STRUCTURAL-FUNCTIONAL ORGANIZATION OF TERRITORIAL TOURISM-RECREATIONAL SYSTEMS BASED ON GOAL, GEOECOLOGICAL FUNCTION AND USAGE REGIME
HUDUDIY TURISTIK-REKREATSION TIZIMLARNING MAQSADI, GEOEKOLOGIK FUNKSIYASI VA FOYDALANISH REJIMI ASOSIDAGI TARKIBIY-FUNKSIONAL TUZILISHI

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Abstract. The analysis of the internal structure of Territorial Tourism-Recreational Systems (TTRS) constitutes a central stage in understanding their essence and in developing practical management decisions. This paper presents an integrated structural-functional analysis of TTRS based on three interrelated analytical dimensions: goal (functional purpose), geoecological function, and usage regime. A four-stage analytical procedure-decomposition, attribution, relational analysis, and integrative synthesis-was applied to the TTRS framework. The analysis identifies (1) eight functional types of TTRS by goal (health-recreation, sport, cultural-educational, ecological, agritourism, religious pilgrimage, business-congress, smart-digital); (2) seven geoecological functions (etalon, ecological restoration, ecosystem services, biotic integration, climate-adaptive, environmental education, monitoring-indication); and (3) seven usage regimes (strict protection, restricted tourist, ecotourism, traditional tourist, intensive tourist, regenerative, smart-digital). The integration of these three dimensions enables multilayered profiling of each specific TTRS. A refined seven-element structural model is proposed-comprising central nodes, connecting corridors, buffer zones, demonstration objects, service infrastructure, management components, and digital platforms-operationalized for the Fergana Valley. The findings provide a methodological foundation for sustainable tourism planning grounded in geoecological principles and offer a practical instrument for territorial-level management decisions.

Keywords: territorial tourism-recreational system, structural-functional analysis, geoecological function, usage regime, sustainable tourism, regenerative tourism, smart tourism, Fergana Valley.

Annotatsiya. Hududiy turistik-rekreatsion tizimlar (HTRT)ning ichki tuzilishini tahlil etish ularning mohiyatini anglashda hamda amaliy boshqaruv qarorlarini ishlab chiqishda markaziy bosqich hisoblanadi. Mazkur maqolada HTRTning o‘zaro bog‘liq uchta analitik o‘lchov - maqsad (funksional vazifa), geoekologik funksiya va foydalanish rejimi asosidagi integratsiyalashgan struktur-funksional tahlili taqdim etiladi. HTRT yondashuviga to‘rt bosqichli analitik protsedura - dekompozitsiya, atributsiya, munosabatlar tahlili va integratsion sintez qo‘llanildi. Tahlil natijasida quyidagilar aniqlandi: (1) maqsadi bo‘yicha HTRTning sakkizta funksional turi (sog‘lomlashtirish-rekreatsion, sport, madaniy-ma’rifiy, ekologik, agroturizm, diniy ziyorat, biznes-kongress, aqlli-raqamli); (2) yettita geoekologik funksiya (etalon, ekologik tiklanish, ekotizim xizmatlari, biotik integratsiya, iqlimga moslashuvchi, ekologik ta’lim, monitoring-indikatsiya); hamda (3) yettita foydalanish rejimi (qat’iy muhofaza, cheklangan turistik, ekoturistik, an’anaviy turistik, jadal turistik, regenerativ, aqlli-raqamli). Mazkur uchta o‘lchovning integratsiyasi har bir aniq HTRTni ko‘p qatlamli profillash imkonini beradi. Maqolada takomillashtirilgan yetti elementli struktur model taklif etiladi - u markaziy tugunlar, bog‘lovchi koridorlar, bufer zonalar, namoyish obyektlari, xizmat infratuzilmasi, boshqaruv komponentlari va raqamli platformalarni o‘z ichiga oladi hamda Farg‘ona vodiysi misolida operatsionallashtirilgan.

Olingan natijalar geoekologik prinsiplarga asoslangan barqaror turizmni rejalashtirish uchun metodologik asos yaratadi hamda hududiy darajadagi boshqaruv qarorlari uchun amaliy vosita taqdim etadi.

