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Technology for Tourism: A Guideline for Best Practices

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A R T I C L E I N F O

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A B S T R A C T

This research employs a comprehensive analysis of technological advancements pertinent to the development of the tourism sector. Drawing upon a synthesis of pertinent literature, the study delineates two primary objectives: firstly, to elucidate the technological attributes relevant to tourism within the framework of Maslow's Hierarchy of Needs, and secondly, to scrutinize the trajectory of technological trends in the tourism industry. Employing a descriptive methodology, the research encapsulates both tangible and intangible facets of these technologies. Identifying existing research lacunae, the study underscores the pivotal role of technology in fostering economic sustainability and growth within the tourism sector. Emphasizing the imperative for innovation via investment in technology, the research advocates for heightened awareness among stakeholders. The study concludes with robust recommendations urging stakeholders to comprehend tourist psychology, devise policies conducive to technological investment, and adeptly manage resources to ensure optimal industry functionality and sustained economic growth.

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INTRODUCTION

Since the advent of the wheel, technological advancements have continually aimed at enhancing efficiency, spurring further innovation and demand. Kondratiev underscored the transient nature of technology, subject to rapid obsolescence due to ongoing innovation and entrepreneurial endeavors (Drucker, 1993). The contemporary landscape has ushered in a mandate for digitalization, Information Communication Technology (ICT), and diverse modes of destination access (Afsahhosseini, 2020; Kiran, 2018; Gössling, 2021; Chowdhury & Giacaman, 2015). Virtualization (pre-visit) and physical visitation synergistically facilitate tourist exploration, revisitation, and nostalgic experiences. Critical scenarios such as over-tourism, crisis management, and emergencies hinge heavily on technological advancements and their efficacy (Santana, 2004; Morakabati et al., 2016; Ribeiro et al., 2023). Wei & Zhou (2024) emphasize tourists' inclination towards destinations evoking nostalgia and offering adequate visibility. Zimik and Barman (2022) conducted an in-depth study highlighting the pivotal role of technology and management in attracting tourists. Consideration of technology's application at destinations suggests that tourist behavior can be predicted through virtual pilot surveys and practical experiences. Notably, tourism can be categorized into tangible and intangible aspects, elucidated comprehensively through tabulations.

Tabulation 1. Features of Technology for Tourism

Tangible	**Intangible**
Infrastructure	Safety/Security
Facilities	Hospitability
Environment	Internet of Thing
Destination	Online Management Tools
Ambience	CRM
Hotels	Guide Assistance

Source: Author Compilation

The 4IR (Fourth Industrial Revolution)

It is imperative to acknowledge the global phenomenon of technological revolution, which fundamentally alters technology, often independently of political and socio-economic changes. The evolution through all four Industrial Revolutions (IR) has witnessed significant paradigm shifts in technology: from the mechanization of labor (1765), to mass production (1870), followed by automation through information technology (IT) and mechatronics (1969), culminating in the present era's focus on the Internet of Things (IoT) and artificial intelligence (AI). This trajectory underscores the direct correlation between technologies and historical epochs. Paradoxically, while the Fourth Industrial Revolution (4IR) signifies a transformative period for many industries, including tourism, unlike its predecessors, it lacks a singular, industry-wide revolution, which warrants further investigation. However, the demand for transformation necessitates constant technological innovation. Consequently, the 4IR mandates industries to embrace adaptability, thereby enhancing productivity and efficiency. Moreover, 4IR initiatives aim to bridge the infrastructure gap between developed and underdeveloped nations,

fostering basic investment in the latter. The 4IR emphasizes the integration of technology across the "4A's" of tourism—Accommodation, Attraction, Accessibility, and Amenity—to meet the evolving expectations and requirements of tourists. These advancements predominantly belong to the realm of intangible aspects, as elucidated in Table 1. Social interactions, hospitality, leisure amenities, online customer relationship management (CRM), and IoT integration emerge as pivotal factors shaping tourists' expectations at destinations. Given the influence of previous Industrial Revolutions, the 4IR strives to enhance and redefine how industries are perceived by tourists and stakeholders alike. This study elucidates the impact of the 4IR on industries and underscores the imperative for adaptation and technological integration to meet evolving demands.

