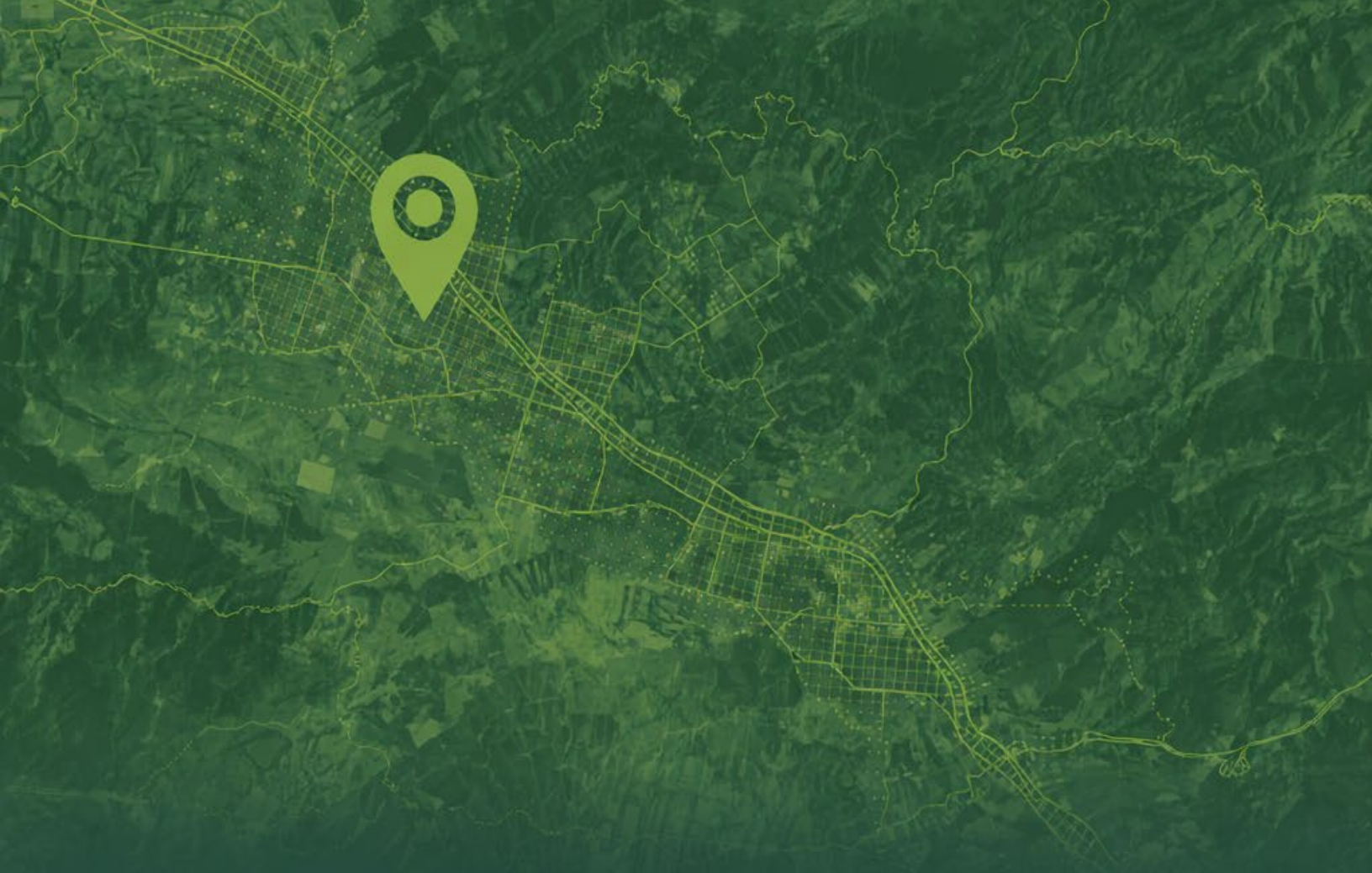

Book of Abstracts

GEO³ Conference 2025

Geography | Environment | Opportunities

University Skopje of Skopje
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INTERNATIONAL SCIENTIFIC CONFERENCE OF THE INSTITUTE OF NATIONAL GEOGRAPHY
GEO³ CONFERENCE 2025
GEOGRAPHY IN THE AGE OF GLOBAL TRANSFORMATION: SPATIAL INEQUALITIES, SUSTAINABILITY, AND TERRITORIAL DEVELOPMENT

Book of Abstracts

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GEO³ Conference 2025

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Dear colleagues,

It is my great honor and pleasure to welcome you to the **International Scientific Conference of the Institute of National Geography – GEO³ Conference 2025**, held under the title *"Geography in the Age of Global Transformation: Spatial Inequalities, Sustainability, and Territorial Development"*.

The GEO³ Conference is organized by the **Institute of National Geography**, in cooperation with the **University of Skopje**, as part of a continuous academic commitment to advancing geographical science in response to profound economic, social, environmental, and territorial transformations shaping contemporary societies. In an era characterized by accelerating globalization, uneven regional development, environmental pressures, and complex spatial dynamics, geography provides indispensable analytical tools for understanding and addressing these challenges through spatially grounded and scientifically rigorous approaches.

I am confident that this conference will serve as a high-quality academic forum for the exchange of contemporary geographical knowledge, theoretical perspectives, and empirical research findings. Through scholarly dialogue on spatial inequalities, sustainable development pathways, territorial governance, and regional transformation, participants will contribute to strengthening the role of geography as a discipline of both analytical depth and societal relevance. The conference encourages critical reflection, interdisciplinary cooperation, and the development of evidence-based insights applicable to policy formulation, spatial planning, and sustainable territorial development.

The GEO³ Conference 2025 brings together academics, researchers, and practitioners from different geographical traditions and research contexts, providing opportunities for intellectual exchange, professional networking, and the establishment of future research collaborations. By fostering dialogue across national and disciplinary boundaries, the conference aims to reinforce geography's contribution to understanding global transformations through spatial, regional, and territorial perspectives.

