








State Environmental Impact Management in Ecological Tourism Development

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ABSTRACT

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This paper aims to enhance the formulation and execution of state-level managerial decisions pertaining to the development of ecotourism, within an environmental protection framework. It posits that in the context of ensuring environmental safety and effective regulatory support for natural resources utilization, state-level management is pivotal. The country's natural environment system serves as the study's object. The research task involves modeling the decision-making and implementation process, particularly those with direct environmental impact geared towards ecotourism development. Utilizing Data Flow Diagram (DFD) methodology, a state management model for environmental impact in the ecotourism development system was developed. Within this model, key factors influencing ecotourism development were identified, and the essential steps and elements to enhance the efficiency of decision-making and implementation in the state management system were established. The chosen methodology effectively demonstrates the information and functional content of the decision-making and implementation processes. The study's novelty lies in the application of a novel modeling method to improve process execution. Limitations exist, as the model was developed considering only the environmental realities of one country, namely Poland. The model's effectiveness in other countries requires modifications in line with dominant local factors. Future work plans to develop similar models for European Union neighboring countries, such as the Czech Republic and Romania, to ensure effective European environmental regulation in the ecotourism development system.

1. INTRODUCTION

This study seeks to enhance the integration and enforcement of ecological tourism development strategies at the state level, considering the increasing urgency of environmental protection. The escalating environmental crisis necessitates a balanced approach to environmental policy, integrating both domestic and foreign strategies.

The internal environmental and economic policy, formed within enterprises, constitutes a key element of regional policy, aimed at simultaneously augmenting competitiveness and mitigating environmental impact. Conversely, external environmental and economic policy is shaped by state and local authorities, encompassing environmental, economic, industrial, and educational policies, and implemented through mutual agreement on innovative developmental strategies for territories.

The condition of the natural resource base for the tourist and recreational complex is largely dictated by the level and nature of economic development. The development of ecological tourism in protected natural areas and rural regions can foster economic and environmental advancement of recreational

resources, without inflicting harm on the regional nature, thus conserving the uniqueness of forests, mountain landscapes, water bodies, etc.

The emergence of the concept of "ecological tourism" is attributed to several trends. First, the escalating number of visitors to protected areas across the globe raised concerns about potential damage to natural complexes. However, with rational management, tourism can provide tangible financial support for nature conservation. Second, it became evident that successful environmental actions require the cooperation of local residents, with ecological tourism playing a vital role. Finally, there has been a shift in tourist preferences, with an increasing demand for active and educational tours.

As such, ecological tourism arose as a response to the search for a new development paradigm, aligning with the concept of environmentally sustainable development as a survival strategy amid acute resource limitations.

Though the development of the concept of ecological tourism is a relatively recent phenomenon, there is no single terminological definition. However, it can be characterized by four main features: use of predominantly natural resources, minimal damage to the natural and socio-cultural environment,

emphasis on environmental awareness and education, and ensuring sustainable socio-economic development, cultural, and environmental well-being.

Ecological tourism is a journey to relatively untouched natural sites, aimed at understanding the natural, cultural, and ethnographic features of a territory, without violating ecosystem integrity. It creates economic conditions where nature conservation becomes beneficial to the local population.

In the context of the developed concept, ecological tourism includes two aspects: it is a nature-oriented tourism product, and a tool for sustainable development. It caters to the demands of eco-oriented consumers, while also ensuring subsequent generations have equal opportunities to utilize the natural resource base.