Aim and Scope

Given the pivotal role of technology and amenities in fostering the growth of tourism industries, there is a pressing need to delve into the specific implications of technology on these sectors. This study aims to meticulously dissect technology's role and assess its impact, enriching both scholarly analysis and industry well-being. Existing literature overwhelmingly underscores the positive effects of technology on enhancing industry performance. However, this study seeks to go beyond surface-level discussions and address research gaps comprehensively. Through a focused review, it endeavors to elucidate how technology uniquely serves the tourism sector and evaluate its effects. The study contends that despite acknowledgments of technology's importance, detailed research in this domain remains scarce, emphasizing the necessity for in-depth exploration beyond cursory examinations.

Objectives

The main objectives of the study are mention as below:

1. To describe the technology features for tourism industries with reference to Maslowian Triangle
2. To analyze the prevailing trends in technology adoption within the tourism industries

LITERATURE REVIEW

While existing literature recognizes technology's role in fostering significant economic growth and improving the socioeconomic status of host communities (Stipanuk, 1993), there remains a dearth of comprehensive research specifically focused on technology within the tourism sector. Through an examination of relevant concepts and scope (see Table 1), this review aims to address this gap.

Tangibleness

Initiating with tangible applications, Khadaroo and Seetanah (2014) emphasize motels, recreational facilities, and leisure amenities as integral tourism infrastructure. Oladimeji et al. (2023) highlight technology's

widespread impact on transportation modes, while Koutoulas (2015) underscores its secondary effects on industrial products. Cai et al. (2019) employ systematic literature review methods to assess tourist interactivity as a metric for technology application in the industry. Yetimoğlu (2005) notes tourists' orientation towards phenomena, influenced by destination technology status. Anaya and Lehto (2020) observe technology's evolving role in travel practices. Tsai et al. (2009) contend that technology offers a competitive edge for tourism. Employing descriptive methodology, this study elaborates on issues via the Travel and Tourism Competitiveness Index. Mandic et al. (2018) employ mixed methods to correlate destination infrastructure and tourist influx. Sonja and Ivana (2016), alongside Khadaroo and Seetanah (2008), affirm technology's tangible elements as crucial for tourism development. Statistical analysis reveals infrastructure investment's positive impact on tourist attraction (Nguyen, 2021; Zimik & Barman, 2023). Munaf et al. (2018) argue for technology's necessity in natural and ecotourism destinations.

Intangibleness

The integration of various technological advancements has emerged as a pivotal strategy in enhancing visitor satisfaction, safety, and overall experience (Sustacha et al., 2023; Dwivedi, 2023). In response to the recurring challenge of managing mass tourist exodus, managerial competency has been underscored, necessitating the inevitable incorporation of technology (Toker & Emir, 2023). Biometric applications, encompassing CCTVs, fingerprint scanning, GPRS, and voice recognition systems, have been advocated for their efficacy in bolstering safety measures and organizational performance (Zimik & Keishing, 2022). Moreover, technological infrastructures such as digital and mobile systems, internet connectivity, and online services have been instrumental in fortifying safety protocols (Shrestha et al., 2020). Notably, the advent of smart tourism, facilitated by technologies like online services and the Internet of Things (IoT), has garnered significant attention (Zhang et al., 2022). Extensive research elucidates the positive impact of IoT adoption on tourism, with smart tourism initiatives attracting a greater influx of tourists and fostering satisfaction and revisitation (Chowdhury et al., 2022; An & Shin, 2020). Furthermore, the augmentation of tourist satisfaction is attributed to IoT-derived amenities such as smart city infrastructure, online payment systems, and digital ticket booking platforms (Rosário & Dias, 2024). The intangible benefits of technology, particularly in enhancing tourist interactions with local communities, have been emphasized (Dionisio et al., 2019). Methodologically, panel vector autoregression models have been employed to discern the positive correlation between interactive tourism and technological innovations (Zimeng et al., 2023). Strategic technological implementations, including kiosks, artificial intelligence, smart tourist guidance systems, mobile applications, IoT, and virtual reality, are recognized as pivotal in the development of the tourism industry and the augmentation of tourist experiences (Topsakal et al., 2022).

The study comprehensively analyzes literature on technology in tourism, focusing on its tangible and intangible contributions. It highlights a gap in

research concerning the detailed exploration of technology's role. This study aims to inform policies and investments for sustainable tourism development and economic viability.

Additionally, the study could raise a serious research questions (RQn) as follows:

RQ1: What are the technologies impacting the tourism industry?
RQ2: What are the various technological features that can enhance the tourism industtry
RQ3: How will technology improve tourists' experiences during their visits?
RQ4: What is the current status of technology at tourist destinations?

