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## FORMATION OF LOGISTICAL COSTS AT DAIRY ENTERPRISES: BIBLIOMETRIC ANALYSIS

The article discusses the formation of logistical costs in the dairy industry using bibliometric analysis. The main attention is paid to the research of scientific works and modern techniques aimed at optimizing costs and increasing the economic efficiency of logistics processes in the context of the specifics of the dairy industry. Bibliometric analysis allows us to identify key research areas, trends and gaps in the study of logistics costs, as well as to assess the contribution of various authors and organizations to the development of this field. The conducted research revealed the insufficient representation of scientific publications on the topic of logistics costs in the dairy industry in the international Scopus database over the past five years, which confirms the relevance of this study.

The purpose of the article is to identify the main areas of activity of researchers in the academic environment, providing quantitative research data on the mechanism of formation of logistical costs based on bibliographic analysis and evaluation of research sources.

The scientific research highlights the need to use modern analytical approaches to better understand the cost structure and develop effective management solutions that will reduce costs and increase the competitiveness of dairy enterprises. The results of the bibliometric analysis make it possible to identify the main authors and study the proposed methodology, which is especially useful for managers, economists and researchers involved in logistics processes in the agro-industrial sector.

Special attention is paid to the methodology of bibliometric analysis, which made it possible to identify key trends, gaps and promising areas in the study of logistics costs. The results of the analysis are focused on solving practical tasks of the dairy industry, including optimizing the transportation, storage and distribution of dairy products. The data obtained became the basis for the development of effective strategies for managing logistics processes that help reduce costs and increase the competitiveness of dairy enterprises.

For research in bibliometric analysis, the main task of the research will be data processing and analysis using the capabilities of special programs and devices such as Vosviewer based on data from modern bibliographic databases SCOPUS, Web of Science, Mendeley.

**Key words:** logistics, logistical costs, bibliometric analysis, cost optimization, dairy industry.

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### Сүт кәсіпорындарында логистикалық шығындарды қалыптастыру: библиометриялық талдау

Мақалада библиометриялық талдауды қолдана отырып, сүт өнеркәсібі кәсіпорындарында логистикалық шығындарды қалыптастыру қарастырылады. Сүт саласының ерекшелігі жағдайында шығындарды оңтайландыруға және логистикалық процестердің экономикалық тиімділігін арттыруға бағытталған ғылыми еңбектер мен заманауи әдістерді зерттеуге баса назар аударылады. Библиометриялық талдау зерттеудің негізгі бағыттарын, логистикалық шығындарды зерттеудегі тенденциялар мен олқылықтарды анықтауға, сондай-ақ әр түрлі авторлар мен ұйымдардың осы саланың дамуына қосқан үлесін бағалауға мүмкіндік береді. Зерттеу соңғы бес жылдағы Scopus халықаралық деректер базасында сүт саласындағы логистикалық шығындар тақырыбы бойынша ғылыми жарияланымдардың жеткіліксіз ұсынылуын анықтады, бұл осы зерттеудің өзектілігін растайды.

Мақаланың мақсаты библиографиялық талдау және ғылыми зерттеу көздерін бағалау негізінде логистикалық шығындарды қалыптастыру механизмі бойынша зерттеулердің сандық деректерін қамтамасыз ететін академиялық ортадағы зерттеушілер қызметінің негізгі бағыттарын анықтау болып табылады.

Ғылыми зерттеу шығындардың құрылымын тереңірек түсіну және шығындарды азайтуды және сүт өнеркәсібі кәсіпорындарының бәсекеге қабілеттілігін арттыруды қамтамасыз ететін тиімді басқару шешімдерін әзірлеу үшін заманауи аналитикалық тәсілдерді қолдану қажеттілігін көрсетеді. Библиометриялық талдаудың нәтижелері негізгі авторларды анықтауға, ұсынылған Әдістемені зерттеуге мүмкіндік береді, бұл әсіресе агроөнеркәсіптік сектордағы логистикалық процестермен айналысатын менеджерлер, экономистер мен зерттеушілер үшін пайдалы.

Логистикалық шығындарды зерттеудегі негізгі тенденцияларды, олқылықтарды және перспективалық бағыттарды анықтауға мүмкіндік берген библиометриялық талдау әдістемесіне ерекше назар аударылды. Талдау нәтижелері сүт өнімдерін тасымалдауды, сақтауды және таратуды оңтайландыруды қоса алғанда, сүт саласының практикалық міндеттерін шешуге бағытталған. Алынған деректер шығындарды азайтуға және сүт кәсіпорындарының бәсекеге қабілеттілігін арттыруға ықпал ететін логистикалық процестерді басқарудың тиімді стратегияларын әзірлеуге негіз болды.