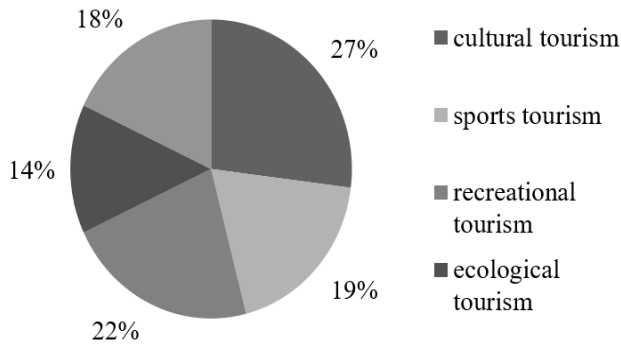


Figure 1. Part of ecological tourism, among other most popular types of tourism in Poland

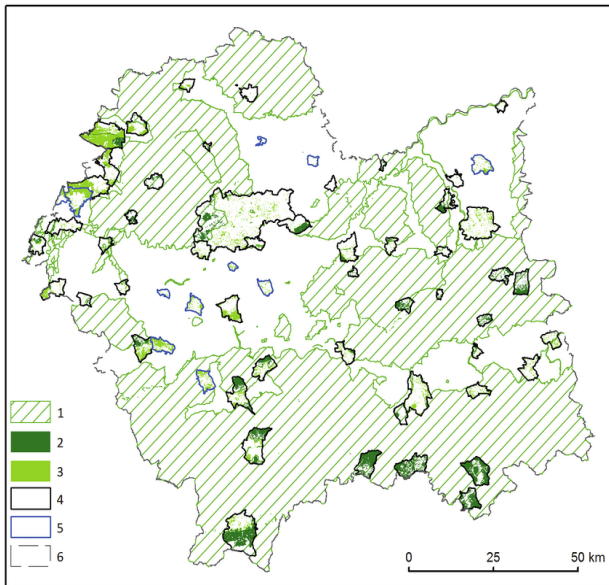


Figure 2. The main nature protection zones of Poland

The study focuses on the country's natural environment system, with Poland serving as a case study due to its wealth of unique natural sites, popularity among domestic and foreign tourists, and the authors' ability to access detailed information about the state of ecological tourism. A critical stage of this research is the examination of the ecological tourism sector, among other popular types of tourism in Poland (Figure 1), and the current nature protection zones (Figure 2).

The paper is structured to include an introduction, a literature review, description of the research methodology,

presentation of the main study findings, a discussion of results and comparison with existing studies, and conclusions.

2. LITERATURE REVIEW

2.1 Essential characteristics and principles of ecological tourism

Considering the essential characteristics of ecological tourism, most authors note that the development of ecological tourism takes into account environmental elements and selects territories that will be used as tourism objects. Ecological tourism, as a type of alternative tourism using natural resources, can empower communities, create additional jobs and attract investment to rural areas. Ecological tourism is also developed through cultural tourism activities, when it is consistent with the development of rural areas, based on the uniqueness and condition of existing areas, by empowering communities for social development and improving social status in society [1, 2].

Other authors [3, 4] note that the principles of ecological tourism mainly focus on products, markets and approaches to the development of society, and also pay attention to the tourism objects that will be developed and used as the main attraction. Through ecological principles, it will promote awareness and benefit to society so that this ecological tourism activity becomes a concern for the environment and its natural resources.

According to a number of authors [5, 6], ecological tourism infrastructure is a key element of state management, which in its structure ensures the interaction of business entities and objects of ecological tourism significance, and also ensures the functioning of ecological tourism activities and regulates the movement of material, financial, spiritual and information flows between them. Tourism infrastructure is understood as a set (complex) of interconnected structures and tourism resources aimed at creating general conditions for the implementation of tourism and serving (providing) tourism activities. The expediency of functioning of the ecological tourism infrastructure is substantiated by the introduction of an innovative concept for the development of ecological tourism, which will increase the economic efficiency and competitiveness of the joint activities of the joint ventures in comparison with a separate activity, with the help of state support at the legislative, regulatory and organizational level.

Considering the development trends of ecological tourism [7, 8], scientists point out that ecological tourism should be developed on the basis of common benefit so that it can achieve environmental, social and economic sustainability. The natural environmental conditions to be turned into an ecological tourism area must be adapted to the developing ecological tourism activities so that these natural attractions become attractive. At the same time, the carrying capacity of the environment is an aspect that must be taken into account in the development of ecological tourism, which can be managed. In population ecology, the carrying capacity of the environment is defined as the maximum environmental load, which is different from the concept of population equilibrium, which can be much lower than the environmental carrying capacity. It is important to take into account the ecological capacity of a certain natural environment.

