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MODEL OF DEVELOPMENT OF TRANSPORT AND LOGISTICS SYSTEMS IN TOURISM

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МОДЕЛЬ РОЗВИТКУ ТРАНСПОРТНО-ЛОГІСТИЧНИХ СИСТЕМ В ТУРИЗМІ

In the fast-paced development of digital technologies, traditional transport and logistics systems within the tourism sector, which rely on static planning models and prolonged decision-making cycles, are ineffective. To maintain competitiveness and ensure the efficient functioning of transport and logistics systems in tourism, it is necessary to transition to models that account for dynamism, integration of digital technologies, adaptability, and real-time operational management. Therefore, this study aims to develop a model for the development of transport and logistics systems in the tourism sector that incorporates the principles of dynamic management, enhances the resilience and efficiency of logistic flows, and contributes to the competitiveness of tourist destinations. Within the framework of the study, a model for the development of transport and logistics systems in tourism is substantiated as a multi-component dynamic system that integrates organizational, logistical, digital, and managerial elements. The effectiveness of this model's functioning is ensured by the application of principles that promote digital transformation, adaptive logistics, and flexible management. This enables the system to respond promptly to changes in demand, seasonal fluctuations, and external challenges. It has been proven that the proposed model for the development of transport and logistics systems in the tourism sector is based on five key principles: dynamism, integration, digitalization, sustainability, and customer orientation. The adaptive nature of the model for the development of transport and logistics systems in the tourism sector ensures its ability to effectively respond to changes in the external environment, while the outlined principles serve as strategic guidelines for its further improvement. The implementation of these principles involves the introduction of a standardized operational cycle for transport and logistics systems in tourism. Such a cycle includes: monitoring the external environment, adaptive planning, technological support, integration into operational activities, and continuous performance evaluation. Prospects for further research lie in analyzing the possibilities of integrating green logistics and sustainable development into transport and logistics systems, taking into account environmental standards and requirements.

Передплатний індекс 21847

В умовах стрімкого розвитку цифрових технологій традиційні транспортно-логістичні системи, побудовані на статичних схемах планування і тривалому циклі прийняття рішень, виявляються неефективними. Для збереження конкурентоспроможності та ефективного функціонування таких систем у туризмі потрібен перехід до таких їх моделей, що враховують динамічність, інтеграцію цифрових технологій, адаптивність та оперативне управління в реальному часі. Відтак метою даного дослідження є розробка моделі розвитку транспортно-логістичних систем у сфері туризму, яка враховує принципи динамічного управління, підвищує стійкість та ефективність логістичних потоків, а також сприяє конкурентоспроможності туристичних напрямків. У межах дослідження обгрунтовано модель розвитку транспортно-логістичних систем у туризмі як багатокомпонентної динамічної системи, що інтегрує організаційні, логістичні, цифрові та управлінські елементи. Ефективність функціонування цієї моделі забезпечується застосуванням принципів, що сприяють цифровій трансформації, адаптивній логістиці та гнучкому управлінню. Це дозволяє системі оперативно реагувати на зміни попиту, сезонні коливання та зовнішні виклики. Доведено, що запропонована модель розвитку транспортно-логістичних систем у сфері туризму базується на п'яти ключових принципах: динамічність, інтегрованість, цифровізація, сталий розвиток та клієнтоорієнтованість. Адаптивний характер моделі розвитку транспортно-логістичних систем у сфері туризму забезпечує її здатність ефективно реагувати на зміни зовнішнього середовища, а зазначені принципи формують стратегічні орієнтири для її подальшого вдосконалення. Реалізація окреслених принципів передбачає впровадження стандартизованого циклу функціонування транспортно-логістичних систем у туризмі. Такий цикл включає: моніторинг зовнішнього середовища, адаптивне планування, технологічне забезпечення, інтеграцію в операційну діяльність та безперервне оцінювання ефективності. Перспективи подальших досліджень полягають в аналізі можливостей інтеграції "зеленої" логістики та сталого розвитку у транспортно-логістичні системи з урахуванням екологічних стандартів та вимог.

