Towards a Smarter and Sustainable Life: An Examination of Tourists' Perceptions on Instituting Smart Cities in Oman

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Abstract

This paper examines international tourists' perceptions of Smart Sustainable Tourism Destinations (SSTDs) within the context of Oman's emerging smart city initiatives. Using a mixed-method approach, the study integrates pre-trip sentiment analysis from 1,740 YouTube comments with post-trip survey responses from 50 tourists and 8 structured interviews conducted in Mutrah, Sohar, and Nizwa. Guided by the 6 A's model and Smart Tourism Destination Framework, the research explores how digital infrastructure, sustainability practices, and smart technologies influence tourist experience, satisfaction, and revisit intentions. Findings reveal generally positive perceptions, specifically in contrast to regional competitors like Dubai and Saudi Arabia. However, there are precautions towards some technologies like AI and blockchain. Factor analysis revealed that attractions (0.897), ancillary services (0.816), and activities (0.895) had the strongest loading components. Similarly, regression analysis showed that attractions (r = 0.686), activities (r = 0.680), and accessibility (r = 0.618) had the highest positive coefficients.

Key Words

Smart Tourism Destination, Sustainable Tourism, Tourist Perception, Digital Infrastructure, Smart City Technologies, Tourist Experience

Track: *Market and Concept Innovations*

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Introduction

The last decade has seen a significant increase in digitalization and sustainability in tourism around the world. Smart tourism has been developed as a response to the need for greater efficiency, enhancement of tours, and a smoother integration between the tourist and resident experiences (Tavitiyaman et al., 2021). Despite growing interest in SSTDs, most academic focus has remained on planning and infrastructure, with limited insight into how these developments are perceived by actual users, especially tourists (Corrêa & Gosling, 2020). Understanding perception is critical, as the success of such initiatives relies not just on innovation but also on how they are received by the public (Politeknik & Bandung, 2022).

In Oman, smart developments in tourist dense areas are limited, therefore, it was crucial to see how current systems are benefitting tourists and what else could enhance their experiences (Sameer N. et al., 2022). Oman is also aligning with Vision 2040 by embedding smart city elements into its development plans to integrate technology that fits global trends in destinations while maintaining local identity (Oman Vision 2040).

This paper investigates the perceptions tourists have about Oman's tourism destinations from a general destination perspective (i.e., big picture) to a more specific technological perspective (i.e., small details), using post-trip survey and interview data, as well as pre-trip narratives based on user-generated content like YouTube comments. The combination of these data sets together will help clarify the tourist's perception on smart tourism, leading to recommendations that could shape the future success of Oman's smart tourism.

Literature Review

Defining Sustainable Smart Tourism Destination

The concept of a sustainable smart tourism destination (SSTD) is a relatively new paradigm that is reshaping trends in tourism while also being an innovative approach to enhancing competitiveness in the tourism industry (Muthuraman & Al Haziazi, 2019; Badri & Hmioui, 2021; Lasisi et al., 2023). While there are multiple definitions of 'Smart Cities', some academics have provided the following:

Table 1. Smart Cities Definitions

Definition	Citation
"A city that monitors and integrates conditions of all of its critical infrastructures, including roads, bridges, tunnels, rail/subways, airports, seaports, communications, water, power, even major buildings, can better optimize its resources, plan its preventive maintenance activities, and monitor security aspects while maximizing services to its citizens."	(Hall et al., 2000)
"a city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance."	(Caragliu et al., 2009)
"A city connecting the physical infrastructure, the IT infrastructure, the social infrastructure, and the business infrastructure to leverage the collective intelligence of the city."	(Harrison et al., 2010)
"Smart cities will take advantage of communications and sensor capabilities sewn into the cities' infrastructures to optimize electrical, transportation, and other logistical operations supporting daily life, thereby improving the quality of life for everyone."	(Chen, 2010)
"Being a smart city means using all available technology and resources in an intelligent and coordinated manner to develop urban centers that are at once integrated, habitable and sustainable."	(Barrionuevo et al., 2012)

These definitions show that smart cities involve strategic investments in physical and human capital, supported by ICT, to improve quality of life and promote sustainability (Hall et al., 2000; Caragliu et al., 2009).