METHODOLOGY

To address the gaps in literature regarding the technological features impacting industries, a descriptive methodological approach was employed. Secondary data from diverse sources including research journals, books, and websites were utilized. The justification for adopting a descriptive methodology, as asserted by Veal (2018), was based on factors such as the novelty of the field, the dynamic nature of the study area and industry trends, and the potential positive impact on industries resulting from a detailed exploration. This study underscores the importance of reevaluating technology within the tourism sector to ensure its sustainability and development in alignment with the stated objectives.

RESEARCH RESULT AND DISCUSSION

Tourism Technology Features

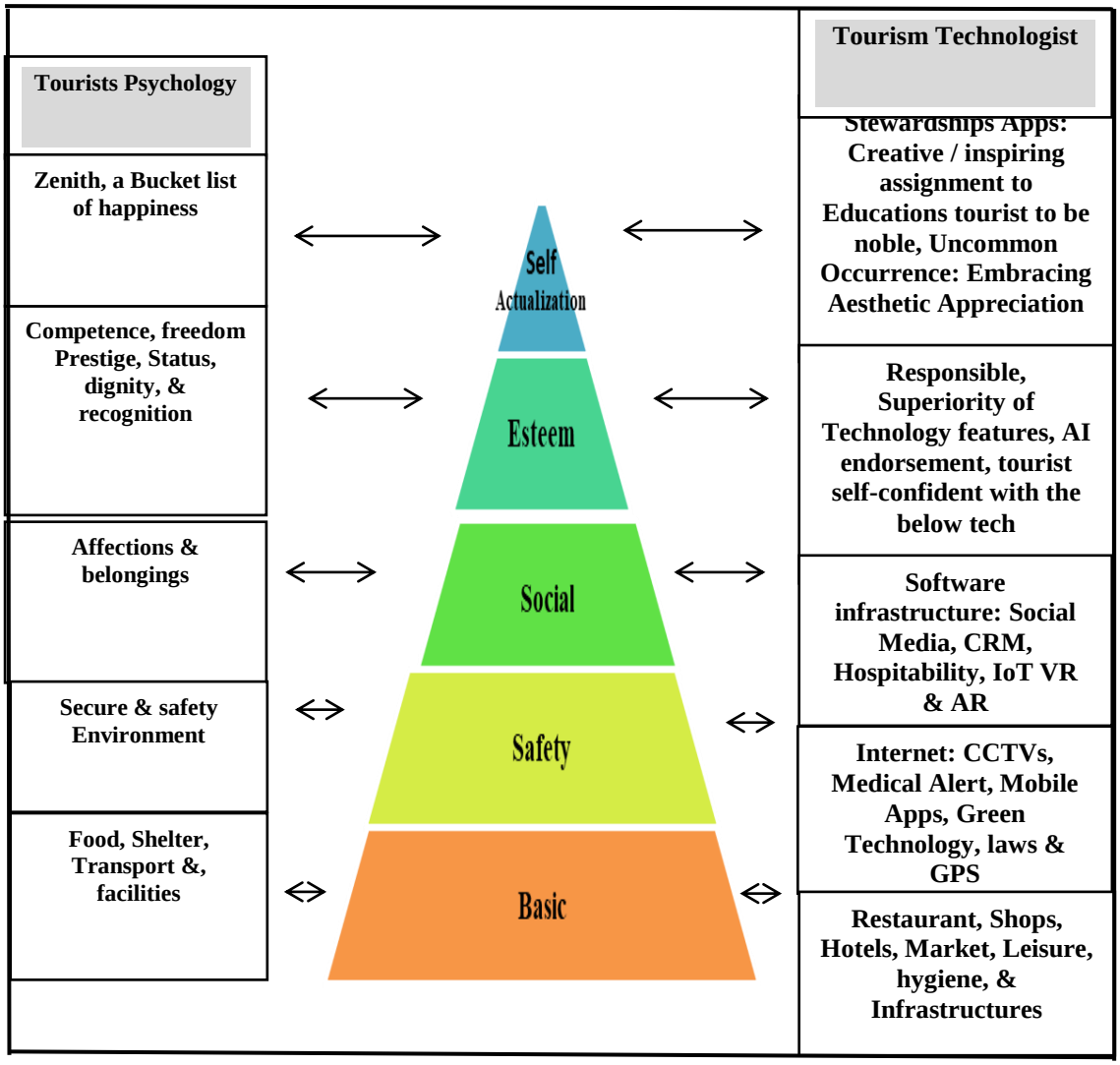

Figure 1.Technology Features for Tourism Industries with Maslowian Triangle

Understanding tourist psychology has become paramount for the advancement of the tourism industry. A pivotal aspect of tourist psychology is ensuring satisfaction across all facets and experiences at destinations. Embracing Maslow's hierarchy as a framework for understanding tourist psychology, this study aims to apply a similar level of scrutiny to the intersection of technology and psychology (Zimik & Barman, 2021; Zimik & Barman, 2023; Zimik & Barman, 2023).

