Rebalancing Tourism Flows in Kotor, Montenegro: Application of STESY Framework for Transitioning from Cruise-Based Pressure to Extended Stay

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Abstract. Kotor, Montenegro, represents a highly sensitive tourism destination where cruise-based visitation, spatial concentration of flows, and extremely short average stays generate significant territorial imbalances. Despite its unique integration of coastal landscapes and mountainous environments, tourism demand remains largely confined to the historic core and port area. This study applies STESY framework in order to support the transition from a high-pressure, short-stay tourism model toward a more balanced and sustainable system based on extended stays. The methodology integrates territorial analysis, spatial mapping of attractors, services, and reachability, cluster-based classification, and the interpretation of indicators, including the Balanced Tourism Supply Index (BTSI), Attraction Potential Index (API), and Diversity Reachability Index (DRI). The results highlight a structural mismatch between tourism potential and actual demand distribution, revealing the under-exploitation of inland areas and the saturation of coastal zones. Based on these findings, the study proposes a multi-scalar intervention strategy combining soft measures, such as an integrated guest card system, with hard infrastructural actions structured around a network of thematic hubs. The proposed framework contributes to the development of replicable, policy-oriented approaches for sustainable tourism planning in complex coastal–mountain heritage destinations.

Keyword: Sustainable tourism planning · spatial analysis · cluster analysis

1 Introduction

Sustainable tourism becomes more and more a core argument in territorial development debate defining local multi-stakeholders' perspectives and global framework for innovation and better management of such complex phenomena [1, 2]. Today tourism is

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recognized as a dominant driver of economic growth in coastal and heritage destinations, yet its rapid expansion has also generated critical spatial and temporal imbalances [3]. In the perspective of the authors, tourism opens to relevant debate in urban and regional planning research as the decision making process connected with tourism management represent a comprehensive framework in which sustainable urban regeneration and transformation, landscape protection actions, economic development issues interacts generating an effective environment to apply sustainable urban development principles, methods and agendas for short term and strategic territorial design [4–8]. Those applications are also oriented to improve the competences of students in academic curricula dealing with territorial design professionals, and this paper comes as a result of a studio in architectural classes following the research tradition [9–14] of sustainable urban planning and design at UNIBAS [15–18].

Tourism as a spatial phenomenon is a multidisciplinary domain where spatial dimension represents a robust analytical dimension for managing information and designs, applying collaborative approach for strategic planning [19–25].

Destinations endowed with a strong cultural identity and environmental vulnerability are subject to intense visitor fluxes, seasonalities, and types of tourist consumption that create minimal value for the local economy [26]. Cruise tourism is a typical example of such a scenario, as it involves intense visitation over limited periods, without significantly benefiting the local economy. Such processes are especially pronounced in destinations with a heterogeneous distribution of accessibility, attractiveness, and services.

In such destinations, tourism demand tends to concentrate in highly iconic areas [24], leaving peripheral or inland zones under-exploited despite their potential.

This imbalance results in environmental pressure, infrastructural overload, and reduced quality of life for residents, while limiting opportunities for more sustainable and diversified tourism development [27].

Kotor, Montenegro, represents a paradigmatic case of this condition. Its geographical configuration, characterized by the coexistence of coastal and mountainous systems, combined with its UNESCO-listed historic center, has positioned the destination as a major node in Mediterranean cruise tourism itineraries.

However, the predominance of short-stay and cruise-based tourism has led to a strong spatial congestion of visitors around the historic urban area and port area, generating significant overtourism and limiting the effective development of the broader territorial system.

This paper aims to develop a spatially informed planning framework capable of supporting the transition from a short-duration, high-pressure tourism model toward a more balanced system based on extended stays and territorial redistribution. The study proposes an integrated methodological approach combining spatial analysis, cluster-based interpretation, and policy-oriented design strategies in compliance with NUA principles. The contribution lies in bridging analytical diagnosis and operational planning within a coherent framework transferable to similar tourism destinations.