Key words: model; logistics in tourism; transport component; logistics component; digital component; managerial component.

Ключові слова: модель; логістика в туризмі; транспортна складова; логістична складова; цифрова складова; управлінська складова.

PROBLEM STATEMENT

As digital technology develops rapidly, the tourism sector encounters significant challenges that directly affect the market structure and behavior [5].

Changes in consumer behavior — such as the increasing demand for personalized services, rapid access to information, and the capacity to book online — necessitate that transport and logistics systems be adaptable and responsive. The emergence of new business models, such as shared transport platforms or integrated tourism services, intensifies competition and increases the demand for rapid adaptation to changes.

Information openness and data accessibility drive increased transparency and raise user expectations regarding service quality and speed. In this context, traditional logistics systems, built on static planning models and lengthy decision-making cycles, prove to be ineffective. They are unable to provide timely adaptation to seasonal fluctuations, crises, or unexpected changes in demand.

To maintain competitiveness and ensure the effective functioning of transport and logistics systems in tourism, it is essential to transition to models that incorporate dynamism, integrate digital technologies, adapt to changes, and manage operations in real-time.

ANALYSIS OF RESEARCH AND PUBLICATIONS

Modern approaches to analyzing the state and development challenges of transport and logistics systems in the tourism sector are highlighted in the works of A. O. Prochan [6], I. Ye. Zhurba, I. V. Nestorishen [2], T. Marusey [3], H. M. Tarasyuk [6], and other researchers. In particular, A. O. Prochan [5] emphasizes key technological, innovative, and global trends in the development of logistics in tourism, stressing the necessity of digitalizing logistics processes and implementing modern service models.

I. Ye. Zhurba and I. V. Nestorishen [2] consider the improvement of tourism logistics as a tool for enhancing the quality of tourism services, emphasizing the importance of customer-oriented approaches and logistical coordination. T. Marusey [3] analyzes logistical innovations in the tourism industry, particularly the impact of digital platforms and mobile services on logistics efficiency. H. M. Tarasyuk [6] focuses on modern logistics solutions and supply chain management in unstable environments, which is directly relevant to tourism companies.

At the same time, most existing studies focus primarily on solving specific applied tasks-such as optimizing tourist routes, organizing transportation, or improving service quality-while the issue

Передплатний індекс 21847

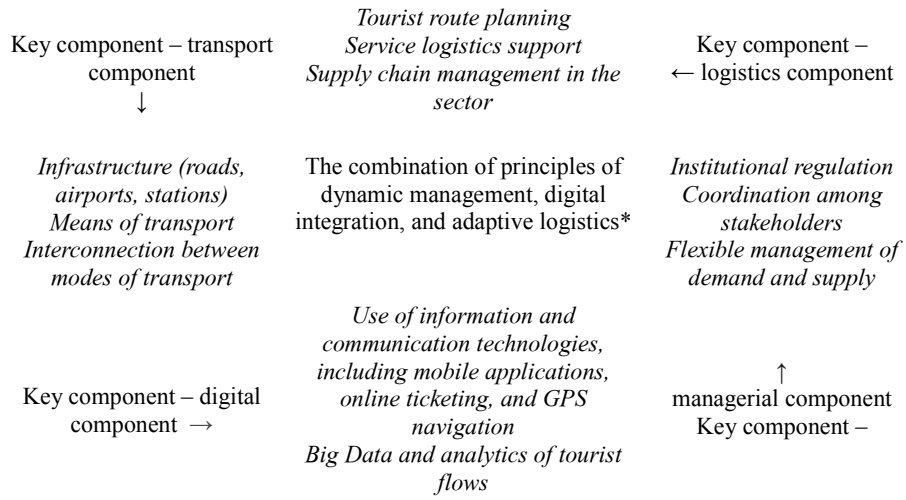

Figure 1. Constituent components of the model for the development of transport and logistics systems in tourism

Note / * ensures the prompt response of the transport and logistics system to changes in demand, seasonal fluctuations, emergencies, and other external environmental factors.
Source: compiled based on [1—2; 6—7].

of developing systemic, model-based approaches to the advancement of transport and logistics systems in tourism remains insufficiently explored.

