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Управление климатическими рисками в банковском секторе: стандарты ESG в мировом и казахстанском опыте.....891

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THE CONCEPT OF SUSTAINABLE DEVELOPMENT OF THE HOTEL BUSINESS BASED ON DIGITAL TRANSFORMATION AND ENVIRONMENTAL MANAGEMENT

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Abstract. The study examines the impact of the pandemic situation on the tourism industry, including innovations aimed at ensuring the sustainable development of the modern hotel industry. He studies the areas of effective coordination of digital transformations and environmental management tools, as well as green hotel systems. The most rational use of economic and natural resources, reducing the burden on the environment, as well as improving the quality of services provided require the active introduction of modern technological solutions. The paper fully analyzes the tools of digital technologies and artificial intelligence, systems for maximum processing, data analysis and indicators, complexes for improving energy efficiency in hotels, systems for applying "green" standards, waste management processes in hotel complexes. The study will determine the importance of environmental management for the development of the hotel business. The methodological basis of the research was reviews of scientific publications and official statistical and analytical materials, systems of analysis and comparison. The sources allow us to reveal the main provisions of the Concept of Sustainable Development in the context of digital transformation and environmental management. The results contribute to optimizing the processes of

implementation and maintenance of these concepts, rational use of resources and increasing the prestige of hotels. It also fully reflects their impact on strengthening competitive positions in the market. The study will propose a comprehensive conceptual model aimed at harmonizing digital and environmental initiatives in the activities of hotel companies. The nominal model will serve as the basis for the effective implementation of innovative, environmentally oriented and safe, socially responsible practices in the hotel industry with maximum respect for the principles of sustainable development.

Keywords: sustainable development, hotel industry, digital transformation, «green» technologies, environmental management, innovation management, concept

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ЦИФРЛЫҚ ТРАНСФОРМАЦИЯ ЖӘНЕ ЭКОЛОГИЯЛЫҚ БАСҚАРУ НЕГІЗІНДЕГІ ҚОНАҚ ҮЙ БИЗНЕСІНІҢ ТҰРАҚТЫ ДАМУ ТҰЖЫРЫМДАМАСЫ

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Аннотация. Зерттеу пандемиялық жағдайдың туристік индустрияға әсерін, оның ішінде заманауи қонақүй индустриясының тұрақты түрде дамуын қамтамасыз етуге бағытталған жаңашылдықтарды қарастырады. Цифрлық трансформация мен экологиялық басқару құралдарын тиімді үйлестіру бағыттары мен жасыл қонақүй жүйелерін зерттейді. Экономикалық және табиғи ресурстарды барынша ұтымды қолдану, қоршаған ортаның төңірегіндегі жүктемені азайту, сондай-ақ көрсетілетін қызметтердің сапасын арттыру заманауи технологиялық шешімдерді белсенді енгізуді талап етеді. Жұмыста цифрлық технологиялар мен жасанды интеллект құралдары,

деректер мен көрсеткіштерді барынша өңдеу, талдау жүйелері, қонақүйлерде энергия тиімділігін арттыру кешендері, «жасыл» стандарттарды қолдану жүйелері, қонақүй кешендеріндегі қалдықтарды басқару үрдістері толықтай талданады. Зерттеу барысында қонақүй бизнесін дамыту үшін экологиялық басқарудың маңыздылығы анықталады. Ал зерттеудің әдіснамалық негізі ғылыми басылымдарға шолулар мен ресми статистикалық және аналитикалық материалдар, талдау және салыстыру жүйелері болды. Дереккөздер цифрлық трансформация және экологиялық басқару жағдайында орнықты даму тұжырымдамасының негізгі ережелерін ашуға мүмкіндік береді. Нәтижелер осы тұжырымдамаларды енгізу мен қызмет көрсету үрдістерін оңтайландыруға, ресурстарды ұтымды пайдалануға және қонақүйлердің беделін арттыруға үлес қосады. Сондай-ақ олардың нарықтағы бәсекелестік позицияларын нығайтуға ықпалын толықтай көрсетеді. Зерттеу аясында қонақүй кәсіпорындарының қызметіндегі цифрлық және экологиялық бастамаларды үйлестіруге бағытталған кешенді тұжырымдамалық моделі ұсынылады. Атаулы модель тұрақты дамудың қағидаттарын барынша сақтап, қонақүй индустриясында инновациялық, экологиялық бағдарланған және қауіпсіз, әлеуметтік жауапты тәжірибелерді тиімді енгізуге негіздеме болады.

