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Ways to Solve the Problems of Information Support in Modern State and Regional Policy

Introduction

When making decisions related to the environment at the national and regional levels, information support for this process is of great importance. Today, this remains a problem for many countries. In particular, state and municipal authorities struggle with the collection, processing, and dissemination of environmental data, which greatly reduces the effectiveness of management in all areas related to environmental protection. Additional obstacles arise from the lack of uniform standards, outdated technologies, and limited public access to environmental information. The introduction of modern digital technologies can significantly improve the efficiency of environmental governance.

The purpose of this study is to analyze the primary issues in information support for environmental policy and develop recommendations for their solution. The tasks include identifying the main barriers, researching modern technological solutions, and analyzing international experience. Particular attention should be paid to the interaction between government agencies, data openness, and the digital transformation of environmental governance. It is also necessary to outline promising areas for the development of information systems in the field of environmental protection.

A review of scientific papers on the selected topic shows that the issues of environmental information accessibility have been actively studied, especially in recent decades[1].

The environmental component has become an integral part of European policy[2]. The environmental policy of a state or an association of states requires special approaches and methods for its development[3], as well as individual strategies – a problem that has not lost its relevance for a long time[4]. Similarly, since the last century, the task of finding a balance between the task of preserving the environment and the needs of the market has not lost its relevance[5]. The participation of the public and non-governmental organizations is of great importance for the development and implementation of state environmental policy information systems[6]. A study of international experience shows that digitalization contributes to increasing the transparency and efficiency of environmental governance[7]. Analysis of modern

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[4] M.E. Kraft (2021). *Environmental Policy and Politics*. 8th Edition. New York. https://doi.org/10.4324/9781003106265.

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[6] R.A. Huber, M.L. Wicki, T. Bernauer (2019). *Public support for environmental policy depends on beliefs concerning effectiveness, intrusiveness, and fairness*. "Environmental Politics", 29(4), 649–673. https://doi.org/10.1080/09644016.2019.1629171.

[7] A. Hsu, M. Schletz (2023). *Digital technologies – the missing link between climate action transparency and accountability?* "Climate Policy", 24(2), 193-210. https://doi.org/10.1080/14693062.2023.2237937; Y. Wang et al. (2024). *Digital government initiatives*

environmental information systems demonstrates the need for their modernization and integration[8]. Cybersecurity[9] and legal regulation[10] issues in the environmental sphere are also important aspects that require attention.

Research methodology

The article uses the methods of analyzing legal acts, comparative analysis of international practices, and expert evaluation. An analysis of the main technological solutions that can improve information support in the field of ecology was carried out. The research is based on the analysis of open data, reports of environmental organizations, and scientific publications. The results can be used to improve environmental policy at the national and regional levels.

Results

Problems of information support in environmental policy

Information support in the general sense is a set of all documents and data stored and circulated in an automated information system, intended for information services to information users and support of staff work[11].

for sustainable innovations, digitalization, and emission reduction policies to balance conservation impact. "Natural Resources Forum", 48(2), 335–349. https://doi.org/10.1111/1477-8947.12570; M. Sibt-e-Ali et al. (2025). *Quantifying the role of digitalization, financial technology, governance and SDG13 in achieving environment conservation in the perspective of emerging economies*. "Environment, Development and Sustainability", 1. https://doi.org/10.1007/s10668-024-05940-4.

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[9] V.V. Mokhor et al. (2021). *Research of the impact on the ecology of the state of cybersecurity of the critical infrastructure objects*. E3S Web of Conferences, 280, 09009. https://doi.org/10.1051/e3sconf/202128009009.

[10] H. Aibao (2024). *Strategies for Building an Intelligent Law Enforcement System for Ecological Environment*. "Journal of Poyang Lake", 4, 5. https://doi.org/10.3969/j.issn.1674-6848.2024.04.001.

