



Conceptual Article

Conceptualizing Accessible Tourism with Smart Technologies

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Abstract

In recent years, UNWTO and academics have called for the development of responsible, sustainable, and universally accessible tourism to promote equal human rights and social inclusion. Prior studies have also revealed the potential and value of smart technologies in reducing, if not removing, barriers to people with access requirements during travel and in their everyday lives. However, a guiding framework of how smart technologies assist in building an accessible destination is still absent, thereby hindering the progress of building accessible tourism. This paper aims to fill this knowledge gap. A conceptual model of smart accessible destination (SAD) was proposed drawing from the intersection of accessible tourism and smart tourism. With the guidance of this conceptual model, tourism destinations and stakeholders can recognize and utilize the synergies of accessible and smart tourism to enhance the social inclusion, competitiveness, and sustainability of a destination.

Keywords

smart accessible destination; accessible tourism; smart tourism; smart technologies; disabled tourists; inclusivity

1. Introduction

The improvement of public transportation and timely tourist information delivered by advanced technologies have made it more convenient for most tourists to travel. However, tourists with special needs, either physically or psychologically, have been largely overlooked. Statistically, about one billion people with disabilities and two billions of their family members, which account for a third of the population, have difficulty accessing tourism facilities (United Nations, 2022b; World Health Organization, 2021). Apart from people with disabilities, Darcy and Dickson (2009) suggested that individuals with temporary injuries and diseases, families with children in prams, and seniors, which account for over 30% of the total population, also have access requirements. Because of the growing aging population and the quest for life experience, it is expected that the market size of individuals with access requirements partaking in tourism would increase rapidly. Therefore, with the threefold objectives of accommodating the travel needs of people with access requirements, promoting equal human rights, and social inclusion, there has been a call by UNWTO and academics to build a “responsible, sustainable and universally accessible tourism” (UNWTO, 2022).

In recent years, accessible tourism has received increasing attention in both industry practice and academic research. Practically, the International Organization for Standardization (2021) launched the ISO21902:2021, a set of requirements and recommendations to guide tourism destinations and stakeholders to ensure equal tourism access and enjoyment for people of all ages and abilities, building an “accessible tourism for all.” In the research domain, scholars from diverse academic fields and

ideological persuasions have identified recreational therapy as a central component of success and social stability (Bennett, 2019). Nonetheless, many existing research on accessible tourism (e.g., Cassia et al., 2021; Darcy & Buhalis, 2011b) has pointed out that people with access requirements still experienced a series of barriers during travel, such as the lack of sufficient and updated information and accessible tourism facilities. To address these barriers and achieve greater accessibility, smart technologies have unprecedented potential and value in facilitating and enhancing the universal tourism experience (Cassia et al., 2021; Darcy et al., 2020).

With the rapid development of Information and Communication Technologies (ICTs), abundant research on the ICT applications in tourism and hospitality has emerged in the past two decades. Despite the increasing number of research on applications of smart technologies in tourism, few smart technology studies have been conducted in accessible tourism (Cassia et al., 2021). For example, Lam et al. (2020) explored the contributions and applications of mobile technologies in removing the knowledge and information barriers for visually impaired visitors in Hong Kong. In addition, Ribeiro et al. (2018) discussed the accessible design of mobile applications for disabled tourists to enhance their traveling experience. Most of these existing studies examined the effects of smart technologies in the accessible tourism context from the tourist perspective, while how smart technologies could assist the accessible tourism development for destinations to increase their inclusivity and competitiveness is generally unexplored. Moreover, in light of the fragmented nature and complexity of tourism, a conceptual framework that synthesizes important constructs and provides guidance for destination stakeholders to build accessible tourism

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Received 22 June 2022; Received in revised form 18 July 2022; Accepted 22 July 2022

with smart technologies collaboratively is highly necessary. However, such a framework is still absent thus far, which hinders the progress of harnessing the power of smart technologies to realize “accessible tourism for all.”

This paper fills this knowledge gap and develop a conceptual model of smart accessible destination (SAD) that can guide the smart accessible tourism development of tourism destinations. In this paper, a SAD refers to a sustainable destination where multiple stakeholders work collaboratively to develop universally designed tourism products, experiences, and environments upon the infrastructure of technologies that all tourists (i.e., populations with disabilities and all abilities) can enjoy independently with equity and dignity. The significance of this conceptual model of SAD lies in its development at the intersection of accessible tourism and smart tourism. With the guidance of the conceptual model of SAD, tourism destinations and stakeholders can recognize and utilize the synergies of accessible tourism and smart tourism to enhance the social inclusion, competitiveness, and sustainability of the destination.

2. Tourism Destination and Destination Competitiveness

The aim of destinations developing accessible tourism with smart technologies is to increase their social inclusion and their destination competitiveness and sustainability. Therefore, it is important to review literature on tourism destinations and destination competitiveness to outline the key elements of a socially inclusive and competitive tourism destination, which contributes to the conceptualization of SAD.

The definition of a tourism destination varies among academics. For example, Leiper (1995) defined a tourist destination as a new place that people visit for days to experience the local culture. The destination can provide not only tangible tourism facilities but also intangible tourism services to meet the travel purposes of tourists (Cooper et al., 1998). This amalgamated nature of tourism destinations leads to manifold interpretations. In one regard, a tourist destination refers to the geographic area that provides an integration of tourism products, services, and experiences to visitors (Buhalis, 2000). In another regard, a tourist destination can be perceived as a brand that develops and promotes the planning and marketing strategies of the local governments and Destination Management Organizations (DMOs) (Buhalis, 2000).