2.2 Modern problems of state management of environmental impact in the system of development of ecological tourism

Considering the analysis of the existing literature [9, 10], it can be said that in the field of state management of environmental impact in the system of development of ecological tourism, there are a number of gaps that are relevant today (Figure 3).

Thus, despite the already existing scientific work, there are still a number of scientific issues that need to be resolved and clarified. Therefore, in our opinion, the key issue is the improvement of the system for making and implementing managerial decisions on issues of state management of environmental impact in the system of development of ecological tourism.

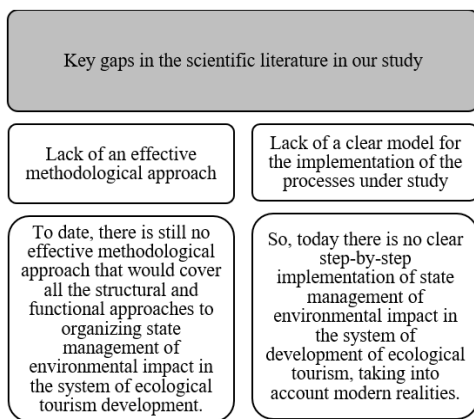


Figure 3. State management of environmental impact in the system of development of ecological tourism

To answer this question, the scientific task is to model the process of making and implementing managerial decisions on the implementation of a direct impact on the environment for the development of ecological tourism. For this purpose, we chose a special methodology that would demonstrate not only the main stages of management decision-making in the field of state management of ecological tourism development, information and functional support for this process.

3. METHODOLOGY

In the course of our research, for a better understanding of the complex processes of state management of environmental impact in the system of development of ecological tourism the DFD methodology was used. The reason for choosing this methodology was that it best demonstrates the information and functional content of the processes of making and implementing management decisions

The classic DFD methodology is based on three groups of modeling tools: diagrams illustrating the functions that the system must perform, and relationships between these functions - for this purpose, the DFD are used, supplemented by data dictionaries and specifications of the processes of the lower level.

All these diagrams contain graphical and textual modeling tools: the first - for the convenience of demonstrating the main components of the model, the second - to ensure an accurate definition of its components and relationships.

The basis of the model - the DFD diagram shows data recipients and addressers external to the system, identifies logical functions (processes) and groups of data elements that connect one function to another (streams), and also identifies data storage devices (stores) that are accessed. Data flow structures and their component definitions are stored and parsed in the data dictionary. Each logical function (process) can be detailed using the lower level DFD; when further detail is no longer useful, one moves on to expressing the logic of the function using a low-level process specification (mini-specification).

The process of building a DFD begins with the creation of the main diagram - it includes the process being modeled and all the external levels with which it interacts. The stage consists in choosing a verb that determines how the external entity uses the main process. For all external entities, an event table is built (interaction with the main thread).

The next stage is the selection of data flows exchanged between processes and their entities. Summarizing all the components of the of using these methodologies, we have formed the main stages of the implementation of this modeling method (Figure 4).

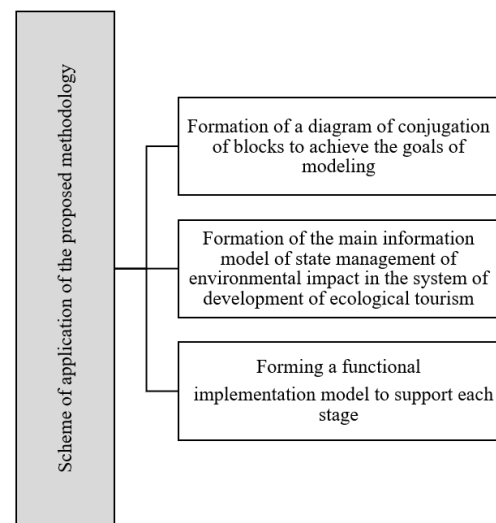


Figure 4. Scheme of application of the proposed methodology

In the context of the study of the methodology we have chosen, it is important to highlight its advantages and disadvantages.