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Information support in any area is based on several key aspects:

a. the composition of information – includes a list of data and information required to solve a certain range of tasks;
b. structure and transformation of data – involves the formation of indicators necessary for the creation and processing of documents;
c. information flow – covers the volume of information flows, transmission routes, and processing time.
d. information quality – assessed in terms of reliability, relevance, and accuracy.
e. processing and transformation methods – determine how to work with data for their effective use.

The process of information support of activities can be divided into several stages (Figure 1).

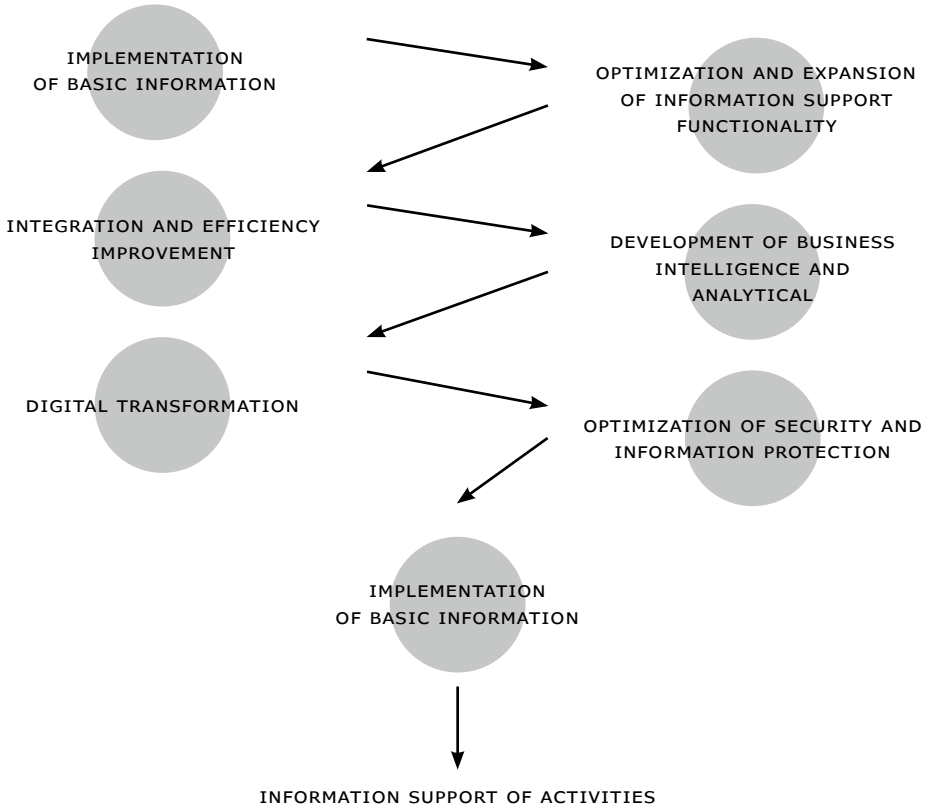

Figure 1. Stages of the process of information support of activities
Source: Created by the author.

In general terms, information on the state of the environment (environmental information) refers to any information in written, audiovisual, electronic, or other material form concerning[12]:

- the state of the environment or its components – land, waters, subsoil, atmospheric air, flora and fauna – and levels of their pollution;
- biological diversity and its components, including genetically modified organisms and their interaction with environmental objects;
- sources, factors, materials, substances, products, energy, physical factors (such as noise, vibration, or electromagnetic radiation) that affect or may affect the state of the environment and human health;
- threats of occurrence and causes of environmental emergencies, the results of their elimination, and recommendations on measures aimed at reducing their negative impact on natural objects and human health;
- environmental forecasts, plans and programs, measures (including administrative ones), state environmental policy, and legislation on environmental protection;
- costs associated with the implementation of environmental protection measures financed through environmental protection funds and other sources, and economic analyses conducted during the decision-making process on environmental issues.

