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SMART STATISTICS AS A NEW PARADIGM FOR STATISTICAL SUPPORT OF TOURISM AND HOSPITALITY SECTOR MANAGEMENT

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ABSTRACT

The article substantiates the concept of smart statistics as a new paradigm of statistical support for the management of the tourism and hospitality sector in the context of digital transformation. The relevance of the study is driven by the rapid growth of data volumes and the increasing need for their real-time use in managerial decision-making.

The limitations of traditional statistics are identified, including its retrospective nature, data fragmentation, and limited applicability for operational management. The necessity of transitioning to an integrated model that combines official statistics, administrative data, and alternative digital data sources is justified.

Smart statistics is considered as an integrated system based on the interaction of data, analytical methods, and modern digital technologies. Its implementation enables a shift from descriptive to proactive management, improves the validity of managerial decisions, and enhances the efficiency of the tourism and hospitality sector.

The scientific novelty lies in the development of a conceptual approach to smart statistics as a unified system integrating heterogeneous data sources and analytical tools within a single functional framework.

KEYWORDS

Smart Statistics, Statistical Support, Management, Tourism and Hospitality Sector, Digitalization, Big Data, Analytics

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Introduction. In the context of the digital transformation of the economy, the role of statistical support as a key instrument for supporting managerial decision-making is significantly increasing. The tourism and hospitality sector, as a complex socio-economic system, is characterized by a high level of dynamism, dependence on external factors, and considerable variability in demand, which leads to increased requirements for the quality, timeliness, and relevance of statistical information. At the same time, traditional approaches to the organization of statistical observations, established in international tourism statistics standards, in particular the *International Recommendations for Tourism Statistics* and the *Tourism Satellite Account: Recommended Methodological Framework* [1; 2], ensure the formation of aggregated indicators; however, they are predominantly retrospective in nature and do not always meet the needs of operational management.

Modern statistical practice is based on the principles of official statistics, which define the requirements for data quality, reliability, and accessibility [3], as well as on standardized models of statistical activity organization, such as GSBPM and GAMS0, which regulate the processes of statistical production [4; 5]. At the same time, the development of digital technologies, the emergence of Big Data, alternative data sources, and analytical tools create preconditions for the transformation of traditional statistics towards its integration with modern information systems and the transition to more flexible and adaptive models of statistical support.

In this context, a new scientific direction is emerging – smart statistics, which involves the integration of heterogeneous data sources, the application of advanced analytical methods, and digital technologies to support decision-making in near real time. Smart statistics is considered not only as a technological upgrade

of statistical tools, but also as a conceptual shift in the paradigm of statistical support for management, implying a transition from descriptive to proactive and forecast-oriented approaches.

Despite the considerable number of studies devoted to the development of tourism statistics and the implementation of digital technologies in statistical practice, the issue of forming a comprehensive concept of smart statistics as a system of statistical support for managing the tourism and hospitality sector remains insufficiently developed.

The aim of the article is to substantiate smart statistics as a new paradigm of statistical support for the management of the tourism and hospitality sector and to identify its key structural components.

The modern development of statistical support for managing the tourism and hospitality sector takes place under conditions of transformation of the information environment, characterized by the growth of data volumes, expansion of data sources, and increasing complexity of analytical processing requirements. The traditional statistical system, built on standardized approaches to data collection, processing, and aggregation, in particular in accordance with international tourism statistics recommendations and the methodology of tourism satellite accounts, ensures the formation of a system of aggregated indicators; however, it remains predominantly focused on describing past processes [1; 2].

The methodological foundations of official statistics, enshrined in international principles and European standards of statistical data quality, define the requirements for objectivity, reliability, and comparability of information, which are necessary conditions for its use in management [3]. At the same time, under current conditions, these characteristics are insufficient to ensure effective decision-making, as there is an increasing need for timeliness, flexibility, and integration of statistical information.

An important element in the development of statistical systems is the implementation of process-oriented models, in particular the Generic Statistical Business Process Model (GSBPM) and the Generic Activity Model for Statistical Organisations (GAMSO), which formalize the main stages of statistical production and the management of statistical activities [4; 5]. The application of these models contributes to improving the efficiency of statistical processes; however, it does not fully address the problem of integrating new data sources and analytical tools.

In this context, the need for a transition to a new paradigm of statistical support becomes relevant, taking into account the possibilities of digital technologies, in particular the use of Big Data, administrative sources, and alternative information. Such an approach involves the integration of heterogeneous data into a unified system that ensures their comprehensive analytical processing and use for supporting managerial decision-making.

In this study, smart statistics is considered as an integrated system of statistical support for management, combining three key components: informational, analytical, and technological. The informational component covers various data sources, including official statistics, administrative data, and digital user traces. The analytical component involves the application of modern data processing methods, including the construction of composite indicators, the use of economic-statistical models, and forecasting methods, which correspond to approaches for building composite indicators [6]. The technological component includes digital platforms, Big Data processing tools, and data visualization instruments.