However, Smart Tourism Destinations (STDs) differ by explicitly recognizing tourists as central stakeholders (Anda Zvaigzne et al., 2023; Cerdá-Mansilla et al., 2024). This people-focused approach aligns with global sustainability goals and ensures that technology serves long-term environmental and social outcomes. Effective implementation depends on strategic planning across all levels (Samancioglu et al., 2024). When sustainability is integrated into STDs, the result is a more holistic and inclusive tourism environment that benefits communities, travelers, and the planet (Shafiee et al., 2019).

Conceptual Models of Sustainable Smart Tourism Destinations

Two of the most prominent models regarding SSTD include the 6 A's Model (Buhalis & Amaranggana, 2015) and the Smart Tourism Destination Framework (Boes et al., 2016).

Dimitrios Buhalis, a Strategic Management and Marketing expert, developed a model emphasizing the importance of maintaining six key aspects to create the smart application of SSTD. These aspects, which were showcased in multiple studies under different terminologies, are known as the 6 A's, including (Buhalis & Amaranggana, 2015; Muthuraman & Al Haziazi, 2019):

1. Attractions: natural or man-made
2. Accessibility: transport systems to and within the destination
3. Amenities: essential tourist services like accommodation and restaurants
4. Available packages: organized tourism bundles
5. Activities: cultural or recreational experiences
6. Ancillary services: supporting systems like healthcare and safety

The second model, developed by Boes and Buhalis (2016), is the Smart Tourism Destination Framework, which consists of three main stages: smart contributions, smart processes, and smart outcomes.

The first stage, smart contributions, is composed of three core elements (Boes et al., 2016):

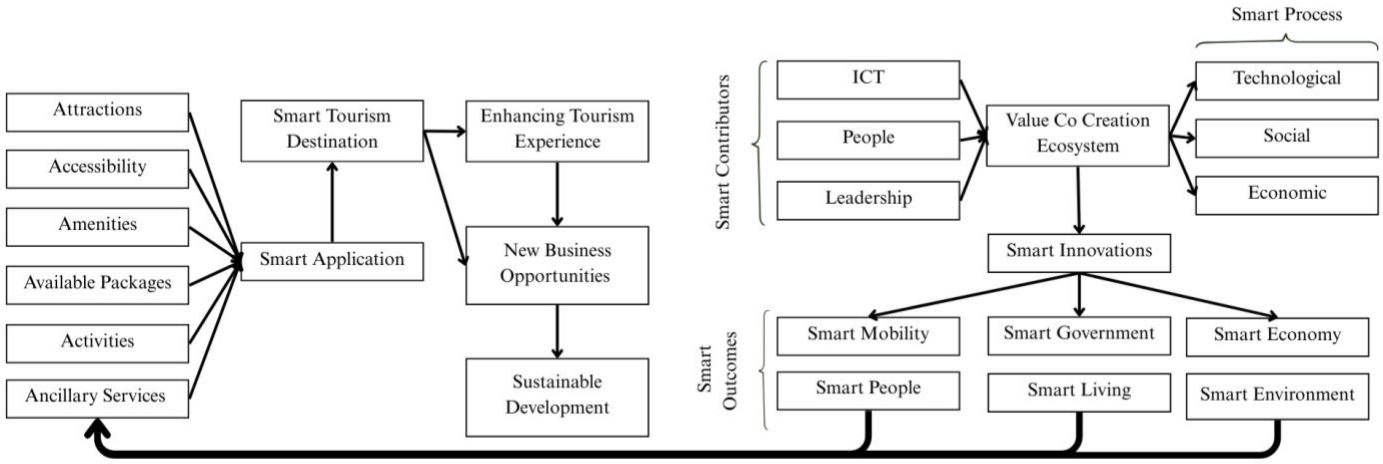
1. ICT (Information and Communication Technology): This includes the Internet of Things (IoT), cloud computing, and big data analytics, all of which play a crucial role in collecting, processing, and utilizing information to enhance tourism experiences and destination management.
2. People: Referring to human capital, social capital, and knowledge management, emphasizing the importance of skilled professionals, engaged communities, and knowledge-sharing practices in driving smart tourism forward.
3. Leadership: Including destination management, policy-making, and regulatory frameworks, ensuring that tourism development aligns with both technological advancements and sustainability goals.