Түйін сөздер: тұрақты даму, қонақ үй индустриясы, цифрлық трансформация, «жасыл» технологиялар, экологиялық басқару, инновациялық менеджмент, тұжырымдама

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КОНЦЕПЦИЯ УСТОЙЧИВОГО РАЗВИТИЯ ГОСТИНИЧНОГО БИЗНЕСА НА ОСНОВЕ ЦИФРОВОЙ ТРАНСФОРМАЦИИ И ЭКОЛОГИЧЕСКОГО МЕНЕДЖМЕНТА

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Аннотация. В исследовании рассматривается влияние пандемической ситуации на туристическую индустрию, в том числе инновации, направленные на обеспечение устойчивого развития современной гостиничной индустрии. Изучает области эффективной координации цифровых преобразований и

инструментов экологического менеджмента, а также зеленые гостиничные системы. Наиболее рациональное использование экономических и природных ресурсов, снижение нагрузки на окружающую среду, а также повышение качества оказываемых услуг требуют активного внедрения современных технологических решений. В работе полностью проанализированы инструменты цифровых технологий и искусственного интеллекта, системы максимальной обработки, анализа данных и показателей, комплексы повышения энергоэффективности в гостиницах, системы применения «зеленых» стандартов, процессы управления отходами в гостиничных комплексах. В ходе исследования будет определена важность экологического менеджмента для развития гостиничного бизнеса. А методологической основой исследования послужили обзоры научных публикаций и официальные статистические и аналитические материалы, системы анализа и сравнения. Источники позволяют раскрыть основные положения Концепции устойчивого развития в условиях цифровой трансформации и экологического управления. Результаты способствуют оптимизации процессов внедрения и обслуживания этих концепций, рациональному использованию ресурсов и повышению престижа отелей. Также полностью отражает их влияние на укрепление конкурентных позиций на рынке. В рамках исследования будет предложена комплексная концептуальная модель, направленная на гармонизацию цифровых и экологических инициатив в деятельности гостиничных предприятий. Именная модель будет служить основанием для эффективного внедрения инновационных, экологически ориентированных и безопасных, социально ответственных практик в гостиничной индустрии с максимальным соблюдением принципов устойчивого развития.

Ключевые слова: устойчивое развитие, гостиничная индустрия, цифровая трансформация «зеленые» технологии, экологическое управление, инновационный менеджмент, концепция

Introduction. The pandemic situation in Kazakhstan has changed significantly in the tourism sector. During COVID-19, the number of visitors to the country decreased. Despite these circumstances, we can say that they opened up new opportunities in the field of Tourism. As part of the modernization of public consciousness, interest in the development of domestic tourism has increased. In principle, the current stage of development of Kazakhstan is determined by digital transformation in all industries and enterprises. If we take the hotel business in these areas, we all know that there are several digitalization technologies in it. The development of named technologies acts in a new way in the space of optimizing business processes and improving quality. The areas and systems of effective coordination of digital transformation and environmental management tools, the provision of contactless technologies and remote services are becoming particularly relevant at this time.

The concept of sustainable development of the hotel business requires fast and high-quality management in digital systems. In our study, two areas are considered equally: digital transformation and environmental management. Here, first of all, the activities of tourist complexes in the direction of the hotel are discussed, to which we include methods and techniques for improving tourist destinations adopted in the development strategy. Among the main ones are the expansion of air and rail routes, access to regular city transport. We also mean the alignment and alignment of road networks, the transport system and infrastructure in the process of crossing the border, as well as water supply. We conclude that the development of local areas, the creation of Solid Waste Management Systems, the maximum supply of facilities with electricity, and the expansion of other elements of tourist infrastructure can be included in these categories.

The proposed concept takes into account both cultural and ethnic, complete historical heritage, as well as unique gastronomic traditions, starting with the natural wealth of the country. They will expand tourist facilities and systems as much as possible, improve the quality of services, and develop a systematic tourism product. Of particular importance, we can mention the project "geography of sacred places of Kazakhstan", because within the framework of which the sacred places of our country are highlighted on the geographical map and are formed as important cultural values (The Government of the Republic of Kazakhstan, 2023).

