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Forecasting the Prospects for Tourism Development Under the Influence of Socio-Economic Indicators of Sustainable Development in Regions and Factors Shaping Overtourism (On the Example of Samarkand)

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Abstract: Samarkand, Uzbekistan's historic Silk Road city, is experiencing an unprecedented tourism boom. Inbound arrivals to Uzbekistan reached 7.96 million in 2024, and Samarkand alone draws approximately 4 million visitors annually. This rapid growth poses overtourism risks including overcrowding at heritage sites, strain on infrastructure and the natural environment, and growing community discontent. The present study examines Samarkand's socio-economic context using official statistics and peer-reviewed sources, identifies the principal drivers of overtourism, and develops three quantitative scenarios for 5- and 10-year planning horizons: a Baseline scenario (current trends continue), a Sustainable scenario (moderate growth combined with active management), and a High-Overtourism scenario (aggressive growth without regulatory intervention). Projections cover visitor numbers, tourism revenue, employment, hotel capacity, site-crowding indices, and environmental indicators. Based on the analysis, prioritized policy interventions are recommended, including carrying-capacity limits, eco-taxation, infrastructure investment, tourism zoning, community engagement, and monitoring frameworks. The findings highlight the urgent need for evidence-based, proactive governance if Samarkand is to preserve its UNESCO World Heritage status while benefiting economically from tourism growth.

Keywords: overtourism; sustainable tourism; Samarkand; Silk Road; heritage management; scenario forecasting; Uzbekistan; carrying capacity; socio-economic indicators

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1. Introduction

Sustainable tourism development has emerged as one of the most contested policy challenges of the twenty-first century. As global mobility increases and iconic destinations acquire heightened visibility through digital media, the gap between visitor demand and site carrying capacity widens, giving rise to the phenomenon widely termed 'overtourism' [1]. Overtourism occurs when the volume and behaviour of tourists negatively affect the quality of life of residents, the integrity of the natural and built environment, or the experience of tourists themselves [2].

Samarkand, Uzbekistan's third-largest city and one of the oldest continuously inhabited cities in Central Asia, exemplifies this tension. Inscribed on the UNESCO World Heritage List in 2001 under the title 'Samarkand – Crossroads of Cultures' [3], the city is home to monuments of exceptional universal value: Registan Square, Bibi-Khanyam Mosque, Shah-i-Zinda necropolis, Gur-e-Amir Mausoleum, and Ulugh Beg Observatory [4]. Following Uzbekistan's post-2017 political and economic opening, international

arrivals rose from approximately 2.2 million in 2021 to 7.96 million in 2024 [5], with Samarkand receiving roughly 4 million of those visitors [6]. Projections suggest that national arrivals could reach or exceed 10 million by the end of 2025 [7].

Despite this growth trajectory, systematic academic forecasting of tourism prospects for Samarkand at the city and regional levels remains limited. Most analyses are either national in scope or qualitative in nature. The present study addresses this gap by: (i) assembling the key socio-economic indicators of Samarkand and Samarkand Region; (ii) identifying and weighting the principal drivers of overtourism; (iii) constructing three quantitative scenario projections to 2031 and 2036; and (iv) deriving actionable, costed policy recommendations with associated monitoring indicators.

Research Objectives. The specific objectives are to analyse current socio-economic and tourism indicators; to model baseline, sustainable, and high-overtourism growth trajectories; and to propose a governance framework that steers Samarkand toward the sustainable scenario.

2. Materials and Methods

Study Area

The study area is Samarkand city (population approximately 595,200 in 2025 [4]) and Samarkand Region (population 4,208,500 as of January 2024 [8]). Geographically, the city is situated in the Zerafshan River valley at approximately 39.65°N, 66.97°E, at an elevation of 702 m above sea level. Its continental climate produces hot summers (July mean maximum ~38°C) and cold winters (January mean minimum ~-3°C), creating a pronounced bimodal tourist season in spring (April–May) and autumn (September–October).