Advantages of the DFD modeling method:

- the ability to uniquely identify external entities;
- ability to design from top to bottom;
- availability of lower-level process specifications (overcoming the incompleteness of the model).

In our opinion, such advantages will make it possible to create detailed models that will demonstrate the hierarchy of key processes, as well as highlight the place and role of information support in this.

Disadvantages of the DFD modeling method:

- the need for artificial introduction of control processes;
- no concept of time.


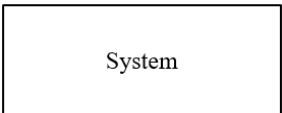

The above-mentioned shortcomings will have a minor impact on the models we have built, which will largely relate to the lack of a time perspective for the implementation of models.

The key structural elements of the modeling are presented in Table 1 for a better understanding and awareness of the flow of information.

It should also be noted that Poland was chosen in the context of our study, given that the authors live in this country and their ability to receive detailed information about the state of ecological tourism in this country.

In addition to the above method, the PESTEL-analysis method was used to assess the main factors affecting the environment of the studied regions. The need for this method is due to the fact that it is important to assess all factors affecting the environment. Thus, the aspects and problematic issues that were discovered during this type of analysis will be taken into account when constructing the following models using the DFD methodology.

Table 1. Modeling elements

Elements	Characteristics
 Process	Model figure symbolizing the implementation of a certain process
 System	The key formative system the model needs and works for
 Database	A database that includes the accumulation of information about a particular process

4. RESULTS OF RESEARCH

Table 2. Results of PESTEL-analysis to assess the main factors affecting the environment of the studied regions (Poland)

Political	Economic
1. Using the environmental issue for political purposes 2. Lack of environmental protection reform	1. Rising inflation and a decrease in the purchasing power of the population 2. Reducing the economic effect of tourism
Social	Technological
1. Rising unemployment 2. Decreased social importance in the natural environment	1. Inefficient use of technology in environmental protection 2. Technological gaps in the system of making and implementing managerial decisions
Environmental	Legal
1. Inefficient system of development of the surrounding natural fund 2. Low environmental safety	1. Lack of reform of legal regulation of environmental protection 2. Gaps in the legal regulation of tourist activities

At the beginning, as already noted in the methodology, the method of PESTEL-analysis was applied. To collect primary information, the authors used specialized literature, monitored the situation in the regions with ecological tourism, and studied reports from analytical agencies. Next, an assessment was made of how these factors might influence ecological tourism. PEST analysis ends with the development of a

diagram of factors influencing the environment of the studied region. The result matrix of the PESTEL-analysis was presented in Table 2.

As a result of the PESTEL analysis, we identified problems in the public administration system, problems in the development of ecological tourism, a low level of state influence on the development of protected areas in Poland, etc. This will be taken into account in future simulations.

This method also has a limitation. Considering that it is limited to a clear list of groups, a factor that does not make it possible to form full-fledged models to the maximum extent possible.

To begin with, we should present the nodes for achieving the modeling goal, which we set as A0 - «Improvement of state management of environmental impact in the system of development of ecological tourism» To do this, it is necessary to perform a number of modeling tasks:

A1. Environmental assessment.

A2. Identification of attractive, in the context of ecological tourism, natural areas.

A3. Acceptance and implementation of managerial decisions.

Along with this, each model must also include functional components, which in our case will be denoted as F1, F2, F3 and modeling results, which will be described below. To achieve A0 it is necessary to fulfill the following Eq. (1):

$$A0 = \{F1, F2, F3\} \in \{A1, A2, A3\} \quad (1)$$

Let us imagine the nodes of merit of the main goal of the modeling (Figure 5).

