Logistics systems in modern conditions of the network infrastructure of the country's transport complex

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Abstract. The article is aimed at studying the essence of the functioning of logistics systems, as well as determining how the use of innovations affects the economic development of enterprises and their logistics systems. The authors use innovative and system-integrated approaches to the development of functioning of logistics systems. The main results of the study are: development of an augmented classification of innovations in the logistics system, which contributes to the determination of objective and adequate models of economic situation and directions of their development, determination of vectors of innovative development of logistics systems in a modern business model, proposal of priority directions for improving functioning of logistics systems. Article materials may be useful in formulating a strategy for innovative development of logistics systems, which will contribute to their harmonization and adaptation to modern dynamic changes in the external economic environment and increase the investment attractiveness of enterprises.

1. Introduction

In modern economic conditions, the process of adaptation and improvement of business models for logistics companies is continuous in nature, reflecting the dialectical laws of development: at each new stage, bottlenecks are discovered that require improvement [1].

Improving the quality and efficiency of the process of movement of logistics flows should be built by formation of integrated logistics systems. Its organization shifts the emphasis from managing individual elements of the system to integrated optimization of business processes. Experience of leading countries shows that the use of modern logistics management can save up to 15-20% of the costs of enterprises. A 1% reduction in logistics costs corresponds to an increase in sales of products and services by 10%.

The demand for logistics and innovation in organization and management of goods distribution is organically associated with increasing complexity of tasks of streamlining movement and optimizing logistics flows, using various opportunities to increase competitiveness of companies, including by adoption of innovative decisions in the field of logistics, with intensification of automation processes of control systems, and also accounting and monitoring the movement of flows.

Increasing volumes and complexity of flow management necessitate the use of modern logistics technologies and introduction of innovations in management system based on the principles of innovative logistics. Innovative logistics makes it possible to develop a constructive strategic program...
for development of an enterprise aimed at optimal organization of stream processes and long-term success in the market, defining guidelines for basic logistics. This means that the mission of the enterprise in tactical and strategic perspectives depends on the decisions made in the field of innovative logistics in its integration version.

The future of logistics and innovative technologies in the management system should be associated, on the one hand, with increasing investment attractiveness of enterprises, an active role of the state in the development of public-private partnerships, and, on the other hand, with formation of vertically integrated companies with the necessary organizational and investment potential organizing a reliable and high-quality process of goods distribution and ensuring a high level of logistics service [2].

Thus, in conditions of formation and development of an innovative economy, formation of the network infrastructure of country's transport complex, an extensive terminal network, requirements for the logistics flow management system are increasing with respect to the directions, volumes and quality of flow service and the search for opportunities for its innovative development is being conducted. To improve the quality of its functioning, it is necessary to use an innovative approach and modern logistics principles in the process of management and control of current processes in the system.

The research of general theoretical and methodological issues of development of logistics and supply chain management is made in the works of such Russian scientists as: B.A. Anikin, V.I. Berezhnoy, A.A. Bochkarev, M.P. Gordon, V.V. Dybskaya, E.K. Ivakin, D.A. Ivanov, S.B. Karnaukhov, D.D. Kostoglodonov, V.F. Lukin, L.B. Mirotin, Yu.M. Nerush, V.E. Nikolaychuk, O.A. Novikov, M.A. Parfenov, O.D. Protsenko, L.O. Protsenko, V.G. Sankov, A.I. Semenenko, V.I. Sergeev, L.A. Sosunov, S.A. Uvarov, V.V. Shcherbakov and others, as well as foreign scientists: D. Jones, L. Kaufmann, M. Linders, E. Mate, D. Tiksier, H. Firon, R.B. Handfield et al.

The issues of developing and management of logistics systems are widely covered in the works of domestic and foreign authors: A.U. Albekov, M.P. Gordon, E.K. Ivakin, S.B. Karnaukhov, L.B. Mirotin, Yu.M. Nerush, D.T. Novikov, A.N. Plotnikov, A.N. Rodnikov, V.I. Sergeev, R.V. Shekhovtsov, D. Bowersox, X. Beckmann, D.J. Kloss, D. Lambert, J. Stock, and others.