In the smart processes stage, social, economic, and technological actors interact to co-create value. Examples include smart mobility, digital governance, and real-time analytics for efficient service delivery and resource use (Wang, 2024).

Finally, smart outcomes represent a fully integrated system defined by smart mobility, governance, economy, people, living, and environment. These outcomes reinforce the elements of the 6 A's Model and contribute to the long-term success of SSTDs.

Both models are visually integrated in Figure 1, presenting SSTDs as a continuous cycle focused on enhancing tourism and sustainable development.

Figure 1. Integration of 3 SSTD Models (Buhalis & Amaranggana, 2015, Boes et al., 2016, and Muthuraman & Al Haziazi, 2019)



Technological Foundations and Sustainable Applications in Smart Tourism Cities

The satisfaction and experiences of tourists in smart tourism cities are deeply influenced by the technologies in place. Traditionally, smart city development focused on infrastructure and operational efficiency, but there is a growing emphasis on user-centered approaches that directly enhance visitor engagement. According to Lee et al. (2020), key technologies like IoT, cloud computing, and sensor networks are essential for optimizing city functions such as energy use and traffic flow. However, their view remains infrastructure-focused, overlooking tourists as direct stakeholders.

In contrast, Javed et al. (2022) present a more tourism-centric view, positioning tourists as both value creators and consumers. They highlight the role of interactive platforms, digital maps, and mobile apps in delivering real-time, personalized experiences. While Lee emphasizes efficiency and scalability, Javed supports a shift toward visitor-centered design that integrates social and cultural sustainability.

A similar theme appears in literature discussing Intelligent Transportation Systems (ITS). ITS utilizes technologies such as Vehicular Ad hoc Network (VANETs), smart traffic lights, and mobility prediction to reduce congestion and enhance transport efficiency (Elassy et al., 2024). These systems also support sustainability by cutting emissions and improving environmental outcomes, positively shaping tourist perceptions of a city's environmental responsibility.

The integration of IoT with ITS, as explored by Musa et al. (2023), goes further by tackling challenges like real-time traffic management and safety through incident detection and advanced signal coordination. In parallel, Smart Energy Systems (SES) aim to increase sustainability by applying IoT and tools like EnergyPLAN (Lund et al., 2021) to enhance energy efficiency and integrate renewables.

Ultimately, smart tourism cities must combine strong infrastructure with accessible, meaningful technologies that center the visitor. Both experiential and operational elements are essential to achieving sustainable urban tourism. Aligning efficiency with human needs will support long-term success and public trust in smart destination development.

Methodology

Research Design

This study uses a mixed-methods approach to assess tourists' perceptions of SSTD in Oman, using three data sources: YouTube comments, a structured questionnaire, and structured interviews. Data was collected at Mutrah, Nizwa, and Sohar. The research framework integrates five hypotheses examining pre-trip expectations,

smart tourism experience, sustainability, satisfaction, and revisit intentions. SPSS will be used for quantitative analysis, while interviews validate survey findings. The framework explores relationships among smart applications, sustainability, and tourist behavior. Hypotheses are based on the influence of digital tools, services, and perceived value. YouTube videos analyzed include: "Why Oman's $5B Smart Cities Are Different" and "Oman's $2.6B 'Smart City' Megaproject," totaling 2,500 comments.