In the context of digital transformation, the role of automated analysis and forecasting systems for developing effective environmental policies is growing. However, several barriers remain, which can be divided into technical and political ones.

Technical challenges include the following:

- ***outdated information systems***: many environmental databases are not updated in time, so the possibilities for analysis are very limited;
- ***lack of interaction between government agencies***: different departments use incompatible systems, which complicate the exchange of information;
- ***limited funding:*** insufficient funding hinders the introduction of modern technologies and the expansion of information platforms.

Political barriers include:

- ***development of the information society***: associated with the dissemination of inaccurate and even outright fake or exaggerated information about the state of the environment, aimed at creating tension and discontent in society, demoralizing the population, creating a constant

[12] *On Environmental Protection: Law of Ukraine of June 25, 1991, No. 1264-XII* (1991). "Bulletin of the Verkhovna Rada of Ukraine", 41, 546; *On Environmental Protection: Law of Ukraine of June 25, 1991, No. 1264-XII* (1991). "Vidomosti Verkhovnoi Rady Ukrayiny", 1991, 41, 546.

sense of stress, dissatisfaction among the general population with the existing state policy in the field of ecology, government structures, etc. The main purpose of such measures is to create conditions and opportunities for manipulating public consciousness for various purposes;
- ***security needs***: restrictions on the dissemination of environmental information under current legislation. These restrictions apply to cases related to national security and commercial secrets.

The main problem in this area is the inconsistency and underdevelopment of legal regulation of public relations in the field of information, which hinders the maintenance of the necessary balance between personal, public, and state interests. The imperfect legal regulation does not allow to complete the formation of competitive Ukrainian news agencies and mass media on the territory of Ukraine[13].

Potential ways to solve the problems

IS researchers rarely extend their studies to expand the possibilities for improving decision-making to achieve environmental sustainability. In addition, existing research does not take into account or explore the impact of digital technologies and their importance for strategic decision-making on environmental sustainability initiatives. Therefore, managers at various levels of management will only be able to design, refine, and manage their sustainability initiatives in an ecologically sound manner once environmental sustainability is embedded in policies and procedures. By including clear parameters for analyzing relevant sustainability data, a new "norm" will emerge in strategic decision-making[14].

Modern digital technologies provide humans with opportunities that have never been available before, including
- cloud computing, which allows storing and analyzing large amounts of data in real time;
- artificial intelligence technologies, which can automatically process environmental indicators and predict risks;
- blockchain technologies, which can increase transparency and protect environmental data from falsification;

[13] Y. Chmyr (2022). *Modern problems of information security of Ukraine and perspective directions of their solution*. "Scientific works of the Interregional Academy of Personnel Management", 2 (62), 149-154. https://doi.org/10.32689/2523-4625-2022-2(62)-23.

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– the creation of a single national environmental platform, which will facilitate the integration of data from various agencies.

Despite the advantages of introducing ICTs to cover the environmental sphere with information, the balance between the benefits and harms of digital technologies is still a matter of debate. The reason for this instability is highlighted in a study which showed that information processing takes place in data centers with high computing power and requires a very large amount of energy. Scientists at the University of Massachusetts conducted a life-cycle assessment of training several common large-scale AI models and found that the process can emit more than 626,000 pounds of carbon dioxide equivalent – almost five times more than the emissions of an average American car over its entire lifetime, including its production[15] (see Figure 2).

