TOWARDS AN SDG-BASED COMPOSITE INDEX OF REGIONAL TOURISM SUSTAINABILITY: A METHODOLOGICAL FRAMEWORK FOR THE KHOREZM REGION OF UZBEKISTAN

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Abstract. Official Sustainable Development Goal (SDG) indicators for tourism are compiled at the national level and do not allow a comprehensive assessment of tourism sustainability within regions. This paper proposes a methodological framework for a composite Tourism Sustainability Index (TSI) for the Khorezm region of Uzbekistan. The framework combines the SDG logic and the UN Statistical Framework for Measuring the Sustainability of Tourism (SF-MST) with destination-level indicator systems (UNWTO, ETIS, GSTC), uses hybrid AHP–entropy weighting and limits compensability between dimensions through geometric aggregation. Official 2024 data showing a strong spatial concentration of accommodation capacity in Khiva are used to justify district-level measurement.

Keywords: sustainable tourism, Sustainable Development Goals, composite indicator, tourism sustainability index, regional assessment, Khorezm, Uzbekistan.

Introduction. International tourism has fully regained its growth path: according to UN Tourism, international arrivals reached about 1.52 billion in 2025, 4% more than in 2024, while international tourism receipts are preliminarily estimated at USD 1.9 trillion [1]. Uzbekistan is one of the fastest-growing destinations in this trend. In 2024 the country recorded 7,957.2 thousand inbound trips of foreign citizens for tourism purposes, an increase of 20.1% over 2023 [2], and the “Uzbekistan – 2030” Strategy sets a target of 15 million foreign tourists by 2030 [3]. Rapid growth, however, raises the question of whether it is sustainable, especially in heritage destinations such as Khiva, whose walled inner town Itchan Kala has been a UNESCO World Heritage Site since 1990 [4].

The 2030 Agenda contains three tourism-specific targets (8.9, 12.b and 14.7) [5], but their indicators – tourism direct GDP (8.9.1) and the implementation of standard accounting tools to monitor tourism sustainability (12.b.1) – are compiled for countries, not for regions [6]. Regional authorities therefore lack a tool to monitor whether growth in tourist numbers is accompanied by acceptable social, environmental and governance outcomes. The aim of this paper is to outline a methodological framework for a composite index that fills this gap at the level of a region and its districts.

Literature review. Measuring sustainable tourism with indicators has a long history. The UNWTO guidebook [7] systematised several hundred destination-level indicators grouped by sustainability issues, while the European Tourism Indicator System (ETIS) [8] and the GSTC Destination Criteria [9] provide shorter, internationally comparable sets that cover management, socio-economic, cultural and environmental issues. In 2024 the UN Statistical Commission adopted the SF-MST, which integrates economic, social and environmental data on tourism in a single statistical framework and explicitly allows subnational application [10]. A systematic scoping review by Rasoolimanesh et al. [11] showed that existing indicator sets are only partly aligned with the SDGs and that governance aspects remain under-represented.

Single indicators are difficult to communicate to decision-makers, so many studies aggregate them into composite indices. Blancas et al. [12] built goal-programming synthetic indicators for Andalusian coastal counties; Lozano-Oyola et al. [13] designed indicators for cultural destinations, a context close to Khiva; Torres-Delgado and López Palomeque [14] measured sustainable tourism at the municipal level in Catalonia. Mendola and Volo [15] and Greco et al. [16] reviewed methodological choices in composite indicators and showed that the results depend strongly on weighting and aggregation. A key conceptual issue is the distinction between weak and strong sustainability [17]: additive aggregation implicitly allows a high score in one dimension to offset a low score in another, which contradicts strong sustainability. Blancas and Lozano-Oyola [18] therefore proposed composite indicators with different compensatory levels. In Uzbekistan, recent studies are mostly based on resident or visitor surveys. Karimov et al. [19] surveyed 345 residents of Samarkand, Bukhara and Khiva on 44 sustainability indicators and found weaknesses in heritage preservation, environmental sustainability and infrastructure, but no composite index for a region based on official statistics and the SDGs has been developed so far.

Methodology. The framework follows the ten-step sequence recommended in the OECD/JRC Handbook [20] and adapts it to regional conditions in five stages.