Data Collection

A sample size of 196 was calculated using a 15% population portion and a 95% confidence level. Six structured interviews were conducted with international visitors at the selected locations. An online questionnaire was distributed via QR codes at hotels, tourist sites, and agencies. It covered smart tourism features, sustainability, satisfaction, and revisit intention using a 5-point Likert scale. Interviews followed similar themes, recorded via phone or in person. YouTube comments were collected using exportcomments.com, then analyzed in ATLAS.ti and Google Colab using sentiment and word cloud analysis.

Data Analysis

SPSS was used for descriptive, factor, and regression analyses. Cleaned YouTube comments (1,740 total) were analyzed for sentiment using VADER in Google Colab. Phrase detection and comparison keywords identified trends in public perception. Triangulation was applied to identify overlaps between survey, interview, and comment data, improving validity.

Ethical Considerations

Ethical standards per APA and BERA were followed. Digital consent, anonymity, and GDPR compliance were ensured. Participation was voluntary, with rights to withdraw. Limitations include non-probability sampling and possible response bias. YouTube identities were anonymized. Interviews were kept private, and participants could skip questions freely.

Results

This study examines tourists' perception of SSTD from pre-trip (YouTube comments) and post-trip (survey and interview) perspectives. A total of 50 respondents and 6 interviews were conducted, while 1,740 YouTube comments were analyzed after cleaning.

Pre-Experience Expectations

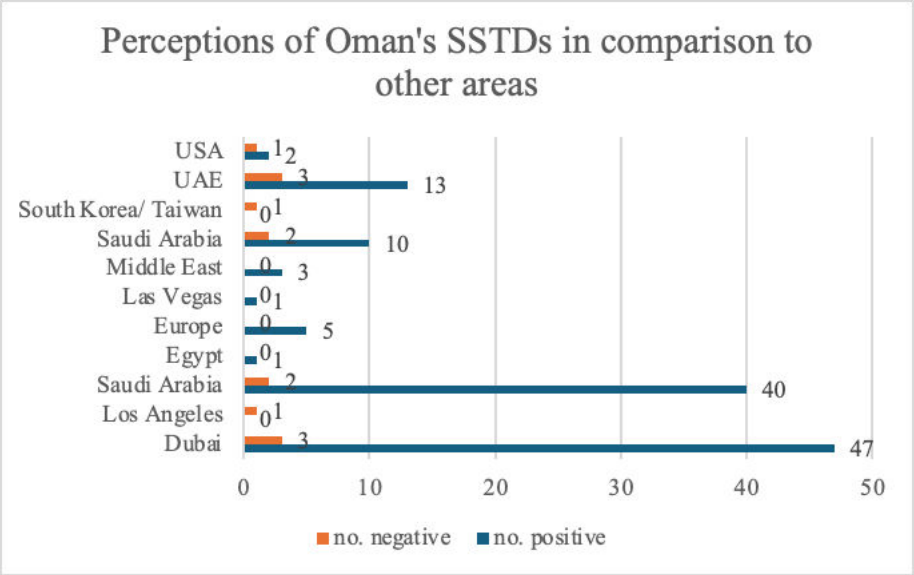
YouTube comments from two videos were analyzed using Google Colab and ATLAS.ti. Most used positive adjectives like "good," "beautiful," and "modern," suggesting perceptions were cautiously optimistic. Minimal negative terms like "bad" and "long" were used, with "western" seen negatively for diminishing cultural identity.

Figure 3. Word Cloud of YouTube Comments Perceptions of Oman

Comparative Perceptions

Dubai and Saudi Arabia were most frequently compared, with Oman seen more positively. Europe, USA, and East Asia were mentioned less frequently. Oman is viewed as a more sustainable alternative, but comparisons raise expectations.