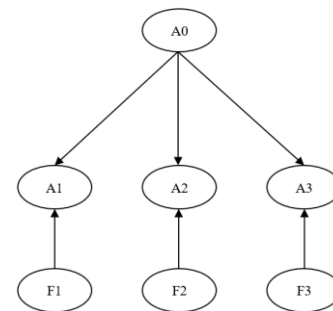


Figure 5. Diagram of conjugation of blocks to achieve the goals of modeling

The main model for the implementation of state management of environmental impact in the system of development of ecological tourism is shown in Figure 6.

Let us consider in more detail the stages formed by us.

1. Environmental assessment. The recreational opportunities of a specially protected natural area (even areas of a national park specially allocated for this purpose) can only be used as additional and subordinate to its nature protection functions. The development of tourism infrastructure here can only take place with priority consideration of environmental restrictions, and the level of satisfaction of the needs of tourists should be determined precisely by these restrictions. The only way out here is manifested in the development of not mass, but alternative types of tourism, which would contribute to the fulfillment of the main task of protecting natural complexes and at the same time help to achieve goals related to environmental education and obtaining a recreational effect. Consequently, tourist specialization in the protection of

natural complexes should be the service of tourists, for whom the main types of recreation are activities based on the minimum consumption of environmental resources and live communication with nature.

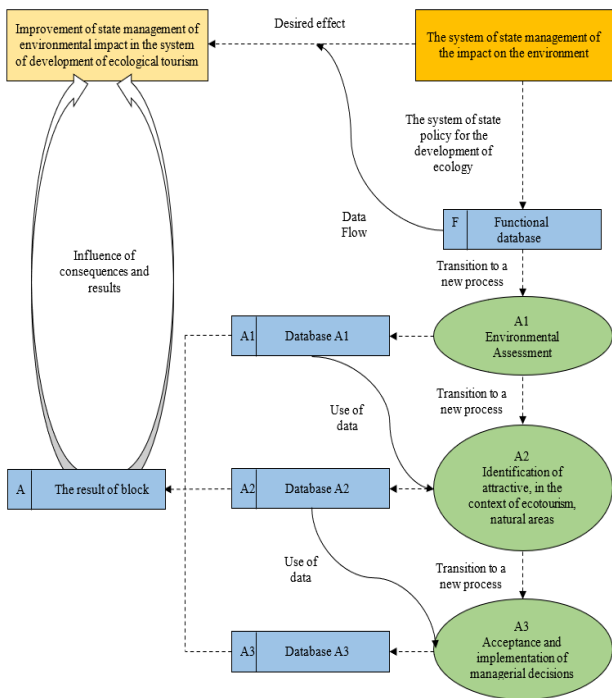


Figure 6. Main information model of state management of environmental impact in the system of development of ecological tourism

Priority should be given to educational forms of tourism, the development of which will help attract educated people to recreation and popularize environmental, cultural and historical knowledge among the population. One of the priority areas for the development of educational forms of tourism are tourist routes or trails that expand the knowledge of the tourists about the processes and phenomena of the nature around them. Another important task is the education of an ecological culture of human behavior as part of the general culture of the relationship of people with each other and the relationship of man to nature. Ecological routes and paths, in addition, are regulators of the flow of recreants, distributing them in different directions, reducing the recreational load on the natural environment. The expedient differentiation of forms of ecological tourism depends on the intensity of recreational activities during its practical organization in nature conservation areas, where functional zoning provides for various modes of nature management.

2. Identification of attractive, in the context of ecological tourism, natural areas. Regardless of what methods are used to manage ecological tourism in protected areas, its priorities should always be: nature protection, improving the quality of life of local communities, improving the tourism product and services. Along with ecological and purely scientific values, it is necessary to take into account economic, political and social issues. The further, the more it becomes obvious that successful tourism management in a protected area is impossible if it completely lacks the aspect of social orientation. It is also necessary to take into account the overall regional context and try to coordinate the goals of the protected area itself and the region in which it is located. If all

these points are taken into account, then a positive impact on both local environmental and socio-economic conditions will be more likely.

