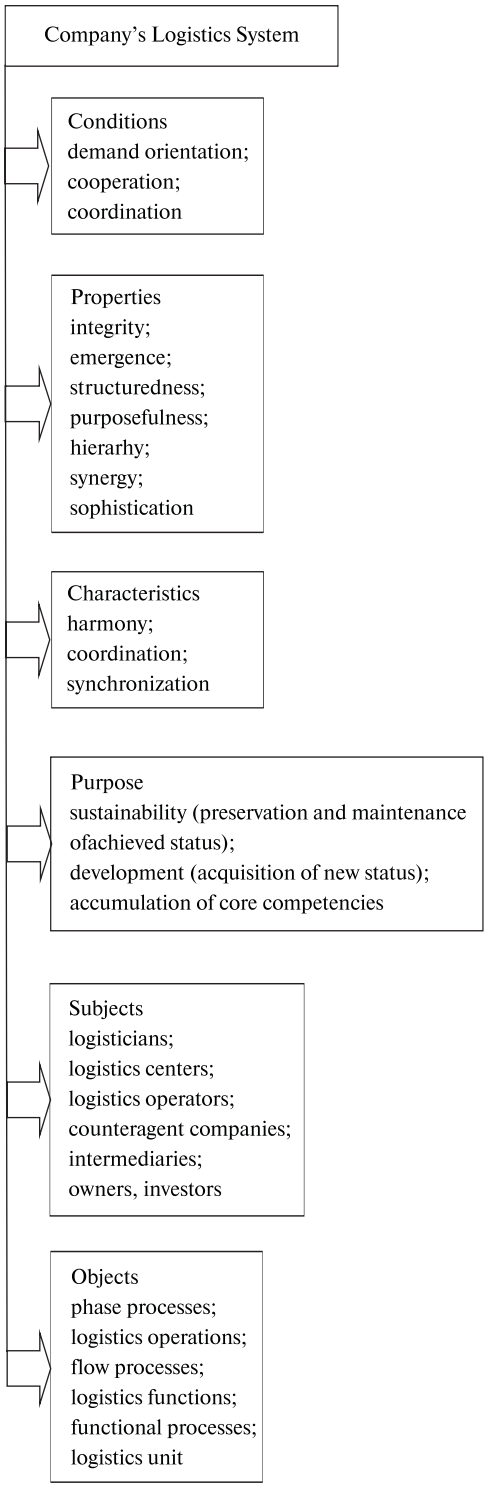

Fig. 2. System decomposition of company's logistics system elements

Conclusions and recommendations for further research. Summarizing the above, it should be noted that the system decomposition of the logistics system reveals its main components and interrelations between its elements and components. The investigation results show that the logistics system may be decomposed into conditions, properties, characteristics, purpose, subjects and objects.

The conditions include the focus on demand, cooperation, and coordination. Using the method of abstraction, we will distinguish the logistics system properties that highlight the most characteristic features of the category under consideration: integrity, structuredness, hierarchy, sophistication, emergence, purposefulness, synergy, and modeling. The characteristics of the logistics system are harmony, coordination and synchronization. Its purpose is sustainability (preservation and maintaining the status achieved), development (acquisition of a new status) and accumulation of core competencies. Subjects of the logistics system should be logisticians, logistics centers, logistics operators, counteragent companies, intermediaries, owners, and investors; the objects should be phase processes, logistics operations, flow processes, logistic functions, functional processes, and logistics units.

Prospects for further development include defining constraints in functioning the logistics system and building a mathematical model, which will consider the impact of environmental factors on the logistics system objects.

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Мета. Проведення системної декомпозиції елементів логістичної системи є важливим і необхідним етапом теоретичного дослідження, результати якого використовуються при формуванні або вдосконаленні логістичної системи з метою підвищення ефективності діяльності підприємства та отримання ним додаткових конкурентних переваг через одержання унікальних компетенцій.

Методика. Використано системний підхід до виокремлення елементів логістичної системи. Застосовано метод наукової абстракції для з'ясування властивостей логістичних систем, що дозволять підкреслити найбільш характерні риси досліджуваної категорії.

Результати. Проведення системної декомпозиції логістичної системи дозволяє виявити основні її складові й навести взаємозв'язок між її елементами. Результати дослідження підтверджують, що системна декомпозиція елементів логістичної системи включає умови, властивості, характеристики, мету, суб'єкти та об'єкти.

Наукова новизна. Наукова новизна одержаних результатів полягає у використанні системного підходу до виокремлення елементів логістичної системи та з'ясування властивостей логістичних систем (інтеграційність, структурованість, ієрархічність, розвиненість, емерджентність, цілеспрямованість, синергетичність, моделювання).

Практична значимість. Проведена системна декомпозиція елементів логістичної системи, що включає умови, властивості, характеристики, мету, суб'єкти та об'єкти, дозволяє провести уніфікацію термінології й позбавитися від невластивих логістиці категорій.

Ключові слова: *системна декомпозиція, елементи логістичної системи, умови логістичної системи, властивості логістичної системи, характеристики логістичної системи, мета логістичної системи, суб'єкти логістичної системи, об'єкти логістичної системи*

Цель. Системная декомпозиция элементов логистической системы является важным и необходимым этапом теоретического исследования, результаты которого используются при формировании или совершенствовании логистической системы с целью повышения эффективности деятельности предприятия и получения дополнительных конкурентных преимуществ за счет формирования уникальных компетенций.

Методика. Применен системный подход к определению элементов логистической системы. Использован метод научной абстракции для выявления свойств логистических систем, которые позволяют выделить наиболее характерные черты исследуемой категории.

Результаты. Проведение системной декомпозиции логистической системы позволяет выявить основные ее составляющие и определить взаимосвязь между ее элементами. Результаты исследования подтверждают, что системная декомпозиция элементов логистической системы включает условия, свойства, характеристики, цели, субъекты и объекты.

Научная новизна. Научная новизна исследования заключается в использовании системного подхода к определению элементов логистической системы и их свойств (интеграционность, структурированность, иерархичность, развитость, эмерджентность, целеустремленность, синергетичность, моделирование).

Практическая значимость. Системная декомпозиция элементов логистической системы, включающая условия, свойства, характеристики, цели, субъекты и объекты, позволяет провести унификацию терминологии и исключить несвойственные логистике категории.

Ключевые слова: *системная декомпозиция, элементы логистической системы, условия логистической системы, свойства логистической системы, характеристики логистической системы, цель логистической системы, субъекты логистической системы, объекты логистической системы*

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