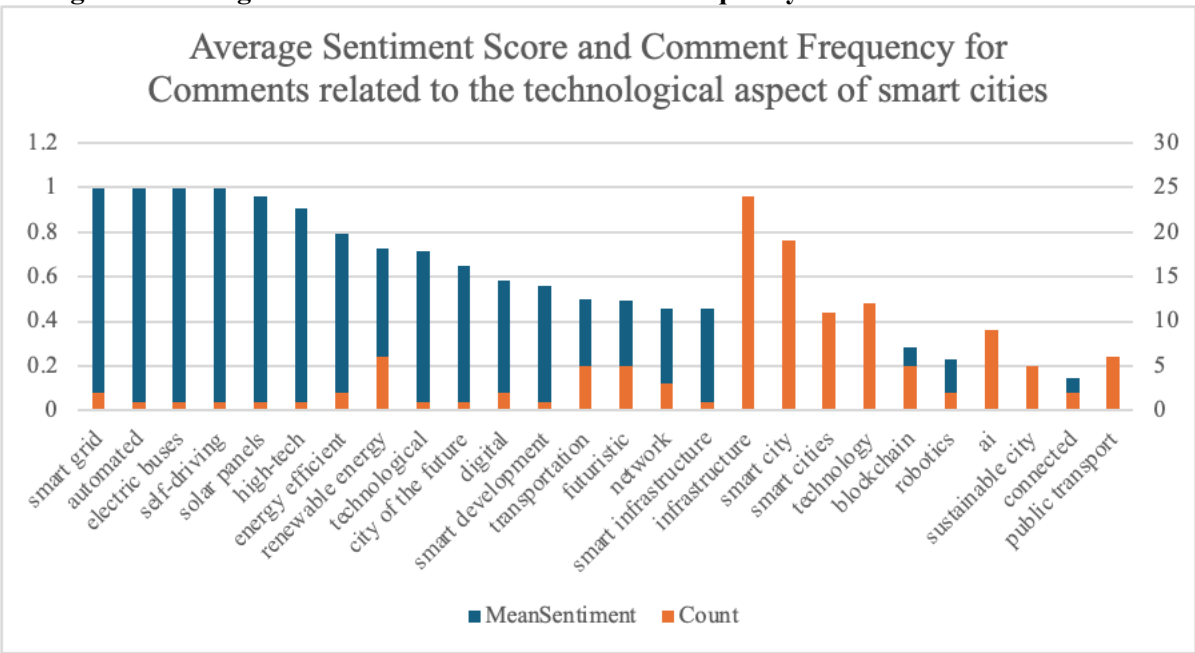
Figure 4. Perception of Oman's SSTDs in comparison to other cities/countries/areas



Sentiment Scores of Tech Comments

Technologies like smart grids and electric buses scored highest (~0.99) but had few mentions. Energy-related tech had high scores (0.73–0.96), while mid-range scores (0.45–0.58) were seen in digital systems and smart networks. The most discussed (e.g., AI, blockchain) had lowest scores (0.11–0.28), reflecting public skepticism and low trust.

Figure 5. Average Sentiment Score and Comment Frequency for SSTD Related Elements



Descriptive Characteristics of Respondents

The largest group was 18–25 years old (46%), mostly European (46%). Most had bachelor's degrees or higher. Interviewees showed diversity in income and travel frequency.

Table 2. Demographic Profile of Respondents

Demographic Variables	Description	Frequency	Percentage
Age	18-25	23	46.0%
	26-35	15	30.0%
	36-45	9	18.0%
	46-55	2	4.0%
	56-65	1	2.0%
Gender	Male	23	46.0%
	Female	27	54.0%
Marital Status	Single	30	60.0%
	Married	15	30.0%
	Other	5	10.0%
Level of Education	Less than high school diploma	3	6.0%
	Highschool Diploma	4	8.0%
	Bachelor's Degree or equivalent	21	42.0%
	Master's Degree or equivalent	19	38.0%
	Doctoral degree	3	6.0%