2 Study Area

This study examines the municipality of Kotor, which lies in the Bay of Kotor, or Boka Kotorska, in Montenegro. It's quite a unique part of the Mediterranean, known for a striking contrast in its landscape. On one hand, there are rugged coastal areas, and on the other, towering mountain ranges. Even though the area isn't very large, it brings together steep limestone mountains that rise over 2,000 m alongside deeply indented coastline stretching along the Adriatic Sea.

The old town of Kotor with its Venetian fortifications and walls dating back hundreds of years has been recognized as a UNESCO World Heritage Site since 1979. The cultural monument represents a significant part of tourist demand, especially for cruise tourism. The town's layout is adapted to the surrounding mountains with a long, linear arrangement along the shoreline and a high concentration of activities across a small area.

Recently, Kotor has emerged as a new Mediterranean tourism destination, but it has become highly dependent on cruise tourism due to the massive seasonal inflows of cruise ships arriving Kotor in the summer months. The length of stay of visitors is predominantly low as a result of a predominance of day-trip visitors coupled with a lack of overnight tourism (Fig. 1).

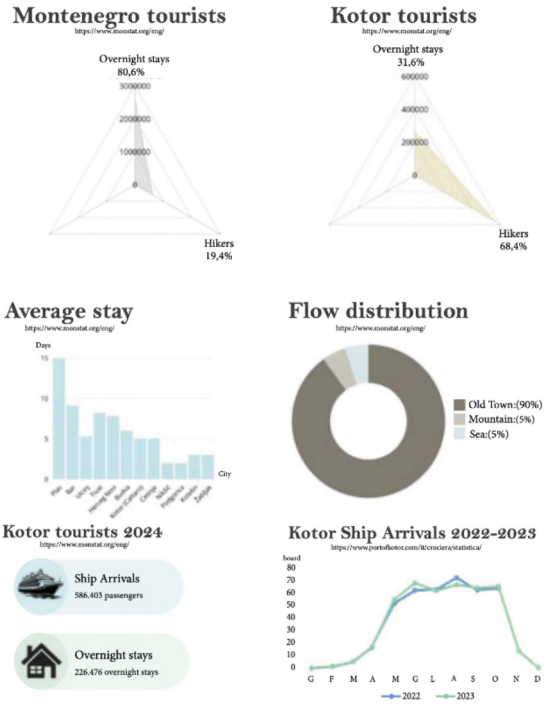


Fig. 1. Comparative overview of tourism dynamics in Kotor and Montenegro.

The figure synthesizes key tourism indicators, including the distribution of tourist activities, average length of stay, spatial concentration of visitor flows, annual tourist volumes, and cruise ship arrivals.

3 Territorial Analysis

The approach adopted in this study is based on the STESY framework [28] conceived as an integrated analytical and interpretative tool for the identification of territorial imbalances and the support of evidence-based planning strategies.

The first phase consists of a contextual analysis of the study area, focusing on the identification and classification of key georeferenced components (PoIs) of the tourism system, including attractors, services, and reachability (Fig. 2). Attractors are grouped into cultural, architectural, and natural, while services are examined on the basis of lodging, food, and visitor assistance. Reachability is analyzed with respect to the existence and integration of transport systems.

The second phase involves the spatial interpretation of these components through a cluster-based approach in order to identifying the Destination Areas of the tourism system in the case study. The territorial system is divided into homogeneous clusters using GeoDA software [29] aimed at identifying distinct spatial patterns. The optimal number of clusters is determined through the application of the Elbow Method [30], ensuring a balance between analytical detail and interpretative clarity (Fig. 3).

To quantify the characteristics of each cluster, three composite indicators are employed (Fig. 4). The Balanced Tourism Supply Index (BTSI) measures the relationship between accommodation capacity and consumption services, distinguishing between overnight-oriented and day-trip-oriented areas. The Attraction Potential Index (API) evaluates the strength of attractors based on their relevance and scale, while the Diversity Reachability Index (DRI) assesses accessibility and intramodality within the transport system.