Thank you for your participation and for contributing to the scientific quality and academic integrity of the GEO³ Conference 2025.

With respect,

Rector
Prof. Dr. Ace Milenkovski
University of Skopje

INTERNATIONAL SCIENTIFIC CONFERENCE

OF THE INSTITUTE OF NATIONAL GEOGRAPHY
GEO³ CONFERENCE 2025

**GEOGRAPHY IN THE AGE OF GLOBAL TRANSFORMATION:
SPATIAL INEQUALITIES, SUSTAINABILITY,
AND TERRITORIAL DEVELOPMENT**

About the Conference

The **International Scientific Conference of the Institute of National Geography – GEO³ Conference 2025** is an international academic conference dedicated to contemporary geographical research focusing on spatial development, territorial transformation, sustainability, and regional inequalities. The conference is organized by the **Institute of National Geography**, in cooperation with the **University of Skopje**, and is conceived as a recurring scientific event aimed at strengthening the analytical and societal relevance of geographical science.

The GEO³ Conference is established as a platform for scholarly exchange addressing the profound spatial, economic, social, and environmental transformations shaping modern societies. In the context of accelerated globalization, uneven regional development, climate pressures, demographic change, and restructuring of territorial systems, geography provides essential conceptual and methodological tools for spatial analysis and evidence-based territorial governance.

The scientific scope of the conference is structured around three main thematic pillars:

GEO-DEV – Geography, Development and Sustainability (Regional and local development, sustainable development pathways, demographic dynamics, urban and rural transformation, environmental sustainability, and resilience of territorial systems).

GEO-TERR – Geography, Territorial Development and Planning (Territorial governance, regional and spatial planning, infrastructure and accessibility, spatial organization of economic activities, cross-border cooperation, and institutional frameworks for territorial development).

GEO-SPACE – Geography, Spatial Inequalities and Transformation (Spatial inequalities, center–periphery relations, regional disparities, urbanization and metropolitan dominance, social and economic polarization, and conceptual and methodological advances in spatial analysis).

Through these thematic areas, the GEO³ Conference aims to encourage academically grounded discussions on how geographical knowledge and spatial thinking can contribute to sustainable territorial development, balanced regional growth, and informed spatial policymaking at national, regional, and global levels.

The main objective of the conference is to emphasize the importance of geographical science as a foundational discipline for understanding and managing spatial inequalities, territorial

restructuring, and sustainability challenges. The working title of the conference, *"Geography in the Age of Global Transformation: Spatial Inequalities, Sustainability, and Territorial Development"*, reflects the intention to address geography as both an analytical science and an applied field with direct relevance for public policy and territorial governance.

The conference seeks to foster dialogue among academics, researchers, and practitioners on innovative theoretical approaches, empirical research findings, and applied geographical methodologies. By integrating scientific rigor with spatially informed reasoning, the GEO³ Conference encourages contributions that offer solutions grounded in strong academic foundations and territorial perspectives.

This international scientific conference supports academics, researchers, and PhD students by providing a forum to present recent research results in geography and related disciplines. Through scholarly exchange, participants contribute to advancing scientific knowledge, strengthening professional competencies, and deepening understanding of contemporary spatial challenges.

Geographical knowledge and professional expertise represent an evolving process shaped by societal change, environmental pressures, and technological development. In this context, the ability to remain analytically current and to continuously enhance methodological and conceptual skills is indispensable within the academic and scientific community. The GEO³ Conference responds to this need by offering a structured environment for critical reflection, interdisciplinary cooperation, and knowledge exchange.

Conference Organizer

Institute of National Geography
University of Skopje

Conference Date

27 December 2025

Conference Venue

University of Skopje
Blvd. "Partizanski odredi" No. 99
1000 Skopje, North Macedonia

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Hybrid event
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Virtual participation via Google Meet platform

Official Language

English

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Abstract Book

GEO-DEV

Geography, Development and Sustainability

Regional and local development, sustainable development pathways, demographic dynamics, urban and rural transformation, environmental sustainability, and resilience of territorial systems

Sports Participation and Geography Education Outcomes: Empirical Evidence on Motivation, Spatial Understanding, and Achievement

Ace Milenkovski[1]
Dejan Nedev

Abstract

The relationship between physical activity and educational achievement has been widely examined in general education research, yet subject-specific empirical evidence remains limited. Geography education, with its strong reliance on spatial reasoning, environmental interpretation, and applied cognitive processing, provides a particularly suitable analytical context for examining how sports participation relates to learning outcomes. This study investigates the correlation between students' participation in organized sports and educational outcomes in geography education, drawing on original survey-based empirical research conducted among lower secondary school students. Data were collected through a structured questionnaire administered to 120 students and analyzed using descriptive statistics, correlation analysis, group comparison tests, and multiple linear regression modeling. The analysis examines relationships between sports participation frequency, motivation for learning geography, perceived spatial understanding, and academic achievement in geography. The findings reveal statistically significant positive associations between regular sports participation and multiple dimensions of geography learning. Sports participation emerges as a meaningful predictor of geography achievement both directly and indirectly through motivational and spatial-cognitive mechanisms. The study adopts a cross-sectional quantitative research design and does not pursue causal inference. Its contribution lies in providing subject-specific empirical evidence that links sports participation to motivational and spatial-cognitive dimensions of geography learning rather than to general academic performance alone, thereby strengthening the analytical foundation for discipline-sensitive research in geography education.

Keywords: sports participation; geography education; academic achievement; spatial thinking; embodied cognition; survey research

[1]**Ace Milenkovski, PhD.,** Full Professor and **Dejan Nedev, PhD.,** Assistant Professor, University Skopje, North Macedonia.

Geographical Science in the Era of Sustainable Development Goals: Knowledge, Analytical Capacities, and Developmental Implications

Dejan Nakovski[2]
Marina Stojmirova

Abstract

The Sustainable Development Goals have introduced a governance framework in which development outcomes depend increasingly on the capacity to interpret and operationalize complex empirical information rather than on data availability alone. Within this context, geographical science assumes renewed analytical relevance by structuring sustainability indicators through spatial and territorial reasoning.