Buhalis (2000) advocated that a tourism destination is often constituted by six main components, namely attractions, accessibility, amenities, available packages, activities, and ancillary services (i.e., six A's). Traditionally, attractions refer to natural, man-made, or cultural heritage sites. Accessibility refers to a public transportation system that facilitates tourists to their destinations. Amenities include support from the hospitality industry (e.g., hotels and restaurants) and the retail industry. Available packages refer to the travel packages offered by intermediaries such as travel agencies. Activities are the experience that tourists partake in during visits to the destinations. Lastly, ancillary services such as postal, banking, and communication services provide support for tourists' visits. These six components add value to tourists' experiences. Moreover, they generate profits and benefits for the tourism destination simultaneously. Most importantly, the six A's are important strategic resources for destinations to distinguish themselves from their competitors. Therefore, making the six A's inclusive and competitive will enable destinations to gain market shares in the fierce global markets (Armenski et al., 2018).

Because of the fragmented nature of tourism and the complexity of the six A's, the collaboration of various stakeholders plays a vital role in achieving the development objective of tourism destinations (Sautter & Leisen, 1999). Traditionally, stakeholders in tourism destinations incorporate government, public sectors, tourists, residents, and tourism enterprises/operators (Buhalis & Amaranggana, 2014; Werthner

& Klein, 1999). The local governments and DMOs take the initiative in developing tourism marketing and management planning. The political and financial powers of decision-makers enable them to support other stakeholders and sustain the long-term destination development (Buhalis, 2000). Public sectors refer to NGOs and other tourism-relevant organizations that provide social benefits to the destinations. Intermediaries and direct suppliers (i.e., private sectors) in tourism destinations, such as travel agencies, hoteliers, and attraction managers, are also important stakeholder groups in tourism. These aforementioned stakeholders perform their duties and characteristics to provide comprehensive travel experiences for tourists. Thus, the establishment of partnerships among stakeholders is essential to achieve the success of sustainable destination development (Buhalis & Cooper, 1998). The collaboration among stakeholders is conducive to ensuring the quality and value of tourism experience co-creation, thereby enhancing the overall destination competitiveness (Buhalis, 2000).

3. Accessible Tourism

To guide destinations to develop accessible tourism with smart technologies, it is critical to understand the notion and relevant discussion of accessible and smart tourism because the conceptualization of SAD is built upon the intersection of these two founding concepts and leverages their synergies.

The research domain of accessible tourism began to emerge in the early 2000s. Most of the early literature (e.g., Burnett & Bender-Baker, 2001; Darcy, 2002) of this research stream encompasses the traveling experience of mobility-disabled individuals. For example, Daniels et al. (2005) revealed the constraints and negotiations that people with physical disabilities experienced during travel. Nonetheless, this narrow focus was quickly extended to include a wider audience, that of individuals with other access requirements, such as mobility, vision, hearing, and cognitive dimensions of access (Darcy, 2006). Subsequently, the dimensions of disability were further expanded by Small and Darcy (2010, p. 5) to include the following:

- Mobility;
- Vision;
- Hearing;
- Cognitive/learning – involving issues of speech or understanding;
- Mental health;
- Sensitivities – including respiratory, food, and chemical; and
- Others.

Small and Darcy (2010) argued that this expanded categorization of people with disabilities urges tourism suppliers to reconsider access and create enabling environments. Alternatively, Darcy and Dickson (2009) introduced the whole-of-life approach to understanding accessible tourism. With this whole lifespan perspective, all people, including individuals with temporary illness or disease, families with children in prams, and seniors are beneficiaries of accessible tourism, apart from people with disabilities. Many scholars subscribe to this whole-of-life approach because it embodies the principles of universal design, providing more inclusive access to a broader group of people (Darcy & Buhalis, 2011a; Qiao et al., 2022).

Because of these dynamic focuses and evolving concepts, accessible tourism has many interchangeable terms or synonyms, such as disabled tourism (e.g., Burnett & Bender-Baker, 2001; Darcy, 2002), barrier-free tourism (e.g., Cameron et al., 2003), inclusive tourism (e.g., Yates, 2007), and universal tourism (e.g., Darcy, 2006). The most widely embraced definition of accessible tourism is that by Darcy and Buhalis (2011a, p. 10), which accessible tourism is defined as

... a form of tourism that involves collaborative processes between stakeholders that enable people with access requirements, including mobility, vision, hearing, and cognitive dimensions of access, to function independently and with equity and dignity through the delivery of universally designed tourism products, services, and environments.

This definition draws upon the three important values of universal design, namely 1) independence, 2) equity, and 3) dignity, and incorporates the important elements of the tourism system and stakeholders. In addition, the definition adopts Darcy and Dickson's (2009) whole-of-life approach, considering that all people throughout their lifespan benefit from accessible tourism.

To achieve "accessible tourism for all" (International Organization for Standardization, 2021) and build an accessible destination, Small and Darcy (2010) outlined the four independent yet correlated concepts of accessible tourism (see Figure 1).

