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Article

Sustainable city tourism—A systematic analysis of Budapest and Mumbai

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Abstract: International Tourist arrivals, guest nights and their contribution to GDP are key indicators reflecting a country's actual perception. A growing percentage of tourists prioritize environmental awareness across tourism products and services each year. Destinations aiming to meet the expectations of eco conscious travellers must center sustainability in their branding strategies. This approach aligns with UNWTO (World Tourism Organization of United Nations) Agenda 2030 of sustainable tourism development. This paper examines various dimensions of sustainability in tourism, focusing on Mumbai and Budapest. Using specific sustainability indicators, it employs sustainability city index to compare international tourism in these cities, which face distinct environmental and infrastructural challenges. By using specific sustainability indicators such as: (1) Carbon Emissions: Measurement of the total greenhouse gases produced by the city. (2) Proportion of Green Public Spaces: Evaluation of the percentage of urban areas dedicated to parks and natural spaces. (3) State of Infrastructure: Assessment of the quality and sustainability of urban infrastructure, including transportation systems. (4) Water Usage: Analysis of the amount of water consumed by the city and its conservation practices. (5) Waste Management: Review of the city's effectiveness in managing and recycling waste. (6) Air Pollution: Monitoring of the levels of pollutants in the air to assess environmental health. This research provides a comprehensive view of how cities can attract environmentally conscious tourists. The findings offer guidance for policy makers and tourism professionals to align strategies with sustainable development goals. This detailed assessment highlights each city's commitment to sustainability and delivers actionable insights for improving tourism strategies in accordance with global standards. While valuable for tourism professionals, it is important to note that this research covers only six SCI factors, with incomplete data for studied countries. The practical and social implications indicate areas needing improvement to enhance tourist appeal, beneficial for industry professionals and educational purposes. This comparative analysis aids in promoting sustainable tourism and can guide governments in achieving sustainability goals with raising awareness of environmental quality and conscious living.

Keywords: sustainable tourism development; destination marketing; urban tourism; comparative analysis; environmental quality

1. Introduction

The term "sustainability" is becoming more popular in current times, and the world is increasingly concerned about economic, environmental, and societal changes. Today's organisations face a range of economic, social and environmental challenges

and have a significant impact on their environment, so to ensure sustainable outcomes, organisations need to take greater responsibility for the environmental problems caused by their activities (Lukács and Papp-Váry, 2024; Miah et al., 2024; Papp-Váry et al., 2023; Vinkóczi et al., 2023, 2024). There are a number of views to make it applicable to present day scenarios. Sustainability is defined as "the integration of environmental health, social equity, and economic vitality in order to create thriving, healthy, diverse, resilient communities for this generation and generations to come", as defined in the Charter of UCLA Sustainability Committee. This promotes responsible use of resources prioritizing the safety of current and future generations. Ancient Indian Architecture exemplifies sustainable practices having pioneered green engineering centuries ago. The authors aim to integrate sustainability into tourism industry.

Tourism plays a vital role in economic growth, with city tourism catalyzing, revitalizing urban and regional economies. Significantly contributes to any economy (Avgoustis and Achana, 2002). Future strategies may involve repositioning of cities to reshape their image and attract diverse visitor segments (Coronel et al., 2022). Sustainability initiatives can enhance a Country's branding (Papp-Váry, 2018).

Notably the G20 Summit 2023 emphasizes on "One Earth, One Family, and One Future" advocating a unified commitment to responsible lifestyles for a cleaner, greener future. In 2022, Indian travel and tourism sector contributed 15.7 trillion to the economy and projected to rise to 37 trillion in the next decade. The COVID-19 pandemic severely impacted global tourism (Kangai et al., 2024), highlighting the need of robust itinerary planning and destination ranking frameworks, like F-TOPSIS successfully applied in assessing. Varanasis's tourist destinations under new normal conditions (Srivastava et al., 2022).

The Pandemic has considerably impacted urban tourism reshaping interactions between local residents and visitors (Aman et al., 2024; Page and Duignan, 2023). This shift calls for a focus on sustainable tourism, a developing concept encouraging adoption of responsible practices crucial for economic resilience. Urban tourism management should prioritze sustainability and resource allocation. The prudent use of natural resources and inclusive development is essential for environmental and economic stability as seen in Ukraine's Kuyalnyk estuary where therapeutic mud integration has brought regional benefits despite funding challenges (Kostetska et al., 2021).