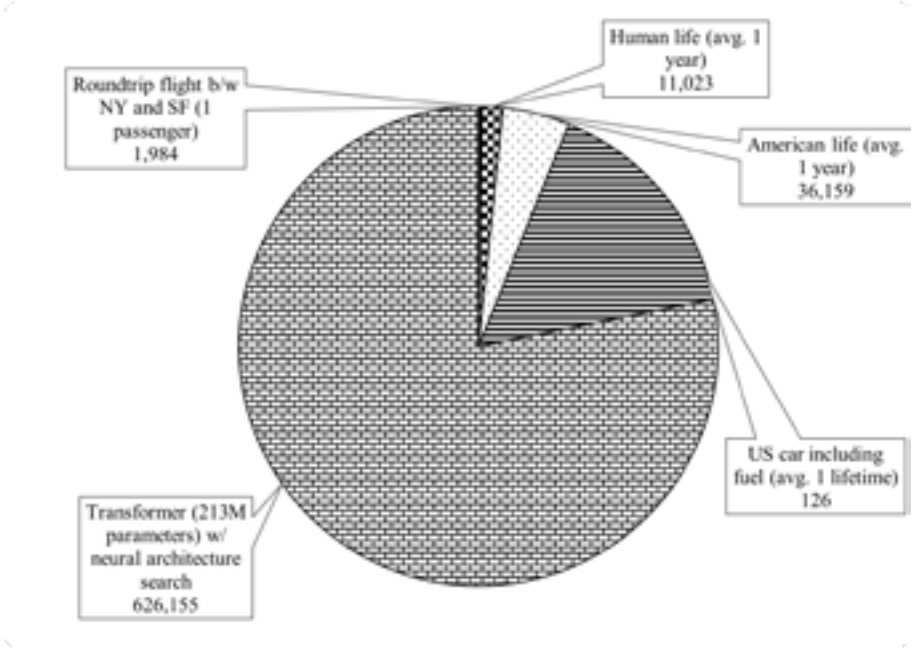

Figure 2. Common carbon footprint benchmarks in lbs of CO2 equivalent
Source: Compiled by the author on the basis of K. Hao (2019, June 6). *Training a single AI model can emit as much carbon as five cars in their lifetimes*. MIT Technology Review. https://www.technologyreview.com/2019/06/06/239031/training-a-single-ai-model-can-emit-as-much-carbon-as-five-cars-in-their-lifetimes/ [accessed: 20 January 2025].

[15] K. Hao (2019, June 6). *Training a single AI model can emit as much carbon as five cars in their lifetimes*. MIT Technology Review. https://www.technologyreview.com/2019/06/06/239031/training-a-single-ai-model-can-emit-as-much-carbon-as-five-cars-in-their-lifetimes/ [accessed: 20 January 2025].

Digital technologies are undoubtedly making important research more accessible. For example, the detection of specific animals and plants using information collected by satellites is not yet universally recognized, although successful examples have begun to accumulate. In particular, moderate and very high resolution satellite images have been used to detect the presence and size of emperor penguins, southern right whales, population sizes of elephants, wildebeests, zebras, etc.[16]

The basis of the information society, which is developing rapidly today, is the rapid spread of ideas and innovations, and this also applies to the tourism and recreation sector. Travelers can get all the information they need about their chosen tourist destination on their mobile phones through search engines and social networks. At the same time, there are a number of threats posed by the development of Internet networks. Fraudulent internet sites that disseminate false information about the environmental safety of recreation in different areas are becoming increasingly common. This is done to anonymously eliminate competitors or attract tourists to environmentally unstable areas. Individuals and business structures suffer from such criminals. In such circumstances, people's access to reliable official information becomes increasingly important[17].

Digital transformation can have a negative impact on the environment. The growing internet footprint, intensive use of digital infrastructure, and the growth of digital waste have the potential to pollute land, air, and water. However, digital transformation is an important component of the activities of states, businesses, civil society institutions, and individuals. Therefore, further exploration of mechanisms for the networked governance of digital transformation and environmental sustainability is needed, potentially using the traditions and cultural heritage of civilization[18].

In this regard, environmental governance is becoming increasingly important. Digital technologies offer many opportunities for governance: from social media and mobile devices to analytics and the Internet of Things, they provide states and organizations with the data necessary to make environmental decisions.