This paper examines geography as a knowledge-generating discipline within the Sustainable Development Goals framework by integrating conceptual perspectives on knowledge-based development with descriptive empirical illustration drawn from internationally comparable indicators for the period 2015–2023. Through spatial reorganization of selected SDG indicators, the analysis demonstrates how geographical interpretation exposes territorial disparities, spatial concentration effects, and relational interdependencies that remain insufficiently visible in aggregate monitoring systems. Empirical illustration from North Macedonia further reveals how challenges related to urban development, climate vulnerability, ecosystem governance, and regional inequality materialize unevenly across territory.

The findings indicate that geography contributes to sustainability governance as an interpretative analytical structure that mediates between empirical observation and policy-oriented reasoning. By embedding SDG indicators within spatial frameworks, geographical science enhances analytical coherence, scale sensitivity, and territorially differentiated interpretation, thereby strengthening knowledge-based development strategies under conditions of institutional complexity.

Keywords: geographical science; sustainable development goals; knowledge-based development; spatial analysis; development policy

[2]**Dejan Nakovski, PhD.,** Full Professor, University Skopje, **Julijana Petrovska, MsC.,** and **Marina Stojmirova, MsC.,** Academic Associate, Institute of National Geography, University Skopje, Republic of North Macedonia

Sustainable Governance of High-Mountain Geosystems: Hydrogeomorphological Constraints and Management Implications from the Kamenjanska River (Šar Planina, North Macedonia) in Comparative Perspective

Igor Stojcevski[3]
Sasko Stefanovski
Daniela Ristova

Abstract

High-mountain geosystems represent territorially constrained environments in which hydrogeomorphological processes impose non-negotiable limits on land use, infrastructure development, and socio-economic activities. In the context of intensifying climate variability and increasing development pressure, sustainable governance of mountain landscapes depends less on the physical severity of natural conditions and more on the capacity of governance systems to recognize and institutionalize these conditions within planning and regulatory frameworks. This paper examines the Kamenjanska River in the Šar Planina massif, North Macedonia, as a representative high-mountain geosystem characterized by steep relief, pronounced lithological heterogeneity, and active fluvial incision.

Rather than adopting a classical territorial comparison between countries, the study applies a functional comparative framework that contrasts a stable set of hydrogeomorphological constraints with divergent governance responses. The Kamenjanska River is analyzed as an empirically grounded geosystem with clearly identifiable physical limitations, while selected Alpine mountain river systems serve as a reference governance model in which similar constraints have been systematically translated into spatial planning instruments, hazard zoning, and land-use regulation.

Methodologically, the research is based on geomorphological interpretation of digital elevation models, secondary hydrological data, and comparative analysis of governance practices documented in peer-reviewed literature and official planning frameworks. Empirical results demonstrate that the physical constraints shaping the Kamenjanska River are broadly comparable to those observed in Alpine regions, yet governance responses differ substantially. While Alpine regions institutionalize hydrogeomorphological knowledge as a structuring element of territorial management, governance mechanisms affecting the Kamenjanska River remain fragmented and weakly aligned with physical realities.

The paper argues that sustainability in high-mountain regions is not determined by the intensity of natural constraints, but by the ability of governance systems to integrate geosystem characteristics as foundational development conditions. By explicitly linking physical geography with governance analysis, the study contributes to contemporary debates on sustainability, spatial inequality, and territorial development in mountain regions.

Keywords: high-mountain geosystems; hydrogeomorphology; sustainable governance; mountain rivers; Šar Planina; comparative geography

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Geodiversity and Ecosystem Services: GIS-Based Mapping and Valuation from a Balkan Case Study (North Macedonia)

Ace Milenkovsk[4]
Dejan Nakovski
Sasko Gramatnikovski

Abstract

Geodiversity has increasingly been recognized as a fundamental component of natural capital, shaping ecosystem processes and conditioning the spatial distribution of ecosystem services. Despite this recognition, geodiversity remains weakly integrated into ecosystem services assessment frameworks, particularly in transitional and mountainous regions such as the Balkans. This paper examines the relationship between geodiversity and ecosystem services through a spatially explicit mapping and valuation framework applied to selected Balkan landscapes.

The study conceptualizes geodiversity as a multi-dimensional assemblage of geological, geomorphological, hydrological, and soil features that underpin ecosystem functioning. Using GIS-based spatial analysis, geodiversity indices are constructed and analyzed in relation to provisioning, regulating, and cultural ecosystem services. The methodological framework integrates digital elevation models, lithological diversity, landform heterogeneity, and hydrological structure with ecosystem service indicators derived from land cover, climate, and accessibility data.

The results demonstrate a strong spatial correspondence between areas of high geodiversity and concentrations of ecosystem services, particularly regulating and cultural services. The findings confirm that geodiversity contributes to ecosystem service provision not as a passive substrate, but as an active spatial determinant shaping ecological processes and landscape functionality, based on a spatially explicit mapping and valuation framework implemented as a national-scale case study in the Balkan context.

Keywords: geodiversity; ecosystem services; spatial mapping; landscape valuation; GIS analysis; Balkan landscapes

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Statistical Processing of Tourism Data in the Republic of North Macedonia with an Empirical Focus on the Period 2019–2024

Goran Karovski [5]
Goran Apostolovski
Sase Kocovski

Abstract

This paper advances a transparent statistical framework for the processing and interpretation of officially reported tourism indicators in the Republic of North Macedonia, with empirical emphasis on the period 2019–2024. The analysis draws on annual data for tourist arrivals and overnight stays, disaggregated by residency, alongside hospitality sector turnover expressed in million denars. All data originate from official releases of the State Statistical Office and are examined through descriptive statistics, annual growth rates, structural proportions, ratio-based indicators, and a limited set of exploratory econometric tools.