The analysis of scientific publications on the studied topic showed that many of them consider application of logistic principles in the enterprise management system and assessment of the quality of logistic services [3 - 15]. However, issues associated with the introduction of innovations in the interaction of elements of the logistics system, as well as with assessing the effectiveness of functioning of this system, have not received sufficient coverage in the scientific literature and require additional research in this area.

This study is relevant and timely, since it is aimed at solving an important problem that is essential for the functioning of logistics systems and identifying trends in their innovative development in modern economic conditions. The study is aimed at developing theoretical and practical provisions, the totality of which can be qualified as a solution to the important task of innovative development of logistics systems based on the disclosure of their organizational and economic features, which is of significant socio-economic importance for increasing the economic efficiency of enterprises and economies of regions and the country. The research results are important in development of innovative forms of organizing logistics flows in a modern business model and determining the directions of innovative development of logistics systems.

2. Methods

2.1 Research Methods

In this study, general scientific principles and methods of cognition were used: empirical-theoretical (observation, measurement, description) and logical-theoretical (comparison, analysis and synthesis, deduction, modeling) research methods; systemic, process, interpretation approaches; program-targeted and structural-functional methods; statistical methods for processing economic data.
We used as an analytical base in the research process statistical data and research results presented in analytical reports, scientific publications in general economic, industry periodicals on the research subject, both from open official sources and materials collected and processed personally by the authors in the process research.

2.2 Research Stages
The initial stage includes a detailed study of modern features of the functioning of logistics systems.

At the second stage, classification of innovations in the logistics system is being developed, which helps to determine the models and directions of its development that are objective and adequate to the current economic situation. At this stage, it is also necessary to conduct a comparative analysis of theoretical and practical developments in the studied area.

At the third stage, directions of innovative development of logistics systems in the modern business model are determined, the use of which is necessary to develop a market strategy and adapt logistics systems to modern dynamic changes in the external economic environment.

3. Results

3.1. Structure and Content of the study
The logistics system is a dynamic system, the quality of its functioning largely depends on the coordination of logistics flows in the supply chain and on the effective interaction of the elements of the system, which directly affects the quality of its functioning, costs and level of service.

The value of the logistic approach is manifested in the combination of interests of enterprises of various ownership forms, development of an incentive system and formation of inter-corporate coordination of participants in the logistic process in order to better serve consumers and achieve a synergistic effect from the use of logistics [2]. This is due to the emergence of the ability of logistically organized systems to function in accordance with logistic rules: at the right time, at the right place, with the provision of required level of quality of service with minimal cost.

Logistics in the field of organization of control systems has enormous economic potential; its implementation is manifested primarily in the areas presented in Fig. 1, and their practical implementation in the activities of enterprises taking into account economic realities.

![Figure 1. Directions for implementation of logistics potential.](image-url)
Logistics of economic activity of enterprises can be carried out at present using both basic and innovative logistics. This is primarily due to the fact that in modern conditions an important element of the activity of logistics systems is management of innovations and investments, as well as logistic coordination in the process of developing and making managerial decisions regarding product or process innovations.

Logistic transformations, as a rule, are accompanied by significant costs, and therefore require consistent implementation of a program of measures, which at the same time are a set of necessary organizational, technical, socio-economic, legal, personnel and other prerequisites for creating a full-fledged logistics system for the operation of economic systems. As the experience of evolutionary development of domestic business structures shows, the logistics process requires a continuous increase in the complexity level of a complex of interconnected operational and strategic logistics functions for optimizing the logistics system.

Logistic system should be built, in our opinion, as an integrated system that integrates all flows and is based on the widespread use of information and communication and innovative management technologies from flow planning to organizing and controlling the process of transport process at all stages, including monitoring, operational dispatching, regulation, control and organization of services.

The most important direction of implementation of logistics is to provide logistics support for the processes of harmonization and synchronization of flows (determining the logistics potential of companies, resource constraints, algorithms for developing a database management system, etc.) in order to increase the efficiency of goods distribution. Using the principles of logistics requires close interfunctional coordination of work of all parts of the supply chain, formation of a special organizational and economic mechanism for ensuring the functioning of logistics system, where the potentials are combined - managerial, organizational, technological, marketing - to achieve a synergistic effect.

