LOGISTICS AND SUPPLY CHAIN MANAGEMENT

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EVALUATION OF AN INNOVATIVE LOGISTICS SYSTEM BASED ON THE LOGISTICS EFFICIENCY INDEX

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Abstract. The innovation process is characterized by the process of converting scientific knowledge into innovation. The expansion of innovation processes is associated with the development of a national innovation system, which is based on the interaction of organizations (structures) of various forms of ownership that are engaged in the production of scientific knowledge and technologies (intellectual property objects) and their preparation for commercialization within national borders. The innovation process is cyclical and this process is carried out in stages. The article deciphers seven stages of the innovation process and notes that in the modern world, including Azerbaijan there is a need to switch to a strategy for innovative logistics development, which is becoming a global problem in this area. The development of innovative logistics technologies makes it possible to process large amounts of data and expand the prospects for using information and analytical centers of logistics providers.

The article also provides classification features, types of logistic innovations and synthesis of basic and innovative logistics. It is determined that basic and innovative logistics primarily complement each other, but at the same time there is a contradiction between them. Only the optimal solution of the entire complex of mutual management tasks allows you to achieve your goals, since only the logistics system is able to recoup all logistical costs and ensure the highest efficiency. The issues related to the expediency of using innovative logistics are noted.

The World Bank Logistics Efficiency Index is a unique benchmarking tool that measures the convenience of logistics systems in more than 140 countries with data for 2023. The index consists of six components - customs assessment, infrastructure assessment, ease of transportation assessment, quality assessment of logistics services, timeliness assessment and tracking.

In market conditions, for the Post-Soviet countries, including the Transcaucasian countries, the strategic guideline for innovative development is the creation of a national innovation system, which this system will ensure the identification of innovation priorities, the formation and implementation of state programs, the development of innovative logistics and the stimulation of innovative activities.

Keywords: innovative logistics, types, logistics efficiency index, development of innovative logistics.

JEL Classification: M11, L81, L91, Q5, Q55.

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INTRODUCTION

Logistics activities are a set of systems of measures that are associated with the formation of balanced ratios of material, information and financial expenses in the company and go through a multi-stage stage of circulation from an external source to the end consumer. Logistics is expanding under the influence of transformations in the field of informatization, forming processes, defining requirements for market participants and excluding those who will not be able to adapt to them. In connection with this problem, the concept of "Logistics 4.0" arose in the context of the development of Industry 4.0 [8, pp.53-58].

In logistics innovation, the most optimal technologies are:

- Enterprise Resource Planning;
- Warehouse Management System;
- Transport Management System;
- Customer Relationship Management;
- Radio Frequency Identification system.

The goal of the digitalization process in logistics innovation is to accelerate logistics processes, make them more uninterrupted, and the process of converting materials (data) to digital using new methods of delivery and automation (robotization) is already changing the logistics market today. Information and communication technology (ICT) has become an indispensable tool for logistics service providers (Internet Service Providers Lsps). Lsps have benefited from the use of ICT in their business processes mainly in terms of reducing costs and improving customer service (Tomoya, Shinya, Huy &Tan, 2017).

The innovation process is the process of consistently turning new ideas into new products or services. The innovation process is characterized by the process of converting scientific knowledge into innovation. Therefore, the innovation process is cyclical. The innovation process is carried out in stages (for example, from 7 stages) (Witkowski, 2017):

- stage 1 is the conduct of fundamental research, which most ideas are born in the process of these studies.;
- stage 2 is applied scientific research, which at this stage checks the technical feasibility of the idea, analyzes the scale of market needs, as well as the potential capabilities of companies to develop and manufacture a new product;
- stage 3 is the development work. The experimental design works include: sketch and technical design; release of working design documentation, including drawings for parts, assembly connections, and the product as a whole; production and testing of prototypes; development of a specific design of an engineering facility or technical system; development of ideas and options for a new facility; development of technological processes; definition of the product name, trademark, labeling, packaging;
- stage 4 is the implementation of the achieved results in production;
- stage 5 is the growth and development of production;
- stage 6 is a slow production growth;
- stage 7 is a decline in sales of companies' products.