The examined period encompasses three analytically distinct phases: a stable pre-pandemic baseline in 2019, a sharp contraction in 2020, and a subsequent phase of recovery and consolidation from 2021 to 2024. Empirical results indicate that the post-crisis rebound has been driven primarily by rising arrival volumes, particularly within the foreign segment, while domestic tourism continues to account for a substantial share of overnight stays due to longer average durations. Hospitality turnover exhibits a strong positive association with overnight stays, as demonstrated by correlation analysis and an illustrative regression specification. Given the short time series and the presence of an exceptional structural disruption, econometric outcomes are interpreted as indicative patterns rather than as stable behavioral parameters.

The paper concludes by highlighting both the analytical value and the inherent constraints of officially available tourism statistics, emphasizing the need for finer spatial and temporal resolution and for consistent use of standardized indicators in tourism policy analysis. By converting basic administrative data into analytically interpretable measures, the study offers a replicable empirical approach suitable for tourism research in data-constrained national settings.

Keywords: tourism statistics; empirical tourism analysis; overnight stays; tourist arrivals; hospitality turnover; post-crisis recovery; statistical indicators; Republic of North Macedonia

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Nature-Based Tourism and Geosite Conservation in a Post-Socialist Mountain Region: Evidence from Berovo, North Macedonia

Slobodan Ivanovic[6]
Ljupce Milenkovski

Abstract

In peripheral mountain territories of Southeast Europe, tourism is often viewed as one of the few viable avenues for economic activity outside agriculture and limited public employment. The Berovo region in eastern North Macedonia represents such a context. It combines notable geodiversity and largely preserved forest landscapes with restricted accessibility and modest institutional integration of conservation into tourism planning.
This study investigates whether geological heritage in Berovo acts primarily as a limiting factor or as a structuring element that defines realistic development pathways. The research design combines geosite inventory work, stakeholder-based survey research (N = 142), GIS-supported spatial assessment, and strategic evaluation. Quantitative analysis includes descriptive statistics, reliability testing, correlation analysis, and one-way ANOVA in order to examine variation across stakeholder categories.
Results indicate broad agreement regarding the importance of geological value and conservation priority, while infrastructure adequacy and inter-institutional coordination receive more critical evaluations. Spatial assessment shows that many high-value geosites are located outside primary transport corridors, creating a patterned separation between resource concentration and tourism infrastructure. The findings suggest that conservation does not hinder tourism development in this setting; instead, it delineates the spatial and administrative parameters within which development can plausibly unfold. The Berovo case illustrates how the practical conversion of geodiversity into tourism activity depends on governance capacity and accessibility conditions in post-socialist mountain settings.

Keywords: nature-based tourism, geosite conservation, SWOT analysis, GIS, Berovo, sustainable regional development

[6]**Slobodan Ivanovic PhD**., Full Professor, and **Ljupce Milenkovski, PhD.,** Assistant Professor, University Skopje, Republic North Macedonia.

The Role of School and Family in Recognizing and Preventing Cyberbullying: A Comparative Analysis of North Macedonia and Croatia

Dejan Nemcic[7]
Beti Stamenkoska Trajkoska
Julijana Petrovska

Abstract

Cyberbullying has emerged as a critical educational and social challenge in increasingly digitalized societies, particularly within primary and secondary education systems. Unlike traditional forms of school violence, cyberbullying transcends physical school boundaries while producing direct consequences for students' psychological well-being, academic performance, and institutional responsibility. This paper examines the role of schools and families in recognizing and preventing cyberbullying through a comparative analysis of North Macedonia and Croatia, focusing on institutional frameworks, governance mechanisms, and preventive practices. The study adopts an institutional perspective, conceptualizing cyberbullying as a socially embedded phenomenon shaped by the interaction between educational policies, family mediation practices, and digital environments. The empirical component relies exclusively on officially published national data, including reports from the Ministry of Education and Science of North Macedonia, the Croatian Ministry of Science and Education, national statistical offices, EU Kids Online Croatia, and UNICEF country reports. The analytical strategy combines descriptive statistics, comparative analysis, and correlation-based interpretation to assess institutional preparedness, reporting mechanisms, and perceived effectiveness of preventive measures.

The findings reveal pronounced cross-national differences. Croatia displays a higher degree of institutional coherence manifested through formalized school protocols, mandatory preventive programs, and structured teacher training, whereas North Macedonia is characterized by a more fragmented institutional configuration marked by limited standardization and greater dependence on family-based intervention.

Keywords: cyberbullying; school; family; institutional governance; education policy; North Macedonia; Croatia

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GEO-TERR

Geography, Territorial Development and Planning

Territorial governance, regional and spatial planning, infrastructure and accessibility, spatial organization of economic activities, cross-border cooperation, and institutional frameworks for territorial development.

Infrastructure Accessibility and Territorial Economic Inequality in North Macedonia: Evidence from Regional Spatial Modelling

Zoran Ivanovski[8]
Mijalce Gjorgjievski

Abstract

Territorial economic inequality remains a persistent structural feature of regional development in small and institutionally centralized states, where infrastructure provision and spatial accessibility are unevenly distributed. In such contexts, economic performance is not determined solely by market mechanisms but is strongly mediated by territorial structures that condition access to labor markets, public investment, and economic networks. This paper examines the relationship between infrastructure accessibility and regional economic inequality in North Macedonia through a spatially explicit analytical framework at the planning-region level. The analysis integrates regional economic indicators with a composite infrastructure accessibility index capturing transport connectivity, proximity to economic cores, and public investment intensity. Spatial exploratory techniques and spatial econometric models are applied to identify clustering patterns and assess the explanatory power of accessibility over regional economic outcomes. The results reveal pronounced spatial polarization of economic activity and demonstrate that infrastructure accessibility exerts a statistically significant and territorially structured influence on regional economic performance. Regions characterized by higher accessibility exhibit systematically higher GDP per capita and employment rates, while peripheral regions remain structurally constrained. The findings underscore the necessity of territorially differentiated development strategies and contribute to geographical debates on the spatial foundations of economic inequality in transitional economies.