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Government agencies and businesses rely on this constant, broad, and voluminous flow of information to make most strategic decisions, but often neglect to use it to identify environmental needs and initiatives. Nevertheless, both government agencies and businesses have the opportunity to explore innovative approaches to achieve their sustainability goals. Therefore, when making decisions, it is advisable to ensure that not only the data needed to achieve certain operational goals is collected, but also information that incorporates an environmental perspective.

The organization of environmental monitoring, as well as the creation and maintenance the national environmental automated information and analytical system to provide access to environmental information, is a function of the Ministry of Environmental Protection and Natural Resources of Ukraine (Ministry of Environment).

The need to integrate diverse sets of environmental decisions is well illustrated by the development of a spatial decision support system. This is because decision-making requires data from different information systems and, sometimes, more than one organization. In such situations, a spatial planning and environmental protection support system, along with a description of spatial data integration, is required when making a decision. The heterogeneity of information systems from which spatial data comes is determined by their purpose[19].

It is advisable to create a single platform that will allow combining environmental data from different sources and standardizing it. This entails creating a single database that would accumulate all the information related to each of the aspects directly or indirectly related to the environment, including atmospheric air, water resources, wastewater, waste, soil condition, biodiversity, etc.[20] The growing importance and accumulation of information resources, in particular, environmental information, which contribute to the development of the information society, require not only unconventional approaches to the legal regulation of various social relations in the e-environment, but also organizational changes at the level of government agencies. These changes are necessary to support and manage the processes of informatization development in Ukraine, which should contribute to the

[19] M. Ponjavic, A. Karabegovic, E. Ferhatbegovic, I. Besic (2019). *Spatial data integration in heterogeneous information systems' environment*. 42nd International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO), Opatija, Croatia, 1559-1564. https://doi.org/10.23919/MIPRO.2019.8756736.

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creation and implementation of a unified humanitarian information policy of the state on a legal basis.

The use of APIs (application programming interfaces) helps to improve the exchange of information between various governmental and non-governmental organizations and institutions. Centralization will facilitate prompt decision-making based on up-to-date environmental indicators. Interaction with international environmental information systems will allow for the adoption of best practices.

The current legislation provides for the involvement of citizens in strategic environmental assessment (SEA). The need to involve the general public in SEA is also dictated by international agreements concluded by the state, in particular the Convention on Environmental Impact Assessment in a Transboundary Context (ratified in 1999) and the EU-Ukraine Association Agreement (ratified in 2014).

SEA is a procedure for identifying, describing and assessing the environmental consequences of the implementation of state planning documents, conducting public discussion and consultations (if necessary, transboundary consultations), taking into account the strategic environmental assessment report, the results of public discussion and consultations in the state planning document, informing about the approval of the state planning document, which is carried out in accordance with the established procedure[21]. It should be borne in mind that increasing transparency and public involvement in environmental monitoring is impossible without open data.

Since the late 1980s, the emphasis on studying large areas over long periods of time has coincided with the development of geographic information systems (GIS). GIS is a set of computer hardware and software for analyzing and displaying spatially referenced objects (i.e., points, lines, polygons) with non-geographic attributes (e.g., species, age). In the field of natural resource management and ecology, GIS is most often used to[22]:

1. determine area or length;
2. perform spatial intersection functions, such as file merging, spatial coincidence analysis, and temporal change detection;
3. conduct proximity analysis;
4. obtain data for input into simulation or growth models, as well as for calculating certain indicators.

Geographic information systems (GIS) help to visualize environmental problems and better understand their scale. The use of mobile applications

[21] *On strategic environmental assessment: Law of Ukraine of March 20, 2018, No. 2354-VIII* (2018). "Bulletin of the Verkhovna Rada", 16, 138.

[22] L.B. Johnson (1990). *Analyzing spatial and temporal phenomena using geographical information systems*. "Landscape Ecology", 4, 31-43. https://doi.org/10.1007/BF02573949.

to collect environmental information allows citizens to be involved in environmental monitoring. Automated sensor systems provide continuous real-time collection of environmental data.