Cluster 1 emerges as the core of the tourism system, combining the highest accommodation capacity (325 units) with a strong integration between cultural assets and food-related services. Although the cluster records the highest attractiveness and quality values across the entire analysis (API 3744; DRI 0.86), a marked imbalance persists between its accommodation capacity and the actual patterns of visitor interests. Despite a BTSI value that would suggest a vocation for longer overnight stays, the area appears structurally saturated due to the predominance of cruise passengers. This form of short-duration tourism places excessive pressure on urban infrastructure and limits the effective use of the accommodation and hospitality services already available.

A similar dynamic can be observed in Cluster 3, where the cultural and landscape components, together accounting for more than 59% of the local tourism offer, are not matched by an equally developed accommodation sector, which remains marginal at 10.7%. Here too, the strong influence of cruise tourism turns what could function as a stay-oriented destination into an area largely dominated by day visitors. As a result, the cluster maintains a relatively low API value (2487), while the tourism offer remains mostly confined to a local and short-term dimension.

By contrast, Cluster 2 is characterised by a profile strongly oriented toward mobility, with a very high share of land-based transport infrastructure, including rail and bus

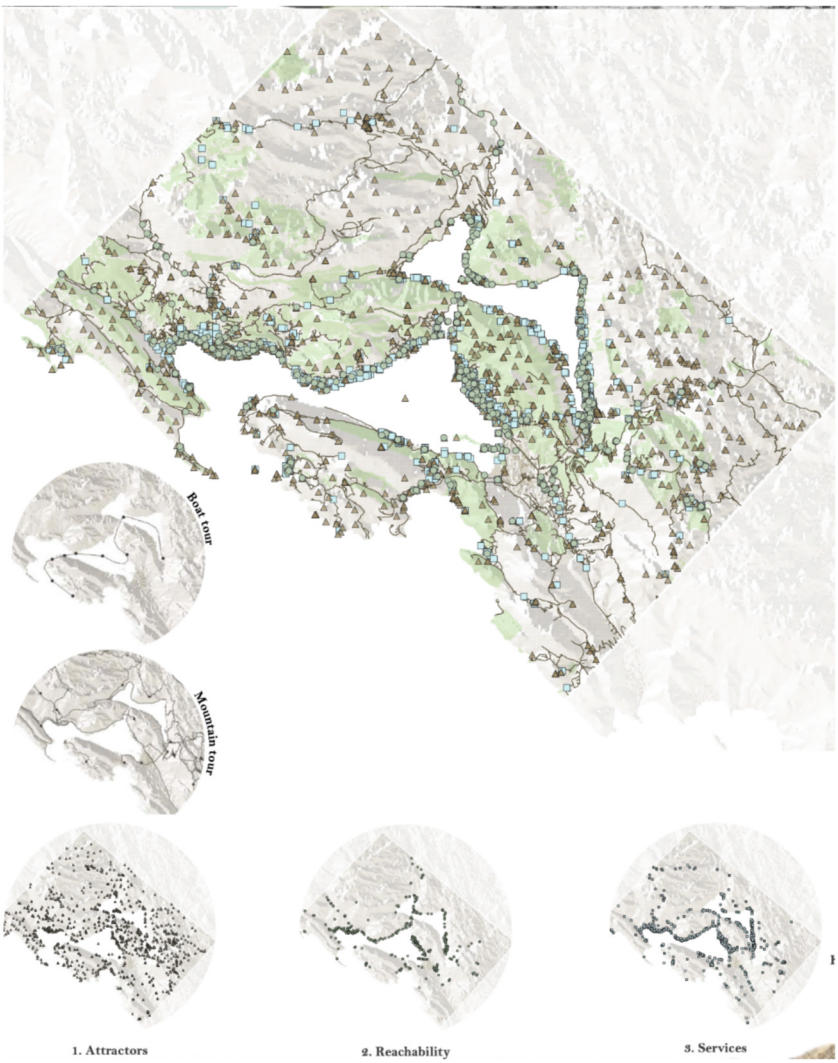


Fig. 2. Distribution of Attractors, services and reachability in Kotor.