Therefore, this topic requires further scientific investigation, particularly considering market dynamics, digital transformations, and the integration of cross-industry solutions, which underscores its significance and relevance.

FORMULATION OF THE ARTICLE'S OBJECTIVES

This study aims to develop a model for the development of transport and logistics systems in the tourism sector that incorporates the principles of dynamic management, enhances the resilience and efficiency of logistic flows, and contributes to the competitiveness of tourist destinations.

THE PAPER MAIN BODY

Within the framework of the study, the authors examine a model for the development of transport and logistics systems in tourism through the lens of a comprehensive approach to organizing, managing, and optimizing the movement of tourists and related flows (informational, material, and service), which takes into account market dynamics, digital transformation, and the specifics of the tourism industry.

We emphasize that modeling is extremely important, given that tourism is a multi-component system that includes not only the movement of people but also the accompanying logistical processes [3].

In terms of the outlined provisions, it is appropriate to agree with V. H. Shchabelska, Yu. Yu. Pologovska, and M. D. Bykova [7] that the specificity of a modern model should be the gradual implementation of development principles that promote digital transformation, adaptive logistics, and dynamic management, thereby enabling the model to respond flexibly to changes in demand, seasonality, and external challenges. At the same time, the key components of the model remain unchanged, including: the transport component, the logistics component, the digital component, and the managerial component. The constituent components of the model for the development of transport and logistics systems in tourism are presented in Figure 1.

According to the outlined provisions, we have identified the following principles for developing a model for the development of transport and logistics systems in the tourism sector [1; 5—6]:

1. Dynamism entails the ability to respond to changes in real time (seasonality, demand, crises).

2. Integration involves the combination of transport, logistics, and tourism infrastructure.

3. Digitalization includes process automation, the use of artificial intelligence, and cloud solutions.

4. Sustainable development which focuses on minimizing negative environmental impact, promoting "green" transport, and collectively enhancing the resilience and efficiency of logistic flows.

5. Customer orientation aims to create a comfortable and safe tourist experience.

The proposed model for the development of transport and logistics systems in the tourism sector is dynamic and adaptive. This ensures the implementation of each of the above-mentioned principles (Table 1), thanks to which the outlined model is not only formed but also guided based on these principles (as they serve as strategic guidelines in its functioning, development, and improvement).

The implementation of the outlined principles should be embedded through a standardized operational cycle of the development model for transport and logistics systems in tourism. This cycle involves the phased introduction of each principle into the management system and the organization of logistics and transport processes. The main stages of this cycle may include [4; 6—7]:

Передплатний індекс 21847

Table 1. Characteristics of the principles for developing the model of transport and logistics systems in tourism