Библиометриялық талдаудағы зерттеулер үшін зерттеудің негізгі міндеті SCOPUS, Web of Science, Mendeley заманауи библиографиялық дерекқорларының деректеріне негізделген Vosviewer сияқты арнайы бағдарламалар мен құрылғылардың мүмкіндіктерін пайдалана отырып, деректерді өңдеу және талдау болады.

**Түйін сөздер:** логистика, логистикалық шығындар, библиометриялық талдау, шығындарды оңтайландыру, сүт өнеркәсібі.

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### **Формирование логистических затрат на молочных предприятиях: библиометрический анализ**

В статье рассматривается формирование логистических затрат на предприятиях молочной промышленности с использованием библиометрического анализа. Основное внимание уделено исследованию научных трудов и современных методик, направленных на оптимизацию затрат и повышение экономической эффективности логистических процессов в условиях специфики молочной отрасли. Библиометрический анализ позволяет выявить ключевые направления исследований, тенденции и пробелы в изучении логистических затрат, а также оценить вклад различных авторов и организаций в развитие данной области. Проведенное исследование выявило недостаточную представленность научных публикаций по теме логистических затрат в молочной отрасли в международной базе данных Scopus за последние пять лет, что подтверждает актуальность данной исследования.

Целью статьи является определение основных направлений деятельности исследователей в академической среде, обеспечивающих количественные данные исследований по механизму формирования логистических затрат на основе библиографического анализа и оценки источников научных исследований.

Научное исследование подчеркивает необходимость использования современных аналитических подходов для более глубокого понимания структуры затрат и разработки эффективных управленческих решений, которые обеспечат снижение расходов и увеличение конкурентоспособности предприятий молочной промышленности. Результаты библиометрического анализа дают возможность выявить основных авторов, изучить предложенную методику, что особо полезно для менеджеров, экономистов и исследователей, занимающихся логистическими процессами в агропромышленном секторе.

Особое внимание уделено методологии библиометрического анализа, которая позволила выявить ключевые тенденции, пробелы и перспективные направления в исследовании логистических издержек. Результаты анализа ориентированы на решение практических задач молочной отрасли, включая оптимизацию транспортировки, хранения и распределения молочной продукции. Полученные данные стали основой для разработки эффективных стратегий управления логистическими процессами, способствующих снижению издержек и повышению конкурентоспособности молочных предприятий.

Для исследований в библиометрическом анализе основной задачей исследования будет обработка и анализ данных с использованием возможностей специальных программ и устройств, таких как Vosviewer на основе данных современных библиографических баз данных SCOPUS, Web of Science, Mendeley.

**Ключевые слова:** логистика, логистические затраты, библиометрический анализ, оптимизация затрат, молочная промышленность.

## Introduction

The logistics activities of dairy enterprises can be represented by the “warehouse – transport – production” scheme, which is inherent in manufacturing enterprises that implement a technological cycle. Transport is one of the most important factors affecting the efficiency of an enterprise, as the availability of road infrastructure and transport services increases mobility and encourages production. El Buzekri, M. Elhazania and E.H.A. Ahemd (2013) identify transportation as an indispensable part of the supply chain, which contributes to the economic development of the enterprise. K. Rantasila, L. Oila (2012) and J.A. Gonzalez et al. (2007) also argue that transportation costs are one of the main factors affecting the competitiveness of an enterprise.

The formation of logistical costs at dairy enterprises in Kazakhstan is an important component of economic activity, on which the profitability and competitiveness of the enterprise largely depend. The country’s dairy industry has a number of specific features, such as the perishable nature of its products, strict quality and safety requirements, and seasonal fluctuations in production volumes. These factors significantly complicate the management of logistics processes and require the introduction of effective cost optimization methods.

One of the key tasks in this sector of Kazakhstan is to provide adequate conditions for the storage and transportation of dairy products, which requires the use of specialized equipment and infrastructure, such as cold storage and refrigerated vehicles. At the same time, the high sensitivity of dairy products to changes in temperature and storage conditions places strict requirements on compliance with sanitary and technological standards at all stages of the logistics chain.

High logistical costs are one of the key factors that prevent agricultural enterprises, especially micro and medium-sized ones, from being competitive in the market. T. Bosona (2013) noted that transportation and other costs, such as inventory, warehousing and administrative costs, can significantly limit the competitiveness of food producers. Transportation costs are high in rural areas, and the risks are compounded by poor local roads, inefficient networks, and transport infrastructure services, which together lead to a low level of coordination between agricultural producers and other market actors.