services (31.1%), alongside a relevant cultural tourism component. While the cluster still shows high attractiveness (API 3181) and a relatively good demand response (DRI 0.71), it appears to be in a transitional phase. Its BTSI value of 0.90 confirms its current role as an excursion-based destination, where visitors tend to consume the tourism offer within a single day, without generating a stable impact on the accommodation sector. This suggests that the average length of stay has not yet been effectively consolidated.

Cluster 4 shows the characteristics of a more balanced area, where cultural and landscape tourism are distributed more evenly and supported by a relatively good degree of transport intermodality. Although this cluster records the lowest market performance

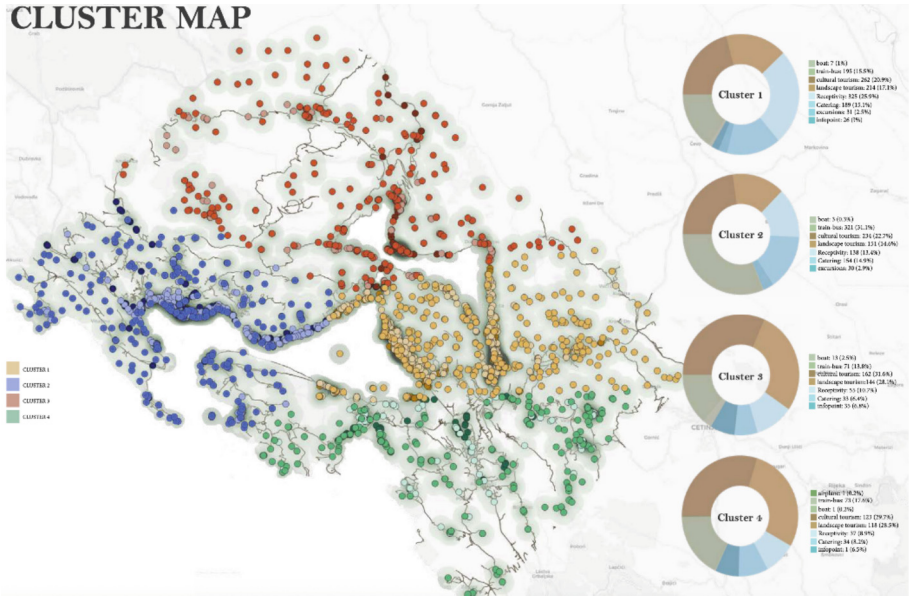


Fig. 3. Clusters identified of Attractors, services and reachability.

indicators in the dataset (API 1937), it appears to be structurally more stable. The relationship between accommodation and food services is more balanced, allowing for a more coherent and manageable orientation toward overnight tourism.

