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The role of AI in improving the inclusion of people with disabilities in the tourism industry

El papel de la IA en la mejora de la inclusión de las personas con discapacidad en la industria turística

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Abstract

AI is playing a transformative role in enhancing the happiness of people with disabilities in the tourism industry by making travel more accessible and inclusive. By addressing physical and social barriers, AI provides equitable access to tourism, allowing disabled travelers to enjoy experiences with greater comfort and ease. Smart infrastructure and innovative solutions are creating an environment where accessibility needs are met, directly enhancing the overall satisfaction and happiness of disabled tourists.

Key AI innovations like advanced navigation systems and accessible transportation enable individuals with disabilities to travel more independently, boosting their confidence and reducing the need for assistance. This autonomy contributes to a more fulfilling travel experience, allowing disabled travelers to explore destinations more freely and with less stress. AI-driven personalized services further enhance the experience by catering to the unique needs and preferences of each

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traveler, ensuring their specific requirements are met, which elevates their enjoyment and comfort.

Additionally, assistive technologies such as speech recognition software and real-time translation devices simplify navigation in unfamiliar environments, reducing the anxiety associated with travel. These tools lead to smoother experiences and increased satisfaction. AI-powered data analysis also supports tourism operators by providing insights into the evolving needs of disabled travelers, allowing for continuous improvement of services. This ongoing refinement ensures that the tourism industry remains adaptable and inclusive, fostering greater happiness and promoting a more inclusive world for all travelers.

Key words: tourism; IA; disability; inclusion; tourist experiences

Resumen

La inteligencia artificial (IA) está transformando la felicidad de las personas con discapacidad en el turismo al hacer los viajes más accesibles e inclusivos. Al eliminar barreras físicas y sociales, la IA permite un acceso equitativo al turismo, ofreciendo experiencias más cómodas y sencillas. La infraestructura inteligente y las soluciones innovadoras crean entornos donde las necesidades de accesibilidad se satisfacen, mejorando directamente la satisfacción y bienestar de los turistas con discapacidad.

Innovaciones como los sistemas avanzados de navegación y el transporte accesible permiten viajar con mayor independencia, fortaleciendo la confianza y reduciendo la necesidad de asistencia. Esta autonomía brinda experiencias más plenas, con menos estrés y mayor libertad. Los servicios personalizados impulsados por IA también enriquecen los viajes al adaptarse a las preferencias y necesidades específicas de cada persona, aumentando su disfrute y confort.

Además, tecnologías asistidas como el reconocimiento de voz o los traductores en tiempo real facilitan la orientación en entornos desconocidos y disminuyen la ansiedad al viajar. Estas herramientas ofrecen experiencias más fluidas y satisfactorias. Finalmente, el análisis de datos con IA ayuda a los operadores turísticos a comprender mejor las necesidades cambiantes de los viajeros con discapacidad, fomentando una industria más inclusiva, adaptable y feliz.

Palabras clave: turismo; IA; discapacidad; inclusión; experiencias turísticas

1. Introduction

Artificial intelligence is significantly contributing to improving accessibility in the tourism industry for people with disabilities (Bhaskar, Baruch, & Gupta, 2023; Ramirez & Portillo, 2024). Through the development of smart devices and intelligent applications, AI-driven solutions are facilitating the participation of individuals with different types of disabilities in a wide range of tourism activities (Harrow et al., 2020; Leung, 2022; Martín Lucas et al., 2025; Pavón Pérez & Robina Ramírez, 2024). AI algorithms are increasingly being applied to the design of customized prosthetics and orthotics adapted to the specific needs and physical capabilities of each individual, allowing users to engage in tourism experiences more comfortably and autonomously (Akhtar et al., 2024).

Artificial intelligence is also transforming the way tourism data are collected, interpreted, and operationalized within accessible tourism environments. AI-based systems are being incorporated into the design of accessible tourist facilities through data analysis and computational modelling techniques capable of optimizing spatial layouts and improving environmental usability for people with disabilities (Zsarnoczky, 2017). By analysing biometric information, mobility patterns, and user preferences, tourism providers are increasingly able to develop individualized tourism experiences adapted to different accessibility requirements and personal expectations.