In developed countries, the concept of an ecological hotel has been developed in order to consider finding harmony with the surrounding environment. We believe that its main goal is to reduce production costs and protect the environment. Green hotels seek to reduce chemical inclusions. It itself is a prerequisite for Environmental Management.

Literature review. We can see in the works of several scientists that today the hospitality industry is undergoing significant changes due to digital transformation and environmental restrictions. Therefore, the hotel business strives to increase competitiveness and correctly implement innovative and technological management solutions. In order to effectively use the resources used in the study and prevent threats, it can set new requirements related to the reduction of waste and their volume, adapt them to them. Traditional management systems that have been used to this day cannot fully ensure the special priority of current economic indicators.

This is due to the fact that the processes of taking environmental responsibility on the part of consumers, the correct use of advanced digital services, and improving energy-saving technologies in practice will be determined. The development of the concept of sustainable development, based on the relationship between ecology, management and digitalization, is a prerequisite for the revival, competitiveness of the services of Hotel Enterprises.

The purpose of the study is to develop digital technologies that shape the sustainable development of the hotel business, a comprehensive concept that aligns the environment with environmental management mechanisms.

Tasks in achieving this goal:

- identification of digital transformation processes in the hotel business;
- analysis of revitalization approaches in Environmental Management;
- development of the "eco-digital management structure" in improving environmental performance with the help of digital tools;
- propose a model for implementing the concept of sustainable development.
- formulate practical recommendations in the systematization of solutions in the application of digital transformation in the hotel management flow.

Methods and materials. Currently, in the hospitality industry, digital transformation and environmental management are closely interrelated and are considered as one of the main factors in ensuring sustainable development. The introduction of digital technologies will allow to comply with environmental standards, optimize operational processes and improve management efficiency. The scientific foundations in this area are widely considered in works analyzing digital changes in the field of tourism and hospitality (Buhalis and Law, 2008). In addition, online platforms, social media and digital communications play an important role not only in promoting hotel services, but also in changing customer behavior and shaping their choice models (Xiang and Gretzel, 2010). And the problems of sustainable tourism and environmental responsibility are characterized as an important condition for the long-term development of the hospitality industry (Gössling, 2000).

Key components of the "green hotel" model in the hospitality industry include Big Data Analysis (Big Data), the Internet of Things (IoT), artificial intelligence, automated energy management systems, "smart rooms" and environmental monitoring technologies (Mensah, 2014). The use of such solutions creates conditions for controlling resource consumption, saving energy and water, efficient waste management and improving the environmental efficiency of hotel activities. Research shows that the introduction of artificial intelligence and IoT technologies in hotel management not only increases operational efficiency, but also contributes to improving sustainability indicators (Tamara Gaich and Marko, 2024). In addition, environmental certification systems such as LEED, ISO 14001 and open digital reporting strengthen the trust of guests and strengthen their tendency to choose environmentally responsible hotels (Agybetova et al., 2025).

International experience shows that the introduction of the concept of "smart hotel" in European countries, Japan, Singapore and South Korea gave tangible results. In particular, a significant increase in the level of energy efficiency, a reduction in operating costs and compliance with environmental requirements prove the practical significance of this model. These trends clearly demonstrate the relationship between digital technologies and environmental management approaches and prove that their coordinated application is an effective tool for achieving sustainable development goals.

At the same time, the role of user-generated content (UGC) is also increasing.

Nowadays, tourists often rely on ratings, comments on social networks and visual materials when choosing a hotel. Such an information environment directly affects the formation of public opinion about the adherence of hotels to the principles of sustainable development.

At the same time, the results of the study show that the level of comprehensive study of digital transformation and Environmental Management in the hotel business in Kazakhstan is still insufficient. In this regard, the scale of the use of digital technologies and the practical impact of environmental management mechanisms require a deeper scientific analysis. To solve this problem, it is necessary to develop a comprehensive concept focused on sustainable development, combining digital transformation and environmental management in the hotel business. Such a concept will increase the competitiveness of domestic hotel enterprises and ensure their compliance with international standards (Sakhanova et al., 2025). In addition, it can be considered as a systematic paradigm that includes a balance of economic, environmental and social interests (Figure 1).