Keywords: infrastructure accessibility; territorial inequality; regional economy; spatial econometrics; territorial development; North Macedonia

[8]**Zoran Ivanovski, PhD.,** Full Professor and **Mijalce Gjorgjievski, PhD.,** Full Professor, University Skopje, Republic of North Macedonia.

Instructional Time among Students Aged 11 to 15 in North Macedonia: Methodological Clarifications and Comparative Evidence from European Education Systems

Igor Jurukov[9]
Aneta Markovska
Julijana Maksimovska

Abstract

Public debates on instructional time in compulsory education frequently rely on numerical claims that obscure fundamental methodological distinctions between annual instructional time and cumulative instructional time up to a given age. This paper addresses these ambiguities by examining instructional time among students aged 11 to 15 in North Macedonia through a rigorously defined comparative framework aligned with European standards. The analysis explicitly distinguishes between nationally defined lesson units and internationally standardized instructional hours, thereby resolving common sources of misinterpretation in cross-national comparisons.

Methodologically, the study integrates documentary analysis of the legal and curricular framework governing compulsory education in North Macedonia with comparative data drawn from European education monitoring systems. Instructional time is reconstructed on the basis of legally prescribed lesson duration, the official school calendar, and subject-specific weekly and annual allocations, followed by conversion into standardized sixty-minute instructional hours to ensure full comparability with European datasets. This approach enables a precise positioning of North Macedonia within the broader European distribution of instructional time in lower secondary education.

The findings demonstrate that claims regarding large annual deficits in instructional time are not empirically sustainable once measurement units are properly aligned. While instructional time in North Macedonia for students aged 11 to 15 is situated slightly below the average reported for lower secondary education in many European systems, the magnitude of this difference is limited to several dozen hours per year rather than several hundred. Substantial numerical gaps become analytically plausible only when instructional time is interpreted cumulatively across multiple years of compulsory education, rather than as a single-year measure.

Through explicit clarification of measurement units and transparent reconstruction of instructional time, the paper provides a policy-relevant and empirically grounded assessment of instructional provision in compulsory education. The analysis underscores the necessity of terminological and methodological discipline in public and policy-oriented discussions and cautions against the use of decontextualized numerical claims as a basis for educational reform debates.

Keywords: instructional time; compulsory education; lower secondary education; methodological comparability; cumulative instructional time; North Macedonia; European education systems

[9]**Igor Jurukov, Ph.D.** Institute for History, Faculty of Philosophy, University Ss. Cyril and Metodij and Head of the education department in the municipality of Gorce Petrov, Skopje, **Aneta Markovska, MsC.,** Municipality of Karpoš and **Julijana Maksimovska, MsC.,** Teaches geography at primary school in Skopje, Republic of North Macedonia.

Artificial Intelligence as a Factor of Transformation in the Macedonian Tourism System

Angela Milenkovski Klimoska[10]
Ljupco Risteski
Dragan Petrovski

Abstract

Artificial intelligence has increasingly emerged as a salient analytical component in contemporary tourism systems, particularly in small and medium-sized destinations characterized by high external dependence, seasonal volatility, and limited institutional capacity. While existing tourism scholarship predominantly examines artificial intelligence as a technological innovation associated with automation, personalization, and service efficiency, this paper conceptually reframes artificial intelligence as an analytical instrument embedded within tourism system governance. The purpose of the study is to examine how artificial intelligence contributes to the transformation of the Macedonian tourism system by extending analytical capacity in demand interpretation, destination visibility, and coordination of tourism flows.

The paper adopts a conceptual–analytical research design supported by empirical contextualization based on official statistical indicators and international tourism development benchmarks. No hypotheses are tested and no causal inference is pursued. Instead, the study combines a structured synthesis of recent literature indexed in the Web of Science Core Collection with descriptive analysis of tourism demand patterns, digital readiness indicators, and destination competitiveness measures relevant to North Macedonia. Empirical data are used illustratively to ground the conceptual argument in observed structural conditions rather than to generate statistical generalization.

The analysis demonstrates that artificial intelligence affects the Macedonian tourism system primarily through algorithmic mediation of demand, analytical restructuring of destination visibility, and indirect influence on managerial coordination. The paper's contribution consists in reinterpreting artificial intelligence as an analytically transformative factor situated within institutionally constrained tourism systems, offering added conceptual precision to discussions on smart tourism and analytical governance in small-scale tourism economies.

Keywords: artificial intelligence, tourism systems, North Macedonia, analytical instruments, destination management, digital demand, smart tourism governance

[10]**Angela Milenkovska Klimoska, PhD.,** Assistant Professor, **Ljupco Risteski, MsC,** Assistant, University Skopje, North Macedonia and **Dragan Petrovski, MsC,** Quality Assurance Engineer, Quipu, Skopje, Republic of North Macedonia.

The Role of Geographic Education in Shaping Environmental Risk Awareness An Empirical Study of Upper Secondary Students Using Survey-Based Analysis

Aleksandra Stoilkovska[11]
Nevenka Stoeva
Beti Brsakovska

Abstract

Environmental risks associated with climate variability, extreme weather events, and landscape degradation increasingly affect everyday life across Europe and the Western Balkans. Geography education plays a central role in mediating societal understanding of these risks by linking physical processes, spatial patterns, and human activity. This paper examines the extent to which formal geography education contributes to environmental risk awareness among upper secondary students in North Macedonia.

The study employs a theory-driven empirical design combining geographical risk theory with original survey data collected from 214 students enrolled in general secondary education. The empirical results indicate a statistically significant relationship between exposure to geography curricula addressing climate, hazards, and spatial planning, and higher levels of environmental risk awareness, preparedness perception, and pro-environmental attitudes.

By integrating empirical findings with contemporary debates in geography education and risk governance, the paper contributes to understanding how educational geography functions as a societal risk mediation mechanism. The findings have implications for curriculum development, pedagogical practice, and policy design in geography education.