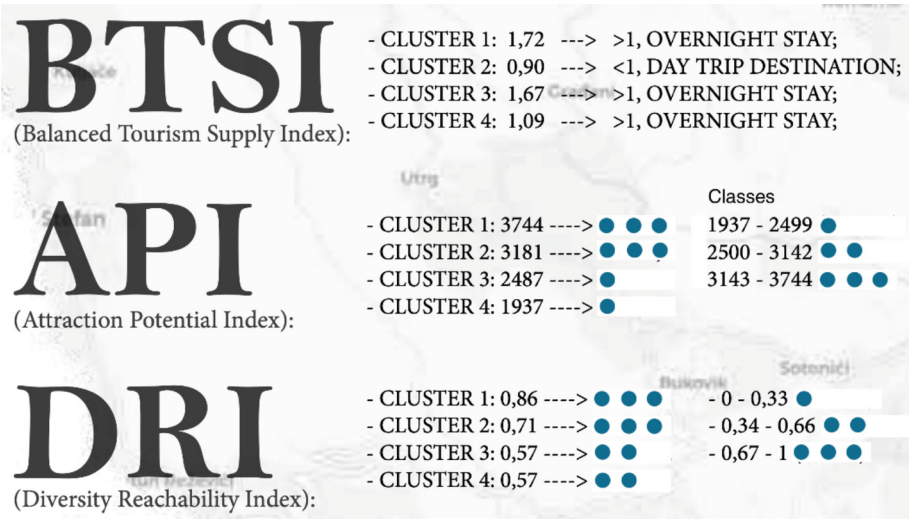


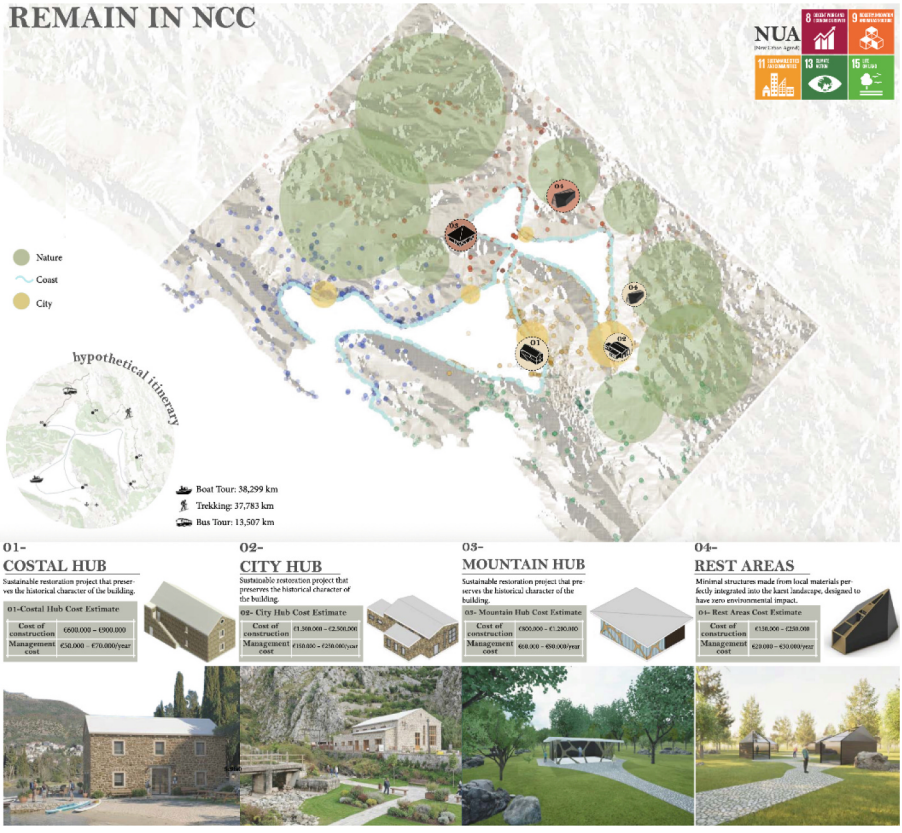
Fig. 4. Indicators applied to each Cluster (Destination Area).

Overall, the results highlight the coexistence of over-concentrated and underutilized areas within the same territorial system, emphasizing the need for integrated planning strategies capable of addressing these imbalances.

4 Discussion and Planning Strategy

The findings of the analysis support the development of a multi-scalar planning strategy aimed at transforming the existing tourism system. The downscaling of NUA [31, 32]compliance assessment supports the definition of spatial strategies aimed at rebalancing tourism flows and enhancing the sustainability of the territorial system. The proposed approach is based on the combination of soft measures and hard interventions, designed to influence both visitor behavior and spatial organization.

Hard interventions are structured around the development of a network of thematic hubs distributed across the territory. These hubs function as strategic nodes connecting coastal, urban, and mountain environments, facilitating the integration of different components of the tourism system. Each hub is designed to enhance specific territorial functions, including mobility management, cultural experience, and access to natural areas.