Figure 1 aims to provide a comprehensive overview of tourist psychology requirements and perceptions, offering a bird's-eye view of the rational approach tourists adopt to meet their expectations.

Basic Technological Features

The fundamental needs of tourists encompass food, shelter, and transportation, forming the cornerstone of their experience. These necessities

align with tangible aspects that technologists can address effectively. Investments in infrastructure, policy frameworks, and maintenance directly cater to these essential requirements. Addressing the diverse demands of tourists necessitates a multifaceted approach to infrastructure, incorporating various modes of transportation, leisure facilities, hygiene standards, hotels, and market platforms, all bolstered by technology to achieve a smart city status. Zimik and Barman (2024) assert that these needs primarily pertain to tangible aspects within the tourism industry framework. However, it's noteworthy that intangible elements like image and landscape play a crucial role in enhancing the overall tourist experience. By strategically leveraging both tangible and intangible features, destinations can effectively attract tourists and bolster promotion efforts.

Safety Technological Features

While safety concerns understandably arise, it's crucial to note that tourists prioritize access to medical assistance and nearby safety measures. Medical services and facilities are integral to fulfilling these basic needs. Additionally, the tourism industry relies on internet resources and detailed information, with GPS services serving as a paramount option to alleviate confusion. This comprehensive approach fosters a 360-degree vigilance at destinations, bolstered by CCTVs to instill confidence in visitors. Developing hospitality and translation apps enhances the tourist experience significantly. Embracing green technology and mobile apps further augments safety measures. Implementing policies such as low carbon emission and renewable energy sources underscores a commitment to safety competence. Both tangible (such as infrastructure) and intangible (information technology) features contribute to meeting tourists' demands effectively.

Social Technological Features

Tourism industries are inherently connected to society, necessitating technologies that are society-centric. Understanding the hierarchy from both individual and societal perspectives is essential. Tourists expect hosts to exhibit friendliness, hospitality, and high social acceptance, prompting technologists to prioritize understanding tourist social dynamics. Customer Relationship Management (CRM) and the Internet of Things (IoT) offer personalized tourist services with spot-on event details, though human effort gaps persist. Societal perspectives can be addressed through approaches like Augmented Reality (AR), Virtual Reality (VR), and social media integration. AR provides detailed information on landmarks and facilities, ensuring tourists fully experience destinations. AR and VR technologies aim to familiarize tourists with new destinations, ensuring they don't miss out on opportunities and highlighting hidden gems. This emphasizes the role of technology in providing social benefits through initiatives like internet cloud integration and Google services, enhancing visitor experiences at their fingertips. This underscores the importance of technology aligning with societal needs for optimal tourism outcomes.

Esteems Technological Features

Learning serves as a significant motivator for tourists to explore specific destinations, as it offers a sense of uniqueness and fosters unbiased sentiments. Interacting with new societies, cultures, quests, and experiences, technological applications enhance fulfillment and esteem. Augmented Reality (AR) and Virtual Reality (VR) afford immersive experiences, providing insights into local lifestyles. Despite their potential, VR applications often fall short in delivering satisfaction. Language barriers can be overcome with translation apps, enhancing host-guest interactions. AI-driven smart apps personalize tourist experiences, while participation in events and sports activities can garner universal recognition. Confidence-building technologies are also noteworthy, integrating various technologies to exceed benchmarks by providing detailed reports, encouraging freedom of expression, and facilitating content generation. Social media platforms enable tourists to express experiences freely, contributing to education and confidence-building, thus motivating others to visit. AR and VR technologies offer glimpses into past, present, and future events, allowing tourists to share unique experiences through creative content tools, enhancing professional documentation. In the digital era, AI intervention in destination portrayal ensures unbiased endorsements, fostering awareness and unbiased perceptions among tourists. This comprehensive approach emphasizes the importance of technology in enhancing tourist experiences while promoting inclusivity and unbiased perceptions of destinations.