GIS is of great importance for the management of territories based on the principles of sustainable development. Developing and implementing partnership programs with public organizations focused on environmental issues is impossible without identifying common priorities and ensuring a wide exchange of reliable information, which is actually provided by GIS. At the same time, existing environmental problems that require increased attention and constant monitoring by the public receive the greatest focus. Each factor that contains a threat element is thoroughly investigated, and short-, medium-, and long-term action plans are developed based on a general description of the existing situation.

The role of legislative regulation in the information support of state environmental policy

The legislative framework of the state in the area under study should ensure data standardization and regulate the exchange of environmental information between institutions.

The right of people to access information was enshrined in Resolution 1 of the UN General Assembly (1946), and the main principles in this area were defined as follows[23]:

- Freedom of information means the right to collect, share, and publish information everywhere and without hindrance. As a result, it is a fundamental prerequisite for any serious attempt to promote peace and global progress;
- Freedom of information certainly requires those who enjoy its privileges to be both willing and able not to abuse them. Its basic principle is a moral obligation to seek objective facts and to disseminate information without malicious intent.

In a general sense, information support is a system of indicators and means of describing them, such as classifiers and codes, economic documentation, and a properly organized information base.

[23] *Calling of an International Conference on Freedom of Information. Resolutions adopted by the General Assembly during its resumed 1st session*, Volume II, 23 October-15 December 1946 (1947). A/64/Add.2. 95.

The right of a citizen to receive the necessary reliable information is enshrined in Article 50 of the Constitution of Ukraine[24]: Everyone has the right to an environment safe for life and health and to compensation for damage caused by a violation of this right. Everyone is guaranteed the right of free access to information about the state of the environment, the quality of food and household items, as well as the right to disseminate it. Such information cannot be classified by anyone. Information support of the environmental policy-making process is the collection, processing, storage, and transmission of data necessary for environmental decision-making. Reliable and comprehensive information allows assessing the environmental situation, predicting risks, and developing effective management strategies. The openness and accessibility of environmental data help to increase public trust and active participation of citizens in decision-making related to environmental issues.

Article 9 "Environmental Rights of Citizens of Ukraine" of the Law of Ukraine "On Environmental Protection"[25] stipulates that citizens should have free access to environmental information and free receipt, use, dissemination, and storage of such information.

The Concept of Environmental Education, adopted in 2001[26], emphasized the importance of solving environmental problems. It noted that the most important international documents on environmental issues and the harmonious development of humanity pay great attention to environmental culture and consciousness, people's awareness of the environmental situation in the world, region, and place of residence, their awareness of possible solutions to various environmental problems, and conceptual approaches to the preservation of the biosphere and civilization.

In ensuring public awareness, the reliability and maximum possible completeness of environmental information are of great importance, as they determine the degree of citizens' trust in government authorities. There are three main mechanisms for trust-building: institutional-based trust, which refers to the commitment and confidence in formal societal systems; process-based trust, which involves prior or expected exchanges based on reputation or real experience; and characteristic-based trust, which reflects

[24] *Constitution of Ukraine adopted on June 28, 1996* (1996). "Bulletin of the Verkhovna Rada of Ukraine", 30, 141.

[25] *On Environmental Protection: Law of Ukraine of June 25, 1991, No. 1264-XII* (1991). "Bulletin of the Verkhovna Rada of Ukraine", 41, 546; *On Environmental Protection: Law of Ukraine of June 25, 1991, No. 1264-XII* (1991). "Vidomosti Verkhovnoi Rady Ukrayiny", 1991, 41, 546.

[26] *On the Concept of Environmental Education in Ukraine: Decision of the Board of the Ministry of Education and Science of Ukraine of 20.12.2001 № 13/6-19* (2001). Verkhovna Rada of Ukraine. https://zakon.rada.gov.ua/rada/show/v6-19290-01#Text [accessed: 20 January 2025].

personal characteristics. When investigating trust in OGD, process-based trust is the most applicable, as past experiences with the government system and the open data it delivers create trust. Accordingly, citizens' trust in OGD combines both trust in the data and in the government that provides it[27].