At the same time, we should not forget that ecological tourism is a business. If it is not profitable, it cannot become an economic benefit for the protected area and local settlements and will only complicate the existing problems. In each specific region, the development of ecological tourism requires a realistic view of the possibilities of its implementation, its profitability and competitiveness. Surprisingly, this seemingly obvious fact is not taken into account in many projects and practical activities.

So, for the leaders of potentially attractive natural territories in the context of ecological tourism, it is extremely important to be aware of the importance of tourism management in their territories. It is necessary to scientifically assess what level of tourism is optimal for a given area, and then develop a strategy leading to the achievement of this level. This strategy should direct the development of tourism in such a way that a) natural complexes are not affected, b) mechanisms are created to increase the employment of local residents, c) there is an opportunity to increase the income of both environmental structures and local settlements, d) develop environmental education. With a strategy in place, governments are able to minimize the “costs” of ecological tourism and maximize its benefits.

3. Acceptance and implementation of managerial decisions. After a national ecological tourism management system is developed at the state level that meets the general objectives of sustainable development and the goals of the country's environmental policy, mechanisms for its implementation and an appropriate legislative framework are created. At the national and local levels, participants in the ecological tourism process coordinate the central and local ecological tourism policy that guarantees the protection of nature, cultural heritage and rational use of natural resources. An important issue is also the proper organization of coordination of actions of participants in the ecological tourism process at the national, regional and local levels.

To implement tasks at the local level, it is advisable to create a coordinating council for tourism among representatives of various forms of management. The following functions should be delegated to this structure:

- determination of criteria for environmentally sustainable tourism, certification of ecological tourism routes and services based on an assessment of their compliance with the principles of sustainable tourism;
- inclusion in a single information space, organization of events for marketing, advertising and promotion of a tourist product outside the region;
- creation of a center for professional training and retraining of specialists for work in the field of ecological tourism;
- development and implementation of a unified pricing policy in the field of ecological tourism;
- creation of mechanisms for monitoring and control of ecological tourism activities in order to prevent harm to natural and ethno-cultural objects;
- coordination of routes and tours, including several destinations;
- marketing support for the promotion of the ecological tourism product at the local level;
- development of a standard workflow for registration of relations with commercial structures;
- introduction of a mechanism for collecting and processing

statistical data on ecotourists;

- holding scientific and practical regional seminars and conferences on key issues of ecological tourism development.

The next step is to define the functions and build the corresponding functional model, which will become the accompanying main one. Thus, as a result of using the appropriate computer programs, we will depict the accompanying functional model for the implementation of the state management of environmental impact in the system of development of ecological tourism (Figure 7).

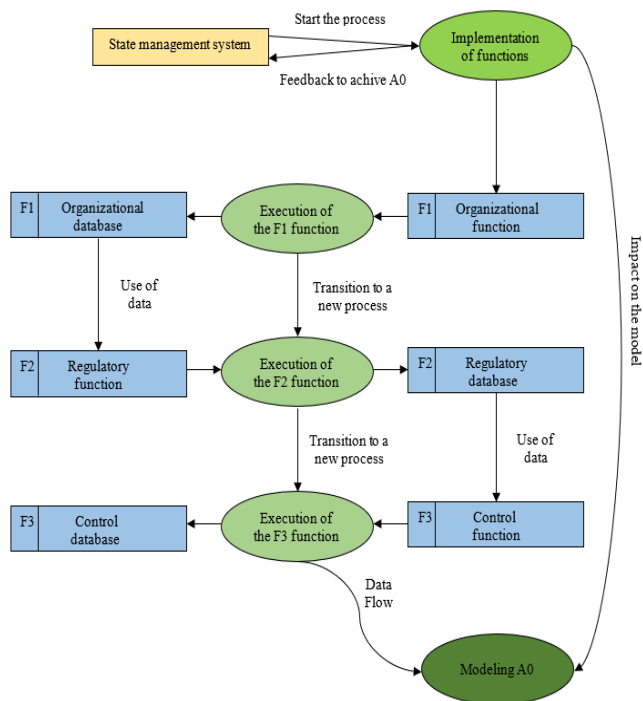


Figure 7. Functional implementation model to support each stage

Let us characterize each of the functions proposed in the framework of our study.