Kalit so‘zlar: hududiy turistik-rekreatsion tizim, struktur-funksional tahlil, geoekologik funksiya, foydalanish rejimi, barqaror turizm, regenerativ turizm, aqlli turizm, Farg‘ona vodiysi.

1. Introduction

Analysis of the internal structure of Territorial Tourism-Recreational Systems (hereafter TTRS) represents a central stage both in achieving a deeper understanding of their essence and in developing practical management decisions. Structural-functional analysis has a long tradition within geographic research, originating in the geosystem teachings of Sochava [21] and Isachenko [6]. The essence of this approach involves examining a system bidirectionally-structurally (of what components is it composed?) and functionally (what tasks does it perform?).

The application of this methodology to TTRS yields two principal advantages. First, it reveals the system's internal hierarchy and the relationships among its components. Second, it identifies the role each component plays in the overall functioning of the system. While the foundational structural models of TTRS have been articulated by Preobrazhenskiy [18], Mironenko and Tverdokhlebov [13], Vedenin [26], and Sarancha [19], the integration of these classical formulations with contemporary geoecological imperatives-climate adaptation, biodiversity conservation, regenerative tourism, and smart-digital transformation-remains an open theoretical task.

This paper addresses that task by proposing a three-dimensional analytical framework. The first dimension is the system's goal, which is externally oriented toward satisfying the needs of tourists and recreational participants. The second dimension is the geoecological function, oriented toward the natural environment and encompassing the conservation of landscapes, ecosystems, and biodiversity. The third dimension is the usage regime, expressed in terms of governance, legal norms, restrictions, and incentive mechanisms. When these three dimensions are unified within a single analytical framework, the genuine essence of TTRS becomes fully accessible to analysis.

The objectives of this study are (1) to articulate a methodologically rigorous structural-functional analysis of TTRS; (2) to classify TTRS along the three proposed dimensions and to identify the principal functional types within each; (3) to propose an integrated profile matrix enabling the systematic characterization of specific TTRSs; and (4) to operationalize a

refined structural model for the case of the Fergana Valley, a region of high tourism-recreational potential in Central Asia.

2. Materials and Methods

This study applies the four-stage structural-functional analytical procedure widely used in geographic research:

(1) Decomposition-disaggregating the system into its principal components; (2) attribution-assigning specific properties and functional roles to each component; (3) relational analysis-identifying direct, feedback, and reciprocal linkages among components; and (4) integrative synthesis-reconstructing how the components operate jointly as a coherent system. Each stage was applied to TTRS in sequence, with the resulting analytical artifacts-component lists, attribute tables, relationship matrices, and synthesis statements-serving as the basis for the three-dimensional classification developed below.

The source base of the analysis comprises three streams of literature. The first consists of foundational geosystemic and recreational-geographic works of the Soviet and post-Soviet schools, including Sochava [21], Isachenko [6], Preobrazhenskiy [18], Mironenko and Tverdokhlebov [13], Vedenin [26], Sarancha [19], and Majar [9]. The second comprises contemporary Uzbek geographic research focused on tourism, environmental management, and the Fergana Valley, including the works of Soliev [22], Abdulqosimov [1], Nigmatov [15], Sharipov [20], Nazarov [14], Tobirov [24], Abduganiyev [2], Usmanov [25], Mansurova [10], Komilova [7], and the author's prior research [3, 11]. The third stream encompasses international concepts and policy documents relevant to sustainable, regenerative, and smart tourism, including the Millennium Ecosystem Assessment [12], the Convention on Biological Diversity [4], the Paris Climate Agreement [16], the Limits of Acceptable Change (LAC) framework [23], and the relevant national policy instruments of Uzbekistan [5, 8].

The Fergana Valley-the empirical context to which the analytical framework is applied-is treated as a single tourism-recreational zone subdivided into three macro-regions corresponding to its three administrative oblasts (Andijan, Fergana, and Namangan). Within each macro-region, several meso-regions (mountain-recreational, valley cultural-historical, and steppe-recreational zones) are identified, which in turn contain micro-regions (individual districts and destinations) and, at the lowest hierarchical level, specific tourism objects.