Self-actualization Technological Features

An intriguing aspect warranting further research in evaluating future tourist experiences is the attainment of self-actualization. From the tourist's perspective, this entails reaching their fullest potential and accomplishing items on their bucket list, while from the host's standpoint, it translates to fostering creative and inspirational assignments that embrace aesthetic appreciation. The demonstration of global recognition elevates the tourist visit from mere sightseeing to a positive and challenging endeavor. Technological interventions addressing this hierarchy include documentation, content generation, and efficient reporting facilitated by apps, educational applications, and media platforms for meaningful engagement. Tourists experiencing natural beauty, aesthetic satisfaction, and engaging with various stakeholders and experts illuminate the path towards enlightenment. With technological assistance, tourists can document and disseminate their meaningful findings and concepts. Management efforts enable cultural exchange platforms, fostering the creation of meaningful ecosystems, morality, and factual acceptance. Technological tools such as the Internet of Things (IoT) and social media facilitate communication and event planning, underscoring the importance of initial planning and communication channels in achieving stewardship and noble actions uncommonly experienced by tourists. The discussed technological features are pivotal for tourism development, highlighting the need for policy and stakeholder consciousness to align with tourist psychology and demands. Tangible features primarily address basic needs, while intangible features are critical for higher-level hierarchy fulfillment. Tourism significantly contributes

to economic sustenance, making classical marketing strategies like "push-pull" applicable in both tangible and intangible aspects to enhance societal well-being through job creation, revenue generation, increased revisit rates, and overall satisfaction for both tourists and management. The trend towards technological advancement in tourism is evident, with developing nations rapidly embracing and implementing advanced technologies to elevate their tourism offerings. It is imperative for policymakers and stakeholders to prioritize technological advancements in tourism to ensure continued growth and competitiveness in the global tourism landscape.

Technologies Trend for Tourism Development

Figure 1 serves to elucidate the technological demands based on tourist psychology, necessitating an analysis of various technological trends for the development of tourism industries, particularly in light of the inadequacy in incorporating the opinions of stakeholders and investors. The 4A's framework and tourist satisfaction emerge as paramount considerations driving technological advancements, integrating theoretical concepts with tourist feedback, complaints, and project designs. Technology enhances industry intelligence and proactivity, pivotal for the dimensional shift in development phases, relying heavily on technological advancements. It serves the common good by addressing general tourist needs. Throughout history, technology has evolved dynamically, from ancient inventions like the wheel to contemporary marvels like nuclear energy, continuously captivating attention and driving progress. Research and development fuel healthy competition for technological dominance, driving transformative advancements. Technology adeptly addresses diverse challenges, optimizing solutions for optimal outcomes. The industry's responsiveness to on and off-season dynamics reflects a deep understanding of tourist psychology and contractor perceptions, resulting in enhanced competitiveness and activity levels.

Technology Spontaneity

Online booking platforms, complemented by branded mobile apps, streamline tourist experiences. Like other brands, technology can be branded to align with policies and tourist expectations, as seen with India's "Smart city" branding. Tourist products, such as the 4A's framework, rely on technologists to meet expectations and foster imaginative experiences. Globalization and liberalization facilitate accessible patents and licenses for technologists, accelerating industry growth.

The IoT

Meeting tourists' expectations involves ensuring device connectivity and sensor feasibility. Access to traffic updates, crowd levels, weather, and climate information is crucial. Smart destination branding necessitates robust technology support, with IT serving as the backbone. Without IT and online platforms, creative ideas for promotion lack practicality. Green technology initiatives drive cost reduction for tourists, spurred by policy-makers' focus on

IT enhancements. Key IoT components like Virtual Reality (VR) and Augmented Reality (AR) technologies offer immersive experiences, challenging stakeholders to enhance destinations. Technology adoption benefits from liberalization and information accessibility, evident in tourists' increasing reliance on online platforms throughout their journey. Engagement with online technologists influences destination decisions and post-visit experiences. Outsourcing technical tasks during peak seasons and attracting foreign direct investment (FDI) can positively impact industries. Revisiting Zimik and Barman's (2023) research motivates investment in infrastructure development. Despite technology's classification into tangible and intangible realms within Maslow's hierarchy, its role and adaptability remain crucial research interests. As technology continues to shape tourist experiences, understanding its dynamic role and adaptability becomes imperative for industry stakeholders and researchers alike.

Big Data: Support to AI

Data management has become crucial for destinations to track tourist inflow, allocate resources, and meet peak demands. Instances like the Shirui off-season celebration illustrate the need for effective information documentation to manage tourist influx and resource limitations. While technology aims to streamline operations and enhance tourist satisfaction, it must also prioritize service and hospitality. This underscores the necessity of AI support across all service aspects. Well-informed destinations, backed by comprehensive tourist data and positive AI feedback, are deemed the ultimate measure of success.