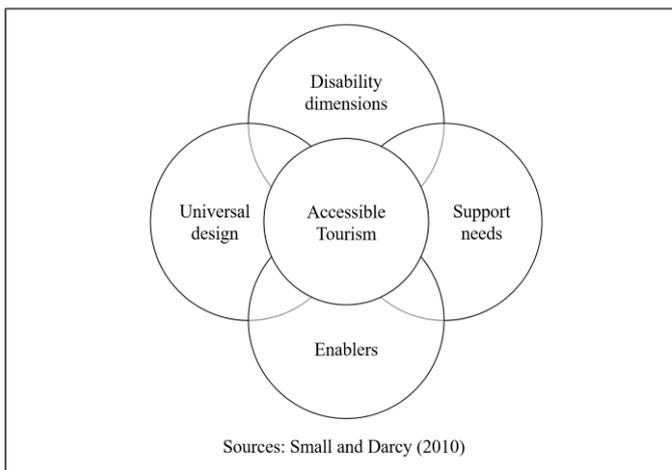


Fig. 1. Small and Darcy's (2010) concepts for understanding accessible tourism

Small and Darcy (2010) conceived that the universal design principle is a key component in developing accessible tourism because it guides the accessible design of tourism destinations, products, and services. Moreover, the combination of the elements of people with access requirements, disability dimensions, and support needs, helps tourism providers to understand the needs of their audience. Disability dimensions refer to understanding different types of disabilities and their requirements for access. Support needs could be presented with a continuum (see Figure 2), ranging from mild to severe. For enablers, it refers to the solutions to barriers that people with disabilities face in their mundane life. This model is valuable in providing a guiding direction to navigate the development of the tourism environment, product, and service. However, barriers that people with access requirements experience and how their access needs could be addressed are not specified. To answer these questions, Nigg and Eichelberger (2021) aimed to explore an efficient method for developing sustainable tourism products for accessible tourism. In their paper, they argued that putting the central value of "tourism for all" in product development is insufficient. Stakeholder collaboration, especially with people with disabilities, is a critical factor in building the success of accessible tourism.

To create the enabling destination, service, and products to accommodate all tourists' needs, understanding the barriers that they face is of paramount importance. Therefore, many researchers (e.g., Gillovic et al., 2018; Michopoulou et al., 2015) have endeavored to reveal various barriers that people with access requirements experience during travel and in their normal daily lives. For example, Daniels et al. (2005) revealed that physically disabled tourists encountered intrapersonal, interpersonal, and structural constraints during travel. Similarly, Darcy and Buhalis (2011b) outlined the three main barrier categories that people with disabilities face in their mundane life, namely 1) intrapersonal or interpersonal, 2) structural environment and institutions, and 3) attitudes or behavior of others. More recently, Cassia et al. (2021) synthesized six main barriers from extant literature, namely 1) information barrier, 2) architectural barrier, 3) political barrier, 4) cultural barrier, 5) relational barrier, and 6) technological barrier.