Thus, formation of a harmonious logistics system will create conditions for optimizing the movement of logistics flows and creation of intermodal transport systems, ensuring an economically feasible distribution of powers and financial resources, forming comprehensive information support and ensuring standardization and unification of management systems, developing economically sound directions for development of competitive activity of enterprises in various market segments.

One of the organizational embodiments of logistics is the formation of an innovation-oriented logistics system that can provide high coordination of material and associated flows, on the one hand, and the growing volumes of these flows, on the other.

At present, innovative management technologies are appearing, business models are being reviewed, latent reserves of management have not been used until now, the best international experience is being studied, and the possibility of its use in Russian conditions is determined taking into account adjustments in accordance with existing realities. The modern approach to improving the efficiency of enterprises and industry as a whole should be focused, in our opinion, on optimizing the management of logistics flows and increasing the competitiveness of enterprises by integrating all processes based on logistic and innovative approaches. Innovative logistics technologies are moving into the field of increasing business efficiency and reducing costs, which is especially important in a crisis.

In relation to the logistics system, it is necessary to determine the main types of innovations and identify their fundamental features (Fig. 2).

Preliminary collection of information on technological changes in the market and the needs of end consumers is required for development and implementation of proposed types of innovations. In this case, one should take into account the possibility of practical implementation of innovations, the correspondence of new types of services to the image of the company and its development strategy. The paramount task is to introduce innovations with the fastest and most effective result, which will allow us to compete in the market, as well as to get the maximum possible profit, offer our services and products to consumers on favorable terms.
Among the most demanded innovations in the logistics system are information innovations due to the increase in the volume of processed information flows and the need to improve the quality of information and reference services to consumers.

Introduction of logistics innovations can be achieved by the use of following organizational innovations: creating a network of multifunctional logistics centers, including formation of commercial and conditionally commercial virtual logistics centers (Virtual Logistic Center - VLC) with functions of electronic marketing, consulting and freight; formation of long-term logistic agreements with participants in the transport process; integration of service functions through development of innovative logistics services. One of the main tasks of modern logistics is the maximum coordination of material and information flows when combining them through the use of electronic data processing, automation of transportation management systems and introduction of new achievements in improving the structure of information flows in logistics.

In the logistics business, high demands are placed on the speed of information processing, which necessitates the use of the latest information technologies, such as: virtualization, use of portal solutions, application hosting, implementation of an operational management system for the transportation process using navigation and automated systems, organization of jobs remote from the enterprise using an automated workstation based on the use of a distributed database.

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**Figure 2.** Classification of types of innovation in the logistics system.

| TYPES OF INNOVATION IN THE LOGISTICS SYSTEM |
|--------------------------------------------|
| Organizational Innovation                  |
| - development and use of new method of doing business, organization of interaction between departments and foreign economic relations |
| Management innovations                      |
| - development of new forms and methods of managing logistics flows and regulation of process of distribution |
| Technological innovations                   |
| - development of a new or improved technology introduced on the market, new technical tool or method of providing services |
| Economic Innovation                         |
| - introduction of changes in the financial and economic sphere of the enterprise and evaluation of the final results of work |
| Marketing innovation                        |
| - implementation of innovative or more effective marketing methods, involving the use of new forms and methods of sales promotion, formation of new pricing strategies |
| Social innovation                           |
| - development of social sphere of the enterprise due to the growth of intellectual capital of the company, activation of human potential, mobilization of personnel to achieve their goals |
| Logistic Innovation                         |
| - development and implementation of organizational and economic improvements in the process of logistic management of economic flows with the aim of rational planning, configuration of flows and their coordination |
| Information innovation                      |
| - creation of organizational and economic mechanisms to ensure high reliability of logistics system by organization of rational information flows |
| Legal Innovation                            |
| - improvement of corporate regulations governing all types of activities of the enterprise, development of social behavior standards aimed at regulating relations between employees |
| Environmental innovations                   |
| - new or improved organizational or marketing methods that enhance environmental safety and prevent negative environmental impacts. |
Following directions can be identified as priority areas for improving the functioning of the logistics system:
- implementation of an integrated approach to development of the logistics system in the regions and the country as a whole;
- development of a network of multifunctional logistics centers;
- improvement of logistic principles and methodology for providing the logistic system with modern information and telecommunication technologies, taking into account economic and environmental aspects;
- Creation of specialized logistics corporations, both on the basis of independent companies and on the basis of subsidiaries of the enterprise;
- integration of implementation and service functions based on the development of innovative logistics services.