F1. Organizational function. The organization is associated with the creation of an effective organizational system through management bodies, the main purpose of which is to perform the functions and tasks assigned to them. The content of the organizational function is to build a system of management bodies that, in the shortest possible time and with effective expenditure of effort, are able to fulfill the tasks assigned to them for the development of ecological tourism.

F2. Regulatory function. The main task of the regulatory function is to achieve stability and improve the system of state management of the development of ecological tourism. It manifests itself in the adoption of measures to prevent deviations in the performance of tasks and goals set before the state management in the course of planning the development of the environment and ecological safety.

F3. Control function. Control can be divided into the following stages: 1) checking the compliance of the actually performed actions with those planned at the planning stage and identifying shortcomings in the development of ecological tourism and environmental protection; 2) assessment of shortcomings for the possibility of their impact on the further activities of government bodies; 3) development of proposals, recommendations and measures to eliminate the identified

shortcomings. The exercise of control at the final stages of management activity indicates that it is an integrating means of complying with and fulfilling the goals and objectives set for management and the compliance with it of all other functions of state management for the development of ecological tourism and environmental protection.

The interaction of these functions consists in their potentiation of implementation at each stage. Each of the functions as a single organism, the mutual implementation of which contributes to the implementation of each individual stage of the model.

As in any think, the execution of a model depends on time. The fact is that the environment and environment are a very dynamic process and require an appropriate, timely response, thus, the time order for executing the blocks of the model should be established (Table 3).

Table 3. Focused approach to executing model blocks

Blocks	1 Month	2 Months	3 Months
A1	+		-
A2		+	-
A3		+	

Thus, making intermediate results of the research results, we highlight the key theses: not only the main model has been built, but also the accompanying functional one. Both the main and the accompanying functional model are explained and characterized in detail. The simulation was made within the geographic areas of Poland.

5. DISCUSSIONS

Discussing the results of our study, it should be noted that they have a number of differences and common features. Our study should be compared with similar ones.

So, summarizing scientific sources [11, 12], ecological tourism is a subcomponent of the sphere of sustainable tourism. The potential of ecological tourism, perceived as an effective tool for sustainable development, is the main reason why developing countries are now embracing it and including it in their economic development strategies at the national level. Ecological tourism as an alternative type of tourism involves visiting natural areas for the purpose of education, training or activities that are environmentally friendly, that is, tourism based on the experience of nature, ensuring the economic and social development of local communities. It focuses primarily on the experience and knowledge of nature, its landscape, flora, fauna and their habitats, as well as the cultural artifacts of the area. A symbiotic and complex relationship between the environment and tourism activities is possible when this philosophy can be translated into appropriate public policy, careful planning and practical implementation in specific areas.

Other authors in their works [13, 14] concluded that at present the development of ecological tourism depends on the availability of unique natural resources. After that, the environment must be supported, funds must be invested in order to create new jobs, develop entrepreneurship in rural areas. The European experience in the development of ecological tourism shows that ecological tourism is an extremely complex activity and therefore requires tools to help in making effective decisions in order to reconcile the

competing economic, social and environmental demands of sustainable development. At the same time, there are potential risks from tourism activities that need to be considered.

In the scientific work of other authors [15, 16], it is noted that the general theoretical approach to this problem in most cases rarely adapts to the level of practical implementation of simulated programs, in particular due to low activity or insufficient awareness on the ground. Many voivodeships in Poland have specific characteristics for the development of ecological tourism: remote geolocation, difficult climatic conditions, lack of a good transport network and many other factors hindering the development of ecological tourism as a new socially responsible practice. At the same time, the presence of competitive advantages, such as unique natural landscapes, places of virgin wildlife, rare species of birds and animals, determine the high potential of the study areas for the development of socially responsible environmental practices.