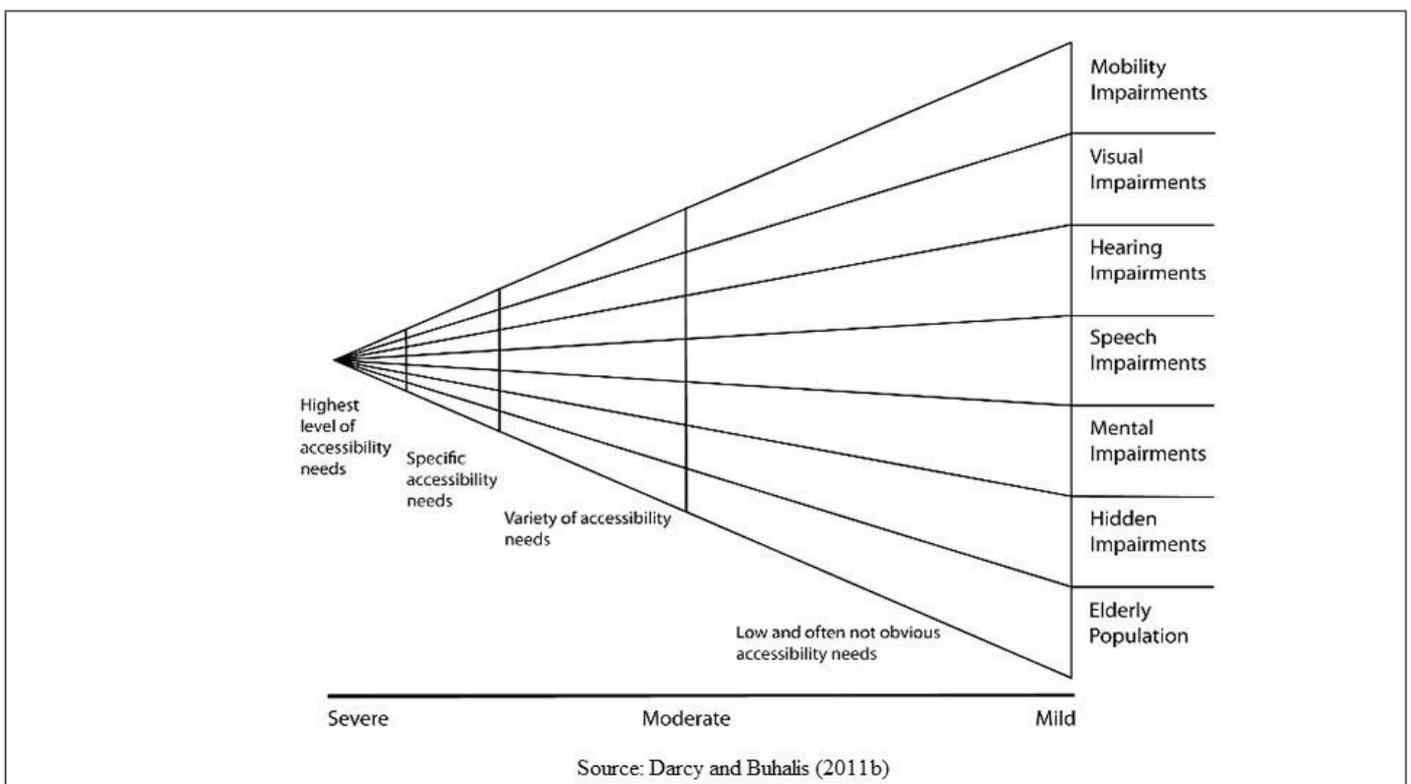


Fig. 2. Continuum of accessibility needs

Information barrier means disabled individuals' difficulties in autonomously obtaining, evaluating, and verifying tourism-related information. Architectural barrier refers to the inconvenience of accessing transportation and moving from one place to another. The political barrier represents the lack of recognition of the needs of people with disabilities in a political agenda. Regarding the cultural barrier, it means the indifference that people with all abilities exhibit toward people with disabilities. Relational barrier refers to the self-righteous attitude of people with all abilities toward their disabled counterparts. For technological barrier, it means the rapid improvement of technology in transportation and communication, creating difficulties for people with disabilities to keep up with such advancements. Reducing, if not removing, these barriers not only require heavy financial investment and leadership of local government (Michopoulou & Buhalis, 2011; Zajadacz, 2015), it also relies on the ongoing innovation, communication, and collaboration of various stakeholder groups in the accessible

tourism ecosystem (Gillovic & McIntosh, 2015; Nigg & Eichelberger, 2021).

To address these aforementioned constraints, many scholars (e.g., Cassia et al., 2021; Ribeiro et al., 2018) are convinced that technology could serve as an efficient operant source to make tourism more accessible and inclusive. Table 1 summarizes some prior literature on the impact of ICTs in facilitating accessible tourism, providing solid proof of the value of smart technologies in upholding the three universal design values and building accessible tourism for all. Nonetheless, most of the existing literature is largely fragmented and mainly identifies various technology solutions to accessible services in the fields of hospitality, health, and communication (Tlili et al., 2021). Thus, scholars (e.g., Teixeira et al., 2021; Tlili et al., 2021) have been calling for amalgamating the existing endeavors and providing innovative directions to fully realize the role of technologies in facilitating accessibility and equal rights in tourism and hospitality.

Table 1. Prior literature on the impact of ICTs on accessible tourism

Type of ICTs	Authors	Impacts on Accessible Tourism
Mobile apps	Lam et al. (2020); Milicchio and Proserpi (2016); Ribeiro et al. (2018)	<ul style="list-style-type: none"> • Platforms to access information; • Allowing personalized information and recommendations; • Navigating directions and wayfinding; • Motivating interactions with strangers; • Translating sign language to regular language; • Making alert to avoid obstacles, making a loud sound to ask for help, and providing live support; • Speech and audio assistance.
Social media	Altinay et al. (2016)	<ul style="list-style-type: none"> • Reaching out information and knowledge about the destinations and tourism activities; • Platforms for networking, and voicing out disable tourists' need and thoughts.
Tourism digital ecosystems (e.g., travel recommendation systems, Internet of Things [IoT])	Cassia et al. (2021); Nitti et al. (2018)	<ul style="list-style-type: none"> • Collecting and storing tourists' user data through different devices for information and service personalization; • Displaying, communicating, and selling tourism experiences; • Allowing tourism stakeholders to exchange information and communicate.
Virtual reality	Thangaraj and Gomathi (2019)	<ul style="list-style-type: none"> • Facilitating virtual tour to inaccessible destinations; • Having a preview before making a destination choice; • Offering immersive tourism experience.

4. Smart Tourism

As a burgeoning direction developed along with the concept of a smart city, smart tourism has attracted significant attention from academics and practitioners in recent years (Höjer & Wangel, 2015). Although research on smart tourism has proliferated, a consensus on the definition of smart tourism has not been reached among scholars (Li et al., 2017). Ye et al. (2021) defined the concept of smart tourism as with the assistance of technologies, tourism-relevant data circulated in the tourism ecosystem can enhance the stakeholders' experience and strengthen the destination competitiveness.

In smart tourism research, different definitions of smart tourism destination have been developed for tourism stakeholders to better understand the essence of smart tourism destination. Table 2 synthesizes some of the most widely embraced concepts on smart tourism destination defined by prior scholars.

There are three commonalities shared among these well-established definitions. First, scholars commonly agreed that technologies are the foundation and core resources to support the development of smart tourism destinations. State-of-the-art technologies, such as cloud services, IoT, and end-user internet service systems, are important infrastructure of smart tourism destinations, which makes everything inter-connected and

intelligent (Gretzel et al., 2015). Second, all levels of stakeholders in the tourism context, including tourists, suppliers, and government, co-create experience and value through the utilization of advanced technologies, thereby enhancing their satisfactions. Third, apart from the availability and quality of technology infrastructure, the vital importance of human (e.g., knowledge networks, education, and social capital) and institutional factors (e.g., leadership, governance, and stakeholder collaboration) toward building smart city and destination is also implied. Boes et al. (2015) argued that the human factor is the critical base to function collective intelligence and social learning, nurturing innovative technology applications. Meanwhile, institutional factor is the key to maintain growth, innovation, and progress of a smart tourism destination (Nam & Pardo, 2011).

The extant concepts of smart tourism destination are valuable in outlining the critical role of technologies in enhancing tourism stakeholders' collaboration and experience, thereby making the destination more competitive. Nevertheless, only a few of the extant definitions of smart tourism destination (e.g., European Commission, 2022; Lopez de Avila, 2015) recognized the significance of accessibility and put this important ingredient into the concept in an explicit manner. Particularly, although some definitions and frameworks of smart destination have mentioned accessibility, many of them refer to the provision of easy access to the wider general population instead of populations with

disabilities (Rucci et al., 2021; Tlili et al., 2021). Comparatively, the concept of SAD proposed by this paper provides a more specific definition by highlighting the incorporation of universal design

values and relevant guidelines in developing tourism products, experiences, and environments for all tourists (i.e., populations with disabilities and all abilities) in a destination.