An important direction in the development of smart statistics is the formalization of analytical procedures that ensure the aggregation of heterogeneous data in the form of integrated indicators of the development of the tourism and hospitality sector. The construction of such indicators is based on the methodology of composite indicators, which involves normalization of primary data, determination of weighting coefficients, and aggregation of indicators into a single integral index [6].

The application of composite indicators makes it possible to perform a comprehensive assessment of the efficiency of the sector's functioning, taking into account both performance and resource characteristics, as well as to identify structural changes in its development. At the same time, an important condition is compliance with the principles of statistical data quality, in particular relevance, accuracy, timeliness, and coherence, as defined in European statistical standards [7; 8].

Given the heterogeneous nature of the indicators, standardization (normalization) is carried out prior to their integration, ensuring their transformation to a unified dimensionless scale in accordance with the methodological recommendations for constructing composite indicators [6]. The normalization of indicators can be performed using linear transformation methods or min–max normalization, which ensures their comparability within a common scale.

The basic model of the integral index of smart development of the tourism and hospitality sector can be represented as follows:

$$I_{SR} = \sum_{k=1}^n \omega_k \times I_k$$

where:

I_{SR} – is the integral index of smart development of the tourism and hospitality sector;

I_k – is the value of the k -th sub-index (economic, social, environmental, and digital);

ω_k – are the weighting coefficients of the components;

n – is the number of sub-indices (in this study, $n = 4$).

The weighting coefficients satisfy the normalization condition, which ensures their consistency:

$$\sum_{k=1}^n \omega_k = 1$$

The proposed model makes it possible to carry out a comprehensive assessment of the development of the tourism and hospitality sector, taking into account the multidimensional nature of its functioning, and provides an analytical basis for managerial decision-making within the framework of the smart statistics concept.

The interaction of these components ensures the transition from a traditional model of statistical support, focused on recording the results of activities, to a smart model that enables forecasting, monitoring, and decision support in near real time. This creates the preconditions for improving the efficiency of management of the tourism and hospitality sector and its adaptation to the conditions of the digital economy.

The conceptual structural and functional model of smart statistics in the management system of the tourism and hospitality sector is presented in Figure 1.

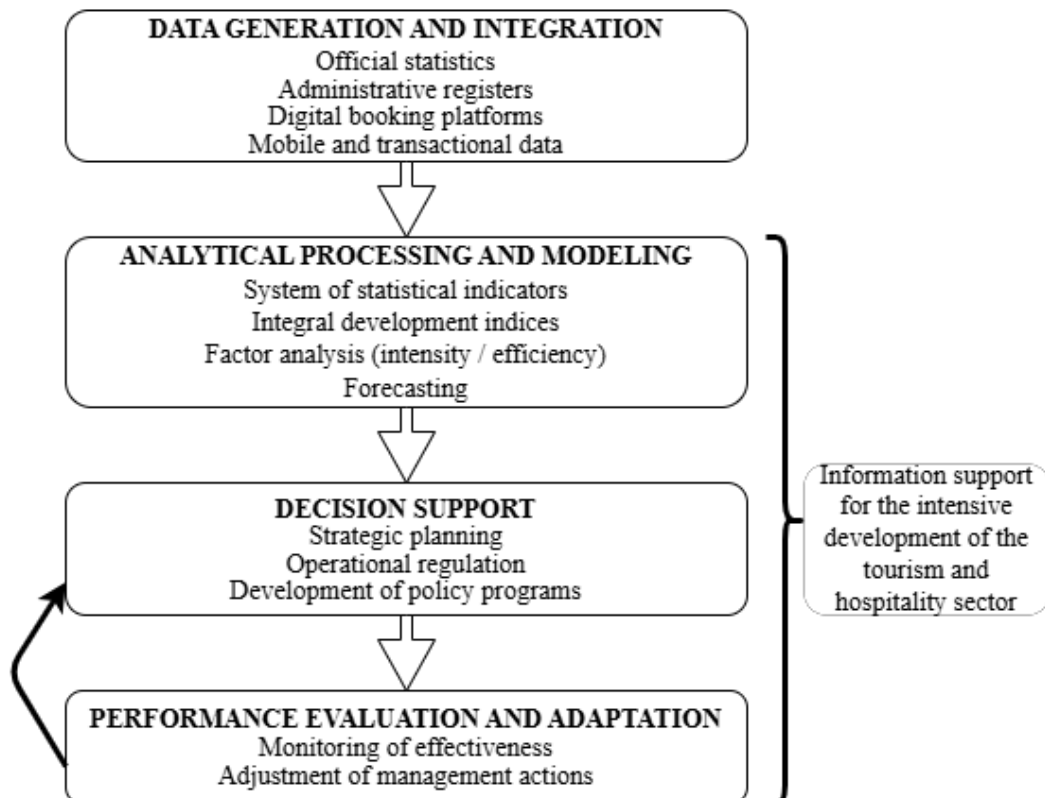


Fig. 1. Structural and functional model of smart statistics in the management of the tourism and hospitality sector

Source: developed by the author

The formation of smart statistics as an integrated system creates fundamentally new opportunities for supporting managerial decision-making in the tourism and hospitality sector. Unlike traditional statistics, which is focused on recording the results of activities, smart statistics provides an information basis for both strategic and operational decision-making.