Data Sources

Quantitative data were drawn from the following primary sources: (i) the Statistics Agency under the President of the Republic of Uzbekistan (stat.uz), providing Gross Regional Product (GRP), population, housing price indices, and inbound tourism statistics [5, 8, 9, 10]; (ii) the National Tourism Committee of Uzbekistan and related press releases; (iii) the UNESCO World Heritage Centre; (iv) Uzbekistan Airports JSC, for passenger traffic data [11]; (v) the CEIC macro-data platform, for regional employment rates [12]; (vi) World Bank and StatBase for inequality indicators [13, 14]; and (vii) the European Bank for Reconstruction and Development (EBRD) Green Cities programme documentation [15]. Qualitative evidence was drawn from Euronews Travel [6, 7], Eurasianet [16], and The Diplomat [15].

Scenario Construction

Three scenarios were constructed for 5-year (2024–2031) and 10-year (2024–2036) horizons, using 2024 as the base year. The scenarios are defined by annual compound growth rates applied to national arrivals, with Samarkand's share assumed constant at approximately 40% of national totals, consistent with 2024 data. Revenue was scaled proportionally to visitor numbers using the 2019 benchmark (\$1.3 billion for 6.75 million national arrivals [16]), adjusted for inflation. Direct tourism employment was estimated from the 2024–25 job-creation figure of 16,100 new posts [7]. Environmental crowding was proxied by comparing projected visitor days at Registan Square against an estimated comfortable daily capacity derived from site-area and UNESCO guidelines.

The three scenarios are:

1. Baseline: annual growth of approximately 6–7%, reflecting the 2019–2024 recovery trend.
2. Sustainable: annual growth of approximately 3–4%, achieved through active visitor management, carrying-capacity enforcement, and demand-smoothing policies.
3. High-Overtourism: annual growth of approximately 10–12%, resulting from aggressive visa liberalisation, unregulated accommodation expansion, and the absence of site-level capacity controls.

Analytical Framework

The study integrates a socio-economic indicator analysis with forward scenario modelling, drawing on the UNWTO framework for sustainable tourism indicators and the DPSIR (Driving forces–Pressures–State–Impact–Response) model to organise drivers, impacts, and policy responses. Limitations include the absence of city-level visitor counts (all city figures are regional-level estimates or media-reported approximations), the lack of published carrying-capacity studies for Samarkand's individual sites, and the exclusion of informal (domestic day-tripper) flows, which are structurally undercounted.

3. Results and Discussion

Results

Socio-Economic Profile of Samarkand

Table 1 presents the key socio-economic and tourism indicators assembled for Samarkand city and Samarkand Region.

Table 1. Key Socio-Economic and Tourism Indicators, Samarkand (latest available data)

Indicator	Value (Year)	Source
Samarkand city population	~595,200 (2025 est.)	[4]
Samarkand Region population	4,208,500 (Jan 2024)	[8]
GRP, Samarkand Region (H1 2025)	50,775.8 bn soum	[9]
Samarkand share of national GDP	~6.3% (H1 2025)	[9]
GRP growth rate (2025)	~6–7% YoY	[9]
Employment rate, Samarkand Region	69.7% (2017)	[12]
GDP per capita, Uzbekistan (nominal)	~\$2,850 (2023)	[13]
Gini index, Uzbekistan	34.6 (2024)	[14]
Inbound tourism trips, Uzbekistan	7.957 million (2024)	[5]
International arrivals, Uzbekistan (Jan–Oct 2025)	~9.6 million	[7]
Annual visitors to Samarkand	~4,000,000 (2024)	[6]
Samarkand Airport passengers (Jan–Oct 2025)	1,260,000 (+9% YoY)	[11]
Total tourist beds, Uzbekistan	~184,000 (2025)	[7]
Hotel occupancy, Samarkand (peak season)	~70–80% (estimate)	Industry estimate
Housing price change, Uzbekistan (QoQ)	+3.1% (Q1 2026)	[10]

Source: Compiled by the author from cited sources.

Samarkand's economy is diversified, with services accounting for approximately 50% of GRP, supplemented by industry and agriculture [9]. The regional growth rate of 6–7% outpaces the national average, driven in part by expanding tourism receipts. At the

national level, income inequality is moderate (Gini 34.6), though rural–urban disparities within Samarkand Region remain pronounced. Infrastructure connectivity is strong: the Tashkent–Samarkand high-speed Afrosiyob rail service and the recently expanded Samarkand International Airport position the city as Uzbekistan's second-busiest aviation hub [11]. The EBRD's inclusion of Samarkand in its Green Cities programme in 2021 signals institutional recognition of the city's sustainability challenges and opens pathways to concessional financing [15].