Table 2. Definition of smart tourism destination

Concept	Authors	Definition
Smart tourism destination	Buhalis and Amaranggana (2014, p. 557)	"...to utilise the system to enhance tourism experience and improve the effectiveness of resource management towards maximising both destination competitiveness and consumer satisfaction while also demonstrate sustainability over an extended timeframe."
Smart tourism destination	Boes et al. (2015, p. 394)	"...can be perceived as places utilising the available technological tools and techniques to enable demand and supply to co-create value, pleasure, and experiences for the tourist and wealth, profit, and benefits for the organisations and the destination."
Smart tourism destination	Lopez de Avila (2015, n.p.)	"...an innovative tourist destination, built on an infrastructure of state-of-the-art technology guaranteeing the sustainable development of tourist areas, accessible to everyone, which facilitates the visitor's interaction with and integration into his or her surroundings, increases the quality of the experience at the destination, and improves residents' quality of life."
Smart destination	Lamsfus et al. (2015, p. 367)	"A Tourism Destination is said to be smart when it makes intensive use of the technological infrastructure provided by the Smart City in order to: (1) enhance the tourism experience of visitors by personalizing and making them aware of both local and tourism services and products available to them at the destination and (2) by empowering destination management organizations, local institutions and tourism companies to make their decisions and take actions based upon the data produced in within the destination, gathered, managed and processed by means of the technology infrastructure."

Most of the existing smart tourism research analyzed the effects of smart technologies on tourists and destinations through the lens of the classic three-stage tourism customer journey, namely, pre-travel, amidst-travel, and post-travel. In recent years, with the emergence and prevalence of assorted immersive technologies, such as augmented reality (AR), mixed reality (MR), and Virtual Reality (VR), scholars (e.g., Buhalis & Karatay, 2022; Gursoy et al., 2022; Neuburger et al., 2018) started to distinguish and discuss tourism experience with the lens of the binary dimensions of virtual and physical. In Neuburger et al.'s (2018) "phygital" customer experience space, the physical dimension refers to tourism stakeholders' in-person experience co-creation

on the site of the destination. Meanwhile, the virtual dimension involves all forms of information exchange among tourism stakeholders of the destination on the Internet. A common essence is shared in this literature. That is, these two dimensions are not separated but closely interconnected through ICT infrastructure and technology applications. Various immersive technologies, such as AR, MR, and VR could facilitate and enhance tourists' virtual, physical, and hybrid tourism experience as the mixed reality spectrum that Buhalis and Karatay (2022) sketched (see Figure 3). In this case, understanding tourists' smart tourism experience with the lens of these dual dimensions opens up a new angle for scholars to reconsider accessibility in tourism.

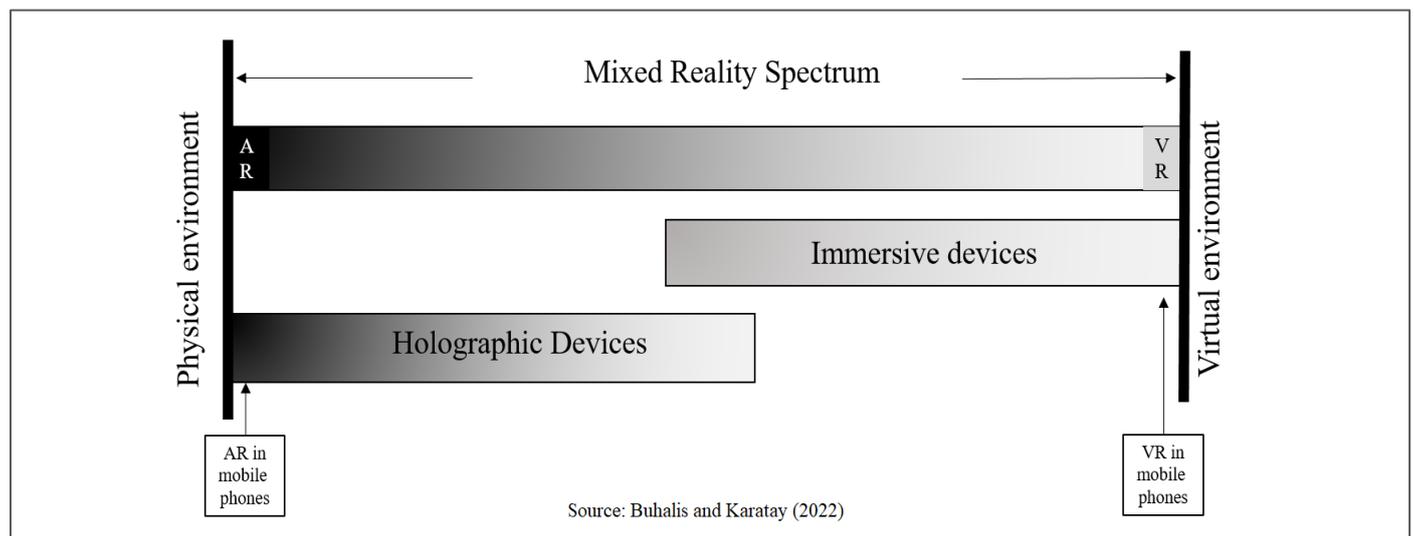


Fig. 3. Buhalis and Karatay's (2022) MR spectrum

5. Conceptual Model of Smart Accessible Destination (SAD)

Based on the discussion above, developing accessible tourism and smart tourism are not two diverging directions for a destination, yet reciprocally synergized. ICTs are not only the foundation to support the development of smart tourism destinations but also important means to enable accessibility of tourism destinations, products, and services for all tourists. Hence, a conceptual model of SAD is proposed (Figure 4), guiding destinations and tourism

stakeholders to develop "accessible tourism for all" by using smart technologies to increase destination inclusion, competitiveness, and sustainability. In this proposed conceptual model, SAD refers to a sustainable destination where multiple stakeholders work collaboratively to co-develop universally designed tourism products, experiences, and environments upon the infrastructure of technologies that all tourists (i.e., populations with disabilities and all abilities) can enjoy independently with equity and dignity.