3. Results

The structural analysis of TTRS begins with the identification of its principal components. Sarancha [19] distinguishes six core subsystems within the TTRS, which in the author's textbook [3] are presented as follows:

(1) The consumer subsystem comprises tourists and recreational participants, whose needs and activities provide the foundational rationale for the formation and operation of the entire system. (2) The natural-resource and environmental subsystem includes all natural objects that are used-or possess the potential to be used-for tourism and recreation. (3) The settlement subsystem encompasses not only the lifestyle of the local population but also the source pool of potential domestic tourists and the labor base for the tourism sector. (4) The social-relations subsystem comprises the social environment of the region-traditions, ethnic and religious characteristics, social values-governing interactions between tourists and local communities. (5) The production (economic) subsystem includes all sectors of economic activity within the region (agriculture, industry, services). (6) The infrastructure and management subsystem encompasses transport, communications, accommodation facilities, leisure venues, institutions, and local and regional tourism-development agencies [3].

Usmanov [25] introduced the concept of "territorial tourism complex" (TTC), defining it as a structural unit that expresses the coordinated development and management of diverse tourism objects on a unified infrastructural foundation at the local scale. As emphasized in the author's textbook [3], "a territorial tourism-recreational system is a complex system consisting of multiple components, whose successful operation depends on the balanced development of all constituent subsystems. For instance, even if the natural-resource subsystem is rich, if the infrastructure and management subsystem is weak or the social environment is unfavorable, tourism will not develop fully. For this reason, an integrated, intersectoral approach is necessary in studying TTRS."

Majar [9] complements this static taxonomy with a dynamic analysis of component interactions: flows of matter, energy, and information among components generate the emergent properties of the system. Within this framework, the true essence of TTRS is revealed not in the aggregation of components but in their interactions. Tobirov [24], examining the case of the Fergana Valley, demonstrated the integration of natural, economic, and anthropogenic components within geosystems used for tourism.

The second structural dimension is the territorial-hierarchical division of TTRS. Mironenko and Tverdokhlebov [13] subdivided territorial recreational systems into five taxonomic units: recreational zone (macro-regional), recreational region (macro-region), recreational sub-region, recreational micro-region, and recreational point. Usmanov [25]

adapted this classification to TTRS as follows: tourism-recreational zone (regional level), tourism macro-region, tourism meso-region, tourism micro-region, and tourism object (a discrete spatial node). Applied to the Fergana Valley, the entire valley is treated as a single tourism-recreational zone; within it, three macro-regions correspond to the Andijan, Fergana, and Namangan tourism complexes; each macro-region is subdivided into meso-regions (mountain-recreational, valley cultural-historical, steppe-recreational); within meso-regions, individual districts and destinations constitute micro-regions; and at the most granular level, specific tourism objects such as the Shokhimardon recreational complex, the Arslanbob walnut grove, the Rishton ceramics center, and the Margilan "Yodgorlik" silk-weaving factory are positioned.

The first functional dimension classifies TTRS according to its goal. The goal of any TTRS is directed toward satisfying specific needs of tourists and recreational participants, and on this basis the following eight functional types may be distinguished.

(1) Health-recreation TTRS aim at restoring human health and replenishing mental and physical capacity. Examples include balneological resorts (Chimyon, Yangiobod), climatotherapy zones (mountain areas), and sanatoria. (2) Sport and active tourism TTRS focus on mountain hiking, alpine skiing, water sports, alpinism, and other active forms; in the Fergana Valley these include the Shokhimardon-Yordon area, Arslanbob, and Chodak. (3) Cultural-educational TTRS are organized around historical monuments, museums, craft centers, and ethnographic complexes, with Margilan, Quva, Rishton, and Andijan occupying leading positions in the Fergana Valley.

(4) Ecological tourism TTRS are oriented toward observing natural ecosystems, becoming acquainted with biological diversity, and acquiring environmental education; such systems form around protected natural areas. (5) Agritourism and rural TTRS are based on engagement with traditional rural life, national cuisine, and farming. (6) Religious pilgrimage TTRS are oriented toward visits to sacred sites in the Fergana Valley. Komilova [7] analyzed the contemporary pilgrimage-site system of the valley within the framework of four ethnolandscape zones and seventeen ethnoecological districts.