Sustainable tourism aims to enriching experiences for visitors while preserving Country's environmental and cultural heritage (Aman et al., 2023; Bódis and Papp-Váry, 2021; Coronel et al. 2022; Smith et al. 2018).

1.1. Theoretical background

Sustainability and the environment are some of the most popular issues of modern times, which also serve as a social goal (Gyurián Nagy and Gyurián, 2023). The concept of sustainability, tracing its roots back to the Brundtland Commission, signifies the interconnection between human activities and the escalating environmental degradation. The commission defined sustainability as "development that meets the needs without compromising the ability of future generations to meet their own needs", stressing the responsibility to preserve resources for the future.

According to the World Tourism Organization, sustainable tourism fulfills the needs of current tourists and host regions while safeguarding and enhancing prospects for the future. This involves managing resources to meet economic, social, and aesthetic needs while preserving cultural integrity, essential ecological processes, biological diversity, and life support systems.

Sustainability should not be viewed in isolation but rather as a system theory emphasizing interconnected components, spanning various disciplines including Engineering, Planning, Sociology, Ecology, and Agronomy. The framework proposed by Elinor Ostrom underlines the significance of considering all system levels, components, and external settings in sustainability decision-making, drawing from Environmental Quality and Justice, Social Economy, Community Economic Development, and Eco-localism.

Environmental Quality and Justice calls for global governments to prioritize a clean and green environment. Social Economy and Community Economic Development encompass community-led initiatives for environmental and social well-being, while Eco-localism promotes local self-reliance and the development of local economic activities and products. Furthermore, sustainable city tourism encompasses aspects such as green cities, eco-cities, low-carbon cities, and smart cities (Kanuri, 2016).

The necessity of sustainable development is rooted in historical practices of traditional societies, which emphasized minimalistic ownership and the use of natural materials, thus maintaining environmental balance. Contrastingly, modern consumerist societies have led to excessive use of non-degradable items, causing strain on the environment.

Sustainability is largely based on the environmental attitudes of consumers and its importance cannot be communicated in one way to different consumer groups (Balassa et al., 2024).

Since the early 1970s, humanity has surpassed the Earth's carrying capacity, using nearly double the finite resources available. The ecological footprint (EF) indicator (see **Figure 1**) developed by Wackernagel and Rees (1996) vividly illustrates the disproportionate consumption of resources. This overconsumption is reflected in the Earth Overshoot Day, which arrives earlier every year, highlighting the urgency of sustainable resource management. In that respect, we cannot forget the importance of education (Annus, 2017, 2021).

The Earth's carrying capacity is finite, and while exact calculation of its limits is challenging, it is essential to consider the capacity for both human and other species. Furthermore, the well-being associated with modern societies has led to an increase in material wealth but has also given rise to a greater prevalence of psychological disorders. These indicators point to an unsustainable trajectory. Additionally, modern economies rely on the use of resources, often at the expense of other communities and the environment, exacerbating global poverty. Two environmental strategies are commonly pursued: more efficient resource utilization, exemplified by energy-saving technologies such as LED lighting, and emissions reduction, as seen in the development of electric vehicles. Both strategies aim to enhance production and consumption. However, greater efficiency often leads to increased consumption, making sustainability untenable in the long run.

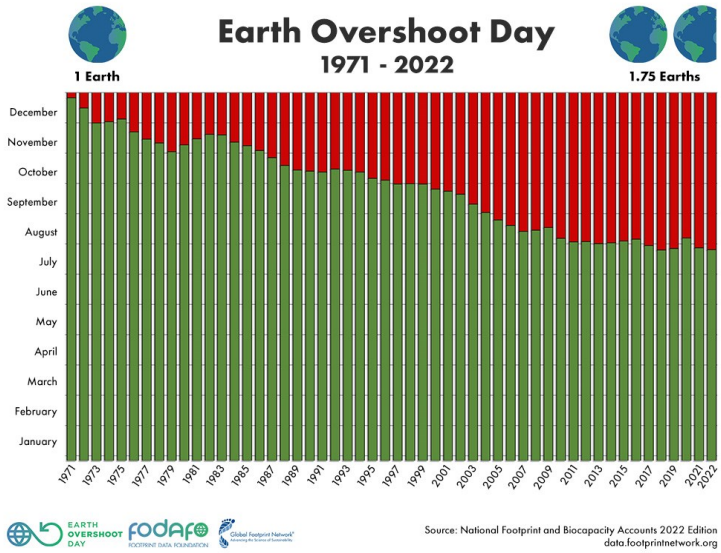

Figure 1. Ecological footprint and earth overshoot day.