Stage 1 – conceptual framework. Tourism sustainability is treated as a four-dimensional construct: economic, socio-cultural, environmental and governance. The governance dimension links the index to SDG 12.b, 16 and 17 and to section A of the GSTC criteria [9].

Stage 2 – indicator selection. Candidate indicators from UNWTO, ETIS and GSTC are screened by four criteria: relevance to an SDG target, availability at district or city level, measurability over time and comparability with international practice. Indicators

missing from official statistics (e.g., residents' satisfaction, water use per guest-night) are collected through surveys of households and accommodation establishments.

Stage 3 – normalisation. Indicators are normalised with the min–max method, with reversed direction for "negative" indicators such as water use or seasonality.

Stage 4 – weighting. Expert-based AHP weights (w^{AHP}) reflect regional policy priorities, while entropy weights (w^{E}) reflect the information content of the data. The final weight of indicator j is $w_j = \alpha \cdot w_j^{AHP} + (1 - \alpha) \cdot w_j^{E}$, where α is chosen by the researcher and tested in the sensitivity analysis.

Stage 5 – aggregation and robustness. Indicators are aggregated arithmetically within each dimension to obtain sub-indices I_k. The sub-indices are then combined geometrically, $TSI = \prod I_k^{wk}$ (k = 1…4), so that a very low score in one dimension, e.g., environmental pressure on heritage monuments, cannot be fully compensated by high economic results. Robustness is checked by varying α, the normalisation method and the aggregation rule, as recommended in [20].

Empirical justification for the Khorezm region. Khorezm is a suitable case for regional measurement because tourism pressure there is spatially concentrated and environmentally sensitive. Official statistics for 2024 (Table 1) show that Khiva city accounts for 64.3% of hotel beds and 64.4% of guests accommodated in the region.

Table 1.

Hotels and similar accommodation establishments in Khorezm region, 2024

Indicator	Region total	Khiva city	Urgench city	Other areas
Establishments, units	100	57 (57.0%)	27 (27.0%)	16 (16.0%)
Rooms, units	2,441	1,491 (61.1%)	572 (23.4%)	378 (15.5%)
Beds, units	4,955	3,186 (64.3%)	1,041 (21.0%)	728 (14.7%)
Guests accommodated, thousand	177.2	114.1 (64.4%)	49.7 (28.0%)	13.4 (7.6%)
Guests per bed per year	35.8	35.8	47.7	18.4

Tour operators based in Khiva served 482.0 thousand of the 497.5 thousand persons served by travel companies in the region (96.9%) [21]. At the same time, rising groundwater and soil salinisation associated with the Aral Sea crisis have been identified as a direct threat to Khorezm's architectural heritage [22]. A regional average

would conceal these contrasts; the index should therefore be computed for each district and city, which allows benchmarking and the identification of under-used areas where tourism could be redistributed.

The analysis also reveals data gaps that the framework must address. Official statistics do not publish foreign arrivals by region, whereas the regional tourism department reports about 3 million foreign and more than 10 million domestic visitors in the first ten months of 2026 and 347 accommodation establishments [23]; these figures are not methodologically harmonised with official statistics. Environmental and governance indicators are not compiled at the regional level at all. Building the index thus requires combining official statistics with administrative records and primary surveys within a single, documented methodology consistent with the SF-MST [10].

Conclusions. The study leads to the following conclusions:

1. National SDG tourism indicators are insufficient for regional policy. A composite TSI built on the SDG and SF-MST logic and enriched with UNWTO, ETIS and GSTC indicators can make regional tourism sustainability measurable and comparable over time and across districts.
2. Given Khorezm's water scarcity and fragile heritage, the index should rely on strong-sustainability principles: hybrid AHP–entropy weighting combined with geometric aggregation across the four dimensions limits compensation between them.
3. The concentration of 64.3% of hotel beds and 96.9% of tour operator services in Khiva calls for district-level calculation of the index and for policies that spread tourism flows across the region.
4. For regular application, a regional sustainable tourism observatory following the UN Tourism INSTO model [24], involving the regional tourism department, statistics office and local universities, is recommended to collect missing data and publish the index annually.

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