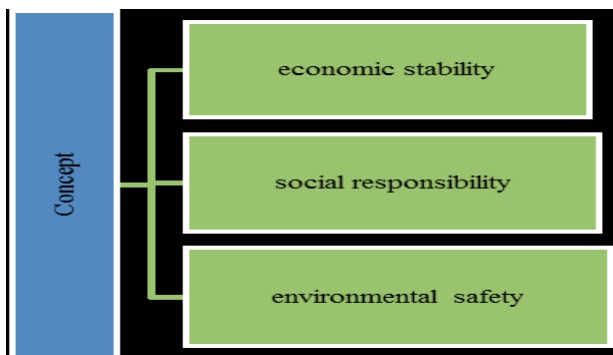


Figure 1 — Classic Triple model of the concept of Sustainable Development
Note: Compiled by authors

As shown in the figure, the ESG (Environmental, Social, Governance) model, which includes the three main components of sustainable development – environmental, social and managerial aspects – is an important platform that determines the strategic development orientation of any organization. Within this model, sustainable development is not limited to environmental issues, but also involves ensuring the economic efficiency, competitiveness and long-term sustainability of the organization. Social responsibility, in turn, aims to create a safe, comfortable and inclusive environment for guests and employees. The environmental component is based on minimizing the negative impact on the environment. Since the activities of hotel enterprises are associated with a large consumption of water, energy and material resources, the problem of efficient use of resources and waste management is of particular relevance in this area. Excessive consumption of resources often leads to an increase in waste and an increase in the environmental burden.

In this regard, the implementation of the principles of sustainable development will improve the efficiency of resource management, improve the quality of service, create an environmentally responsible corporate image and preserve long-term commercial values. The ESG model creates conditions for organizations to systematically improve sustainability indicators, as well as improve the quality of managerial decisions at the strategic and operational levels. As a result, the increase in environmental awareness of consumers and the strengthening of environmental requirements are becoming an important factor in the long-term profitability of the hotel business (Yashkov and Volkova, 2021). In this context, a comprehensive management approach is formed that combines economic efficiency, environmental responsibility and social significance.

In the scientific literature, sustainable development is considered as one of the models of the evolutionary development of society, in which the biosphere is recognized as the natural habitat and the basic condition for the existence of mankind. In accordance with this, the concept of sustainable development is characterized as a systematic approach to management that ensures mutual harmonization of human activities and the natural environment. The main goals of the sustainable development of hotel enterprises are formed on the basis of these principles (Fig.2).

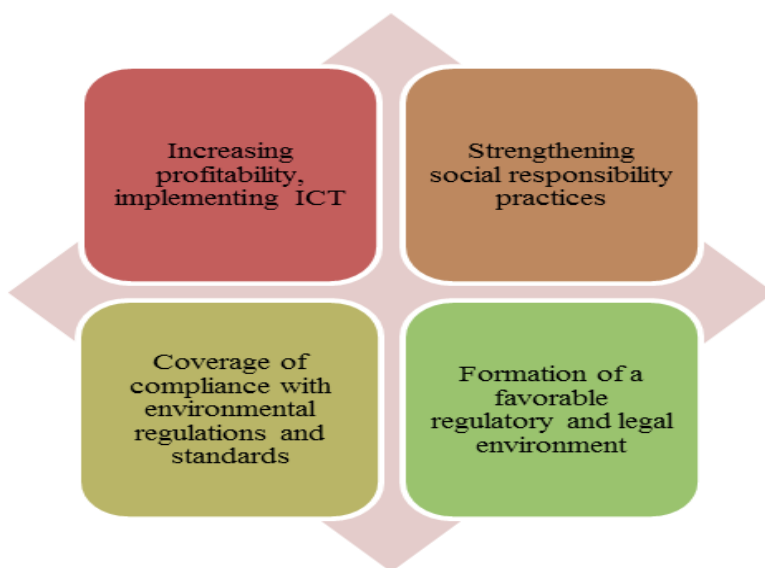


Figure 2 — goals of sustainable development of Hotel Enterprises

Note: Compiled by authors

Along with the goals shown in the figure, such areas as improving anti-crisis management strategies and increasing overall competitiveness in the context of the sustainable development of Hotel Enterprises also occupy an important place (Kobyak and Makhlof, 2020). Hotels strive to increase customer satisfaction and loyalty by offering various combinations of additional and auxiliary services. This,

in turn, will become a key factor in effective management, stable profitability and long-term position in the market (Rakhimbekova et al., 2024).