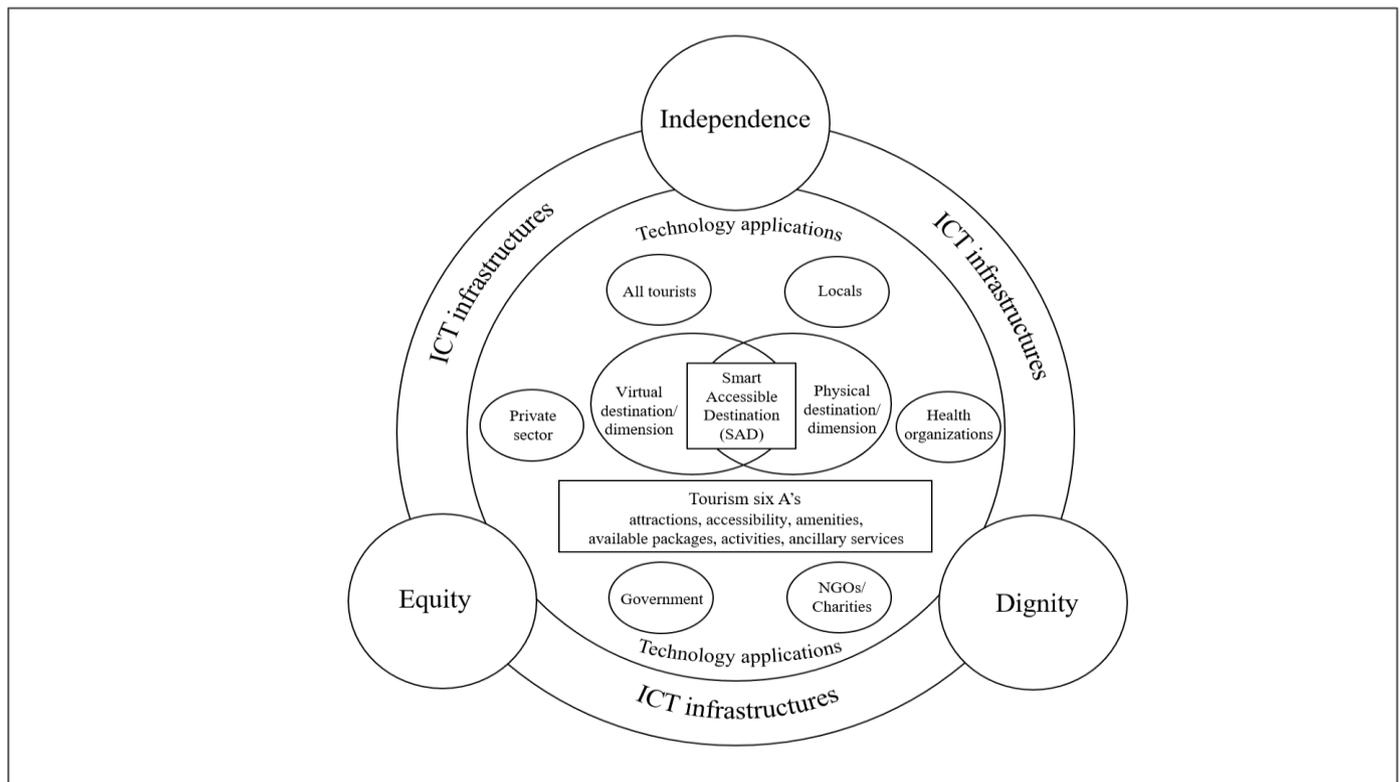


Fig. 4. Conceptual model of smart accessible destination (SAD)

The conceptual model of SAD is adapted from the three models previously mentioned, namely 1) Small and Darcy's (2010) concepts of understanding accessible tourism, 2) Boes et al.'s (2015) framework of smart tourism destination, and 3) Neuburger et al.'s (2018) "phygital" customer experience space. The three universal design values, namely independence, equity, and dignity, borrowed from Small and Darcy's (2010) accessible tourism model serve as the cornerstones in the SAD. Sharing the same essence as Boes et al.'s (2015) framework of smart tourism destination, the ICT infrastructure and technology applications are infostructures for tourism stakeholders' experience and value co-creation in the SAD. More critically, in the SAD, the ICTs are important means to uphold the universal design values, enabling all tourists' independent access to equitable and dignified tourism experiences. By using the universally designed ICTs, stakeholders of the SAD can work collaboratively to provide accessible tourism six A's (Boes et al., 2015; Buhalis, 2000) to all tourists not only in physical dimension but also in virtual dimension (Buhalis & Karatay, 2022; Neuburger et al., 2018), thereby maximizing the destination accessibility and competitiveness of the SAD. Despite taking reference from smart tourism destination frameworks, two main prominences distinguish the concepts of the SAD from extant definitions of smart tourism destination. First, the concept of SAD explicitly includes the universal design values in the design of ICTs, tourism products, experiences, and environments in the SAD. Second, the SAD takes the dual dimensions of tourists' experience facilitated by the state-of-the-art ICTs into consideration to guide stakeholders to reconsider accessibility of a tourism destination. The proposed conceptual model of the SAD has the following five key concepts.