Nationality	Australia	1	2.0%
	Central Asia	2	4.0%
	East Aisa	1	2.0%
	Europe	23	46.0%
	Middle East	7	14.0%
	North Africa	3	6.0%
	North America	6	12.0%
	South Asia	6	12.0%
	Southeast Asia	1	2.0%
Annual household income	$110,001 to $130,000	5	10.0%
	$130,001 to $150,000	6	12.0%
	$50,001 to $70,000	11	22.0%
	$70,001 to $90,000	7	14.0%
	$90,001 to $110,000	3	6.0%
	Less than $50,000	13	26.0%
	More than $150,000	5	10.0%
Number of travels per year	2–3 times a year	24	48.0%
	4–6 times a year	11	22.0%
	More than 6 times a year	4	8.0%
	Never	1	2.0%
	Once a year	10	20.0%

There is an equal number of interviewees who were female and male, where most stated they are single (75%). Furthermore, the largest age group interviewed were 18-25 year-olds (50%), following is 46-55 year-olds (37.5%), and lastly 26-35 year-olds (12.5%).

Table 2: Demographic Profile of Interviewees

No.	Age	Gender	Marital Status	Education Level	Nationality Region	Annual Household Income	Number of Travels per Year	City Visited	Purpose of Visit
1	18–25	Female	Single	Bachelor's degree	South Asia	$70,001–$90,000	4-6	Nizwa	Leisure
2	46–55	Male	Married	Master's degree	South Asia	$50,001–$70,000	4-6	Sohar	Leisure

No.	Age	Gender	Marital Status	Education Level	Nationality Region	Annual Household Income	Number of Travels per Year	City Visited	Purpose of Visit
3	46–55	Male	Married	Doctoral degree	North Africa	$50,001–$70,000	2–3	Sohar	Leisure
4	26–35	Female	Single	Doctoral degree	Middle East	$50,001–$70,000	More than 6	Nizwa	Business
5	46-55	Male	Single	Master's degree	Europe	More $150,000	More than 6	Mutrah	Business
6	18-25	Female	Single	Master's degree	Middle East	$70,001–$90,000	2-3	Mutrah	Business and leisure
7	18-25	Female	Single	Highschool Diploma	Europe	$50,001–$70,000	2-3	Mutrah	Leisure
8	18-25	Male	Single	Bachelor's degree	Middle East	$50,001–$70,000	Once a year	Sohar	Leisure

Smart Tech Use During Trip

Table 3. Respondents' Use of Smart Technology and Applications

Variables	Description	Frequency	Percentage
Smart Devices Used	Smart Phone	49	98.0%
	Tablet	11	22.0%
	Camera	14	28.0%
	Apple Watch	10	20.0%
Smart Technology Applications Used	Navigation apps	47	94.0%
	Mobile Payments	35	70.0%
	Charging Stations	4	8.0%
	Power Bank rental kiosk	5	10.0%

Augmented Reality apps	2	4.0%
Guide apps	11	22.0%
Traffic rerouting apps	7	14.0%
Hotel booking sites	35	70.0%
Flight and transportation booking	17	34.0%
City-wide Wi-Fi	12	24.0%
E-Scooter Rentals	6	12.0%
Taxi apps	22	44.0%
Translation apps	7	14.0%
Currency converter apps	15	30.0%
Self-check-in kiosks	3	6.0%
Smart luggage tracking apps	4	8.0%

Phones (98%), navigation apps (94%), and booking sites (70%) were widely used. VR and smart kiosks scored low. Interviews reflected similar findings, with tourists expecting improved digital infrastructure. Participants in interviews mostly mentioned using basic smart technologies like navigation apps and mobile booking services, which they found essential for smooth travel. These tools were especially useful in navigating unfamiliar areas and finding accommodation. However, most had little interaction with advanced technologies like VR/AR or smart kiosks. Some said they hadn't seen or been offered such options. One interviewee noted, "Yes, but it's somewhat limited. It should be improved, AI-based, more available, and network issues should be resolved." This reflects a broader expectation for better integration of advanced technologies, showing that Oman's smart tourism experience is still developing.