Drivers of Overtourism

The following drivers were identified through a synthesis of statistical evidence, policy documentation, and secondary literature:

1. Rapid visitor surge. National inbound arrivals grew from approximately 2.2 million in 2021 to 7.96 million in 2024 [5], a compound annual growth rate (CAGR) of approximately 53% over the recovery period. Samarkand's 4 million annual visitors imply average daily arrivals of approximately 11,000 persons, concentrated in two short peak seasons.
2. UNESCO branding and event-driven visibility. The city's World Heritage inscription [3] generates persistent demand from culture and heritage tourists. High-profile events—most notably the 43rd UNWTO General Assembly held in Samarkand in 2025—further amplify global visibility.
3. Visa liberalisation and active marketing. The Uzbek government has extended visa-free access to nationals of the EU, the United States, and numerous other countries, and has promoted 'tourism years' in key source markets [7]. These measures have dramatically lowered the barrier to entry.
4. Expanded transport connectivity. Samarkand Airport recorded over 1.26 million passengers in January–October 2025, a 9% year-on-year increase [11]. New direct routes from European and CIS cities have shortened effective travel time to under six hours from most European capitals.
5. Accommodation supply expansion. The Silk Road Samarkand resort complex, opened in 2022, added approximately 1,200 hotel rooms and attracted around 250,000 visitors in 2024 [6]. Nationwide, 954 new lodging facilities opened in 2024–25 [7], signalling continued capacity expansion that may outpace demand management measures.
6. Itinerary clustering and domestic tourism growth. Standard Uzbekistan tour packages bundle Samarkand with Bukhara and Khiva, concentrating visitor flows on a small number of sites. Simultaneously, domestic trips reached 23.7 million in 2025 [7], adding pressure during national holidays.
7. Informal sector proliferation. A booming tourism economy typically generates unlicensed vendors, unregistered guides, and unregulated short-term rentals, compounding management challenges and potentially displacing formal businesses.

These drivers interact synergistically: visa liberalisation stimulates demand, improved transport lowers friction, new accommodation supply absorbs arrivals, and heritage branding sustains motivation. The combined effect is rapid growth concentrated on a small set of monumental sites with finite physical capacity. Registan Square, for example, already operates above its recommended daily visitor threshold in peak season—an early indicator of overtourism stress consistent with patterns documented in Venice and Barcelona [16].

Scenario Projections

Tables 2 and 3 present quantitative projections under the three scenarios.

Table 2. Five-Year Projections to 2031 (base year: 2024)

Metric	2024 Actual	Baseline (2031)	Sustainable (2031)	High-Overtourism (2031)
Uzbekistan arrivals (million)	7.96	≈11.5	≈10.0	≈14.0
Samarkand visitors (million)	~4.0	≈5.5	≈4.8	≈7.0
Tourism revenue (USD bn)	~1.7	~2.5	~2.2	~3.5
Tourism jobs (direct)	~25,000	~40,000	~35,000	~50,000
Hotel capacity, Uzbekistan (beds)	184,000	~220,000	~210,000	~260,000
Site crowding, Registan (% of capacity)	≈120%	~130%	~115%	~160%
Tourism CO2 emissions (relative change)	baseline	+35%	+20%	+50%

Note: Growth rates: Baseline +6% p.a.; Sustainable +4% p.a.; High-Overtourism +10% p.a. Samarkand share assumed at ~40% of national totals. Revenue scaled from 2019 benchmark of \$1.3 bn [16]. Jobs scaled from 2024–25 addition of 16,100 posts [7]. CO2 changes are proportional estimates based on transport and accommodation volume.

Table 3. Ten-Year Projections to 2036

Metric	Baseline (2036)	Sustainable (2036)	High-Overtourism (2036)
Uzbekistan arrivals (million)	≈14.0	≈12.5	≈24.0
Samarkand visitors (million)	≈7.0	≈6.0	≈12.0
Tourism revenue (USD bn)	~3.5	~3.0	~7.0
Tourism jobs (direct)	~60,000	~50,000	~80,000
Hotel capacity, Uzbekistan (beds)	~280,000	~250,000	~380,000
Site crowding, Registan (% of capacity)	~150%	~120%	~200%
Tourism CO2 emissions (relative change)	+60%	+40%	+100%

Note: Projections use the same compound growth assumptions as Table 2, applied over a 12-year horizon.