The methods of determining logistics costs differ from such parameters as the scope of an enterprise’s economic activity, the components of logistics activities, and cost accounting (Bosona, 2013).

Today, scientists have proposed several classifications of logistical costs. J. Rodrigue (2020) proposed to consider logistical costs in terms of their division into three components: transportation, storage, and inventory costs. A. Rushton, P. Kroucher, and P. Baker (2014), exploring the essence of logistical costs, refers to the three components proposed by J. Rodrigue. In addition, we’ve also added administrative expenses. Timirgaleeva R.R., Utukina T.A. identified five components of logistics costs: the cost of purchasing materials, transportation, warehousing, inventory and packaging, as well as the cost of logistics-related labor (Timirgaleeva, 2018). A. Zeng and K. As a result of their research, Rossetti identified another set of five main elements of logistics costs: transportation, warehousing, order processing, customer service, administration and inventory management (Zeng, 2003).

Given the large range of products produced (milk, yoghurts, cheeses, fermented dairy products, etc.) and their short shelf life, dairy enterprises face the need to quickly turn around stocks and minimize storage costs. Improper inventory management can lead to significant losses, which makes it critically important to apply modern methods of logistics and inventory management of dairy products.

Kazakhstan’s dairy industry is subject to regional and seasonal fluctuations in the production and supply of raw materials. This requires companies to be flexible in planning logistics and developing localized logistics schemes. In such a situation, the introduction of logistics cost management systems adapted to the specifics of the industry makes it possible to efficiently use resources and reduce overall costs.

At the present stage of intensive development, scientific research has become the norm for actively replenishing and updating the information and reference base in all industries. Nevertheless, it becomes necessary to analyze important and necessary, relevant data from the information base in order to verify their reliability. It follows from this that the bibliographic analysis is carried out on the topic of scientific research as part of an expert examination based on research from previous years, authors, publication titles, citations. It is advisable to use the possibilities of bibliographic analysis in order to provide a complete understanding of the procedure and specifics of the formation of logistics costs, to develop practical recommendations for effective management, to identify factors affecting costs in accordance with the stages of the logistics process, to identify existing gaps in research in order to consider the possibility of sharing best practices aimed

at reducing costs and improving business competitiveness.

Bibliometric analysis is a research method used to evaluate and analyze, systematize scientific publications, citations, authorship, and other parameters in scientific research. This approach makes it possible to assess the state and development trends of a particular scientific or applied field based on an analysis of publication activity.

In the course of the study, a comprehensive study of studies on the mechanism of formation of logistical costs using bibliographic analysis tools was conducted.

Bibliometric analysis is an important tool for assessing the state, trends, and development prospects of various industries, including the dairy industry. In the context of increasing competition, stricter product quality requirements and the need to improve production efficiency, bibliometric analysis provides enterprises and researchers with the opportunity to identify key areas of scientific research, identify current problems and explore advanced solutions offered by the global community.

### Literature review

The formation of logistics costs is a key aspect of effective supply chain management, as well as a complex mechanism involving many factors and variables. A review of the literature in this field is aimed at systematizing knowledge about the factors affecting logistics costs and the main aspects of the cost generation mechanism. It allows you to determine the structure and strategies and methods for evaluating and optimizing factors that determine the magnitude and dynamics of logistics costs, and the main research areas related to the formation of logistics costs in enterprises of various industries.

Logistics costs include all costs related to managing the flow of goods and information from suppliers to end users. However, the methods of determining and measuring logistics costs may vary depending on the industry and business model of the enterprise (Christopher, 2016). Factors affecting logistics costs include transportation and infrastructure, inventory management, and information technology. Research shows that effective transport management and the use of optimal routes have a significant impact on reducing transport costs (Rushton et al., 2014). The use of modern information technology solutions, such as supply chain management (SCM) systems, helps automate processes and increase efficiency (Chopra, 2016).

Strategies for optimizing logistical costs include the Just-in-time methodology and the introduction

of Internet of Things (IoT) technologies. The Just-in-time methodology helps to reduce storage costs by precisely matching supplies with consumer demand (JohnMangan, 2016). The use of sensors and IoT networks makes it possible to optimize logistics processes and track shipments in real time, which contributes to the management of goods and services (Ivanov et al., 2016).

The role of the human factor in logistics cost management includes the processes of staff training and knowledge development, reverse logistics management.

Research highlights the importance of employee training for effective implementation of logistics strategies and technologies (Coyle et al., 2012).

The mechanism of formation of logistical costs consists of many interrelated factors. Understanding this mechanism allows enterprises to develop effective cost management strategies and increase competitiveness in a dynamic business environment. The literature review in table 1 shows the need for an integrated approach to studying the cost generation mechanism, as well as the importance of new technologies and optimization strategies for managing the effectiveness of logistics processes.