6 A's Framework

Table 3. Results of Factor Analysis

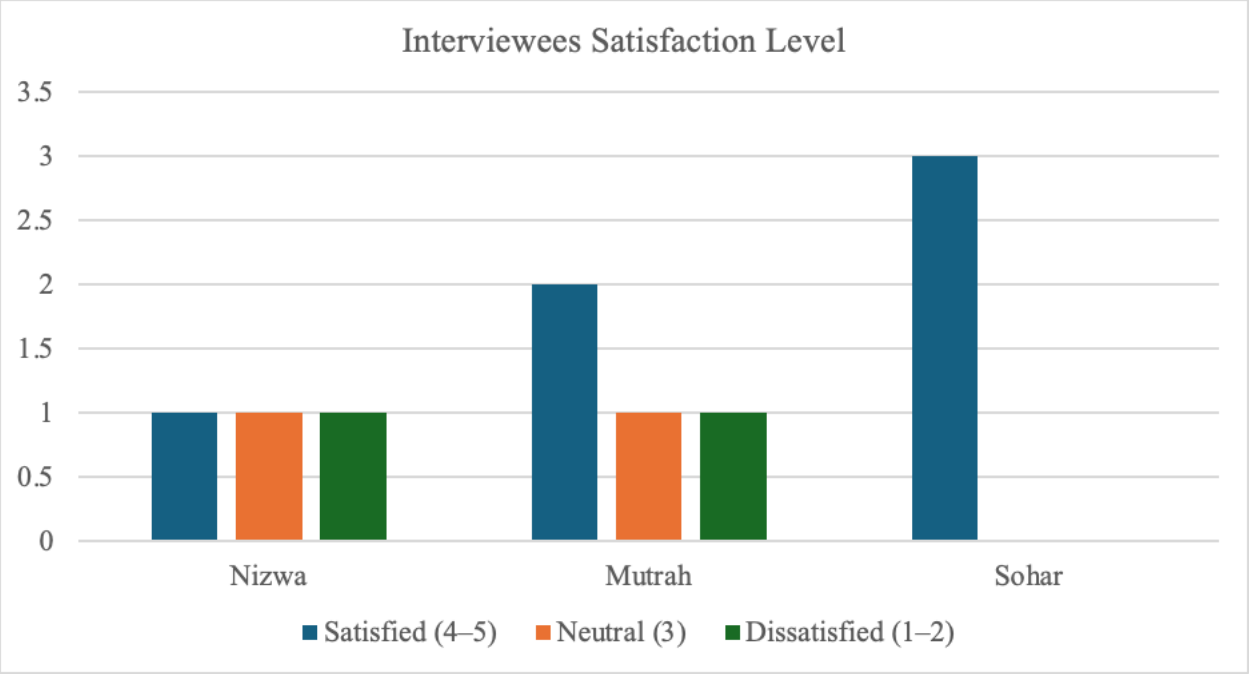
Item	Coefficient	Communalities	Component
Accessibility	0.618	0.467	0.684
Amenities	0.593	0.597	0.772
Attractions	0.686	0.804	0.897
Available Packages	0.515	0.641	0.800
Activities	0.680	0.802	0.895
Ancillary Services	0.505	0.666	0.816

The 6 A's showed moderate positive correlations, highest between attractions and activities ($r = 0.696$) and lowest between accessibility and ancillary services ($r = 0.505$). Communalities ranged from 0.467 to 0.804, with attractions and activities best represented, and accessibility the least. These values show how much variance in each variable is explained by the factor. All variables loaded strongly onto a single component, Smart Tourism Experience, with loadings from 0.684 to 0.897. This confirms that the 6 A's align well, reflecting a shared underlying dimension and supporting their use as a unified construct in the model.