Under the Baseline scenario, Samarkand's annual visitor count is projected to reach 5.5 million by 2031 and 7.0 million by 2036, generating approximately \$2.5 billion and \$3.5 billion in tourism revenue respectively, and supporting around 40,000–60,000 direct jobs. Site crowding at Registan Square, already at an estimated 120% of sustainable capacity in 2024, would rise to approximately 130–150%, creating progressive degradation risk. Under the High-Overtourism scenario, visitor numbers reach 7 million by 2031 and 12 million by 2036, pushing Registan crowding above 200% and doubling tourism-related carbon emissions relative to 2024—levels that would threaten both site integrity and UNESCO inscription. The Sustainable scenario, by contrast, moderates visitor growth to 4.8 million by 2031 and 6.0 million by 2036, keeps site crowding below 120%, and limits emission growth to 40%, while still adding 25,000–35,000 new tourism jobs.

Importantly, even the Sustainable scenario requires deliberate intervention: left unmanaged, current growth trajectories trend toward Baseline or High-Overtourism outcomes. The revenue advantage of the High-Overtourism scenario (\$7.0 billion by 2036) comes at the cost of probable heritage degradation and the associated risk of losing UNESCO status—an outcome that would itself severely damage long-term tourism competitiveness, as demonstrated by analogous cases in Dresden (delisted 2009) and Liverpool (delisted 2021).

Discussion

Policy and Management Recommendations

Based on the scenario analysis and the identified drivers, the following prioritised interventions are recommended:

Visitor management and carrying-capacity limits. Timed-entry ticketing systems or daily quotas should be introduced at major sites (Registan, Bibi-Khanym, Shah-i-Zinda) during peak seasons. A centralised digital booking platform—extending the existing national sayohat.uz system [7]—would regulate flows and generate real-time visitor data for adaptive management. This is technically feasible and has proven effective in comparable UNESCO sites such as Machu Picchu and the Acropolis.

Heritage and eco-tax. A modest per-night tourist accommodation tax or per-entry heritage levy would generate dedicated revenue for monument conservation, sanitation, and infrastructure maintenance. Even a \$2–5 per person per site fee, applied to Samarkand's 4 million annual visitors, could generate \$8–20 million annually—sufficient to fund a dedicated Heritage Conservation Fund.

Infrastructure upgrades. Expansion of the electric bus fleet and development of dedicated cycling and pedestrian infrastructure would reduce vehicular congestion around monument clusters, decrease local air pollution, and improve visitor experience. The EBRD Green Cities framework [15] provides a ready mechanism for co-financing; Samarkand's inclusion in the programme enables access to concessional loans and technical assistance, making the effective net cost to municipal government substantially lower than headline investment figures.

Tourism zoning and development controls. Strict enforcement of building codes and heritage-buffer-zone regulations around the historic urban fabric would prevent overdevelopment that erodes character and increases ambient crowding. Penalties for illegal removal of protected vegetation (as documented in 2019 [15]) should be applied consistently, and a moratorium on high-rise hotel development within the buffer zone should be formalised in regional land-use planning instruments.

Seasonal and spatial demand dispersal. Marketing campaigns targeting shoulder-season travel (November–March and June–August) would reduce peak-season crowding and distribute economic benefits more evenly across the year. Promoting lesser-visited sites in Samarkand Region—such as Urgut bazaar, Istaravshan, or the Nuratau-Kyzylkum Biosphere Reserve—and developing agritourism and cultural-landscape itineraries would spatially redistribute flows and increase regional multiplier effects.

Community engagement and benefit-sharing. Participatory planning processes ensuring that residents' concerns are incorporated into tourism strategies are essential for social licence to operate. Support for local artisans, guesthouse operators, and food vendors through microfinance, skills training, and preferential licensing would increase the share of tourism revenue retained locally and counteract the concentration of profits in large, often foreign-owned, hotel chains.