Thus, introduction of innovations and use of new principles for supporting and developing logistics systems based on the integration and coordination of processes and management methods at the micro and macro levels will improve the quality and soundness of management decisions at all levels of management.

The logistics approach is to consolidate individual elements of the logistics system into an integrated system that can ensure its timely operation at minimal cost. The interaction of elements of the logistics system in form of integration is advisable due to following advantages: reducing uncertainty, increasing competitiveness of the enterprise, accelerating diffusion of implemented innovations, minimizing logistics costs. The market environment is characterized by random, unsteady processes; one of the most important requirements for logistics systems is their ability to adapt to market conditions.

The organizational structure of the logistics system is influenced by a number of factors: external and internal economic environment in which the system operates; size and scale of its activities; concept and methods of managing a logistics system, etc.

A feature of the logistic system is presentation of its elements as a synthesis of an object and a control subject, and individual elements can represent functionally separate logistic subsystems with established goals, local and global optimization criteria. Therefore, to achieve the strategic goal of logistics system, the necessary level of integration, coordination and directive management at the highest level of the company's logistics management must be ensured.

Conducting a comprehensive study and generalization of the experience of functioning of logistics systems contributes to the construction of adequate models of their economic behavior, which, on the one hand, will most reliably reflect the ongoing logistics processes in real-life economic systems, on the other hand, will allow the use of appropriate methodological apparatus in practice when solving problems of stimulation of innovative development of logistics systems. A distinctive feature of the improved model of logistics system is establishment of relationships between system objects and determination of groups of indicators that affect the movement process (volume, speed) of flows between system elements.

3.2. Implementation steps
Conducting a comprehensive study and generalization of the experience of modeling the innovative behavior of economic systems contributes to the construction and further implementation of adequate models of innovative behavior of logistics systems, which, on the one hand, will most reliably reflect the ongoing innovative processes in real-life economic systems, on the other hand, will allow the use of appropriate methodological apparatus in practice when solving problems of stimulating innovative development of industry objects.

The content of the stages of implementing the mechanism of organizational and economic support for implementation of the modern business model differs in the initial conditions. In the PUSH model, stages of market strategy implementation begin with fundamental and applied research and development of innovative products and technologies, and then move on to market promotion, sales.
promotion and preparation of a unique selling proposition for the user. But in this model there is also a significant drawback, which consists in including marketing and logistics in the process of selling products (services) already at the final stages. As soon as a prototype is received and a trial batch of innovative products is manufactured, creation of a marketing complex, creation of a distribution structure and logistic promotion of products, begins.

The PULL model is diametrically opposite. Here the sequence of stages is carried out in the reverse order, starting from determining market demand during a marketing survey, and then moving on to the behavior of research and development of innovative products targeted at potential buyers, taking into account their relevance in the market. Thus, knowing the volume of potential demand for manufactured products, innovator company has the necessary justifications, confirmed by the results of previous market research and consumer surveys about the existing demand for manufactured products and the possibility of their successful implementation on the market.

However, the created business model of the PULL market strategy, confirmed by the results of the marketing research conducted on the market and determining the potential demand of customers for manufactured innovative or improved products, also has certain risks, the prevailing ones being the risks of choosing business partners and system of distribution and delivery of finished products to the final consumer. This necessitates adaptation of the model to work with the implementation of innovative products and technologies. In this model the main emphasis is placed on the importance of the right choice of distribution channels for finished products by development companies before the start of the production process of innovative products. In this case, there is an objective need for establishment of after-sales service centers, implementation of warranty and post-warranty repairs, and information and reference services for consumers. If, at the same time, manufacturing company does not have sufficient resources to fulfill these requirements, and its contractors and business partners do not agree or do not consider it appropriate to fulfill them, then a gap arises between production and consumption.