The interviews supported the study findings with rich insights. One tourist called Oman's amenities "well-arranged and within reach," but another noted a "lack of quality and authenticity," showing a gap between access and experience. Language barriers also affected access, as locals like taxi drivers often struggled with English. Transportation access varied, while Mutrah had a tour bus, a Sohar tourist said only taxis or private cars were available, adding, "Taxis are expensive and not always available." Regarding activities and packages, responses were neutral. Tourists wanted better planning tools, noting tech suggestions were helpful but lacked personalized or organized local options.

Sustainability, Satisfaction & Revisit Intention

Figure 6. Interviewees' Stated Satisfaction Level



Perceived sustainability was mainly explored through interviews, as its integration in Omani tourism remains limited. Most participants barely mentioned it. One noted, "Sustainability is linked to being a smart city," calling for better infrastructure in Suhar. This shows tourists connect sustainability with smart development. Overall satisfaction was moderate ($r = 0.562$), while revisit intention was weaker ($r = 0.444$), possibly due to limited smart or sustainable features. Though tourists were generally satisfied, many felt the experience lacked innovation. Still, all expressed interest in revisiting, suggesting natural beauty and cultural appeal matter more than digital tools for overall satisfaction. As one participant said, "My decision is not based only on digital tools. The people are kind, and the city has a special charm."

Discussion

The study highlights tourist perceptions of Sustainable Smart Tourism Destinations in Oman (SSTDs) from both pre-trip and post-trip. This paper has only two prior studies that matched this paper's model, which is the first of its kind in the Omani context.

For the pre-trip insights, the comments were analyzed through two different YouTube videos: "Oman's $2.6B 'Smart City' Megaproject Is Disrupting the Dubai Archetype" and "Why Oman's $5B Smart Cities Are Different", highlighting YouTube comments as a qualitative basis. Some online respondents shared how Oman is

leaning toward becoming a smart destination. “The best middle eastern project I’ve seen so far. Nice to see some countries actually understand city planning,” stated one user. Another wrote, “Finally, a sensible and reasonable project. Well done, Oman, well done indeed.” A third comment added, “Good job Oman for keeping these developments realistic! Seems like a great contrast to the UAE.” This indicates delight in Oman compared to more luxurious neighbors, among 1,740 comments. These perceptions offer value. Oman can leverage this image by branding itself with its unique identity as a culturally grounded destination, committed to sustainability goals.

Surveys and interviews were conducted in Mutrah, Nizwa, and Sohar. Fifty survey responses showed moderate to high correlation between attractions and smart tourism experience, measured by the 6As: attractions, accessibility, amenities, available packages, activities, and ancillary services. Six semi-structured participants were interviewed. Most interviewees travel over two times a year, with technology important for travel. Participants highlighted the importance of smart technology such as navigation apps and Google Maps. Interviews showed positive feedback on technology use, especially social media. “I usually check the local bloggers and all the Instagram pages.” However, one participant noted: “We had to download a specific app just to order a taxi.” Most participants stated they did not interact with VR or AR. One commented, “The useful information is somehow limited, it should work in a better way, it should use AI, be more available, and the network is sometimes down.”

Literature supports these concerns. Javed et al. (2022) and Lee et al. (2020) state that smart tourism needs strong digital infrastructure. Experts (Hall et al., 2000; Caragliu et al., 2009; Harrison et al., 2010; Chen, 2010; Barrionuevo et al., 2012) noted that smart cities require investment in ICT. This paper's results match prior findings and expand on them using multiple data sources to show how tourists experience and process information today.

Conclusion

This study evaluated tourists' views on SSTDs in Nizwa, Sohar, and Mutrah. YouTube comments reflected belief in their potential, while survey data showed strong correlation between the six A’s (0.505–0.686). Interviews supported the findings. The research emphasizes embedding sustainability in smart tourism to enhance satisfaction and revisit likelihood. It introduces evaluation criteria for projects like Sultan Haitham and Yeti Sustainable City. Oman should invest in smart infrastructure, improve stakeholder collaboration, and launch educational initiatives to raise awareness. These efforts will support effective SSTD adoption and align with Oman Vision 2040 for inclusive tourism development.

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