It should be noted that the company's profit begins with the fourth stage of the innovation process.

There is a basic system of innovation economy and includes information, production technologies and computerized systems. These systems fundamentally transform production systems, technologies, and various means in the field of information production and enhance human intellectual activity (Stock & Lambert, 1982).

Scientific and technical novelty is considered to be one of the main characteristics or properties of innovations. Since scientific novelty, in turn, is evaluated according to technological parameters, as well as with a market position (Tian, Aksentievi ć, Ivani ć & Jardas, 2019). In the

field of innovation and various innovations, there is not only the development of something new, but also in the field of management, finance, logistics, marketing, information, which confirms the all-encompassing nature of innovation.

In modern Azerbaijan today, there is a need to switch to a strategy of innovative development of all sectors, including logistics, which is becoming a global problem in this area. The country's accession to the World Trade Organization and the development of international and economic standards lead to an increase in the need for high-quality logistics services. Currently, various logistics methods require an integrated innovative approach in the field of information storage and processing. The Azerbaijani economy is going through a difficult period and requires a way out of the current economic situation.

LITERATURE REVIEW

A review of economic literature shows that the issues of conducting research on the development and implementation of innovations in the transport system and logistics are devoted to the work of many scientists and it has been of interest to foreign scientists in recent years. However, there has been a limited amount of theoretical research on the topic of logistics innovation. While the prerequisites and results of logistics innovations have been identified in leading logistics journals, very few empirical trials have been conducted. The spread of logistical innovations has also been given attention in the logistics literature (Grawe, 2009).

Some researchers describe innovative logistics as a set of scientific knowledge, methods and skills for the study and rational optimal organization of any flow processes in order to increase the effectiveness of their results by identifying and using additional, usually hidden management reserves. The development of logistics technologies has become possible due to the active introduction of information technologies that allow processing large amounts of data and open up prospects for the use of information and analytical centers of logistics providers. Investments in logistics technologies have become the main factor in the development of supply chains.

Such investments provide not only economic benefits from the supply of various types of transport, but can also give a significant boost to the country's economy. A large share of investments in the development of information technologies in the field of supply chain development corresponds to the global trend:

-investments in the field of information systems and technologies are growing;

-information systems and technologies are used in logistics and supply chain management (Karpenko, 2018).

The development of innovative logistics technologies has become possible due to the active introduction of the latest information and their technologies, which allow processing large amounts of data and expand the prospects for using information and analytical centers of logistics providers. Logistics automation and cloud technologies allow you to reduce the costs associated with attracting labor resources, optimize delivery processes, look for partners and customers, participate in electronic auctions and monitor cargo levels online (Akkaya & Kaya, 2019).

Innovation logistics is gaining significant growth in a developed system of relationships between scientists, educators, entrepreneurs and government officials. It is the four subsystems (knowledge generation system; knowledge application system (production, commercialization); innovation infrastructure; knowledge reproduction and personnel training system (formation of competencies)), which are regulated by the state (state regulation - legal, organizational, social, economic, etc.) that form the national innovation system. The state creates the legal field of activity of the national innovation system and regulates the work of all its elements. The national innovation system is both a process and a result, since its dynamism and openness allow it to produce (import), modify and ensure commercial implementation and diffusion of scientific knowledge and technologies. It represents the main productive force - knowledge (ideas of J. Schumpeter), and the results of its functioning are correlated with scientific knowledge and technologies (objects of

intellectual property). For the effective functioning of the national innovation system, a certain complex of institutions of the national economy is important, which must be connected by close ties to ensure the effective functioning of this system.

It can be assumed that in the future the share of investments in the development of information technologies in logistics will increase [6, pp. 65-69]. According to industry experts, Germany is a leading country in the development and implementation of logistics technologies. Currently, the country's main logistics centers are located in 7 cities: Berlin, Hamburg, Dusseldorf, Frankfurt, Stuttgart, Munich and Nuremberg. All of them are mainly located in the western part of the country and transport activities are carried out by 11 large logistics operators. For example, Maneuverability logistics, Concept Logistics, CS4 Logistics, Interglobal Shipping, etc. (Madakam, Ramaswamy & Siddharth, 2015).