Logistics costs play a key role in determining the cost of dairy products. The dairy industry refers to specific branches of the agro-industrial complex, where factors of time, storage and transportation conditions are of particular importance due to the fast shelf life of dairy products and the requirements for compliance with temperature conditions at all stages of the logistics chain. Logistics costs significantly affect the final cost of products and can account for a significant proportion of the total cost of dairy products.

The study of costs in the agro-industrial complex of Kazakhstan is an important area for ensuring sustainable economic growth of agriculture and increasing the competitiveness of agricultural enterprises. Researchers in this field are engaged in the economic efficiency of agricultural production, cost management, optimization of production processes and the development of strategies for sustainable agricultural development. The theoretical and methodological issues of the formation of the economic mechanism system of the agro-industrial complex of Kazakhstan are reflected in the works of O.Sabden, J.Rayymbekov, K.T.Taygashinova, B.Sh Syzdykova, G.Kaliev, K.I.Iskhakov, K.Kairbekov, V.E. Levichev, J.S.Sundetova, T.I.Espolova, M.I. Sigareva and other economic scientists. However, there are still problems and issues that have been poorly studied and poorly covered in the Russian-language literature.

**Table 1** – Approaches to the mechanism of formation of logistical costs

Direction of view	The given comments	Authors
<b><i>The definition of the mechanism for the formation of logistics costs</i></b>		
General understandigs	Emphasizes that logistics costs include transportation, warehousing, management and information costs, creating a complex cost structure in the supply chain.	Christopher (2016)
Theory of logisstics costs	It is based on a systematic approach to logistics process management and focuses on the integrated accounting of all types of costs arising at various stages of the logistics chain.	Rykalina O.V. (2016)
An integrated approach to costs	cost accounting should not be limited only to financial indicators and individual items of expenditure, but should include all types of costs arising in the course of economic activity, and takes into account their impact on various aspects of the company's work.	Moiseeva N.K. (2010)
Communication with the supply chain	logistics costs are closely related to the activities of the supply chain, and the mechanism of their formation is often considered in the context of supply chain management	Coyle et al. (2012)
<b><i>Factors influencing the formation of logistics costs</i></b>		
Supply and demand	It shows the influence of market dynamics on the formation of logistics costs, especially on changes in demand.	Bardi and Langley (2002)
Volume and scale of transportation	Having studied how the volume of transit affects logistics costs, he stressed the importance of achieving an optimal range of operations	Murphy et al. (2014)
Globalization	It is discussed how globalization affects logistics costs, requiring new strategies and management approaches.	Rugman and Verbeke (2004)
Technology in logistics	Research raises the question of the impact of modern technologies, such as supply chain management systems (SCM) and the Internet of Things (IoT), on the efficiency of logistics processes and, accordingly, on cost formation.	Gattorna (2017)
<b><i>Methods for estimating logistics costs</i></b>		
ABC analiysis	ABC analysis is an analysis of the assortment, sales volume to various consumer groups, and inventories by dividing them into three categories (classes) that differ in their significance and contribution to the turnover or profit of the enterprise: A – the most valuable, B – intermediate, C – the least valuable.	Chertykovtsev (2024)
Life Cycle Costing	The method of estimating the total costs of the product lifecycle allows you to take into account the long-term impact of logistics costs.	Ferreira and Sousa (2008)
<b><i>Strategies for optimizing logistics costs</i></b>		
Just-In-time (JIT)	Fulfilling the tasks of the «just-in-time» system in practice will lead to the elimination of unfavorable components in the activities of a production organization: surpluses, losses, and imbalances	V.V. Serikov, I.A. Svishcheva (2020)
Green logistics	The research examines the impact of environmental logistics strategies on cost formation, taking into account the requirements of sustainable development.	Tuzkaya et al. (2011)
Inventory optimization models	Explores various models for optimizing inventory management that help reduce storage costs and increase overall efficiency.	Belozertseva N.P. et al. (2018)
Inventory management strategy	Examines inventory management strategies, including ABC analysis and JIT, as well as their impact on the structure of logistics costs.	Mochalova L.A., Sokolova O.G. (2018)
<b><i>The influence of the human factor on the formation of logistics costs</i></b>		
Humans' resource role	Emphasizes the importance of training and development of personnel in the field of logistics for successful cost management and process optimization.	Sahin et al. (2011)
Note – compiled by the authors		

In general, logistics costs represent the monetary value of the labor used, means and objects of labor, financial costs and various negative consequences of force majeure, which are caused by the preservation of material assets (raw materials, products, goods) at the enterprise and between enterprises, as well as the maintenance of stocks (Sabden, 2010).

