USING THE BIG DATA TOOL TO INCREASE THE EFFICIENCY OF LOGISTICS ACTIVITIES OF ENTERPRISES IN THE CONDITIONS OF DIGITAL TRANSFORMATION

ВИКОРИСТАННЯ ІНСТРУМЕНТУ BIG DATA ДЛЯ ПІДВИЩЕННЯ ЕФЕКТИВНОСТІ ЛОГІСТИЧНОЇ ДІЯЛЬНОСТІ ПІДПРИЄМСТВ В УМОВАХ ЦИФРОВОЇ ТРАНСФОРМАЦІЇ

UDC 658.004

DOI: https://doi.org/10.32782/dees.13-18

Sakun Oleh[1]
PhD Student
of the Department of Management
and Marketing,
Odessa State Academy
of Civil Engineering and Architecture
Stankevych Iryna[2]
Master's in Economics, Professor,
Head of the Department of Management
and Marketing,
Odessa State Academy
of Civil Engineering and Architecture
Sakun Hanna[3]
PhD in Philosophy, Associate Professor,
Associate Professor of the Department
of Management and Marketing,
Odessa State Academy
of Civil Engineering and Architecture

Сакун О.В.
Одеська державна академія
будівництва та архітектури
Станкевич І.В.
Одеська державна академія
будівництва та архітектури
Сакун Г.О
Одеська державна академія
будівництва та архітектури

Digital transformation is based on innovative solutions in four areas: mobility, cloud, big data/analytics and social networks. A special place among these technologies is occupied by the field of logistics, which plays a fundamental role in the economic growth of the country and maximally contributes to changing people's lives for the better, helps people to expand their opportunities in real time. In the logistics activities of enterprises and organizations, there is now the most important transition stage, when new high-speed technologies are intensively introduced, the range of services and customer service modes is expanded, and the structural restructuring of the industry begins. The constant growth of data traffic leads to the creation of huge networks that require significant financial costs to support the logistics infrastructure, and the future deployment of 5G will only increase costs at every point of the ecosystem. With the advent of 5G and the explosion of IoT prospects, the network structure that has served the industry for so long is showing its cracks, leaving companies rightfully worried about how they will manage demand and generate revenue.
Key words: *logistics activities, digital technologies, Big Data, efficiency, "chains" of value, risks.*

Сьогодні цифрові технології трансформують усі сфери економічного та соціального життя, формують новий спосіб мислення щодо економічного зростання, соціального добробуту та культури. Цифрова трансформація базується на інноваційних рішеннях у чотирьох сферах: мобільність, хмара, великі дані/аналітика та соціальні мережі. Особливе місце серед цих технологій займає сфера логістики, яка відіграє фундаментальну роль в економічному зростанні країни та максимально сприяє зміні життя людей на краще, допомагає людям розширювати свої можливості в реальному часі. У логістичній діяльності підприємств і організацій зараз є найважливіший перехідний етап, коли інтенсивно впроваджуються нові високошвидкісні технології, розширюється спектр послуг і режимів обслуговування споживачів, починається структурна перебудова галузі (перехід від вертикальної до горизонтальної інтеграції бізнесу), радикальні зміни відбуваються в «ланцюгах» вартості та складу гравців логістичного бізнесу. В цих умовах компанії стикаються з проблемою «розмивання частки ринку» та середнього доходу на користувача (ARPU). Постійне зростання трафіку даних призводить до створення величезних мереж, які потребують значних фінансових витрат для підтримки логістичної інфраструктури, а майбутнє розгортання 5G лише збільшить витрати в кожній точці екосистеми. З появою 5G і вибухом перспектив IoT мережева структура, яка так довго обслуговувала галузь, демонструє свої тріщини, що змушує компанії виправдано хвилюватися про те, як вони керуватимуть попитом і отримуватимуть дохід майбутньому.
Ключові слова: *логістична діяльність, цифрові технології, Big Data, ефективність, «ланцюги» вартості, ризики.*

Introduction. Today, digital technologies are transforming all spheres of economic and social life, forming a new way of thinking about economic growth, social well-being and culture. The global telecommunications industry is developing dynamically. Major players seek to expand the boundaries of development, to create more long-term and reliable relationships between market participants and buyers everywhere.