The PwC Central and Eastern Europe report on this area highlights five main factors influencing the development of the transport and logistics industry:

digitalization of the sphere;

changes in logistics processes due to the introduction of new software;

changing market dynamics;

changes in international trade;

changes in technological processes due to the introduction of new equipment (Gabdullina & Tolysbaev, 2020).

Innovative logistics can be considered as a set of scientific knowledge, methods and skills for the study and rational necessary organization of any flow processes in order to increase the effectiveness of their final results by identifying and using additional.

PAPER OBJECTIVE

The purpose of this paper is to investigate the innovative logistics system, determine the effectiveness of investment in innovative technology and logistics process.

METHODOLOGY

The presented study uses data from several sources, including materials on the development of innovative systems in logistics, statistical materials on these issues and World Bank materials on the countries of the world on the logical efficiency index. The theoretical basis of the article on the logistics aspect is the work of scientists Post-Soviet countries and far abroad on the formation and development of an innovative logistics system. Statistical and information bases of work on innovative logistics are government programs, periodic scientific publications, etc. As a methodological basis for the work, the author used system-functional, statistical analysis, comparison and rating of indices.

The work also used the method of analyzing the rating indicators of the LPI logistics efficiency index.

RESULT AND DISCUSSION

Innovative logistics follows the path of increasing the height of logistics process management in connection with the application of various innovations aimed at improving the quality of customer service, increasing the efficiency of logistics processes and reducing various costs.

Innovative logistics systems are connected and directly involved in the organizational system of product movement, which is a chain of logistics operations and system-wide innovations. Logistics innovations have a multi-level appearance (see the table 1).

Table 1.

Classification features and types of logistics innovations

No. by pore	Classification feature	Types of logistics innovations
1	Areas of logistics	– procurement activities; – warehousing; – transportation; – distribution of resources in production; – production processes and inventory management; – marketing activities.
2	Commodity Distribution Group	- functional logistic chains; - micro–macrological chains.
3	Scope of application	-local industry; – inter; –industry - system-wide.
4	Usage level	-operational; – procedural; – functional.
5	Types of business processes in logistics	- Technological - Managerial - Organizational

Source: compiled by the authors on the basis of (Mozharova, 2011; Pruemper & Butz, 2004)

Online business owners and logistics experts should be aware of the latest developments in the field of logistics. Since the expectations of fast and affordable delivery motivate further research and development in the field of logistics innovations in the field of automation.

Logistics innovations represent improvements (changes) in logistics services, starting with warehousing and ending with order fulfillment and delivery at the "last mile". Therefore, it is necessary to highlight the following stages of the main logistics innovations of recent years, which have an impact on the supply chain in the logistics sector.

Such aspects include:

– warehousing – according to requirements;
– Last-mile delivery;
– Warehouse management systems;
– Automation potential;
– Blockchain transactions;
– Geolocation technologies;
– Drones;
– Crowd shipping technology;
– Big data analytics;
– Autonomous vehicles;
– Cloud computing.

With a full set of technologies (a vendor-oriented dashboard and WMS used in all our order fulfillment centers), companies with data on the above-mentioned stages of the order fulfillment process for logistics innovation ensure transparency, consistency and visibility.

In innovative logistics, one of the parts is strategic logistics, which is, first of all, a science involved in building logistics capacity in various logistics process management systems. It should be emphasized that the structure has its differences in many ways:

– the process of conceptual revision and elimination of specific obstacles that put pressure on the organization is being built;

– all transformations of innovative logistics relate to the entire management system;

– in the process of logistics, all new divisions of the enterprise are transferred to the category of derivatives. The process of formation and functioning of market structures is associated with the choice of strategies. Market structures create a system for managing flow processes in terms of mutual partnership.

Innovative logistics services should be considered as management services. That is, traditional routine activities in economics and supply management (supply logistics) should be excluded from their composition, namely: physical operations with elements of flows in the field of commodity and material movement. Table 2 shows the synthesis of basic and innovative logistics.