(7) Business and congress TTRS focus on professional meetings, conferences, and exhibitions. (8) Smart and digital TTRS represent novel forms of tourism integrated with contemporary digital technologies and virtual experiences. A practical manifestation of this category may be observed in the "Eco Fergana" mobile application proposed by Khakimova, Abduhalilov, and Mamanazarova. The classification holds considerable operational significance, as each functional type requires a distinct infrastructure, workforce profile, and

marketing strategy. In the author's earlier doctoral research [11], this classification was applied to the administrative-territorial units of Fergana Province along seven directions: recreational tourism, historical-cultural acquaintance tourism, pilgrimage tourism, natural-acquaintance tourism, agritourism, craft and shopping tourism, and sport tourism.

The second functional dimension-and the most analytically central for the geoecological orientation of TTRS research-is the geoecological function of the system. The geoecological function expresses the impact of TTRS on the natural environment and the role TTRS plays within it. Drawing upon the methodology developed by Abduganiyev [2] for protected natural areas and adapting it to TTRS, seven geoecological functions are distinguished.

(1) The etalon (reference) function characterizes TTRS that occupy undisturbed or minimally anthropogenically influenced exemplary tracts of natural landscapes; such systems serve as scientific reference benchmarks. They are located within the cores of protected natural areas (strict nature reserves) and admit only limited tourist activity, such as ecotourist trails and observation towers. In the Fergana Valley, the Chatkal Biosphere Reserve and adjacent specially protected natural territories perform this function.

(2) The ecological-restoration function applies to TTRSs that contribute to the restoration of landscapes affected by anthropogenic disturbance but retaining recovery potential. Revenues from tourism are reinvested in landscape restoration-an applied expression of the contemporary concept of regenerative tourism [17]. Nazarov [14] proposed a set of practical measures for ecological restoration in the Fergana Valley-improvement of soil structure, crop rotation, and erosion control-each of which can be integrated with tourism activity.

(3) The ecosystem-services function emphasizes TTRS as a mechanism for converting the services obtained from natural ecosystems-water purification, air quality, microclimate regulation, biodiversity-into economic value. This function rests on concepts developed by the Millennium Ecosystem Assessment [12] and the Convention on Biological Diversity [4].
(4) The biotic-integration function captures the role of TTRS in conserving biodiversity, supporting species reproduction, and facilitating migration. Particular attention is given to the formation of ecological corridors, ecocanals, and eco-bridges-elements of the ecological framework proposed by Abduganiyev [2].

(5) The climate-adaptive function manifests the adaptive capacity of TTRS under climate change and positions such systems as models of climate adaptation for the population: green energy, water-saving technologies, and carbon-neutral infrastructure. This

function aligns with the 2015 Paris Climate Agreement [16] and the national strategy for transitioning Uzbekistan to a green economy in 2019–2030 [5]. (6) The environmental-education function characterizes TTRS that serve not only tourists but also the local population and future generations as agents forming environmental awareness and ecological culture. This function relates closely to the social mechanisms of landscape diversity conservation analyzed by Sharipov [20] in the context of Tashkent Province. (7) The monitoring-indication function positions TTRS objects as indicators for tracking changes in the geoecological situation: tourist-flow dynamics, landscape quality, and ecosystem-parameter trends serve as evidentiary inputs for the assessment of the regional ecological state.

The third functional dimension is the usage regime, defined by the intensity of tourist activity, its spatial-temporal characteristics, and its legal restrictions. Seven principal usage regimes may be distinguished.

(1) Strict protection regime sharply limits tourist activity to scientific and educational purposes carried out under prior authorization. This regime applies to the cores of protected natural areas and is regulated under the Law of the Republic of Uzbekistan on Specially Protected Natural Areas [8]. (2) Restricted tourist use regime permits tourist activity under specified limitations (caps on visitor numbers, restricted activity types, seasonal limits). This regime applies to the buffer zones of biosphere reserves and to the service zones of national parks. The Limits of Acceptable Change (LAC) model [23], considered by Mansurova [10], provides a practical methodology for setting such limits.