Using modern Big Data / Analytics technologies, it is possible to obtain much more insightful information than traditional data analytics, and improve the performance of mobile cellular networks and increase the revenue of operators. Companies that can effectively use these vast amounts of data outpace their competitors, increase their market share, and improve their bottom line.

In the conditions of digital transformation of society, "digital destruction" is a reality in most industries and regions. Established players are facing new competitors who are using digital asset-based business models to compete with them very effectively. These new competitors use one or more of three sources of value: the value at which they offer lower costs to the consumer; experiential value, through which they offer a better customer experience; and the value of the platform through which they create network effects that benefit customers. The most formidable competitors are those who use all three of them [2].

Analysis of recent research and publications. In recent years, there has been a rapid growth of scientific research devoted to logistics, innovative modernization of transport systems and digitalization

[1] ORCID: https://orcid.org/0009-0006-9282-0429
[2] ORCID:https://orcid.org/ 0000-0003-3937-9145
[3] ORCID: https://orcid.org/0000-0002-5878-7809

of logistics processes both in Ukraine and abroad. Research aimed at the practical application of digital technologies in logistics, in particular, the development of innovative solutions for the optimization of transport flows, inventory management and interaction with customers by such scientists as Dzyamulych M., Shmatkovs'ka T., Mazur N., Mohsen B., Zrybnieva I., Smirnova E. and others.

However, these studies need further development in the direction of the use of modern technologies and the development of new methodologies for evaluating the effectiveness of logistics solutions.

The objective of research is to generalize the theoretical and methodological bases for the use of applied tools to increase the efficiency of the logistics activities of enterprises in the conditions of digital transformation based on the implementation of advanced analytics and Big Data technology.

The main part. Big Data empowers businesses to transform mass marketing into highly personalized customer experiences. By providing granular insights into individual consumer behavior, companies can create tailored marketing strategies and deliver one-to-one customer service.

Big data analytics is revolutionizing the logistics industry, transforming daily operations through powerful insights. As previously discussed, the benefits of harnessing this vast data are substantial and continually expanding. Logistics companies that effectively leverage big data analytics and information strategies will gain a significant competitive advantage [4].

Implementation of Big Data technologies requires not only technical, but also organizational support. The first refers to the organization of data extraction, data storage, unified ARM for analysis, digital modeling, optimization and prediction. The second direction will require the formation of appropriate qualifications in the Big Data business. The main reasons for the widespread adoption of Big Data are the high cost of the software, the time required for specialists to adapt to its use, as well as a number of technical problems related to the imperfection of the algorithms used in Big Data tools.

The use of Big Data changes most business processes of companies, raising existing services to a new level, and also allows introducing fundamentally new services to the market (Figure 1).

The source of Big Data is not only corporate databases and the array of the social Internet, but also information from various devices, sensors, measuring and "smart" devices, as well as publicly available data. Modern tools and technologies developed on the basis of artificial intelligence, mathematical and statistical analyses, crowdsourcing, predictive analytics, simulation modeling, and others are used to process Big Data. Most often, Big Data technology is used to extract information that is still unknown, but necessary for the company [1].

The scope of using Big Data technologies is multifaceted and extensive. So, with the help of Big Data, you can improve the business processes of working with customers, learn about their preferences and tastes, about the effectiveness of marketing campaigns and offers, or conduct a risk analysis of the logistics activities of enterprises and organizations.

From the marketing standpoint of the logistics activities of enterprises and organizations, Big Data technologies allow finding hidden relationships, new sources of information, improving the quality and efficiency of decisions made on personalization and processing of client offers, interaction and client retention, and developing new unique services.

Personalization and improving the user experience can have a big impact on creating and maintaining a subscriber base. Since the field of logistics activities of enterprises and organizations has access to huge amounts of customer data generated every day, they must be able to obtain information from them that can become the basis of a business strategy to improve ARPU. Incorporating big data analytics to analyze customer data is an important step in this direction. Data analysis will provide operators with important information in terms of customer preferences.

"Diversification", "Innovation", "Customer experience", "Creation of synergies", "Identification of the most important partnerships", "Identification of market segments for growth", "Data analysis" are among the key strategic areas that logistics companies must integrate as part of their ARPU strategies [1].