The innovative aspect of logistics gives a unified methodology in terms of completeness and logical completeness. All management decisions in the activities of companies related to procurement, warehousing, transport, service, distribution, etc. processes, in accordance with the concept of logistics, should be made taking into account the rationalization of the entire flow process.

Table 2.

Synthesis of different types of logistics

Types	Management objects	Forms and methods of management
Basic logistics	Material and non-material values	Necessary to ensure an acceptable level of management of this logistics structure
İnnovative logistics	Any streaming processes	Necessary for optimal management of any streaming processes
Synthesis of basic and innovative logistics	Material and related financial and information flows	Necessary for optimal management of the supply of goods

Source: compiled by the authors on the basis of (Baumgarten, 2021; Gabdullina & Tolysbaev, 2020).

From an economic point of view, basic and innovative logistics primarily complement each other, but at the same time there is a certain contradiction between them.

Only the optimal solution of the entire complex of mutual tasks (tactical and strategic) of management in a certain time mode based on the use of the main and additional potential of the entire logistics system allows you to achieve the invented goals. In this case, only a logistics system that combines the majority of the numbers of operations or processes, levels, creating a synergistic effect, is able to recoup all logistics costs and ensure the highest efficiency.

It follows that the expediency of using innovative logistics is determined by:

– the possibility of developing a broader and meaningful logistics program by creating an end-to-end analytical and optimization organization for managing a set of material and service flow processes, i.e. integrated logistics, in several links of the supply chain of products or services based on a common information space in order to identify and use additional management reserves;

– solving logistical problems in various parts of the logistics chain in order to identify areas of mutual benefit and a promising compromise for several owners or associated logistics systems, etc.

Based on the above information on innovative logistics, it can be determined that the main principle of developing an organizational and economic management mechanism for this system is:

– detailing the main goal of the logistics project into composite sub-goals;

– the choice of an organizational management structure that provides the highest level of innovation sensitivity;

– formation of a new model for the development of companies in unstable environmental conditions;

– creation of a high-efficiency control and management accounting system for innovative logistics;

– creation of a new personnel management model focused on the collective participation of employees in the innovative logistics process, achieving the motivation of "resistance to change".

An analysis of the experience of foreign countries shows that based on factors such as economic, cultural, historical, social, etc. The innovative development of the countries of the world is individual. Therefore, so far, there is no single model that would suit all countries of the world without exception, and attempts to simulate the successful experience of other countries, perhaps, will not lead to the desired result without adapting to local conditions. However, there are certain areas for studying approaches to innovation management in countries with a high level of LPI.

According to the World Bank Group, most countries are well aware of the importance of logistics efficiency for development and integration. The book "Trade Logistics in the Global Economy" notes that the unambiguous nature of logistics is: logistics is not only the connection of infrastructure, but also the regulation of services, resilience or simplification of procedures in the trade industry.

The World Bank Logistics Efficiency Index is a unique comparative analysis tool that measures the convenience of logistics systems in more than 140 countries with data in 2023. The World Bank Group uses the Logistics Efficiency Index as the most important starting point for dialogue with member countries on the driving forces of logistics efficiency. The index consists of six components - customs, infrastructure, ease of transportation, quality of logistics services, timeliness, and tracking (Arvis et al.,2023)

The World Bank identifies the countries with the best trade logistics every two years, starting in 2007.

Table 3 shows the TOP 10 countries and Post-Soviet countries according to the logistics efficiency index in 2023.

Calculations show that, according to the logistics efficiency index, the countries occupying the top ten (TOP 10) have the highest indices in the range of 4.0-4.3 points.

And the CIS countries, according to the country's logistics efficiency index (calculated by the World Bank), occupy 27 (Estonia)-128 (Kyrgyz Republic), which corresponds to 2.3-3.6 points on the index. The countries in the top ten are: 1st place Singapore (4.3 points), 2nd place Finland (4.2 points), 3rd-6th place Denmark, Germany, the Netherlands and Switzerland (all 4.1 points), 7th-10th place Austria, Belgium, Canada and Hong Kong (all 4.0 points).