Assessment of sustainable development is not limited to the framework of the ESG model, but is carried out through an expanded system of indicators, which includes the features of the institutional environment and the level of development of information and communication technologies. Such an integrated approach makes it possible to comprehensively assess the sustainability-oriented activities of organizations.

The introduction of the principles of sustainable development in the hospitality industry will bring the activities of enterprises to a qualitatively new level. In particular, hotels and restaurants create a high-level service environment by ensuring environmental safety, efficient use of resources, and strengthening social responsibility. In addition, the creation of favorable working conditions for employees strengthens the internal stability of the organization and increases corporate efficiency.

At the present stage, the rapid development of digital technologies has a significant impact on sustainable development processes (Gavchuk, 2024). Technologies such as the integration of online and offline spaces, communications in social networks, mobile applications, virtual and augmented reality, as well as the Internet of Things (IoT) are transforming consumer behavior and changing the forms in which they interact with brands. These trends make it possible to form new competitive advantages through the introduction of innovative solutions for enterprises in the field of hospitality (Arkhipova et al., 2020).

In the course of the study, a complex of analytical, comparative and graphic methods was used. These approaches made it possible to systematically analyze international and domestic scientific publications, concepts of sustainable development, as well as environmental management mechanisms in the context of digital transformation. A comprehensive review of the scientific literature was conducted as a theoretical and methodological basis, and the experience of implementing digital technologies and environmental management at Hotel Enterprises in Kazakhstan was considered in comparison with the practice of leading international hotel chains.

In addition, as part of the study, a conceptual model was developed and hotel websites, mobile applications, "smart" technologies and online services were evaluated in terms of customer orientation and quality of Service. As a result of the use of analytical methods, the level of digital transformation and compliance of the hotel industry in Kazakhstan with environmental standards was comprehensively assessed and applied models of sustainable development were identified. This, in turn, made it possible to compare them with international best practices.

In the course of the study, a number of systemic barriers to the development of tourist infrastructure were identified and specific recommendations were developed aimed at overcoming them. These issues were considered not only at the level of

individual regions, but also as complex factors affecting the national economy. As a result, their economic efficiency and influence were evaluated (Kurbanbayeva et al., 2024). In addition, the main factors affecting the development of international tourism and the synergistic effects arising from their relationship have been scientifically substantiated.

Results. The introduction of digital solutions is aimed at optimizing operations in the activities of the hotel and its interaction with the environment. In particular, such technologies make it possible to reduce costs, improve the quality of staffing, use resources more efficiently and flexibly adapt the organization's activities through the automation of business processes. The concept of Environmental Management, in turn, is considered as a comprehensive management system aimed at minimizing environmental risks associated with the economic activities of the organization and ensuring long-term sustainable development.

In this regard, we can see in Figure 3 an evening of organizational activities to achieve the goals that shape environmental management. The figure also shows the levels of characterization as a combination of management practices.



Figure 3 — the main components of an environmental management system
Note: Compiled by authors

The environmental management system is considered as a set of interrelated components implemented through management processes of a continuous and periodic nature (Kaviyarasu, 2024). Achieving sustainable development in the hotel and restaurant business is achieved through the integration of several functional areas. These include digital transformation in the optimization of operational processes, automation aimed at the efficient use of labor resources, analytical tools in the reduction of errors, forecasting models in cost management, initiatives aimed at reducing environmental risks and improving the environmental performance of infrastructure. In addition, these trends contribute to ensuring long-term economic stability, increasing customer satisfaction, and creating socio-environmental responsibility (Porter and Heppelmann, 2015).

Categorical data analysis allows for a systematic classification of environmental factors and management services in the hospitality industry. These processes include hotel management and monitoring systems, waste management and recycling mechanisms, as well as analytical platforms and CRM systems. In order

to improve energy efficiency, automated lighting and temperature control systems, IoT sensors for weather monitoring, mobile applications and contactless service technologies are widely used. In addition, environmentally oriented innovative architectural solutions are considered as a strategic tool in the hotel industry. These include "green" roofs, energy-saving technologies and engineering systems based on the rational use of Natural Resources. These approaches not only increase the energy efficiency of buildings, but also reduce the anthropogenic impact on the environment and are an effective mechanism for implementing the principles of Sustainable Development at a practical level (Michael Hall and Gossling Stefan, 2020).