Principles	The core of the principle	Practical action of the principle	Advantages
Dynamism	The system must be flexible and capable of adapting to changing conditions — seasonal fluctuations, sudden crises (epidemics, wars, natural disasters), changes in demand for tourism services, and so on.	Use of demand forecasting systems for transportation depending on the season, holidays, or events. Application of intelligent transportation systems that allow real-time route adjustments. Flexible management of logistics flows depending on infrastructure load.	Cost optimization. Improvement of the efficiency of tourist transportation services. Reduction of congestion and downtime.
Integration	Creation of a unified infrastructure system where all elements interact: transportation (land, air, water), logistics (warehouses, hubs, deliveries), and tourism facilities (hotels, landmarks, routes).	Unified transport-tourism cards or platforms (for example, a single ticket for train, bus, and museum entry). Integration of logistics with hotel and tourism services (for example, baggage delivery from the airport directly to the hotel). Joint planning of transport and tourism infrastructure development.	Continuity of logistics chains. Convenience for tourists. Enhancement of the region's competitiveness.
Digitalization	Wide use of digital technologies for process automation, data collection and analysis, enhancing transparency and convenience.	Implementation of mobile applications for travel planning, transportation, and hotel booking. Use of IoT (Internet of Things) for monitoring vehicles and logistics flows. Application of artificial intelligence for demand forecasting, flow management, and service personalization.	Reduction of service time. Decrease of human factor errors. Providing tourists with a convenient digital experience.
Sustainable development	Priority on environmental safety, preservation of natural resources, and development of ecological transport and logistics.	Transition to electric transport, bicycle logistics, and low-emission public transport. Route planning with consideration of minimal environmental impact. Encouraging tourists to use "green" transportation modes (through subsidies, bonuses).	Improvement of the region's image as an environmentally responsible area. Reduction of the carbon footprint. Preservation of tourist locations for future generations.
Customer orientation	Focus on the needs, convenience, safety, and emotional experience of the tourist during the journey.	Personalized services based on customer behavior data. Providing tourists with information in a convenient format. Ensuring safety, inclusivity, and ease of movement (especially for people with disabilities, elderly tourists, families with children).	Higher customer loyalty and satisfaction. Increase in repeat visits. Positive reviews and reputation.

Source: compiled based on [1—2; 4—5].

1. Monitoring and environmental analysis, which involves collecting data on tourist demand, seasonal fluctuations, infrastructure status, logistics flows, and external threats (economic, environmental, social). In this case, the implementation of the principle of dynamism occurs through the use of analytics for real-time response [3].

2. Planning and modeling, which include the development of adaptive strategies taking into account current conditions, forecasts, and the principles of integration, sustainability, and customer orientation. In this case, the implementation of the principles of integration and sustainable development occurs through route planning, combining different modes of transport, and ecological design.

3. Technological support encompassing the implementation of digital solutions for system management: smart applications, artificial intelligence, cloud services, Internet of Things. In this case, the realization of the digitization principles occurs through ensuring automation and innovative flow management.

4. Implementation into operational activities, which includes the execution of transportation and logistics services according to approved plans with continuous user feedback. In this case, the realization of the customer orientation principle occurs through personalized service, service quality, and convenience for the tourist.

5. Performance evaluation and feedback, which includes analyzing results, identifying shortcomings, gathering feedback from tourists and partners, and improving the system.

Thus, the action of each principle is not isolated but integrated at all stages of the cycle, from data collection to the continuous improvement of the

Передплатний індекс 21847

model structure. This facilitates the creation and ongoing adjustment of the transport and logistics system model based on the needs of the tourist. In this case, all principles will operate jointly and continuously (based on the received data, the cycle repeats, but already taking into account new conditions [4]).

CONCLUSIONS

Within the study, a model for the development of transport and logistics systems in tourism is substantiated as a multi-component dynamic system that integrates organizational, logistical, digital, and managerial elements. The effectiveness of this model's functioning is ensured through the application of principles that promote digital transformation, adaptive logistics, and flexible management. This enables the system to quickly adjust to demand changes, seasonal variations, and external challenges.

At the same time, the research results are characterized by the following conclusions:

1. The proposed model for the development of transport and logistics systems in the tourism sector is based on five key principles: dynamism, integration, digitalization, sustainable development, and customer orientation.

2. The adaptive nature of the model for the development of transport and logistics systems in the tourism sector ensures its ability to respond effectively to changes in the external environment, while the aforementioned principles form strategic guidelines for its further improvement.

3. The implementation of the outlined principles involves the introduction of a standardized operating cycle for transport and logistics systems in tourism. This cycle includes: monitoring the external environment, adaptive planning, technological support, integration into operational activities, and continuous performance evaluation.

The prospects for further research lie in analyzing the possibilities of integrating "green" logistics and sustainable development into transport and logistics systems, taking into account environmental standards and requirements.

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Передплатний індекс 21847