Keywords: geography education, environmental risk, climate hazards, risk awareness, empirical study, secondary education

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From Interpretative Mediation to Algorithmic Support: Artificial Intelligence and the Transformation of Tourist Guiding Practices

Marina Stojmirova[12]
Filip Nakev
Roberto Milenkov

Abstract

Tourist guiding represents a professional practice grounded in interpretation, contextualization, and communicative mediation between visitors and destinations. In the context of accelerated digital transformation, artificial intelligence is increasingly emerging as a supportive infrastructure within tourism experiences through personalized recommendations, automated guides, chatbots, and intelligent mobile applications. While existing tourism research predominantly emphasizes technological capabilities and improvements in user experience, significantly less attention has been devoted to the professional, interpretative, and institutional implications that such systems generate for the role of tourist guides.

This paper examines the application of artificial intelligence in tourist guiding as a matter of professional responsibility, interpretative legitimacy, and institutional governance rather than as a purely technological innovation. The study develops a conceptual framework distinguishing between augmentative, co-existent, and substitutive uses of artificial intelligence in guiding practices, emphasizing that sustainable integration of intelligent systems depends on clearly defined boundaries between algorithmic support and human interpretation. The analysis draws on relevant theoretical and empirical studies published in Web of Science–indexed journals, focusing on tourist experience, smart destinations, and automation in tourism. The paper concludes that the future of tourist guiding does not lie in technological replacement, but in hybrid guiding models that preserve the interpretative and ethical responsibility of the profession.

Keywords: artificial intelligence, tourist guides, smart tourism, interpretative mediation, professional responsibility

[12]**Marina Stojmirova, MsC., Filip Nakev, MsC.** and **Roberto Milenkov, MsC.** Assistant, University Skopje, Republic of North Macedonia.

Normative Regulation of Teaching Staff in Primary and Secondary Education: Legal Coherence, Governance Capacity, and Comparative European Perspectives

Blagoj Conev[13]
Jana Ilieva

Abstract

The quality and stability of primary and secondary education systems are structurally dependent on the normative regulation of teaching staff. Legal frameworks governing teacher qualification, recruitment, professional development, evaluation, and employment security constitute a central pillar of educational governance. In post-socialist education systems, including North Macedonia, these regulatory arrangements reflect a complex interaction between inherited institutional models, ongoing reform agendas, and external European policy influences.

This paper provides a comprehensive legal analysis of the normative framework regulating teaching staff in primary and secondary education in North Macedonia, situating it within a comparative European context. Adopting a governance-oriented legal methodology, the study examines statutory provisions, secondary legislation, and implementation mechanisms governing teacher entry, professional status, workload, evaluation, and career progression. Comparative reference is made to selected European education systems, including Germany, Slovenia, Finland, and Croatia, in order to identify convergences, divergences, and structural constraints.

The analysis demonstrates that while the Macedonian regulatory framework formally aligns with European standards in terms of qualification requirements and professional duties, it exhibits normative fragmentation, procedural rigidity, and limited coherence between employment law and pedagogical governance. The paper argues that effective regulation of teaching staff requires not only formal legal alignment but also institutional coordination, legal clarity, and enforceable governance mechanisms. The findings contribute to comparative education law by highlighting how normative design conditions professional stability, pedagogical autonomy, and system-wide educational quality.

The analysis further demonstrates that formally centralized regulation generates territorially differentiated governance outcomes, highlighting the relevance of spatial and territorial perspectives in education law.

Keywords: teaching staff regulation, education law, primary and secondary education, governance capacity, comparative education, Europe, territorial governance

[13]**Blagoj Conev, PhD.,** Associate Professor and **Jana Ilieva, PhD.,** Full Professor, University of Skopje, Skopje, Republic North Macedonia.

Re-Specifying Destination Image Hierarchies: The Structural Primacy of Territorial Dairy Identity in North Macedonia with Comparative Evidence from Selected EU Cheese Regions

Ace Milenkovski[14]
Sreten Miladinovski

Abstract

Destination image theory has not conclusively established whether territorially embedded agricultural products can occupy an initiating structural position within perceptual hierarchies. Products are commonly conceptualized as experiential complements rather than as exogenous constructs capable of influencing the internal ordering of image architecture. This study evaluates whether territorial dairy identity is compatible with upstream structural specification within a covariance-based hierarchy and whether its structural location varies across institutional environments characterized by different levels of geographical indication consolidation.

Using covariance-based structural equation modeling on cross-national survey data (N = 342), the analysis compares partially mediated and fully mediated specifications. The sample consists of respondents familiar with rural tourism contexts in North Macedonia (n = 156) and consolidated PDO regions in Italy, France, and Greece (n = 186). In the North Macedonian context, territorial dairy identity demonstrates both indirect effects through experiential value and a residual direct association with cognitive image. In consolidated PDO environments, the direct cognitive pathway attenuates while affective mediation intensifies.

Nested model comparison indicates significant deterioration of fit when the direct dairy identity–cognitive image path is constrained ($\Delta\chi^2(1) = 7.84$, $p = 0.005$; $\Delta CFI = 0.013$). Multi-group testing confirms structural divergence between emerging and consolidated institutional settings ($\Delta\chi^2(1) = 5.62$, $p = 0.018$). The findings suggest that destination image hierarchy is contingent upon institutional consolidation. By positioning agricultural identity as an exogenous latent construct within a constrained covariance framework, the study advances a structural reordering of destination image theory and extends terroir scholarship into perceptual modeling.

Keywords: territorial dairy identity; destination image hierarchy; PDO/PGI; experiential value; rural tourism; structural equation modeling; North Macedonia; comparative EU regions

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GEO-SPACE

Geography, Spatial Inequalities and Transformation
Spatial inequalities, center–periphery relations, regional disparities, urbanization and metropolitan dominance, social and economic polarization, and conceptual and methodological advances in spatial analysis.