Source: Global Footprint Network. (n.d.).

Maintaining the current way of life involves three critical factors: raw materials, energy, and money. While money can be created and energy sources can be replenished to some extent, many materials used in products cannot be completely recycled even in a circular economy. Therefore, increased efficiency may only buy time rather than provide a definitive solution. The current knowledge and resources available cannot sustain infinite growth, making it evident that our trajectory is not sustainable. Even in an ideal society, the finite availability of resources would present challenges. However, the reality is far from ideal, with phenomena like global warming, pollution, and the loss of biodiversity marking the course of technical civilization. These factors hasten an inevitable endpoint, as evidenced by the finite history of technical civilizations, as hypothesized by Von Hoerner's theory and the Fermi paradox. Hence, it is of utmost importance that the young generation be aware of these facts, be more environmentally cautious, and live a more sustainable life (Lukács et al., 2023; Szeberényi, Rokicki, et al., 2022; Szeberényi, 2022). The challenges of sustainable development raise not only theoretical questions but also practical problems. Research on battery production indicates that public opinion expresses concern about sustainability, the labor market, and environmental protection, emphasizing the importance of stricter regulations and public education (Remsei et al., 2023). According to research on workplace discrimination, vaccination requirements can have a significant impact on employees and may hinder sustainable development by exacerbating social inequalities (Poór et al., 2021).

Despite the seemingly apocalyptic nature of this trajectory, human history is characterized by resilience and action. As former Prime Minister of Hungary, József Antall, remarked, "I am a pessimist, but I act as if I am an optimist." This perspective encourages proactive engagement with challenges. The urgency for action is evident, particularly regarding the concerning trend of increasing CO_2 and methane emissions. These greenhouse gases have surged since the industrial revolution, posing significant consequences, especially as methane contributes to heightened warming compared to CO_2 (see **Figure 2**).

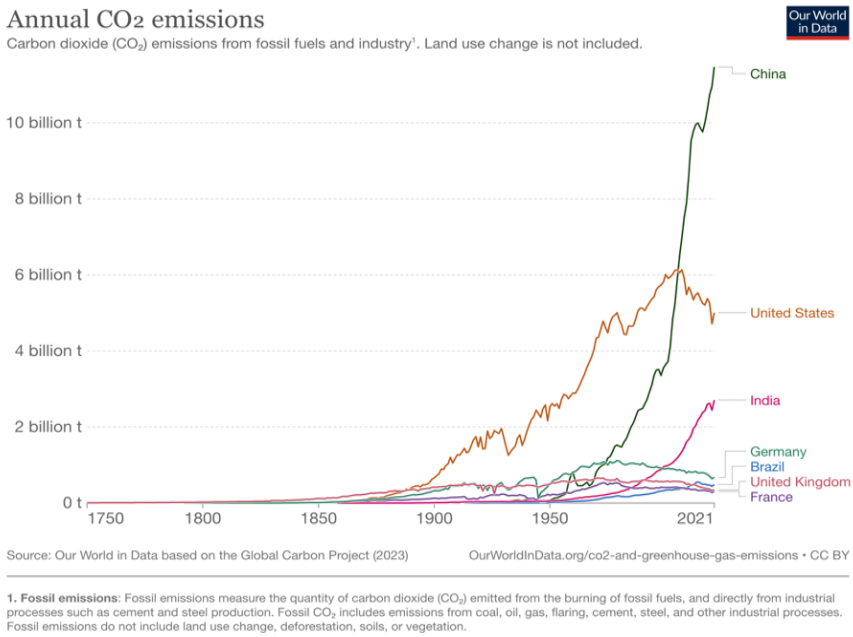

Figure 2. Annual CO_2 emissions (1750–2021).

Source: Our world in data.

1.2. Sustainable development in tourism

The impact of globalization, increased mobility, and economic progress has led to a resurgence in tourism. The UN World Tourism Organization (UNWTO) is a global body that focuses on studying and analyzing tourism. According to their definition, tourism can be considered sustainable when it satisfies the needs of visitors, hosts, and service providers while also taking into account the current and future economic, social, and environmental impacts of the activity (UNWTO, 2023). The analysis of the economic and social impacts of the COVID-19 pandemic highlighted that sustainability and the adaptability of cities are essential for managing crises and maintaining competitiveness (Poór et al., 2023). Metropolitan areas are intricate and expansive systems that must prioritize the concerns of their residents. These include tackling climate change, decreasing CO2 emissions, addressing youth unemployment, ensuring efficient transportation and healthcare services for both residents and individuals with disabilities, and enhancing local and regional economies (Florido-Benitez, 2024).