(3) Ecotourism regime structures tourist activity so as to minimize impact on the natural environment in accordance with ecological standards. This regime is regulated under the relevant decree of the Cabinet of Ministers of the Republic of Uzbekistan and is implemented within the framework of a national ecotourism development program. (4) Traditional tourist regime is the most widespread, encompassing standard commercial tourist activity: hotels, excursion services, transport, and food services. The principal evaluative criteria here are economic efficiency and service quality.

(5) Intensive tourist regime applies to areas of high tourist flow and concentration-major tourism centers, World Heritage objects-and requires specialized management mechanisms, including flow distribution, seasonal management, and capacity control instruments. (6) Restoration and regenerative regime channels tourist activity toward the restoration of landscapes and local communities. The regenerative tourism concept developed by Pollock [17] and other contemporary researchers provides the theoretical foundation of

this regime. (7) Smart and digital regime relies on digital technologies-mobile applications, the Internet of Things (IoT), and artificial intelligence (AI)-to optimize TTRS functioning, manage carrying capacity in real time, and create personalized tourist experiences. Mansurova [10] articulated practical mechanisms for this regime through proposals for a "Smart Tourism Data System" laboratory and a "Sustainable Tourism" statistical platform.

The genuine structural-functional organization of TTRS is revealed through the integration of the three preceding dimensions-goal, geoecological function, and usage regime. These dimensions do not substitute for one another but rather complement one another, jointly constituting a multilayered profile of TTRS. The practical significance of such integration lies in its capacity to define specific characteristics for each particular TTRS.

By way of illustration, the Shokhimardon tourism complex may be characterized along these three dimensions as follows. By goal: mountain-recreational and sport tourism (partly ecological). By geoecological function: etalon and biotic-integration functions. By usage regime: restricted tourist and ecotourism regimes. This composite profile supports concrete management decisions: which types of infrastructure should be developed, how much tourist flow may be admitted, and which ecological measures must be implemented.

The integrated approach permits the construction of a profile matrix for each TTRS, in which the relevant characteristics along the three dimensions are recorded. As noted in the author's textbook [3], the assessment of TTRS within this matrix must encompass two principal geoecological aspects: (1) the suitability of natural conditions for recreational processes (resource potential and constraints), and (2) the magnitude of the environmental impact of anthropogenic tourism-recreational pressure. The first aspect is evaluated through analysis of the natural-resource characteristics of the territory (climate, landscape, biodiversity, water objects, aesthetic value). The second aspect requires analysis of existing and projected tourist-flow volumes and the ecological changes they generate (soil compaction, vegetation cover damage, increased waste output) [3].

In the author's doctoral research [11], the integrative linkage among these three dimensions was applied to Fergana Province through ArcGIS mapping, resulting in a four-tier typology (very high, high, medium, low) for the administrative-territorial units of the province. Tobirov [24] proposed a GIS-based methodology for classifying tourism objects in the Fergana Valley, and its integration with the present three-dimensional classification yields a more comprehensive synthesis.

Building upon the preceding analysis, an enhanced structural-functional model of TTRS is proposed. This model is composed of seven elements:

(1) Central nodes-the principal objects and destinations of highest tourism potential (Margilan, Quva, Rishton, Shokhimardon). (2) Connecting corridors-routes, transport pathways, and tourist trails linking the nodes. (3) Buffer zones-zones of moderated growth and managed access surrounding the central objects. (4) Demonstration (key) objects-the most distinctive and characteristic components of the system. (5) Service infrastructure-hotels, transport, food services, and visitor services. (6) Management-administrative components-state and private management bodies and the relevant legislative agencies. (7) Information and digital platforms-the database of information and services accessible to tourists.

This seven-element model functions as a TTRS-scale expression of Abduganiyev's [2] ecological-framework model-comprising central nodes, ecological corridors, restoration areas, and buffer zones-and is proposed as its refined extension. The model preserves the ecological logic of the original framework while integrating the management, service, and digital components essential for operational TTRS functioning.