When studying non-traditional management accounting of logistics costs, it can be seen that qualified cost management by the logistics management contributes to improving the efficiency of companies and increasing their competitiveness. To do this, logistics management should proceed from cost accounting methods and methods of calculating the cost of products, services and methods of their classification using cost information. (Taigashinova, 2014)

Logistics costs are part of the cost of finished products and significantly affect their price, however, little attention is paid to accounting for this group of costs in domestic practice, there is no systematic approach to their identification, analysis and optimization. (Rayymbekov, 2019)

It is noted that in most studies, the formation of logistical costs was considered in a generalized form, however, within the framework of the topic under study, no studies were conducted on the mechanism of formation of logistical costs in the production of dairy products, whose products are susceptible to rapid destruction, which requires special conditions during transportation, storage and marketing.

At this stage, the following factors can be considered, which are involved in the mechanism of formation of logistics costs in the dairy industry:

- classification of logistics costs by dairy industry;
- formation of specifics of accounting for the production process of dairy products and their cost;
- cost structure analysis for production process management (transportation, storage, sales);
- creation of models for optimizing logistical costs.

The importance of the topic of logistics cost formation in the dairy industry of Kazakhstan is due to several factors that relate both to the specifics of the industry itself and to the general economic conditions of the country. Key aspects highlighting the importance of this study are:

- the strategic importance of the dairy industry;
- consumer demand growth;
- the need to optimize costs;
- innovations and technologies;
- geographical and climatic conditions;

- government support.

Logistics costs significantly affect the overall efficiency of a business. Optimization strategies based on a thorough analysis of the factors affecting logistics costs, as well as the introduction of modern technologies and staff training, are the main areas of logistics cost management.

Therefore, a real challenge arises – to modernize the existing accounting system of the dairy industry in Kazakhstan so that it can solve the problems of logistical functions.

## Methodology

The general research is aimed at a bibliometric review of databases on logistics costs, the mechanism of their formation and industry-specific features of logistics cost management. The method based on the analysis of indicators makes it possible to determine the quantitative parameters of scientific publications, their citations and trends, the main authors, publications, and assess the impact of scientific research by industry in a bibliometric review. Qualitative and quantitative methods allow us to conduct research on citation indicators based on databases, scientists, publications, intervals between years, relevance by field of science, subscription language, etc. (Bakhmatova, 2019)

The principle of bibliometric analysis is related to the quantitative analysis of document flow. (Darinskaya, 2010) A data stream is a set of source documents that work in a community. (Vaneeva, 2006)

In the context of digitalization and rapid technological progress, bibliometric analysis is becoming a tool that helps enterprises integrate advanced technologies such as artificial intelligence, process automation, and quality management systems. This contributes:

- to the optimization of production processes, including the processing of raw materials and logistics management.
- minimizing costs through the introduction of technologies and innovative solutions identified during the analysis.
- sustainable development and increased competitiveness, both in national and international markets.

To conduct research, it is necessary to choose modern bibliographic databases (SCOPUS, Web of Science, Mendeley). Based on a set of quotes and phrases relevant to the research topic, you can achieve the accuracy of the result by speeding up the search path and reducing the search range.

The study analyzed information about the formation of logistical costs in the dairy industry using filtering criteria by publication period, search mechanisms (articles, reviews, conferences, etc.), and the language of publication. Vosviewer and SciVal functions were used for data processing and analysis, which helped to visualize the results of the bibliometric sample and highlight the main elements.

An array of information was obtained from scientific databases such as Web of Science (WoS), Scopus, RIS, publications were structured by the number of citations, author's team and countries. The program allowed you to create certain clusters, visual maps that show their relationship and dependence.

Thus, bibliometric analysis not only helps to keep abreast of the latest scientific developments, but also becomes an important element in shaping growth strategies in the modern market. Its application contributes to more accurate decision-making, improving business processes and ensuring the long-term success of enterprises.

### Discussion and results

The use of bibliometric analysis is especially important because it allows:

- systematize knowledge (analyze the volume of available literature, scientific publications and patents to determine the level of development of the industry);

- to identify gaps in the research base (to identify insufficiently studied aspects such as the introduction of environmentally sound technologies, logistics management or optimization of production processes);

- develop sound development strategies (based on the results of the analysis, enterprises can adapt their plans to global trends and scientific achievements).