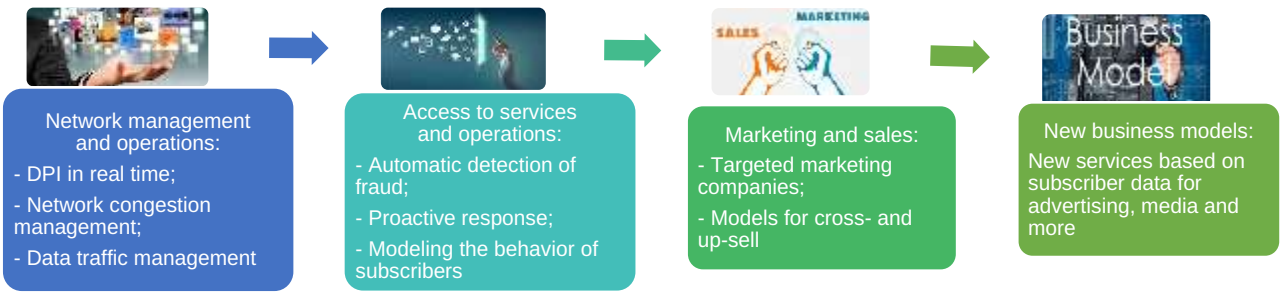

Figure 1. Changing the company's business processes

Data analysis based on Big Data technologies has a special place in this strategy, because personalization and improving the user experience can have a big impact on building and maintaining a customer base. Because companies have access to the vast amount of customer data generated every day, they need to be able to gain insights from it. Incorporating big data analytics to analyze customer data is an important step in this direction.

According to the consulting company McKinsey & Company, there are 5 main ways of using Big Data in the economy and business:

1. Creation of "transparent" information;
2. Making mathematically based management decisions;
3. Narrow segmentation of customers taking into account personal wishes;
4. Increasing the speed of decision-making due to complex analytics;
5. Development of new generation goods and services [5].

The use of the Big Data tool to increase the efficiency of the logistics activities of enterprises and organizations in the conditions of digital transformation involves the implementation of extremely complex stages (Figure 2).

Each of the stages includes the performance of a number of tasks aimed at increasing the efficiency of logistics activities of enterprises and organizations in the conditions of digital transformation [3].

Stage 1) Finding the company's big data and understanding the system in which it intends to improve the level of efficiency of its own activities. The implementation of stage 1 is due to the fact that companies usually face questions related to the volume of big data, the speed of its arrival, variety and variability. That is why it is important to evaluate the data (available and possible) and their systematization. At this stage, the following tasks must be completed:

Task 1.1. Find valuable data by gathering information from various sources. Logistics companies need to determine exactly what data represents value for business, data coming from their systems, accumulated as a result of work and coming from customers. These data sets can be structured or unstructured – depending on the readiness of the data for use and analysis. Their main sources are customer relationship management systems (registration logs and audio recordings) – they are CRM, the Internet (social networks, video files, images and sound files) and M2M. Often, structured data is data collected about customers. Some of them are mandatory (for example, information necessary for concluding a contract), others are auxiliary (provided by the client for the convenience of providing additional services). Data can be observed depending on various independent characteristics (Figure 3).

Task 1.2. Data analysis for effective use. To get a clear idea of the state of existing data sets and their characteristics, it is necessary to perform an accounting of data sets, to determine which data are relevant to business needs. In addition, consider the possibility of collecting additional data or refining existing data sets:

– open data – viewing publicly available data sets to obtain additional information;