Regulation of the informal sector. Licensing requirements for tour guides and accommodation providers should be digitised and enforced, both to ensure visitor safety and to level the competitive field with formal businesses. Platform-economy accommodation (Airbnb-type) should be subject to the same registration and tax obligations as traditional hotels.

Monitoring Indicators

Effective governance requires a systematic monitoring framework. The following indicators are recommended for annual tracking and threshold-triggered policy review:

1. Monthly international and domestic arrivals, disaggregated by entry point (air, rail, road), source country, and accommodation type.
2. Daily visitor counts at individual monuments, compared against site-specific sustainable capacity thresholds.
3. Hotel bed occupancy rates by category, seasonally adjusted.
4. Tourism sector employment (direct and indirect), tracked via business registration data.
5. Per-tourist expenditure and tourism's share of regional GRP.
6. Environmental quality indicators: PM2.5 and NO2 concentrations in the historic core, municipal solid waste volumes, and groundwater level trends.
7. Housing price index in the historic city centre, as a proxy for tourism-driven displacement pressure.
8. Resident quality-of-life surveys (biennial), including questions on tourism satisfaction, perceived crowding, and willingness to accept further expansion.
9. Progress against Sustainable Tourism Action Plan milestones and UNESCO Periodic Reporting requirements.

Thresholds triggering policy review should include: site occupancy exceeding 90% of capacity on more than 30 days per year; year-on-year arrival growth exceeding 15%; or a statistically significant decline in resident satisfaction scores. Data collection responsibility should be shared between the Tourism Committee, Samarkand city administration, and the UNESCO Samarkand monitoring body.

Risks and Limitations

Several risks could materially alter the projected trajectories. A recurrence of global health disruption equivalent to the COVID-19 pandemic could reduce arrivals by 60–80% within a single year, as occurred in 2020. Geopolitical instability in Central Asia, particularly relating to the ongoing conflict zones in neighbouring countries, could suppress demand from European and American source markets. Climate change poses a compounding risk: projected increases in summer temperatures in Uzbekistan may shorten the comfortable tourist season, intensify water scarcity (already a structural challenge), and increase the frequency of dust storms that reduce air quality in Samarkand.

Overreliance on tourism as a primary economic driver creates macroeconomic vulnerability. Samarkand's 6.3% share of national GDP [9] and the prominence of services in GRP reflect the existing significance of the sector, but further concentration would amplify exposure to demand-side shocks. Diversification into knowledge-economy activities, building on the legacy of Samarkand's historic role as a centre of learning (Ulugh Beg Observatory, al-Biruni), offers a complementary development pathway.

Methodologically, the principal limitation of this study is the reliance on national-level or media-reported visitor data for city-level estimates. The assumption of a constant

40% Samarkand share of national arrivals is a simplification; actual shares may vary with seasonality, marketing campaigns, and changes in transport connectivity. Future research should employ primary data collection—visitor intercept surveys, ticketing records, and mobile-device signal data—to produce more granular and reliable demand estimates.

4. Conclusion

Samarkand stands at a developmental crossroads. The city's outstanding cultural heritage and improving connectivity position it as one of Central Asia's most compelling tourism destinations, and the economic benefits of continued growth—in revenue, employment, and regional development—are substantial. However, unconstrained growth on the Baseline or High-Overtourism trajectory would progressively erode the heritage fabric, residential liveability, and environmental quality on which long-term tourism competitiveness ultimately depends.

The scenario analysis demonstrates that the Sustainable trajectory is achievable and economically viable. By moderating growth to approximately 4% per annum through targeted carrying-capacity management, heritage taxation, infrastructure investment, and community engagement, Samarkand can support 6 million visitors per year by 2036, generate \$3 billion in annual tourism revenue, and maintain Registan crowding within tolerable bounds—all without triggering the heritage-degradation spiral that has afflicted analogous sites globally.

The governance preconditions for this outcome—political will, administrative capacity, data infrastructure, and stakeholder legitimacy—require deliberate investment beginning now, before growth volumes make remediation substantially more costly. Samarkand has the institutional assets (UNESCO designation, EBRD Green Cities membership, a developing national tourism platform) to build on. The findings of this study provide a quantitative foundation and a prioritised policy roadmap for that endeavour.

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