As a result of bibliometric analysis, bibliographic analysis of quotations «logistics costs», «optimization», «supply chain», it is possible to identify the main trends and directions in the study of logistics processes. An analysis of publications mentioning «logistical costs» in modern supply chain research shows that there is a growing interest in studying the structure and dynamics of costs in modern supply chains. Researchers pay attention to how effective logistics management can reduce costs and increase the competitiveness of enterprises.

Quantitative data on the most common keywords in accordance with the Scopus scientific literature database are presented in Table 1.

**Table 1** – Keyword data according to the branches of knowledge based on the Scopus database for 2013-2024

№	The main criteria	Number of results
1	When selecting the main citations «logistics», «costs»	58 049
2	As a result of selection by fields of expertise, including:	21 195
2.1	Business, management and Accounting	12 222
2.2	Social Sciences	7 903
2.3	Economics, Econometrics and Finance	3 979
2.4	Agricultural and biological sciences	0
3	Depending on the type of document	21 195
4	The result of applying the criterion of accessibility of articles in the field of science	2621
Note – is based on data from the database Scopus		

The results obtained for the keywords «costs», «logistics», «dairy industry» collected 5,8049 articles, reviews, textbook chapters, reviews, conference materials.

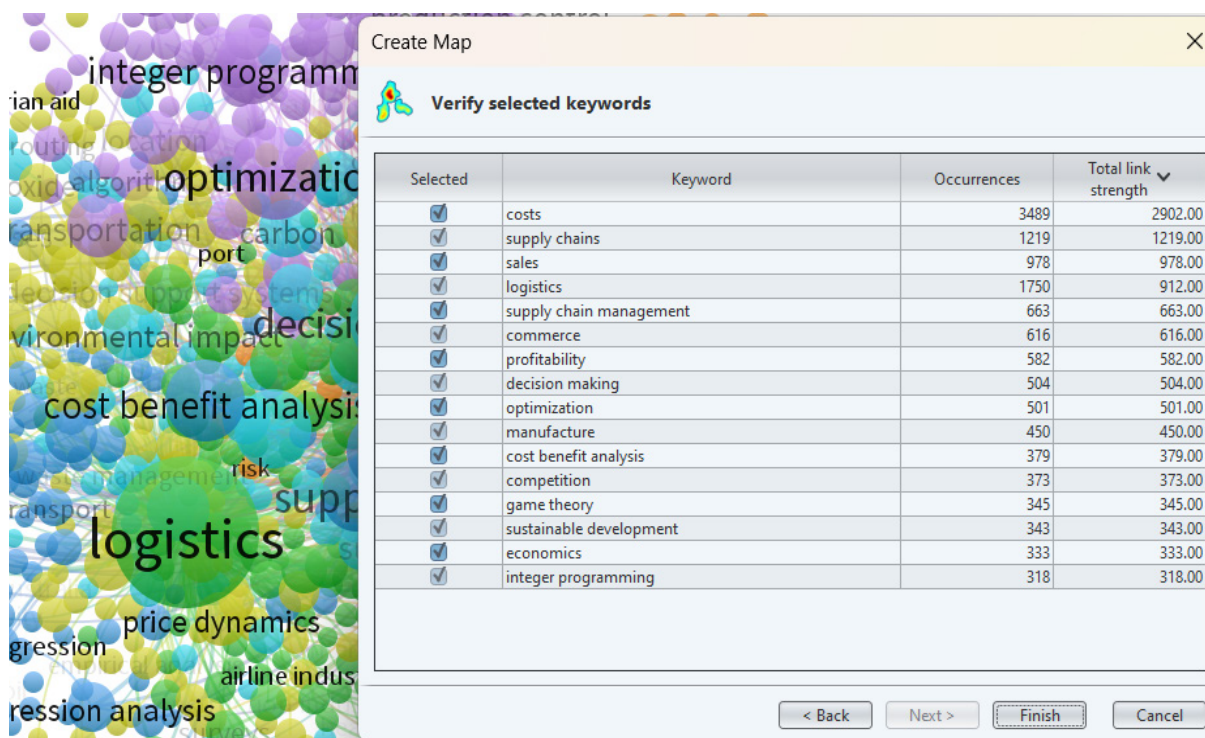
As part of the selection process for 2013-2024, 21,195 scientific papers in the fields of knowledge

were selected: «Business, Management and Accounting», «Economics, Econometrics and Finance», «Social Sciences», «Agriculture and Biological Sciences».

As a result of the accessibility criterion, 2,621 documents were collected.







**Figure 2** – Keyword citation frequency statistics  
 Note – The result was obtained using the Vosviewer platform

Figure 2 shows the relationship between the term “logistics” and the keyword “costs” for events was observed 3489 times, for the overall strength of the link – 2902, i.e. logistics costs are one of the topics that need to be studied.