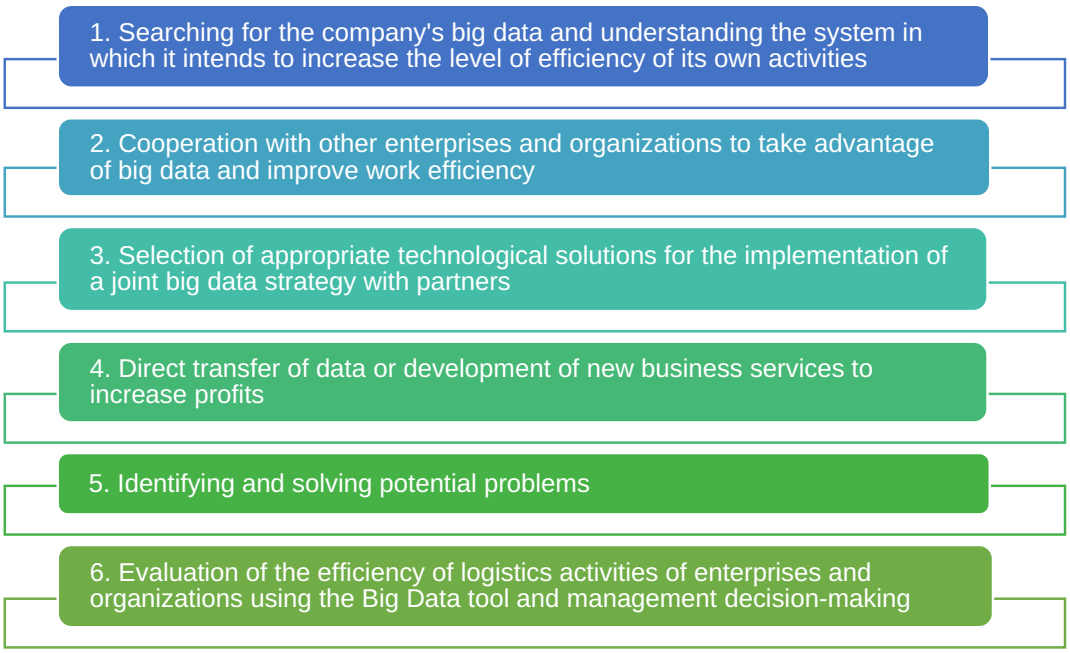

Figure 2. Stages of using the Big Data tool to improve the efficiency of logistics activities of enterprises

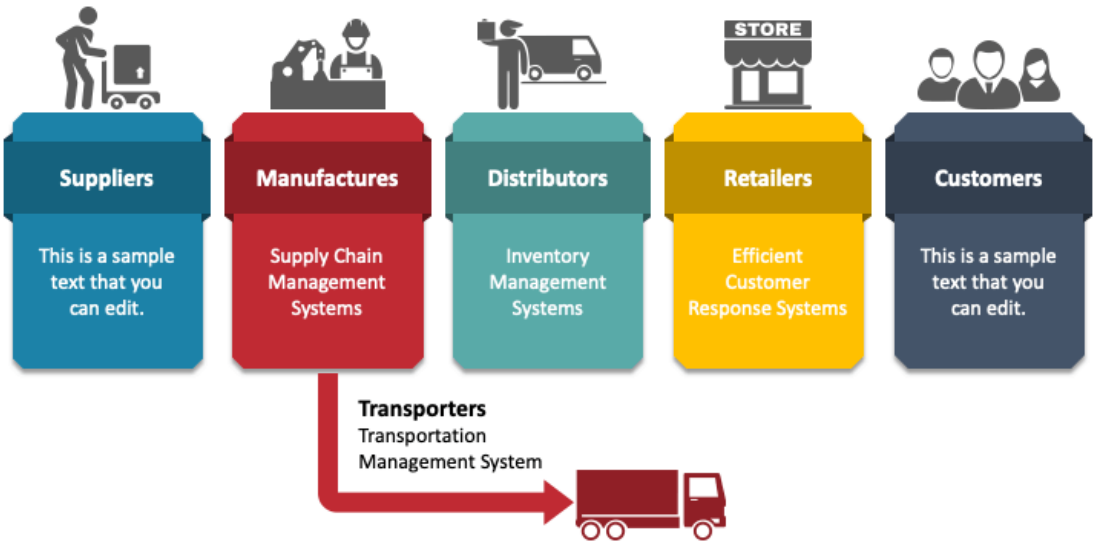

Figure 3. The value chain in e-commerce

– Internet – viewing of Internet resources to access content created by users;

– commercial data – access to the CRM database, development of loyalty programs and (or) use of registration forms to collect additional data about customers;

– M2M and Internet of Things technologies – collection of data about customers or employees in real time using M2M (for example, with M2M applications with user location functions) and the Internet of Things (sensors, mobile protocols, etc.);

– ecosystem – buying the necessary data or establishing cooperation with another organization (depends on the big data strategy adopted by the company) [2].