Sustainable tourism positively impacts host communities by providing stable employment, income and social services. It also preserves cultural heritage, traditional values and fosters cross cultural understanding and tolerance.

Furthermore, it emphasizes the importance of maintaining ecological processes and the preservation of natural heritage and biodiversity through responsible use of environmental resources. The aim is to provide a meaningful and satisfying experience for tourists while also raising awareness about sustainability, thereby encouraging the practice of sustainable tourism. In the context of sustainability, the commonly used measure is resource productivity, and this has a specific interpretation within the tourism sector.

2. Methodology

Most of the world's international tourism is directed to big cities. These destinations are further the sustainability of tourism in urban areas presents a significant concern due to the pronounced distance from natural environments in comparison to rural areas. Accordingly, the analysis of sustainability indices for cities holds particular importance. In this study, the authors utilized the publicly available Sustainable Cities Index (SCI) developed by Corporate Knights Inc. This index assesses six factors: greenhouse gas emissions, air quality in terms of dust pollution, the proportion of open public spaces, transport accessibility, water and waste management, and sustainability policy.

Notably, only Mumbai was included in the SCI, while data for Budapest had to be sourced and calculated from alternative references. First, the population and floor area of Budapest were determined, and data from Google's GHG emissions database (Google EIE, 2023) was utilized. The authors simplified the analysis of greenhouse gas emissions to focus on vehicle-related emissions, aligning with the definition of Scope 1 emissions provided by Vallinder and Farbstein (2023). The decision to exclude heating-related emissions from the analysis was based on the climatic characteristics of Mumbai, which diminishes the significance of heating-related emissions in the city.

Considering the unavailability of Budapest's data in the SCI, the authors derived the city's greenhouse gas emission information through calculations. This involved utilizing the method introduced by Broekhof et al. (2019), where the total emissions were determined by aggregating GHG emission data from buildings and vehicles. Subsequently, 37% of this total was considered as consumption emissions, reflecting the approach outlined by Broekhof et al. (2019).

Relating to air quality, the authors obtained information about particulate matter concentration (PM 2.5 particles: 23 $\mu g/m^3$) from the Air Quality Index data (AQI, 2023).

The proportion of green public areas, a crucial sustainability indicator for cities, was sourced from the Statista Research Department (2023). Data regarding the density of the road network was extracted from Eurostat (2020) statistics, and the proportion of environmentally friendly mobility was reported by Giaume (2022). The authors also sourced data on water access and consumption from various sources, including the KSH (2022) statistics and the Metropolitan Water Works (2023).

By employing these diverse sources and methodologies, the authors aimed to ensure a robust analysis of the sustainability factors for both Mumbai and Budapest.

The comprehensive assessment of sustainability includes the evaluation of a country's resilience to climate change and environmental impacts (NDG, 2023), which facilitates country ranking (NDG, 2021). The ND-GAIN index assesses a country's vulnerability to climate change and global impacts across six crucial sectors: food, water, health, ecosystem services, human habitat, and infrastructure. Preparedness is measured by evaluating a country's capacity to invest in adaptation measures. This index aids in effective investment categorization. The NDG index is derived by aggregating two datasets: preparedness level and vulnerability level. While the NDG methodology uses a specific formula for aggregation, the SCI in this study computes

the index using the ratio of readiness to vulnerability. As the NDG ranks countries and the SCI ranks cities, determining Budapest's NDG index value was necessary. This involved calculating Budapest's ND-GAIN index score using Hungary's preparedness and vulnerability quotient, derived from the ratio of India's and Mumbai's NDG index.

The final index value in the SCI reflects the number of sustainability-related regulations established by the city administration. Analyzing Budapest's case, the national environmental protection and sustainability laws and programs were taken into account, with the data (Oppla, 2017) indicating a total of four such regulations, equating to one-fifth of Budapest's score. Although the methodology does not outline the calculation of the sub-indicator's point value, it is confirmed to fall between 0 and 1. According to the study, a value of 0.8 was assigned based on the prior calculation. This was deemed appropriate since the score for Mumbai in this indicator is 0, rendering the ratio calculation unfeasible. Ultimately, Budapest's indicator scores were aggregated using the specified weights in the SCI methodology (Torrie and Morson, 2023), resulting in the calculation of Budapest's overall SCI score.