The proposed model of smart statistics formalizes the process of managerial decision-making at different levels of management, allowing its practical implementation to be specified.

At the strategic level of management, smart statistics provides:

- identification of priority directions for the development of the tourism and hospitality sector based on the integral smart development index and its sub-indices;
- development of national and regional development programs taking into account the results of structural analysis and interregional disparities;
- assessment of the impact of investment and institutional decisions through changes in integral and partial performance indicators of the sector.

At the operational level of management, smart statistics provides:

- monitoring of demand for tourism services based on the integration of administrative and Big Data sources in near real time;
- optimization of resource management of tourism and hospitality enterprises using analytical forecasting models and revenue management tools;
- prompt response to changes in market conditions and external factors based on streaming data and short-term dynamics indicators.

In addition, the use of integrated information and analytical systems contributes to increasing the transparency of managerial processes and ensures the possibility of objective evaluation of management outcomes, which is consistent with the principles of official statistics quality and European standards of statistical production [3; 7].

The identified directions of the use of smart statistics at the strategic and operational levels of management are specified through a system of managerial decisions implemented at different levels of the tourism and hospitality sector. This allows the integration of analytical results into management practice and ensures their consistency across national, regional, local levels, and business.

The systematization of managerial decisions at different levels of management of the tourism and hospitality sector based on smart statistics is presented in Table 1.

Table 1. Managerial decisions and functions of smart statistics in the tourism and hospitality sector

Level of management	Main users of statistical information	Managerial tasks	Analytical function of smart statistics	Type of data / source
National	Cabinet of Ministers, Ministry of Economy, State Agency for Tourism Development	Formulation of national tourism policy	Monitoring of sector development, evaluation of program effectiveness	Official statistics, administrative data, Tourism Satellite Accounts (TSA)
Regional	Regional administrations	Development of tourism clusters, regional programs	Analysis of regional disparities and infrastructure planning	Regional statistics, administrative registers, geospatial data
Local communities	Local self-government bodies	Management of tourism load, development of the local economy	Monitoring of flows, assessment of territorial capacity	Local administrative data, mobile data, transactional data
Business	Hotels, tour operators, booking platforms	Demand forecasting, resource management	Revenue management, demand analytics	Big Data, transactional data, booking platform data, CRM systems

Source: developed by the author

The systematization of managerial decisions presented in Table 1 confirms that smart statistics ensures the integration of heterogeneous data sources and analytical tools into a unified system for supporting the management of the tourism and hospitality sector. Its application makes it possible to coordinate decision-making processes at different levels of management and to improve their efficiency through the use of both traditional statistical sources and modern digital data. This corresponds to current approaches to the development of statistical systems focused on the use of Big Data and integrated analytical platforms [6–8].

Conclusions.

The study substantiates smart statistics as a new paradigm of statistical support for the management of the tourism and hospitality sector, formed under the conditions of digital transformation of the economy and the growing role of data in decision-making. It is demonstrated that the traditional statistical system, primarily oriented toward retrospective analysis, does not provide a sufficient level of timeliness, integration, and relevance of information required for effective management.

A conceptual approach to smart statistics as an integrated system combining informational, analytical, and technological components has been developed. A model of the integral index of smart development of the tourism and hospitality sector is proposed, which enables a comprehensive assessment of its functioning based on the aggregation of normalized sub-indices of different nature. This ensures a transition from the analysis of individual indicators to a systemic evaluation of sector development.

It is substantiated that the implementation of smart statistics ensures the transformation of management from descriptive to proactive, oriented toward forecasting and supporting decision-making in near real time. The practical significance of the study is confirmed by the systematization of managerial decisions at different levels of management, which allows the coordination of the use of statistical information across national, regional, local levels, and business.

It is established that the integration of official statistics, administrative data, and alternative digital data sources creates the preconditions for improving the validity of managerial decisions, reducing information asymmetry, and increasing the efficiency of the tourism and hospitality sector.

The scientific novelty of the obtained results lies in combining an integral approach to assessing the development of the tourism and hospitality sector with the concept of smart statistics as a decision-support system based on the integration of heterogeneous data sources and modern analytical tools.

Prospects for further research include the development of applied models for assessing the smart development of the tourism and hospitality sector at the regional level, the empirical testing of the proposed integral index, and the improvement of methods for integrating Big Data into the system of official statistics.

Conflict of interest: No conflicts of interest to declare.

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