Digital technologies are identified as a strategically important tool in achieving sustainable development. Based on the analysis of Big Data (Big Data), the possibility of automated management of hotel resources, optimization of operational loads and increasing the accuracy of management decisions is formed. In addition, digital solutions ensure transparency and reliability of environmental reporting, reducing errors associated with the human factor in the process of using sensor systems.

As a result of the study, a conceptual model was developed that interconnected and integrated the mentioned structural elements. This model relies on a system analysis approach based on the consideration of the hotel as a complex socio-economic system. In addition, in the process of forming the model, methods for assessing the level of digital improvement, the results of expert interviews and a comparative analysis of the implementation of environmental solutions were used.

Based on the results of the study, a concept for sustainable hotel development based on digitalization and environmental management was developed, in this concept several important components are given. The main ones are adaptive digital infrastructure, the following comprehensive resource monitoring systems, responsible behavior between guests and employees, the integration of operational data in a single environment. The model "eco-digital Hotel Management stage" analyzes the direction of the integrated structure (Figure - 4).

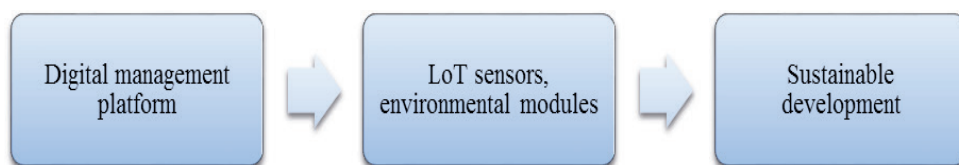


Figure 4 — Model "eco-digital hotel management"
Note: Compiled by authors

In this model, environmental aspects and digital technologies are combined into one system. Table 1 below shows the relationship between key environmental indicators and digital transformation.

Table 1 — Indicators of digitalization on Environmental Protection

Digital Technologies	Environmental Impact	Usage Level, %
Smart automated accounting tools	Reduction of water consumption	10–25
IoT sensors	Energy monitoring	15–30
Big data analytics (Big Data)	Load optimization	30
Mobile services	Cost savings	50–70

Note: compiled by the authors.

As can be seen from the table, mobile services, that is, the transition to the provision of electronic services, online booking systems reduce paper costs, administrative costs. And involving guests in environmental initiatives through digital platforms strengthens the hotel's sustainability strategy, promoting responsible consumption. We can see the indicators on it in Table 2 below.

Table 2 — Hotel stability indicators

Dimensions	Indicators
Environmental	Water and energy consumption, waste
Economic	Profitability, operational efficiency
Social	Guest satisfaction, corporate culture

Note: compiled by the authors.

The three areas analyzed as sustainability indicators in the table can also reflect the actual environmental impacts of the hotel. In general, digital and environmental modernization, which has a similar effect on this basis, is carried out through a special program. In principle, some innovative practices in the use of such digital technologies were analyzed, including the study of modernization measures to save electricity, the results of which can be seen in Figure 5.

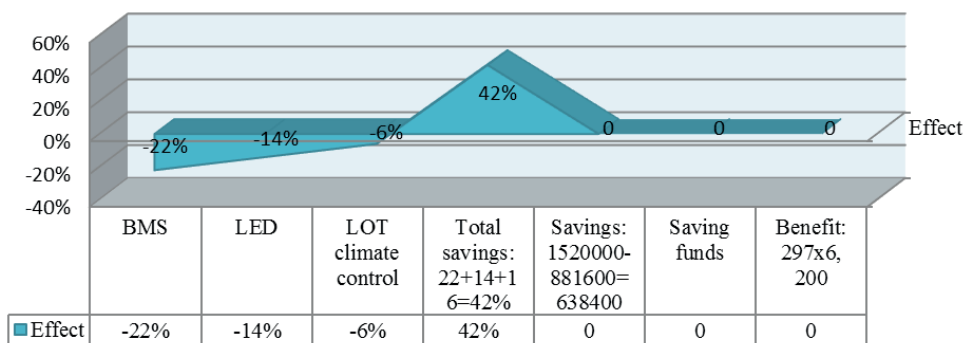


Figure 5 — Analysis of electricity consumption after Digital and environmental modernization

Note: Compiled by authors

As it turned out, we can see an increase in performance indicators in the analysis of energy saving. The study analyzed the overall resource and cost savings (figure 6).