Leveraging existing data sets will enable the company to construct a comprehensive and organized customer database, which can be effectively utilized on the CRM platform to extract crucial business intelligence.

Task 1.3. Defining data strategy and capabilities. Development of own data usage strategy. Can use the services of organizations specializing in big data processing, and (or) develop their own tools for big data management and analysis. The implementation of such a strategy should be started gradually – set achievable goals and not expect immediate results. the complexity of data segmentation and evaluation depends on the industry, the field of activity and the size of the enterprise.

Stage 2) Collaboration with other businesses and organizations to benefit from big data and improve operational efficiency. Logistics companies should consider cooperation or partnership with other organizations. Such relations will allow participants to get additional resources and opportunities, which means to implement a project on the use of big data faster and more efficiently.

Stage 3) Selection of appropriate technological solutions for the implementation of a joint strategy for big data with partners. It is necessary to find a technology and a partner to implement the big data strategy (transition from own IT infrastructure to providing analytical and business services). The data market is not yet sufficiently formed – currently it is constantly changing. Therefore, subjects of the ICT sector strive to offer flexible and customizable services in order to meet the needs of clients as fully as possible (for example, the convenience of accessing external and internal databases may be important for the client).

In their ecosystem, ICT actors play a key role because they ultimately enable companies to clean, transform, combine and package accumulated data. this cycle of data makes it easier to work with them and sell information to customers, or optimizes their internal use and, as a result, the work of the company. In such an ecosystem, companies can still develop their own big data structures, independently or using third-party services. It is important for a company to define its own strategy for big data, considering the field of activity, internal assets, customer profiles and market position. It may take a long time – the implementation period depends on the amount of resources that the company can allocate to the project. Therefore, start with small and practical big data projects [4].

Despite the complexity of the ecosystem, companies must understand that investing in big data is very important strategically. Neglecting big data can negatively affect the organization in the future and make it vulnerable in the competition. You need to define specific business tasks and understand what data to solve them you need to collect and analyze, and then determine the value of this data (Figure 4).

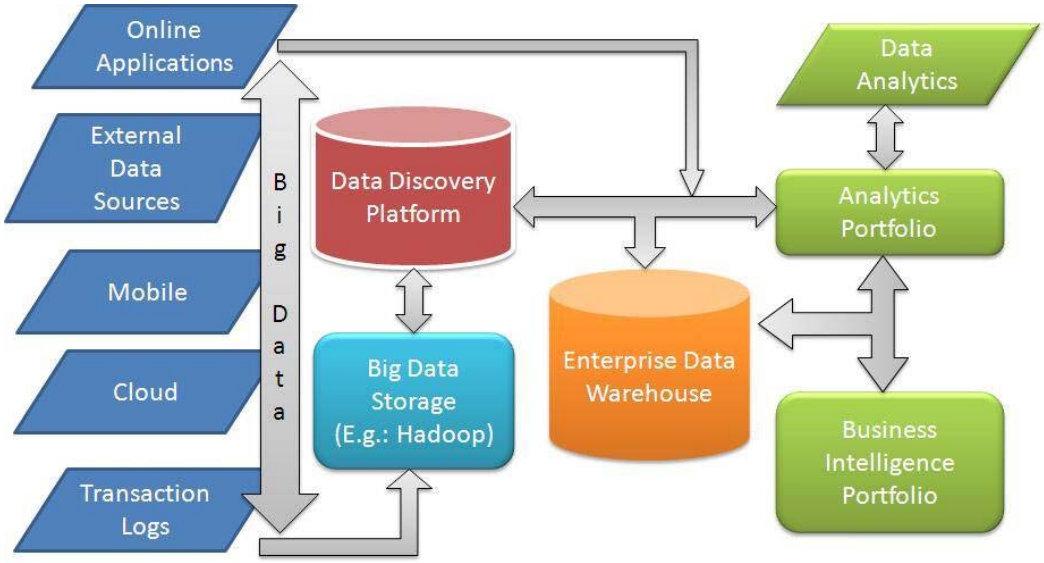

Figure. 4. Big data ecosystem of a logistics company

In alignment with the joint big data strategy roadmap, Stage 3 requires partner companies to undertake the following actions:

Task 3.1. Development of KPIs and management of complex events by optimizing company processes and asset utilization. Logistics companies can collect, store and analyze data to find performance indicators and events for the most complete optimization of enterprise assets. This should enable them to improve the allocation of resources and optimize business processes. For this, analytical tools should be used to fully unlock the potential of big data. Currently, three analytical methods are used to fully reveal the potential of big data:

– basic analytics – standard means of reporting and tracking indicators in order to obtain information about current processes and the state of the company;

– predictive analytics – includes segmentation, statistical analysis, or sensitivity analysis to create future performance-enhancing factors;

– analytical forecasting – predictive modeling and modeling that allows to obtain an analytical picture [5].

Task 3.2. Real-time processing of complex events to optimize routine operations.

Task 3.3. Reducing the cost of data ownership with the help of modern management tools:

– new solutions for data management (for example, an increase in computing power, which allows you to cope with a large volume of data and a high speed of its arrival);

– reducing the cost of information storage (decreasing the cost of data center services, free software, etc.);

– cloud solutions (easier and faster data access based on Infrastructure / Software as a Service, IaaS and SaaS models, respectively).

Task 3.4. A deeper understanding of the ecosystem will help companies more easily find business opportunities and collaborate with the right partners. For this you need:

3.4.1. Compare yourself with other members of the ecosystem. The result of the comparison is the formation of a more effective business strategy based on a more complete knowledge of business prospects and market changes.

3.4.2. Identify the most promising partners. Mobile operators can create profitable partnerships or strategic alliances by taking advantage of big data analysis capabilities, which helps to gain a clear understanding of the ecosystem and position of all key players in the field of logistics.

Task 3.5. Expanding knowledge about customer behavior, perceptions and preferences to offer them specialized services. To thrive in the intensely competitive logistics industry, companies must prioritize the prompt and effective fulfillment of customer needs.

Task 3.6. Compilation of customer profiles to deepen knowledge about them. Combining customer information from internal CRM systems with external data on social media activity and website interactions provides a deeper understanding of customer preferences, needs, and journeys. Thus, the logistics company can personalize its offers taking into account detailed information about the client. It can improve customer segmentation models to identify current trends, predict future customer behavior, and ultimately improve products based on the analysis [2].

Task 3.7. Offering a service to an interested client at the right time. In general, the knowledge obtained as a result of data analysis should help the company make offers more individualized and, as a result,

reduce the risk of customer churn, increase sales, and contribute to improving business decisions.

Stage 4) Companies transfer data directly or develop new business services to increase profits. Using data helps support diversification and shape business development strategies. Most of the raw data held by operators can be reused or converted into a database format to create new products or services. Unlocking the potential of customer data allows mobile operators to generate additional revenue through direct data exchange and development of new business services. As part of the implementation of stage 4, the following tasks must be completed:

Task 4.1. Sale of raw data or datasets. Many private firms and public organizations support open data initiatives by disclosing part of their own data sets (unstructured or structured) to third parties – for example, developers.

Task 4.2. Launch of new services related to data. Any company in the field of logistics can offer not only solutions for analytics and data management, but also the infrastructure on which they are based. Companies are willing to pay a fair price to gain access to important metrics or reports. To do this, they need access to a big data platform.

Task 4.3. Big data planning and management. Thus, to remain competitive in their industry, companies must find a way to apply big data and acquire competencies in data analysis and management. Businesses must implement a practical strategy to unlock and benefit from big data. Four main advantages of such a strategy contribute to the development of the company's business by improving the business strategy and positioning in the market (Figure 5)/

Deriving value from big data is a complex process that requires a good understanding and anticipation of the potential problems that may be encountered.

Stage 5) Identification and resolution of potential problems. Logistics companies can harness the potential of big data inside and outside the enterprise using small and cost-effective pattern recognition tools and methods. But before that, it is necessary to familiarize yourself with all the risk factors: business, operational, technological and legal. As part of the implementation of the 5th stage, the following tasks must be completed:

Task 5.1. Solving business problems.