The limit of points scored by the countries ranked 1-10 in the assessment of the logistics efficiency index according to the Customs Committee was 3.7-4.2 points. Among these countries, the lowest score was in Austria (3.7 points), and the highest was in Singapore (4.2 points).

Table 3.

Ranking of the TOP 10 countries and Post-Soviet countries according to the logistics efficiency index, 2023

Range	Countries	LPİ Score, points	LPİ Group	Customs Score, points	Infrastructure Score, points	International Shipments Score, points
1	Singapore	4,3	1	4,2	4,6	4,0
2	Finland	4,2	2	4,0	4,2	4,1
3	Denmark	4,1	3	4,1	4,1	3,6
4	Germany	4,1	3	3,9	4,3	3,7
5	Netherlands	4,1	3	3,9	4,2	3,7
6	Switzerland	4,1	3	4,1	4,4	3,6
7	Austria	4,0	7	3,7	3,9	3,8
8	Belgium	4,0	7	3,9	4,1	3,8
9	Canada	4,0	7	4,0	4,3	3,6
10	Hong Kong SAR	4,0	7	3,8	4,0	4,0
…	…..	…	…	…	…	…
27	Estonia	3,6	26	3,2	3,5	3,4
36	Latvia	3,5	34	3,3	3,3	3,2
40	Lithuania	3,4	38	3,2	3,5	3,4
81	Belarus	2,7	79	2,6	2,7	2,6
84	Georgia	2,7	79	2,6	2,3	2,7
85	Kazakhstan	2,7	79	2,6	2,5	2,6
88	Ukraine	2,7	79	2,4	2,4	2,8
96	Russian Federation	2,6	88	2,4	2,7	2,3
97	Uzbekistan	2,6	88	2,6	2,4	2,6
100	Armenia	2,5	97	2,5	2,6	2,2
109	Moldova	2,5	97	1,9	1,9	2,7
112	Tajikistan	2,5	97	2,2	2,5	2,5
128	Kyrgyz Republic	2,3	123	2,2	2,4	2,4

Source: compiled by the authors on the basis of (Arvis et al.,2023)

In the CIS countries, this indicator was in the range of 1.9-3.3 points. Among these countries, Moldova had the lowest score (1.9 points), and Latvia had the highest score (3.3 points).

The assessment of the country's infrastructure in the top ten received 3.9-4.6 points. Since Austria scored the lowest score (3.9 points), and Singapore scored the highest score (4.6 points). The CIS countries had a score within 1.9 points (Moldova) and the countries Estonia and Lithuania scored 3.5 points each.

According to the international freight transport indicator, the countries in 1st - 10th place had a score limit of 3.6-4.1. Among them, Canada, Denmark and Switzerland were rated with the lowest score of 3.6, and Finland with the highest score-4.1.

Among the CIS countries, the lowest level of assessment was in Armenia (2.2 points), and the highest was in Estonia and Lithuania (3.4 points).

Thus, it can be noted that the difference between Singapore, which took the first place, and the Kyrgyz Republic, which took the last place, according to the Logistics Efficiency Index was 2.0 points.

It should be noted that Azerbaijan's data on this indicator is not included in the assessment of the logistics efficiency index. In our opinion, Azerbaijan, having the Alat Free Economic zone and the Ipek Yolu road, would occupy a certain number according to the logistics efficiency index.

The Zangezur Corridor is a transport corridor project promoted by Azerbaijan through the territory of Armenia (about 40 km), considering providing transport links between the western regions of Azerbaijan and the Nakhichevan Autonomous Republic (NAR). The transport corridor project is promoted by Azerbaijan and Turkey every time. Armenia constantly objects to it, arguing that the "logic of the corridor" is not noted in the trilateral ceasefire statement. It should be noted that this is considered a form of propaganda by Armenia.

Various observers comment on the "Zangezur Corridor", analyzing the political consequences of using this term and, if implemented, characterizing the opening of this corridor as a pan-Turkist agenda.