Soft measures focus on the introduction of incentive-based mechanisms to encourage longer stays and more balanced spatial distribution of visitors. In this context, the implementation of an integrated guest card system represents a key tool. By linking access to mobility services and tourism experiences to a minimum length of stay, the system aims to transform short-term visitors into overnight tourists while promoting the exploration of less frequented areas (Fig. 5).

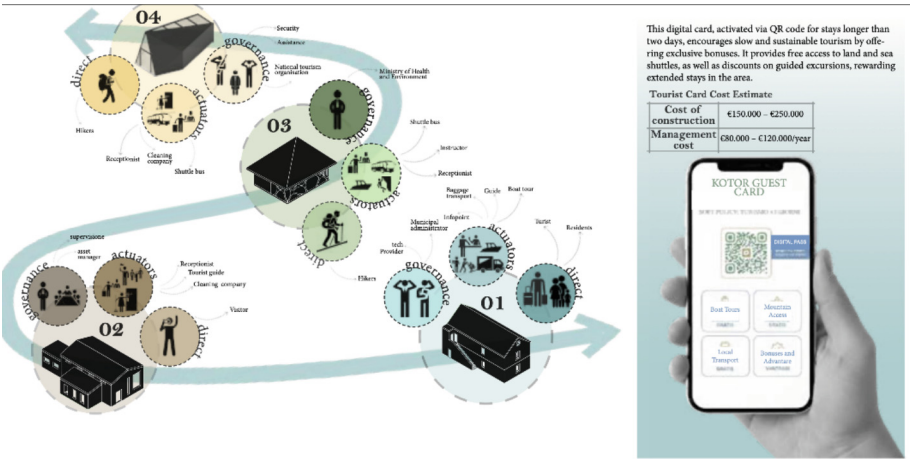


Fig. 5. Guest card system

The combined effect of these measures is expected to generate a significant transformation of the tourism system. The average length of stay is projected to increase substantially, while visitor flows are redistributed from highly congested areas toward peripheral zones. This shift supports the extension of the tourism season and the creation of a more resilient and diversified local economy.

5 Conclusions

This study has developed a spatially informed planning framework for addressing tourism imbalances in complex coastal–mountain destinations, using Kotor as a representative case. The integration of territorial analysis, cluster-based interpretation, and composite indicators has enabled the identification of structural mismatches between tourism potential and actual demand distribution [33–36].

The proposed strategy demonstrates how the combination of soft and hard measures can support the transition from a short-stay, high-pressure tourism model toward a more balanced system based on extended stays and territorial redistribution. By enhancing the role of underutilized areas and improving the integration of mobility, services, and attractors, the framework contributes to the development of more sustainable and resilient tourism systems.

The approach is designed to be replicable and adaptable to other destinations facing similar challenges, offering a practical contribution to the field of sustainable tourism planning and territorial governance.

The whole application is structured on the STESY framework [28, 37, 38]: a robust spatial analytical framework driving from the early stages the strategic design in sustainable tourism for a specific destination area. The framework had been applied in a number of local studies selected among major destinations (i.e. EU Capitals, UNESCO Sites, Environmental global attractors etc.) [39, 40], minor inland tourism areas (i.e. Vulture, Pollino national Park) [41, 42] and niche tourism sites (i.e. Islands) [43–45].

In this paper the main limitation comes from the lack of discussion with local stakeholders. In facts the research was fully development on desk and remotely. It is also relevant to point out how the STESY method effectively supported the process providing a guide to students to start with effective local analysis, to perform meaningful spatial interpretation of a complex phenomenon, to identify design options/solution for a strategic proposal compliant with NUA international principles.

The indicator dashboard included in the STESY platform allows to compare this application with other case study in a significant and effective way, supporting the decision-making process in identifying intervention priority to better plan tourism sector locally benefitting of multi scale assessment options and accountability management of global objective for sustainable and climate responsive design [46–48].

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