It is useful to begin the process of establishing contacts between government agencies and the public by conducting a realistic and honest assessment of current strengths and weaknesses in the area of access to environmental information, i.e., a SWOT analysis (see Table 1 for a generalized scheme).

Table 1. SWOT analysis of the capacity to deploy an open government communications plan (OECD)

Strengths	Weaknesses
– Support of partners, such as donors, NGOs, and academia – Strong existing communication framework (skilled staff, infrastructure, etc.)	– Resistance from some stakeholder groups towards the new approach – Few employees are currently trained on open government or communication
Opportunities	**Threats**
– Build a stronger network of civil society organizations willing to partner – Increase youth participation in public life	– Programs cannot be delivered on time because of a lack of infrastructure – Change in political circumstances interrupts rollout

Source: OECD.

Conclusions

Information support is a key factor in effective environmental management. The introduction of modern digital technologies can improve the quality of data and the speed of its processing. Improving interagency cooperation ensures better coordination in the implementation of the state's environmental policy, while openness of environmental information helps to intensify citizen participation in decision-making. At the same time, it is important to create and maintain effective mechanisms to protect environmental information from manipulation and cyber threats. Accordingly, comprehensive support

[27] S. Zhen, G. Yue, L. Xiaotong, B. Stuart (2020). *Sources of Influences on Customers' Trust in Ride-Sharing: Why Use Experience Matters?* Industrial Management & Data Systems. https://doi.org/10.1108/IMDS-12-2019-0651.

for digital initiatives is becoming increasingly important, as it facilitates the faster adoption of information technologies. Sustainability and effectiveness of the state policy in the field of information support of environmental policy are possible only if there is close cooperation between government agencies, scientific institutions, businesses, and the general public.

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Abstract

This article discusses the key challenges related to information support for modern national and regional environmental policy. Effective environmental governance relies on accurate, up-to-date, and complete data that enable policymakers to make informed decisions and implement sustainable development strategies. However, many countries face ongoing challenges in collecting, processing, storing, and disseminating environmental information. These problems are related to outdated information management systems, a lack of interaction between government agencies, limited funding for technological progress, and insufficient public access to environmental data. The fragmentation of environmental databases and the lack of standardized data exchange protocols further complicate decision-making processes at both the national and regional levels. To address these challenges, the article discusses potential solutions aimed at improving the efficiency and reliability of environmental information systems. Modernization of digital platforms with the help of cloud computing, big data analysis, and artificial intelligence can significantly expand the capabilities of data collection and processing. In addition, strengthening interagency cooperation and integrating different environmental databases into a single system can ensure more efficient data exchange and reduce discrepancies in environmental assessments. Public access to environmental information also plays a crucial role in ensuring transparency and enhancing citizen participation in environmental decision-making. Expansion of open data initiatives, introduction of digital monitoring tools, and use of geographic information systems (GIS) can further improve access to real-time environmental information. The study emphasizes the importance of a legislative and regulatory framework to ensure the smooth implementation of digital environmental governance. Establishing clear legal mechanisms for data exchange, implementing cybersecurity measures, and facilitating cooperation between government agencies, research organizations, and private stakeholders are essential to building a reliable information support system. Integrating these measures into national and regional environmental policies will contribute to more effective environmental management, better resource allocation, and the achievement of long-term sustainable development goals. By introducing advanced information technologies, facilitating intergovernmental cooperation, and increasing the availability of data, competent authorities can significantly improve decision-making processes in the field of environmental protection. The proposed measures will not only increase the effectiveness of national and regional environmental policies, but also ensure a more transparent and participatory approach to environmental governance, which will ultimately lead to improved environmental sustainability and resilience.

Keywords: state information policy, environmental information, information society, public, digital transformation