Highlighting related keywords in databases allows for a more detailed study of the topic, revealing their context and helping to identify significant aspects. Figure 3 below shows a bibliographic map of the Scopus scientific literature database for the query “logistical costs”.

As can be seen from Figure 2, the Scopus scientific literature database identifies several important areas of research, namely “costs”, “logistics”, and “optimization”.

This figure reflects the frequency of studying the term “costs” in dairy production in the Scopus database. The figure is limited to 2019, as the number of studies decreased after 2019, which is shown by the yellow line.

Therefore, the study of the logistical costs of milk production is one of the topics that needs to be studied at the present time. Optimal cost management is the key to the development of dairy produc-

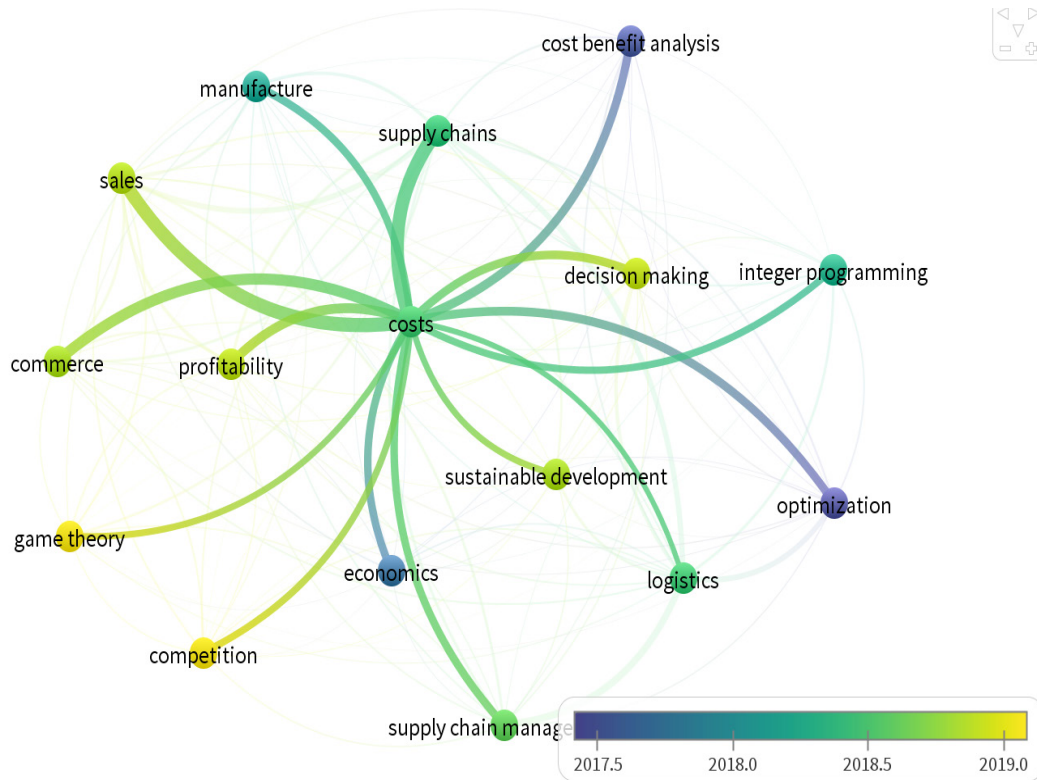
tion, taking into account its specific features and the ability to be in a competitive environment.

As a result of the study of the Kazakh milk production market, the following distinctive characteristics of the use of modern technologies, automation and innovative approaches can be cited to optimize logistics processes, reduce costs and improve product quality (Figure 4).

The discussion and results of the bibliographic analysis on the topic “logistical costs” cover several aspects:

- trends and dynamics of research the analysis of bibliographic data on the topic “logistical costs” determines the sustained interest and progressive development of research in this field. The publications cover various aspects of logistics costs, from structure to optimization methods in various sectors of the economy.;

- bibliographic analysis identifies the main components of logistics costs, such as transportation, storage, inventory management, and information technology. These components are often the subject of separate studies aimed at optimizing specific aspects of logistics processes;