AI Personalization

This section explores the feasibility of customization aligning with tourist psychological expectations. Whether conscious or subconscious, technological support is essential for any emerging thought. The diverse demands of tourists and contributions from stakeholders emphasize the collaborative functioning of industries. This concept, echoed by Zimik & Barman (2024), underscores the necessity of supporting industries. Their proposed concept, the constructed environment, serves as the essence and requirement for industry advancement, emphasizing the need for tailored experiences to meet tourist expectations efficiently.

The study underscores a significant need for integrating technology within tourist psychology and the broader tourism industry. Findings indicate that the tourism sector requires enhanced technical expertise and stakeholder competence. Emphasizing the role of technology is crucial for fostering sustainable tourism development and addressing industry needs. The trend towards advanced technology suggests that effective application is essential for the tourism industry's growth. As illustrated in Figure 1, technology applications in tourism align with the hierarchical levels of the triangle, with higher levels representing more intangible aspects. This indicates that as technology advances, its applications become increasingly abstract. Based on these observations, the study recommends investing in training and infrastructure to improve resource management. Furthermore, the research

highlights the challenge for developing nations to keep pace with technological advancements, specifically AR and VR. A key contribution of this study is the emphasis on integrating IoT, AI personalization, and innovative technologies beyond traditional methods to enhance tourism experiences.

The discussion centers on the essential technological infrastructure needed for the tourism industry. Given the economic challenges associated with directly acquiring advanced technologies, a strategic approach involving partnerships with technologically advanced nations appears more feasible. This collaborative strategy could mitigate the risks of technology obsolescence and support policy development that favors investment in technological advancements for tourism. The study highlights the importance of CE interventions and emphasizes that tourism destinations should be strategically located near major transportation hubs to enhance accessibility. Effective training and research and development (R&D) for construction professionals are crucial for ensuring high-quality outputs. Adapting to and upgrading technology is increasingly becoming a trend that developing nations must embrace to remain cost-effective while integrating advanced technologies. As discussed, the intangible aspects of technology become more pronounced at higher hierarchical levels, necessitating a heightened awareness and pragmatic approach from policymakers. Additionally, there is a concern that technology-oriented tourists might overlook the genuine beauty and essence of their visits. This is a critical issue that warrants further analysis. The study proposes future research to evaluate the application of technology at each hierarchical level, aiming to understand its impact on tourism experiences more comprehensively.

CONCLUSIONS AND RECOMMENDATIONS

Insufficient attention has been given to elucidating the profound interplay between technology and the tourism industry. The accessibility of advanced technology from developed nations offers promising prospects for nurturing tourism sectors in developing and underdeveloped nations. Given the tourism industry's intrinsic connection to the environment, there is a pressing need for eco-friendly technology solutions. Our study highlights several avenues for advancing technology in the tourism sector, including bolstering investment, enhancing competence, fostering professionalism, ensuring timely project completion, promoting education, and securing social acceptance of dynamic technologies. Figure 1 elucidates our primary objective, while the descriptive approach delves into our secondary objectives. Recognizing the pivotal role of technology in education, it emerges as a central theme. Financial support is crucial for technological evolution, despite initial concerns about costs. However, technology proves profitable through revenue generation and enhancing societal well-being. Travel duration serves as a crucial determinant, impacting tourist satisfaction and technology costs. Comprehensive technology for tourism development, epitomized by Constructed Environment (CE), encompasses both tangible and intangible features necessary for progress. Technological interventions are contingent upon destination specifics, tourist demographics, and psychology, emphasizing

the need for customization beyond Maslow's basic hierarchy. Innovation, facilitated by thoughtful planning, yields remarkable outcomes, exemplified by projects like Malaysia's Garden of Bay or mini wonder parks, offering virtual experiences of distant wonders while reducing costs. Technology-driven branding enhances effectiveness, while 360-degree surveillance and versatility underscore technology's capabilities surpassing human efforts. This study underscores the future trajectory of technologists, advocating adaptability. Success hinges on the consciousness and competence of policymakers and stakeholders. As the tourism industry evolves, embracing technological advancements is imperative for sustainable growth and enhanced tourist experiences.

ADVANCED RESEARCH

This research still has limitations so further research needs to be done on the topic "Technology for Tourism: A Guideline for Best Practices."

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