Innovative development of modern business model of the enterprise, its marketing and logistics technologies should, in our opinion, be carried out by synthesizing PUSH and PULL models based on the introduction of new marketing strategies (market and product development) and logistics concepts (SCM, VMI, etc.), making significant changes to the supply and distribution management system based on improved models of supply chains, introduction and development of marketing and logistics information technologies.

The leading competitive logistics strategy for development of enterprises, interaction of suppliers and consumers of products in the supply chain, strategy of concentrating their resource potential on the principles of synergy (synergistic effect) actualize the use of a multi-level model for assessing the effectiveness of supply chain and integration of industrial enterprises with business partners based on recognized international SCOR standards (Supply Chain Operation Reference). It is necessary to solve the problems of supply and sales and link operations of transportation, information exchange, inventory and warehouse management, cargo processing, packaging, etc. into a single process. Systematic interaction of participants in the logistics system and innovative resource management are fundamental aspects of development of marketing logistics in the enterprise. To do this, it is necessary to revise principles and tools of marketing management in logistics and move on to integrated logistics management both at the macro and micro scale levels, and at the level of industrial enterprises of various forms of ownership based on establishing partnerships with business partners.

Thus, integration of marketing and logistics concepts in a modern business model will allow the enterprise: to harmonize its internal business processes and increase efficiency of economic activity; maintain and expand the market; reduce logistics costs; increase enterprise competitiveness.

4. Discussions
Specifics of applying the innovative approach in logistics as applied to the material and related flows management system has not yet received adequate coverage in scientific literature. However, this issue requires a special approach, since organization of logistics flows, configuration of network of
movement of material flows, quality of logistics services depend on the specifics of logistics and application of innovations in this area, which confirms the relevance of the scientific search for organizational and economic solutions for innovative development of logistics systems.

Dynamic market changes that significantly affect implementation of finished products (services), the use of new information and telecommunication technologies contribute to an increased interest in logistics in marketing, and also lead to the solution of new problems that marketing logistics is actively involved in [1]. So, currently strategically important is identification of factors affecting the choice of trajectory of movement of goods to the market. Moreover, the overwhelming majority of factors determining mainly correctness of choice of this trajectory, i.e. the goals of the enterprise, its size and nature of products, must be taken into account in the initial information when developing a distribution plan. Another part of factors, as a rule, does not depend on the enterprise and its goods, however, they are no less mandatory when accounting.

Innovative elements in the behavior of logistics systems are currently the most demanded from the point of view of market conditions [2]. In modern conditions of economic development, it becomes extremely necessary to develop measures to stimulate the activity of enterprises in terms of implementing a logistic approach to building effective supply chains and network structures [6]. However, scientific understanding of the nature of relevant processes is necessary to effectively stimulate the innovative behavior of economic entities. The best way to identify the essence of economic phenomena and their effective development is the use of systematic and integrated approaches to the subject of research and development of new models for implementation of market strategies.

Development of logistics systems is impossible without a systematic approach to solving continuously arising complex problems and tasks. A systematic approach involves a clear goal setting in solving managerial problems and eliminating identified problems, determines construction of the system structure and functioning of organizational and economic mechanism for implementation of the ultimate goal.

In modern conditions, for successful economic activity in the external environment, for which time and place are the main factors, organizations distinguish logistics management as a system that ensures timely order execution and the work of "focused" enterprises that produce products and services for geographically isolated areas. One of the important stages in the process of formation and implementation of logistics strategy of enterprises is the awareness of the needs of final customers and contractors of the supply chain. This is a natural condition for development of effective marketing and logistics aimed at meeting the needs of economic entities of the market.

5. Recommendations
Materials of the article are important for business leaders in substantiating management decisions to improve the functioning of logistics systems, regional authorities in formation of a strategy for innovative development of logistics systems, as well as in developing measures aimed at improving the efficiency of goods distribution.

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