First, the three values of universal design, namely independence, equity, and dignity, should be the grounding principles in the development and provision of smart technologies and tourism products in SAD. To guide designers from different industries to achieve the three universal design values, the Center for Universal Design (2022) provides seven principles as follows:

1. Equitable use;
2. Flexibility in use;

3. Simple and intuitive use;
4. Perceptible information;
5. Tolerance for error;
6. Low physical effort;
7. Size and space for approach and use.

Darcy and Dickson (2009) suggested that the concept of universal design can provide a basic understanding and foundation to build accessible tourism for populations with disabilities and all abilities. Thus, these principles should not only be applied in designing the physical environment such as installing ramps in attraction sites, but also in the virtual dimension. To ensure digital accessibility and inclusion for users, the Web Content Accessibility Guidelines (WCAG, [W3C], 2022) developed by the World Wide Web Consortium (W3C) should be adopted to guide designers and programmers to develop the content of webpages and mobile devices that satisfy the inclusion requirements. The WCAG 2.1 (W3C, 2022), published in 2018, is the most updated version. The WCAG 2.1 consists of 12 guidelines under four general principles (i.e., perceivable, operable, understandable, and robust). Each guideline includes a different set of success criteria that evaluate the web or mobile content with three progressive levels (A, AA, and AAA), from basic to excellent. Apart from the international standards like the ISO21902:2021 and WCAG 2.1, policymakers in destinations can base on the *United Nations Convention on the Rights of Persons with Disabilities* (United Nations, 2022a) and the universal design values to develop relevant and applicable policies, guidelines, and campaigns that fit their contexts. Most importantly, various stakeholders should maintain ongoing communications about the needs and implementations of embracing the aforementioned values, principles, and guidelines to ensure joint effort working toward the same goal should be maintained. Besides, periodic assessments can be conducted to continuously improve the accessibility and inclusion of tourism products, experiences, and environments.

Second, well-functioning ICT infrastructure and efficient technology applications serve as the crucial foundation and means to construct a SAD. In a smart destination, ICTs are not only the

info-structure for visitors to co-create experience and value but also the fundamental component for a smart tourism ecosystem to operationalize its smartness and innovation (Boes et al., 2015). Aligned with this essence, ICTs are enablers for the development, provision, and sustainability of the dual dimensions of SAD, providing information and service accessibility for all tourists. In this conceptual model, ICT infrastructure refers to an array of ICTs, such as 5G networks, cloud computing, database resources, IoT system, webpages, mobile applications, blockchain, AR, MR, and VR (Buhalis & Karatay, 2022; Nam & Pardo, 2011). Technology applications mean the process of utilizing these mentioned ICT infrastructures to facilitate or enhance tourists' tourism experience (Buonincontri & Micera, 2016) through human innovation and community collaboration. In the virtual dimension of SAD, cloud computing, live streaming, big data storage, and processing, AI, blockchain, three-dimensional (3D) building, and VR are fundamental technological components to create the life-like cyberspace and immersive tourism experience. New forms of digitalization, such as live-streaming travel (Lin et al., 2022) or immersive VR travel experiences in the metaverse (Gursoy et al., 2022; Sarkady et al., 2021), could potentially conquer or partially eliminate the discrimination that people with access requirements face when visiting destinations or attractions with not easily deployable accessibility (Oliver, 2009), thereby enabling independent, equitable, dignified travel experience for all tourists. Moreover, assistive technologies, such as mobile applications, IoT, AR, MR, head or eye trackers with on-screen keyboards, Braille displays with audio and brain-computer interfaces (Bruckamp, 2020; Egger & Neuburger, 2020; Puhertmair & Nussbaum, 2011), also help individuals with access requirements to facilitate or enhance their tourism experience in both virtual and physical dimension of SAD.

Third, a SAD offers accessibility and tourism experiences to all tourists in its dual dimensions of virtual and physical. In the physical dimension, traveling to a destination and its attractions often requires a tourist to move from one place to another with transportation means. However, physical travel is not always possible because of the various environmental or (and) personal constraints. For example, individuals with severe disabilities who need sophisticated medical support, such as people with cervical spinal cord injury, are difficult to participate in physical transit and traditional tourism experience (Luther, 2013). In a broader environmental context, border restrictions, flight cancellations, and city lockdowns caused by the COVID-19 pandemic make physical travel temporarily impossible for most tourists. To enable access to the greatest extent, the SAD should not only consider presenting the destination in its physical dimension but also making the destination virtually accessible as an alternative form for tourists if physical access is constrained (Lu et al., 2022). The virtual dimension of the destination can be presented in various digital ways, such as through webpages, mobile applications, and (or) the metaverse, which provides paralleled experience of the physical destination (Gursoy et al., 2022). With the aid of state-of-the-art ICT infrastructure and technology innovations, the SAD could not merely provide necessary and accessible information to tourists with access requirements but also immersive and interactive digital tourism experience (Gursoy et al., 2022). Apart from physically visiting the destinations, the virtual environment also enables tourists to perceive the "sense of place" and feel "being there" with minimal architectural barriers (Tjostheim & Waterworth, 2020), facilitating greater accessibility.