5.1.1. Find your place in the data value chain and get the most out of big data projects and services. In a big data environment, companies need to combine information, skills and resources to create in-demand services based on big data and develop a mutually beneficial strategy.

5.1.2. Choosing a market entry strategy: independently or in cooperation with a partner (partners). Undoubtedly, the complexity of the big data ecosystem is driving all companies today to create alliances and partnerships.

5.1.3. Choosing an appropriate company structure that will allow talent to emerge and facilitate data sharing. Big data radically changes the structure of the enterprise, because the client becomes the key factor of business. This disrupts traditional information architectures as it leads to a shift from data stores (such as data disks) to shared data arrays (allowing information to be shared). As a result, the enterprise needs to implement a new operating model that "supports" big data. among such models, three are worth noting: decentralized services, embedded common services, and individual common services (Table 1).

Task 5.2. Solving operational problems.

5.2.1. Implementation of an operational model with support for big data. In most cases, the most effective operating model will be a combination of decentralized business intelligence services and a single shared analytics service. The specific choice always depends on the industry and the capabilities of the company.

5.2.2. Stimulation of data exchange between groups and resolution of disagreements. The structure of the operator is also important for the formation of a culture of data exchange. To capitalize on big data, managers need to bridge divisions between company departments and encourage cross-departmental data sharing.

5.2.3. Attracting and retaining valuable personnel. Thanks to a new structure, a positive internal culture and an attractive salary level, logistics companies will be able to attract and retain valuable employees. Big data has led to the emergence of new roles, the scope of work and skills of which must be clear and clearly defined. These positions:

– technology specialists who manage tools and administer platforms;

– technical and data processing and analysis specialists whose tasks are to analyze, combine and track large data sets (a data processing and analysis specialist is the most valuable specialist who has deep knowledge in the field of mathematics and statistics combined with business knowledge);

Figure 5. The main advantages of a practical strategy

Table 1

Risk factors for the use of the potential of big data by logistics companies and necessary measures

Risk factors	Measures to be taken to eliminate them
business factors	– development of a viable model and assessment of potential return on investment; – finding a market niche and forming a business plan; – determining the cost of the solution and infrastructure;
operating rooms	– development of a new operating model; – development of a culture of trust and data exchange in the company; – attraction and retention of talented employees;
technological	– definition of the infrastructure necessary for the operator's business; – selection of big data processing tools that can be developed using NoSQL, BI, analytics, etc.; – considering the issue of opening a data set and implementing an API interface;
legal	– forecasting the impact of new requirements on data collection, their analysis and processing; – providing users with the ability to process data; – building trusting relationships with clients, increasing the transparency of the mobile operator's work

business managers who are able to understand the problems of their clients and give them recommendations [2].

A logistics company must assess the amount of resources needed and plan their allocation, taking into account the best available tools, skills and methods.

Task 5.3. Solving technological problems.

5.3.1. The choice of approach to investing in technology (in-house, acquisition, or outsourcing) depends on the enterprise's long-term plan for big data. Choosing the best technological means is a difficult task for an enterprise. It currently presents a whole host of data quality issues; determination of data characteristics; data interpretation and visualization:

– data quality: it is necessary to choose a data management tool that allows you to consider only useful data and focus on obtaining complete data sets;

– determination of data characteristics: identification or hiring of a data processing and analysis specialist and selection of a data management tool that will enable data labeling and organization of their storage;

– data analysis and interpretation: for effective data analysis, purchase appropriate software, after which specialists in data processing and analysis can clarify previously identified patterns based on their own knowledge of the business;

– data visualization: it is necessary to find a suitable specialist (for example, from the field of business analytics) and tools for complex presentation of results to interested departments.

5.3.2. Selection of appropriate tools and necessary resources for each step of the data processing and analysis cycle. To do this, it is necessary to choose appropriate tools at each of the stages of the data cycle – collection, transformation, unification and packaging.

5.3.3. Exploring the limitations of technology. Large companies currently offer enterprise data management and analytics solutions based on open source or proprietary technologies. These solutions allow companies to master existing data, combine it with external data, and derive maximum value.