According to the calculations of the Center for Analysis of Economic Reforms and Communications of Azerbaijan, unblocking transport links between the territory of Azerbaijan and the NAR will help the country to increase exports by $710 million. In this regard, Azerbaijan will save about $10 million on subsidizing flights from Baku to Nakhichevan. Also, the opening of the railway will help to establish gas supplies, since gas supplies are carried out through Iran. According to this, Iran retains 15% of Azerbaijani transit for gas supplies. According to experts, the opening of the Kars-Nakhichevan-Meghri-Zangilan-Baku railway is important from the point of view of lifting the blockade of Nakhichevan.

Also, this road is important for reducing transport costs, increasing the possibility of foreign trade, developing the tourism sector and passenger turnover, as well as attracting local and foreign investments in this region.

CONCLUSION

In the current conditions, for the Post-Soviet countries, including the Transcaucasian countries, the strategic guideline for innovative development is the creation of a national innovation system. The National Innovation System will provide for the identification of innovation priorities, the formation and implementation of state programs for the development of innovative logistics and the stimulation of innovation activity.

The technological level of existing transport systems and their management in the Post-Soviet countries is insufficient. Effective innovations are being introduced very slowly into the innovation and logistics industry and developed foreign experience is slowly spreading. The transport infrastructure at this stage is characterized by a lag in the application of modern organization and management of freight and passenger transportation, advanced technologies for the construction and repair of transport networks, as well as in the informatization of management and control processes.

In modern conditions, innovation management and assessment of the importance of investment projects, as well as logistical coordination in the decision-making process related to product or process innovations, become an important element of the activities of logistics innovation systems.

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ОЦІНКА ІННОВАЦІЙНОЇ ЛОГІСТИЧНОЇ СИСТЕМИ НА ОСНОВІ ІНДЕКСУ ЛОГІСТИЧНОЇ ЕФЕКТИВНОСТІ

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Інноваційний процес характеризується процесом перетворення наукових знань в інновації. Розширення інноваційних процесів пов'язане з розвитком національної інноваційної системи, яка базується на взаємодії організацій (структур) різних форм власності, що займаються виробництвом наукових знань і технологій (об'єктів інтелектуальної власності) та їх підготовкою до комерціалізації в межах національних кордонів. Інноваційний процес є циклічним і цей процес здійснюється поетапно. У статті розшифровано сім етапів інноваційного процесу і зазначено, що в сучасному світі, в тому числі і в Азербайджані, існує необхідність переходу до стратегії розвитку інноваційної логістики, що стає глобальною проблемою в цій сфері. Розвиток інноваційних логістичних технологій дає можливість обробляти великі обсяги даних і розширює перспективи використання інформаційно-аналітичних центрів логістичних провайдерів.

У статті також наведено класифікаційні ознаки, види логістичних інновацій та синтез базової та інноваційної логістики. Визначено, що базова та інноваційна логістика насамперед доповнюють одна одну, але водночас між ними існує протиріччя. Тільки оптимальне вирішення всього комплексу взаємних управлінських завдань дозволяє досягти поставлених цілей, оскільки тільки логістична система здатна окупити всі логістичні витрати і забезпечити найвищу ефективність. Зазначені питання, пов'язані з доцільністю використання інноваційної логістики. Індекс ефективності логістики Світового банку - це унікальний інструмент бенчмаркінгу, який вимірює зручність логістичних систем у понад 140 країнах світу з даними за 2023 рік. Індекс складається з шести компонентів - оцінка митниці, оцінка інфраструктури, оцінка легкості транспортування, оцінка якості логістичних послуг, оцінка своєчасності та відстеження.

У ринкових умовах для країн пострадянського простору, в тому числі і для країн Закавказзя, стратегічним орієнтиром інноваційного розвитку є створення національної інноваційної системи, яка забезпечить визначення інноваційних пріоритетів, формування та реалізацію державних програм, розвиток інноваційної логістики та стимулювання інноваційної діяльності.

Ключові слова: інноваційна логістика, види, індекс логістичної ефективності, розвиток інноваційної логістики.