Others argue in their works [17-20] that the creation of a favorable investment climate, the rapid introduction of innovations and the development of new technologies can ensure a systematic and effective partial reorientation of the country's regions in line with modern environmental trends and practices. Regional transformation towards post-industrial environmental innovation is a complex multifactorial process that takes place at the central and local levels. Among the variety of tasks to be solved in the course of structural reforms, an important role is given to regional policy aimed at strengthening innovation activity, developing new economic clusters, and leveling interregional material disparities.

According to the above, the key issue that is raised is the role of the state and its administrative apparatus in the system of ecological tourism and environmental safety. Thus, we have determined that today it is especially important to actively research and form new paradigms for state management of the development of ecological tourism, taking into account modern realities.

Thus, comparing the results of our study with existing ones, we can note a number of differences and similarities (Table 4).

Table 4. The main differences and similarities of our study

Similarities	Differences
We are of the opinion that ecological tourism is no less important than other types of tourism, given this, it should have the same relevance in the field of its science-based organization and provision.	We have applied an innovative approach to modeling.
We also agree that today the legal organization of state management of environmental impact in the system of development of ecological tourism is especially important.	Using a graphical language to present results.

Thus, in our opinion, our study is relevant in the matter of proper organization state management of environmental impact in the system of development of ecological tourism. The innovativeness of the study lies in the fact that a qualitatively new modeling method was used to improve the implementation of the processes under study. This method, in our opinion, is innovative in the context of this study, given that it is practically not used in the field of public administration. So, innovation lies not so much in the method, but in the fact that within the framework of the development of ecodynamics and the development of recreational services in compliance with environmental standards.

6. CONCLUSIONS

Thus, by using the DFD methodology for modeling, we have formed a model for state management of environmental impact in the system of development of ecological tourism.

Certain generalizations can be made from the results obtained above. Diverse in its types, tourism has become an integral part of modern life. All over the world, it is recognized as a significant factor in economic development. Today, ecological tourism can become a profitable and dynamic industry. It stimulates the development of the country's national economy and makes it possible to effectively use the natural, historical and cultural potential. To increase efficiency, it is necessary to fully involve natural, ethno-cultural, historical and other potentials, while emphasizing mainly differences from other European countries in order to show what other peoples have already lost. World practice suggests that ecological tourism should be declared a priority industry in the country. This requires a systematic process of development of this industry in the state and its development in each region, in particular. in the process of forming the tourism market, it is not enough to develop a tourism product with certain qualities and prices, but it is necessary to introduce a set of marketing communications that allows you to promote this product to the market.

Ecological tourism has great prospects for development through a system of incentives for other industries, primarily agriculture. Tourism revenues enable more efficient use of resources and the use of more modern technologies. All this gives a significant impetus to the development of the economy and the growth of the well-being of local residents, especially in areas remote from industrial centers, with a traditionally low level of economic development.

An influx of income can cause development in the desired direction. The economic benefits that local residents will receive from the development of tourism will largely depend on the completeness and diversity of tourism services. These aspects should be carefully considered when organizing economic interactions on the ground. Ecological tourism will have a positive impact on the development of rural areas, the growth of the living standards of peasants; creation of new jobs for residents of suburban areas; promoting the development of regional infrastructure; revival of the cultural traditions of the people; will provide new jobs for rural residents.

The practical value of the results obtained lies in the fact that with the help of this modeling method, the persons responsible for the formation and implementation of state management mechanisms for the state of the environment in the ecological tourism development system will be able to more quickly and efficiently implement their functions, while contributing to the development of ecological tourism.

The study has a limitation. Since the formation of the model took into account the environmental realities in the ecological tourism development system of only one country. This is due to the fact that in the process of forming the models, factors influencing the ecological tourism sector in Poland were taken into account. These models can only be optimal and sufficiently effective in other countries if they are modified in accordance with the dominant factors influencing the game. In the future, it is planned to create similar models for neighboring countries of the European Union system (Czech Republic, Romania), which will be able to ensure the normal functioning of European environmental regulation in the

ecological tourism development system. In addition, it is important to include in future studies a broader and more comprehensive analysis of all the key features of the safety aspects of ecological tourism.

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