**Figure 3** – Bibliographic map

Note – The result was obtained using the Vosviewer platform

Localized logistics schemes	in regions with a high level of dairy production (for example, Pavlodar, North Kazakhstan, Almaty and Zhetysu regions in Kazakhstan), enterprises create networks of processing points that minimize the cost of transporting raw milk. This allows for faster delivery of raw materials for processing, while maintaining their quality.
The use of modern technology	•Food-Master, JLC, and Adal are actively implementing supply monitoring systems using GPS trackers and automated warehouses, which minimizes time and transportation costs.
•Outsourcing of warehouse operations	•To reduce transportation and warehousing costs, some enterprises transfer these functions to specialized logistics companies, for example, through logistics outsourcing platforms such as FM Logistic.
An integrated approach to cost management	Enterprises are implementing digitalization programs for accounting logistics costs, which combine data on purchases, transportation and distribution of products. This allows the company to flexibly respond to seasonal changes and reallocate resources in the face of growing demand.
Automation of warehouse processes:	Automated distribution centers equipped with warehouse management systems (WMS) are used. This allows you to optimize inventory management and minimize manual labor, reducing the cost of product storage.

**Figure 4** – Distinctive characteristics of Kazakhstan’s milk production market

Note – compiled by the authors

- the results of the analysis reflect the variety of methods and strategies used to optimize logistical costs. This includes technology adoption, supply chain management, the use of ABC analysis, JIT (Just-In-Time) and other cost-reduction approaches;

- research on logistics costs focuses on regional and industry-specific features. Some studies focus on costs in specific regions or sectors, emphasizing the importance of adapting strategies to specific circumstances;

- bibliographic analysis highlights the importance of technology and innovation in reducing logistical costs. Research in this field describes the role of digital technologies, the Internet of Things, artificial intelligence and automation in process optimization;

- the results of the analysis also reveal the problems faced by researchers and practitioners in managing logistical costs. These may include issues related to sustainability, risk management, and adaptation to changes in the business environment;

- some studies show the influence of the human factor on logistics costs, including employee training, development of logistics competencies and employee motivation;

- bibliographic analysis on the topic "logistics costs" allows you to get a broad understanding of current trends, problems and prospects in the field of logistics management. Researchers and practitioners are in the process of searching for effective strategies and tools to optimize logistics processes in a dynamic business environment.

## Conclusion

The formation of logistics costs at dairy enterprises is a complex and multifaceted process that requires taking into account a number of specific features of this industry. Analyzing the key aspects, we can draw several important conclusions.

Firstly, the perishable nature of dairy products in the Kazakhstan market places serious demands on logistics, which requires enterprises to implement efficient storage and transportation systems capable of ensuring compliance with the necessary temperature conditions. This, in turn, entails significant costs that must be taken into account at the planning stage.

Secondly, the high degree of dependence on the quality of raw materials and strict processing requirements emphasize the importance of creating reliable and sustainable logistics chains. Incorrect selection of suppliers or insufficient control at the stage of obtaining raw materials can lead to losses

associated with product damage and consumer dissatisfaction.

Thirdly, given the scale of the territories of the Republic of Kazakhstan, the need for a flexible approach to inventory management in conditions of seasonality and fluctuations in demand creates additional problems for enterprises. Effective forecasting and inventory management can significantly reduce logistics costs, while ensuring uninterrupted supply and availability of products to the end user.

In addition, modern information technologies and process automation in the context of the digitalization of the economy make it possible to significantly optimize logistics cost management, improving coordination and transparency at all stages of the supply chain. The implementation of data-driven management systems allows dairy companies to make informed decisions and adapt to rapidly changing market conditions.

The bibliometric analysis revealed a shortage of research aimed at studying logistics costs in the dairy industry, which indicates the need to develop and implement effective logistics management mechanisms to increase its competitiveness.

Among the main problems of the development of the agro-industrial complex of Kazakhstan is the lack of a developed transport and logistics infrastructure (infrastructure wear, low railway capacity, lack of wagons in the season); \* high transport costs and logistical difficulties.

To solve these problems, it is necessary to improve the processes of planning and regulating the supply chain in agriculture, the development of logistics infrastructure, and the optimization of flow processes based on the management of total logistics costs at various levels of the economic system.

In conclusion, the bibliographic analysis conducted on the formation of logistics costs is an important cost management tool at dairy enterprises to improve the functioning of logistics processes and the algorithm for accounting for logistics costs, budgeting logistics costs.

The practical significance of the research is based on the creation of the most efficient routes that reduce delivery time and transportation costs, the introduction of management and control systems for quantitative stocks of logistics operations, such as automated warehouse systems and temperature control sensors, the creation of regional distribution centers for combining batches of products that reduce logistics costs and improve customer service., as well as the creation of energy-efficient refrigeration units and control systems, vehicle operation, etc.

The mechanism of formation of logistics costs at dairy enterprises in Kazakhstan helps to reduce logistics costs, product costs and improve the quality

of services, which allows to strengthen its status and form a trademark in the market, as well as increase financial stability.

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