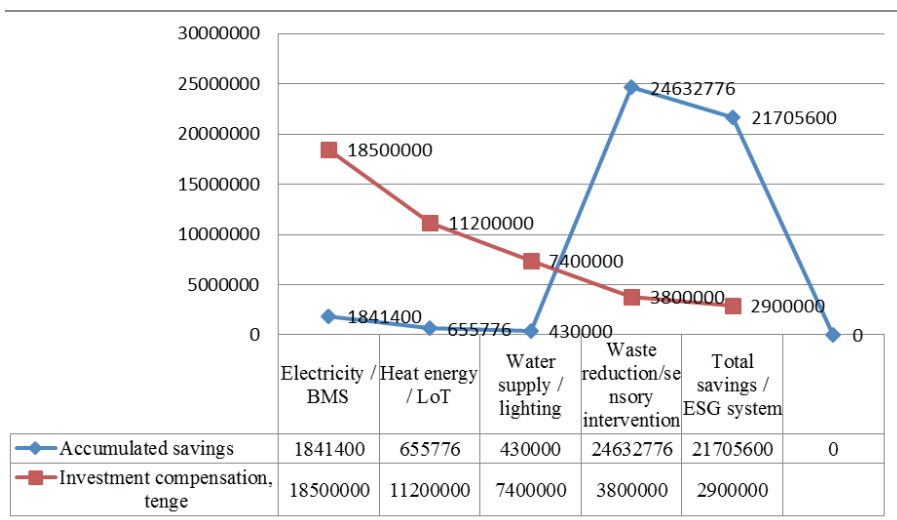


Figure 6 — Analysis of resource and cost savings after environmental protection measures

According to the data presented, the indicators of resource savings and cost reduction in environmental protection measures showed high efficiency. Thus, the analysis of digital transformation in various areas has introduced an environmental-digital model of the environment in our specific conditions. Made according to the model:

- reduces energy consumption by 42 percent;
- reduces water consumption by 24 percent;
- minimizes annual expenses;
- increases the interest of guests and staff.

The introduction of such models in hotels will improve environmental management systems. It also makes the financial performance of hotels more profitable. Reduces the number of failures in mechanical systems, introduces measures aimed at Sustainable Development.

Discussion. Digital transformation requires the introduction of innovative digital solutions aimed at radically changing organizational structures, operational processes, mechanisms for interacting with guests and mechanisms for making managerial decisions. This process has a significant impact on the business strategies of enterprises and serves as the basis for the development of new models of value formation. From the point of view of the hotel industry, the introduction of digital technologies allows for faster service processes and higher efficiency. In particular, the use of integrated management systems, the integration of Internet of Things (IoT) technologies into the management of intellectual infrastructure, and the use of mobile services and contactless solutions to increase the comfort and safety of guests are relevant.

In addition, artificial intelligence (AI) and big data analysis are increasing in importance in the modern hospitality industry. These tools allow you to predict

customer behavior, provide personalized services, and improve management decisions. The integration of these technologies with energy management systems contributes to ensuring resource efficiency and implementing the principles of sustainable development.

An important place in the formation of Sustainable Development Strategies is occupied by collective intelligence, institutional responsibility and multi-level management mechanisms. At the same time, the need to balance the contradictions between economic growth and environmental safety complicates the methodological framework for sustainable development, since the simultaneous coordination of both directions directly affects the quality of management decisions.

Conclusion. The results of the study determine the relevance of improving environmental management systems and implementing digital transformation in the hotel industry in Kazakhstan. During the development of this direction, a number of structural problems were identified. These include a shortage of qualified specialists, insufficient development of digital infrastructure, obstacles to the introduction of modern technologies and management decisions. The lack of experience in the integrated implementation of digital solutions and systematic approaches to tourism development strategies indicates the need to take into account the regional characteristics and local conditions of the country.

Based on the results of the study, the following recommendations are proposed:

- First, the creation of a single digital platform that combines automated control tools, energy efficiency systems and services for attracting guests online;
- Secondly, the systematic implementation of data analysis in management processes;
- Third, assessment and control of sustainability indicators using digital technologies;
- Fourth, the development of corporate environmental culture through the active involvement of guests and employees in environmental initiatives;
- Fifth, the phased implementation of digital transformation and its integration into a single management system.

In conclusion, the combination of digital technologies and environmental management concepts is a strategic direction for the sustainable development of the hotel business. The presented models allow you to improve the control system, effectively apply digital solutions.

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