Spatial Perception of Urban Heat Risk and Governance-Mediated Adaptation in a Post-Socialist City: Empirical Evidence from Skopje

Liljana Vojneska[15]
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Valentina Fidanovska

Abstract
Urban heat risk is increasingly recognized as a spatially differentiated hazard shaped by land cover, built form, and unequal access to ecosystem services. In Southeast European cities, rapid urban densification and uneven green infrastructure provision generate localized heat stress that interacts with governance capacity and household-level adaptation. This paper examines the relationship between perceived urban heat stress, neighborhood-level access to green spaces, and governance-related perceptions in Skopje, North Macedonia.
Adopting a governance-oriented geographical framework, the study conceptualizes green infrastructure as a spatial public good whose effectiveness is conditioned by institutional capacity, public trust, and coordination. The empirical analysis is based on a survey administered to adult residents across eight municipalities within the metropolitan area of Skopje (N = 210). Four multi-item constructs are operationalized: green space accessibility, perceived urban heat stress, governance trust and capacity, and household adaptation behaviours. Reliability analysis confirms acceptable internal consistency across all constructs (Cronbach's alpha = 0.706–0.806).
Correlation and regression analyses reveal a statistically meaningful negative association between green space accessibility and perceived heat stress, while both perceived heat stress and governance trust positively predict household adaptation behaviours. These findings support an interpretation of urban heat as a governance-relevant spatial experience produced through the interaction of environmental infrastructure, spatial inequality, and institutional credibility rather than as a purely physical phenomenon.
The paper concludes by identifying policy-relevant conditions for urban heat resilience that align with international guidance on green infrastructure, public health, and climate-risk governance.

Keywords: urban heat, green space accessibility, Skopje, governance capacity, environmental perception, survey research

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Diagnosed Morbidity versus Epidemiological Risk in Chronic Respiratory Diseases: A Spatially Standardized Analysis of North Macedonia

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Abstract

Recorded morbidity is commonly employed in public health analysis as a measurable representation of population health; however, its territorial distribution frequently mirrors the spatial organization of healthcare systems rather than the underlying geography of epidemiological exposure, such that recorded disease burden often fails to materialize where diagnostic access is structurally constrained (Krieger 2011; Marmot 2020). This paper develops a spatially standardized analytical framework to examine divergences between diagnosed morbidity and underlying epidemiological risk in chronic respiratory diseases in North Macedonia. The analysis integrates age-standardized morbidity rates with a composite epidemiological risk index derived from environmental exposure, demographic structure, urbanization intensity, and socioeconomic vulnerability, following established approaches in spatial epidemiology (WHO 2022; EEA 2023). Spatial econometric techniques are applied to identify structural mismatches between diagnostic outcomes and latent disease risk. The results reveal statistically significant spatial autocorrelation in both diagnosed morbidity and epidemiological risk, alongside weak explanatory power of epidemiological risk variables over diagnosed morbidity once healthcare accessibility is introduced into the models. These findings demonstrate that diagnosed morbidity constitutes an institutionally mediated spatial phenomenon rather than a direct proxy for disease burden. The study advances a geographically grounded interpretation of chronic respiratory disease patterns and supports territorially differentiated, policy-relevant public health planning in healthcare systems characterized by persistent spatial inequality.

Keywords: chronic respiratory diseases; diagnosed morbidity; epidemiological risk; spatial standardization; health geography; North Macedonia

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Human Resources, Institutional Governance, and Spatial Inequalities in the Labor Market: A Comparative Perspective

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Abstract

Labor markets represent inherently spatial systems in which employment outcomes are shaped by the interaction between human resource endowments and institutional governance arrangements. While economic geography has traditionally emphasized agglomeration processes, sectoral structure, and spatial accessibility, comparatively less attention has been devoted to the institutional mechanisms through which human resources are regulated, mobilized, and spatially distributed across regions. This paper examines the role of institutional governance in conditioning spatial inequalities in labor market performance through a comparative geographical perspective. Using harmonized regional data from selected European and Western Balkan contexts, the study integrates labor market indicators, human capital measures, governance indices, and spatial accessibility variables. The empirical analysis combines descriptive statistics, correlation analysis, multivariate regression modeling, and GIS-based cluster classification. The results demonstrate that regions characterized by coherent and decentralized governance arrangements exhibit higher employment rates and lower levels of spatial polarization, whereas fragmented institutional environments tend to reinforce persistent regional disparities. The findings contribute to labor geography by clarifying how institutional governance intersects with spatial structures to shape differentiated labor market outcomes at the sub-national level.

Keywords: human resources; labor markets; institutional governance; spatial inequalities; comparative geography; regional development

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The Educational Significance of Geographic Information Systems for Teaching Relief in Geography Education: Methodological Foundations, Pedagogical Value, and Curricular Alignment

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Miroslav Velkovski

Abstract

Relief constitutes a foundational component of geographical knowledge, providing the spatial framework through which natural processes and human activities are interpreted. Despite its central position within geography curricula, relief is frequently taught through static representations that limit students' ability to grasp spatial complexity, scale, and processual dynamics. This paper examines the educational significance of Geographic Information Systems for teaching relief through a pedagogically grounded and methodologically coherent analytical framework.

Geographic Information Systems are conceptualized not as a technical add-on but as a pedagogically mediated instructional environment that enables three-dimensional visualization, spatial analysis, and interpretative engagement with relief forms and processes. Drawing on documentary analysis of curricular frameworks and peer-reviewed pedagogical literature, the paper analyzes how GIS reshapes the cognitive, methodological, and didactic dimensions of relief education. Particular attention is given to the alignment between GIS functionalities and core geographical concepts, including elevation, slope, aspect, watershed structure, and geomorphological processes.

The analysis demonstrates that GIS-supported relief instruction enhances conceptual understanding by enabling learners to move beyond descriptive memorization toward analytical interpretation and spatial reasoning. The paper argues that the educational value of GIS depends on methodological sequencing, curricular integration, and pedagogical mediation rather than on technological availability alone. By situating GIS within the disciplinary logic of geography education, the study provides a concise and policy-relevant framework for strengthening relief instruction in contemporary school systems.