3. Results

Table 1. SCI scores of examined cities.

City	**Mumbai**	**Budapest***
Country	**India**	**Hungary**
Region	**Asia-Pacific**	**Europe**
Overall score	24.04	30.30
Rank in Year 2023	65	54
Scope 1 GHG Emissions score	0.27	0.25
Consumption-Based GHG Emissions score	0.29	0.32
Particulate Air Pollution score	0.06	0.13
Open Public Space score	0.02	0.33
Road Infrastructure Efficiency	0.16	0.02
Sustainable Transport score	0.55	0.42
Vehicle Dependence	0.11	0.07

Table 1. (*Continued*).

City	**Mumbai**	**Budapest***
Country	**India**	**Hungary**
Region	**Asia-Pacific**	**Europe**
Water Access score	0.46	0.57
Water Consumption score	0.38	0.38
Solid Waste Generated score	0.58	0.58
Climate Change Resilience score	0.29	0.55
Sustainable Policies score	0.00	0.80

Sources: Torrie and Morson (2023)—Bombay data; * = authors' own calculation—Budapest data.

In **Table 1**, a comprehensive summary of the results achieved by the authors is presented.

Please take note of the following information:

Interpreting the table requires an understanding that a higher score consistently indicates a more favorable outcome and a higher ranking. A comparison of the results reveals that both cities perform similarly in per capita water consumption and solid waste generation. This similarity can be attributed to the common characteristics of large cities, such as high population density leading to increased waste production and water consumption. However, differing factors, such as geographical location and country development, influence specific aspects. For instance, access to piped water is more prevalent in Budapest compared to Mumbai.

When considering infrastructure and sustainable transport, Mumbai demonstrates a more favorable score primarily due to its dense road network, ten times more than that of Budapest. The score for transport sustainability is also favorable, attributed in part to a higher poverty rate, resulting in fewer private vehicles per household and a greater reliance on walking or cycling. Mumbai's well-organized and developed public transport further contributes to its favorable score. Additionally, Mumbai's Scope 1 GHG emissions from vehicles and heating are in a more favorable position compared to Budapest, as Mumbai has lower vehicle density and no cold seasons. Conversely, Budapest performs better in GHG emissions related to consumption, possibly due to the adoption of modern, environmentally friendly technologies, as well as its targeted green policy.

Notably, Budapest's climate readiness index is higher, and vulnerability index is lower compared to Mumbai, indicating a higher degree of preparedness and lower vulnerability.

Additional sustainability factors, such as tourism and public safety, are considered important. According to the Sustainable City Index report by Corporate Knights in 2023, Budapest ranked 25th and Mumbai ranked 72nd, influenced by indicators such as attractions and nightlife. Public safety, a crucial aspect for sustainable tourism, is quantified by the TSA index, with scores below 33 indicating high danger, scores between 33 and 66 indicating moderate danger, and scores above 66 indicating safety. Mumbai scored 49, while Budapest scored 76, indicating a notable difference in perceived safety for tourists.

4. Conclusions

The importance of sustainable cities is clearly outlined in the United Nations Sustainability framework and goals (UN Department of Economic and Social Affairs, 2015) and it is imperative for cities to take steps towards sustainability. This research study delves into a comprehensive analysis of various factors that influence sustainable tourism, including but not limited to greenhouse gas emissions, air quality, and pollution. It specifically focuses on the cities of Budapest and Mumbai, examining their Sustainable Cities Index (SCI) scores. The goal is to provide actionable insights for their respective governments to pursue Sustainable Development Goals (SDGs) and achieve sustainable tourism, ultimately leading to the creation of safer, more inclusive cities for residents and visitors alike.

The research paper aims to raise awareness among readers about the importance of environmental quality, the protection of human rights, and a mindful way of living

that demonstrates empathy for the environment and oneself. It serves as a clarion call about the perils of environmental degradation and urges all stakeholders—including governments, citizens, and youth—to actively participate in the transition towards sustainable tourism. This transformative shift is expected not only to enhance environmental and social well-being, but also to drive job creation in the tourism industry and make significant contributions to the GDP of the respective nations.

Author contributions: Conceptualization, SM; methodology, BGK; validation, JG; formal analysis, ZZ; investigation, VL; writing—original draft preparation, SMS and AT. All authors have read and agreed to the published version of the manuscript.

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