4. Discussion

The three-dimensional structural-functional framework developed in this paper offers several methodological contributions to TTRS research. First, by treating goal, geoecological function, and usage regime as orthogonal but complementary axes, the framework supports a more nuanced classification than single-axis typologies (purely by goal or purely by usage regime) that have predominated in earlier literature. Each individual TTRS receives a composite profile that captures simultaneously what it is intended to achieve, how it interacts with its natural environment, and under what managerial regime it operates.

Second, the framework explicitly elevates the geoecological function to equal analytical status with the goal-functional dimension. In much of the earlier tourism-systems literature, ecological considerations have been treated either as background conditions or as constraints upon economic optimization. By contrast, the seven geoecological functions identified here-etalon, ecological restoration, ecosystem services, biotic integration, climate-adaptive, environmental education, and monitoring-indication-position the ecological dimension as a primary functional axis. This positioning aligns the framework with the discipline of environmental protection and rational use of natural resources, providing a coherent foundation for geoecological research on tourism.

Third, the inclusion of regenerative and smart-digital regimes among the seven usage regimes reflects the most recent theoretical and technological developments in tourism research. Regenerative tourism, articulated by Pollock [17] and subsequent contributors,

challenges the conventional sustainability paradigm by requiring tourism activity not merely to minimize harm but actively to restore landscapes and communities. The smart-digital regime captures the rapidly expanding role of mobile applications, IoT-based monitoring, and AI-driven personalization in destination management. The framework therefore remains open to ongoing theoretical evolution rather than fixing TTRS analysis in static categories.

Fourth, the proposed seven-element structural model offers a practical instrument for territorial planning. Its constituent elements-central nodes, connecting corridors, buffer zones, demonstration objects, service infrastructure, management components, and digital platforms-correspond directly to categories of intervention available to regional and municipal authorities. The model thus bridges the gap between abstract systems analysis and concrete planning decisions, an integration that has been identified as a persistent weakness in earlier TTRS literature.

Several limitations and avenues for further research should be acknowledged. First, the operationalization of the framework in empirical research requires harmonizing data of fundamentally different epistemic statuses: quantitative economic indicators, qualitative ecological assessments, GIS-based spatial data, and socio-cultural information. Second, the relative weights to be assigned to the three dimensions when constructing composite indices may vary across contexts-mountainous versus lowland regions, mass-tourism versus niche destinations-and standardization remains an open question. Third, the resilience of the proposed framework under climate-change and demographic-pressure scenarios warrants empirical testing through longitudinal case studies.

5. Conclusion

This study has analyzed the structural-functional organization of Territorial Tourism-Recreational Systems through three interrelated criteria. First, with respect to goal, eight functional types have been identified: health-recreation, sport, cultural-educational, ecological, agritourism, religious pilgrimage, business-congress, and smart-digital tourism. Second, with respect to geoecological function, seven functional dimensions have been distinguished: etalon, ecological-restoration, ecosystem-services, biotic-integration, climate-adaptive, environmental-education, and monitoring-indication. Third, with respect to usage regime, seven regimes have been articulated: strict protection, restricted tourist, ecotourism, traditional tourist, intensive tourist, regenerative, and smart-digital.

The integration of these three dimensions enables the construction of a multilayered profile for any specific TTRS and provides a methodological foundation for concrete management strategies. The refined seven-element structural model-central nodes, connecting

corridors, buffer zones, demonstration objects, service infrastructure, management components, and digital platforms-has been adapted for practical application in the conditions of the Fergana Valley. The results synthesize the classical conceptual framework of the post-Soviet recreational geography school (Preobrazhenskiy, Mironenko, Tverdokhlebov, Vedenin, Majar, Sarancha) with the contributions of contemporary Uzbek scholars (Soliev, Abdulqosimov, Nigmatov, Usmanov, Tobirov, Nazarov, Abduganiyev, Mansurova, Sharipov) and with international contemporary concepts-sustainable tourism, smart tourism, regenerative tourism, and climate-adaptive tourism.

Future research priorities include the empirical operationalization of the framework through multi-criteria decision-analysis methods such as the Analytical Hierarchy Process; the integration of remote-sensing-based landscape monitoring with the geoecological-function classification; the development of standardized indicators for each of the three dimensions; and the application of the framework to comparative international case studies, beginning with the mountain-valley regions of Central Asia.

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