Task 5.4. Solving legal problems. Logistics companies need to review the legal framework for companies and customers to facilitate data sharing and increase transparency.

5.4.1. Rethinking privacy in the age of big data. In the new conditions, the concept of "consent" takes on a special role – it is both a powerful weapon of the user and a manifestation of trust in the information age. In order to build trust-based relationships with customers and obtain broader data sets from users, companies need to create an efficient cycle of transparency that balances the ecosystem without losing control.

Stage 6) Evaluation of the efficiency of logistics activities of enterprises and organizations using the Big Data tool and management decision-making. Using big data to improve logistics efficiency in enterprises and organizations takes into account the assessment of the impact of big data analytics on logistics efficiency and decision-making and a big data-based approach to measuring and improving logistics efficiency.

Logistics businesses must explore and adopt a high-margin strategy to reduce churn, retain and grow their customer base, and increase revenue per customer. Elemental strategies such as providing offers on data plans, reducing tariff rates may have a short-term impact and are unlikely to provide a sustainable solution for them.

Conclusion. Thus, Big Data becomes one of the main tools (drivers) for the formation of information and communication technologies in modern conditions of high-tech production. The constantly growing possibilities of analyzing a large amount of information are currently significantly changing the business environment and business processes occurring in the logistics activities of enterprises and organizations. The use of Big Data technologies can

play an important role in the innovative development of the digital economy soon.

Despite certain difficulties and problems of development, Big Data technologies are becoming one of the most important directions for the formation of new services, increasing the competitiveness of service enterprises, and creating innovative marketing tools for the promotion of services in the knowledge economy. The use of the results of the conducted research will allow to increase the level of efficiency of logistics activities of enterprises and organizations in the conditions of digital transformation.

REFERENCES:

1. Dzyamulych M.I., Shmatkovs'ka, T.O. (2022). Vplyv suchasnykh informatsiynykh system i tekhnolohiy na formuvannya tsyfrovoyi ekonomiky [Influence of modern information systems and technologies on the formation of the digital economy]. *Ekonomichnyy forum*, no. 2, pp. 3–8.

2. Mazur N.A. (2022). Tsyfrova transformatsiya ekonomiky: mikro- ta makroaspekty: kolektyvna monohrafiya [Digital transformation of the economy: micro- and macro-aspects: collective monograph]. Kamianets-Podilsk. national University named after I. Ohienko. Chernivtsi: Chernivtsi. national University named after Yu. Fedkovicha.

3. Kam Pui, Liu, Chiu Weisheng. (2021). Supply Chain 4.0: the impact of supply chain digitalization and integration on firm performance. *Asian Journal of Business Ethics*, 10, 371–389.

4. Krstić, Mladen & Tadić, Snežana & Zečević, Slobodan. (2021). Technological solutions in Logistics 4.0. *Ekonomika preduzeca*, 69, 385–401.

5. Mohsen, B. (2023). Impact of Artificial Intelligence on Supply Chain Management Performance. *Journal of Service Science and Management*, 16, 44-58.

БІБЛІОГРАФІЧНИЙ СПИСОК:

1. Дзямулич М.І., Шматковська Т.О. Вплив сучасних інформаційних систем і технологій на формування цифрової економіки. *Економічний форум*. 2022. № 2. С. 38.

2. Цифрова трансформація економіки: мікро- та макроаспекти: колективна монографія / за заг. ред. Н. А. Мазур, д.е.н., проф.; Кам'янець-Подільськ. нац. ун-т ім. І. Огієнка. Чернівці: Чернівец. нац. ун-т ім. Ю. Федьковича, 2022. 440 с.

3. Kam Pui, Liu, Chiu Weisheng. Supply Chain 4.0: the impact of supply chain digitalization and integration on firm performance. *Asian Journal of Business Ethics*. 2021. № 10. P. 371–389.

4. Krstić, Mladen & Tadić, Snežana & Zečević, Slobodan. Technological solutions in Logistics 4.0. *Ekonomika preduzeca*. 2021. № 69. P. 385–401.

5. Mohsen B. Impact of Artificial Intelligence on Supply Chain Management Performance. *Journal of Service Science and Management*. 2023. № 16. P. 44–58.