Fourth, stakeholder collaboration plays a pivotal role in facilitating digital inclusion (Minghetti & Buhalis, 2010), improving smart technology innovations, and maintaining sustainable development of SAD. Traditionally, stakeholders in tourist destinations include government, public sectors, tourists, residents, and tourism enterprises/operators (Buhalis & Amaranggana, 2014). While developing SAD, technology and health-relevant stakeholders should be incorporated. First, the local government should make the strategic planning and initiate collaboration among other stakeholders. The initiatives mainly

include making policies, guidelines, promotional campaigns, and execution plans in embracing universal design values and shaping ICT diffusions. For example, the Chinese government provides political and financial support to many provinces and cities, such as Beijing, Yunnan, and Macau SAR, to proactively improve their ICT infrastructure and build tourism instant data platforms (Beijing Tourism, 2022; Go-Yunnan, 2022; Qi, 2021). The Indian government launched the Accessible India Campaign and National Policy on Universal Electronic Accessibility to enhance digital accessibility (Kulkarni, 2019). Then, public sectors, such as health organizations, NGOs, and charities are another important role in providing social services to help tourists and locals, especially those with access requirements. For instance, complicated technology design may not be friendly to elderly or tourists who are less tech-savvy. While developing the SAD, necessary auxiliary services provided by well-trained human helpers should be equipped as alternatives. Hence, the involvement of these public sectors plays a critical role in helping and (or) training tourists with high support needs and populations with inadequate ICT knowledge and skills to operate the smart technologies for more equitable and enjoyable travel experiences. Private sectors, such as tourism enterprises and technology companies are the important suppliers of the SAD. Compared with conventional tourism destinations, SAD is constructed upon state-of-the-art technologies and aims to welcome and serve all tourists. Therefore, residents in SAD should be more friendly and open-minded to embrace the rapidly evolving technologies and guests with special needs from all over the world. Because technologies are implemented to facilitate the travel process, all stakeholders are welcome to participate in the destination, product, and service development of virtual and physical dimensions of SAD to ensure that the needs and skill gaps of various stakeholder groups could be acknowledged and resolved.

Lastly, providing six A's (attractions, accessibility, amenities, available packages, activities, and ancillary services) in the dual dimensions of SAD through smart technologies enables destinations to increase destination inclusiveness and competitiveness. In the physical dimension, smart technologies such as mobile apps, robots, AI, AR, and MR could facilitate interactions between tourists and attraction sites, thereby enhancing the tourist experience. In addition, SAD can develop virtual attractions (e.g., in video or 3D cyberspace) for the convenience of all tourists. By accessing the virtual attractions, potential tourists may be attracted to the physical destination (Lin et al., 2022). Moreover, an advanced visit to the virtual attractions allows tourists to make smarter travel plans and become more familiar with the local environment. This pre-travel preparation is especially beneficial in reducing tensions and anxieties for families with members with disabilities or high levels of emotional support (Sedgley et al., 2017). Tourism packages and activities could also offer this paralleling experience in dual dimensions to be more inclusive and accessible for all tourists. For example, multilingual instant translation technologies can assist foreign tourists to communicate with residents by removing the linguistic barrier. The design of the transportation system should be inclusive and considerate to ensure accessibility in physical dimension of SAD. Barrier-free access is essential for people with special needs. Moreover, because the construction and operation of SAD rely highly on ICTs, SAD should ensure the availability and affordability of the design and provision of these technologies (Qiao et al., 2022). As for the design of amenities, it should also incorporate barrier-free facilities, such as lifts and barrier-free restrooms. The information on barrier-free transportation and amenities should be displayed in an easily accessible and understood manner for all tourists, such as an AR guide in the physical dimension and a virtual assistant in the virtual dimension. In SAD, ancillary services should be more accessible and smarter. For instance, the real-time tourist flow and contact information of banks and hospitals can be displayed on mobile applications for tourists' easy and instant reach. Special care service is one of the most important ancillary services that individuals with disabilities

and the aging population need during travel (Lyu, 2017). Therefore, more staff should be trained to utilize smart and assistive technologies to assist tourists with access requirements to enjoy the tourism experience in the SAD. SAD could build a more inclusive and competitive six A to serve a wider potential audience by leveraging the smart technologies. It is beneficial for destinations to build a more socially responsible destination brand and enhance their destination competitiveness.

6. Conclusions

Smart and accessible tourism are promising development directions that have attracted increasing attention from academics and practitioners over the past decades (Darcy & Buhalis, 2011a; Gretzel et al., 2015). Smart technologies can be leveraged to improve the accessibility and inclusiveness of tourism destinations, and therefore enhance destination competitiveness and promote its sustainable development. Thus, providing a framework that synergizes the concept of accessible tourism and smart tourism before implementing the concepts in the industry is important. From a theoretical perspective, this study reviews the literature on destination competitiveness, smart tourism, and accessible tourism. A conceptual model for developing a smart accessible destination was proposed. In SAD, ICT is the foundation and facilitator to support the development of smart tourism destinations. Under the value of universal design, stakeholders collaborate to offer comprehensive services to all tourists at the virtual and physical levels. Compared with extant definitions of smart tourism destination, there are two prominences in the concept of the SAD. The first is the explicit inclusion of universal design values in the ecosystem of SAD. Second, SAD reconsiders accessibility of tourism destinations by promoting dual dimensions of tourist experience through state-of-the-art smart technologies. This model contributes to the theoretical development of a new direction in the tourism field and serves as the strategical guideline for decision-makers. Nevertheless, the proposed SAD framework is still at the conceptual development stage and needs to be verified empirically in the future. In-depth interviews and surveys should be conducted to collect insights on SAD from both suppliers and tourists. The overall design of the SAD model can, and should, be incrementally improved based on feedback of practice.

Declaration of competing interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Acknowledgements

This research was partly supported by a research grant funded by the University of Macau.

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