Keywords: geographic information systems; geography education; relief; spatial visualization; pedagogical methodology; curriculum alignment

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Artificial Intelligence in Contemporary Geography Education: Methodological Alignment, Pedagogical Time Constraints, and Institutional Preconditions

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Abstract

Contemporary geography education increasingly operates within digitally mediated learning environments shaped by geospatial data platforms, satellite imagery, and algorithmic systems. Artificial intelligence has emerged as a core pedagogical infrastructure mediating data processing, spatial representation, and instructional adaptation.

Unlike earlier educational technologies, artificial intelligence introduces algorithmic mediation into fundamental pedagogical processes, including instructional planning, assessment, and spatial reasoning. Despite its growing presence, its integration in geography education remains methodologically uneven and frequently misaligned with curricular structures, pedagogical time allocation, and institutional capacity.

This study advances the argument that the instructional value of artificial intelligence in geography education depends primarily on methodological alignment, pedagogical time sufficiency, and institutional governance rather than technological sophistication. Using a theory-driven empirical design, the research combines policy document analysis with original survey data collected from 128 geography teachers in primary and secondary education.

The results reveal a persistent structural misalignment between compressed instructional time and the methodological requirements of artificial intelligence-supported geography teaching. Methodological adequacy emerges as the strongest predictor of perceived instructional value, followed by institutional support and pedagogical time sufficiency.

The study contributes to geography education scholarship by reframing artificial intelligence adoption as a spatially structured pedagogical and institutional challenge rather than a purely technical innovation.

Keywords: artificial intelligence, geography education, primary and secondary education, pedagogical governance, instructional time, comparative education

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Computational Systems and Geographic Analysis: Algorithmic Processing of Spatial Data in Contemporary GIS Applications for Tourism, Urban Systems, and Environmental Management

Leonid Dzinevski[20]
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Toni Malinovski

Abstract

The rapid expansion of spatial data availability has transformed geography into a computationally intensive scientific field in which the analytical capacity of computer systems increasingly determines the scope, precision, and applicability of geographic research. In domains such as tourism planning, urban system management, and environmental monitoring, spatial phenomena are no longer interpreted solely through descriptive cartographic representations but are processed through algorithmic procedures embedded in contemporary Geographic Information Systems. This paper conceptualizes geographic analysis as a form of computational processing and examines how computer system architectures, algorithms, and data structures condition the analytical treatment of spatial data in applied geographic domains. Methodologically, the study adopts a system-oriented GIS framework that integrates spatial data modeling, algorithmic processing, and applied analysis across tourism, urban, and environmental contexts. By synthesizing computational theory with geographic application, the paper demonstrates that the analytical quality of spatial decision-making is increasingly shaped by the computational logic governing spatial data transformation rather than by the mere availability of spatial datasets. The contribution of the study lies in repositioning GIS from a representational tool toward a computational system that actively structures geographic knowledge production.

Keywords: Computational geography; Geographic information systems; Spatial data processing; Algorithmic spatial analysis; Tourism planning; Urban systems; Environmental management; Computer systems architecture

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Spatial Narratives and Territorial Visibility: The Role of Journalism and Marketing in Shaping Geographic Perception

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Abstract

Territorial visibility has become a decisive dimension of contemporary spatial development, increasingly shaping how places are perceived, prioritized, and integrated into development agendas. In mediatized societies, geographic perception is not formed exclusively through material spatial conditions, but through discursive representations produced by journalism and marketing communication. This paper develops a geographically grounded analytical framework for examining how spatial narratives constructed through media reporting and marketing practices operate as mediating mechanisms that structure territorial visibility.

Rather than treating journalism and marketing as auxiliary communication domains, the study conceptualizes them as spatial forces actively involved in the production of geographic meaning. Drawing on recent advances in human geography, media studies, and place branding scholarship, the analysis examines how narrative selection, framing, and repetition shape spatial hierarchies by amplifying certain territories while marginalizing others. Methodologically, the paper integrates qualitative discourse analysis with spatial contextual interpretation, linking dominant narrative patterns to territorial characteristics such as centrality, accessibility, and development status.

The findings demonstrate that territorial visibility follows patterned spatial inequalities that often diverge from material geographic potential. Territories repeatedly represented through positive or strategic narratives accumulate symbolic spatial capital, while peripheral areas remain discursively invisible despite comparable developmental conditions. By explicitly linking geographic analysis with journalism and marketing studies, the paper contributes to contemporary debates on spatial inequality, territorial governance, and the mediated production of space.

Keywords: territorial visibility; spatial narratives; journalism; marketing; geographic perception; spatial inequality

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Revenue Density and Demand Volatility in Music-Based Cultural Tourism: A Dual-Segment Model from North Macedonia in a Comparative Perspective

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Ana Petrovska

Abstract

This study examines the structural relationship between revenue density and normalized demand volatility in music-based cultural tourism using North Macedonia (2005–2024) as an empirical case. Two segments are analyzed: territorially dispersed traditional music events and internationally oriented jazz festivals. Drawing on primary survey data (n=1,247) and official attendance records, direct tourism revenue is estimated through an expenditure model, while volatility is measured using GARCH modeling to capture time-varying variance and asymmetric shock persistence. Findings reveal a dual structural configuration. Traditional music demonstrates lower volatility (CV=0.20) and territorially distributed income generation. Jazz produces higher per-visitor expenditure (€110–145) and greater foreign participation (52–68%) but exhibits substantially elevated attendance variability, with GARCH estimates confirming volatility clustering and asymmetric responses to negative shocks. Comparative benchmarking with Novi Sad, Newport, and Montreux positions the Macedonian jazz segment within an emerging and fragmented configuration characterized by moderate revenue density (€4.2–6.8 million annually) alongside high normalized volatility (σ/μ=0.48). The results indicate that institutional consolidation and revenue concentration, rather than event multiplication, are associated with volatility containment in small cultural economies. The study contributes a revenue-risk portfolio framework for understanding structural resilience in festival-based tourism systems.

Keywords: cultural tourism economics; revenue density; demand volatility; festival governance; GARCH modeling; portfolio resilience; North Macedonia

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