AI algorithms additionally play a central role in enhancing personalization processes within the tourism sector (Prahadeeswaran, 2023). Through the analysis of behavioural patterns and previous travel interactions, these systems can generate more precise recommendations and adaptive services capable of improving users' experiences and perceived comfort (Suanpang & Pothipassa, 2024). This personalization process is further reinforced through the use of AI-driven simulators and virtual environments, which enable travelers with disabilities to explore destinations and assess accessibility conditions in advance within safe and controlled digital settings before undertaking physical travel experiences.

Moreover, AI not only contributes to accessibility improvements but also enables tourism organizations to better understand the needs, concerns, and behavioural dynamics of travelers with disabilities through the analysis of large volumes of data (Himeur et al., 2021). Advanced AI-driven monitoring and video analysis systems can identify accessibility barriers, detect behavioural patterns, and provide tourism operators with more accurate information regarding users' experiences during their visits. This capacity for continuous learning and adaptation allows tourism services to become progressively more responsive, personalized, and inclusive.

Despite these technological advances, research examining the relationship between AI-driven accessibility solutions and the emotional dimension of tourism experiences among people with

disabilities remains limited. Existing studies have predominantly focused on operational accessibility, assistive technologies, or smart tourism infrastructures, while comparatively less attention has been paid to how these technologies influence perceived happiness, autonomy, emotional comfort, and inclusion within tourism environments (Buhalis & Amaranggana, 2015; Mohammed & Watson, 2019). This gap is particularly relevant within the emerging perspective of Happiness Management, which argues that technological and organizational innovations should not only improve efficiency and functionality, but also contribute to individuals' well-being, dignity, self-determination, and positive emotional experiences.

In this context, the present study examines how Data-Driven Design (DDD), Smart Device Development (SDD), and AI-driven Simulators and Virtual Environments (SVE) contribute to improving the happiness of people with disabilities within the tourism industry. Spain was selected as the empirical setting due to its international relevance as one of the world's leading tourism destinations and its growing institutional commitment to accessible and inclusive tourism policies. Furthermore, Spain possesses an extensive network of disability support organizations and specialized centers, making it an appropriate context for analysing the role of AI in advancing inclusive tourism practices.

The remainder of this article is structured as follows. First, the literature review develops the theoretical foundations related to happiness, accessibility, and AI-driven inclusion in tourism and presents the research hypotheses. Second, the methodology and data collection procedures are described. Third, the empirical findings are presented. Finally, the discussion, conclusions, limitations, and future research directions are outlined.

2. Literature review

2.1 The Role of Happiness in Using AI of People with Disabilities in the Tourism Industry (HPD)]

Artificial Intelligence (AI) is increasingly transforming tourism experiences for people with disabilities by reducing physical, communicative, and social barriers that have traditionally limited their participation in tourism activities (Sahoo & Choudhury, 2023). Through intelligent accessibility systems, adaptive interfaces, and personalized digital services, AI contributes to the development of more inclusive tourism environments capable of responding to diverse functional needs (Bhaskar, Baruch, & Gupta, 2023). This is especially relevant in accessible tourism, where inclusion, disability, ageing, and tourism participation have been identified as central issues for both tourism demand and supply (Buhalis & Darcy, 2011).

In this study, happiness is understood as a positive emotional state derived from the perception of autonomy, comfort, dignity, safety, and meaningful participation during the tourism experience. This conceptualization differs from satisfaction, which usually refers to the cognitive evaluation of

a specific service encounter, and from broader notions such as well-being or quality of life, which involve more stable and general assessments of life conditions (Nawijn et al., 2010; Nawijn, 2011). Accessibility, in turn, refers to the possibility of entering, using, and enjoying tourism spaces and services, while inclusion refers to the extent to which people with disabilities are able to participate in tourism on equal and socially recognized terms (Buhalis & Darcy, 2011). Therefore, happiness is not treated here as a synonym for accessibility, inclusion, satisfaction, or well-being, but as an emotional outcome that may emerge when accessible and inclusive tourism conditions are effectively experienced.

This distinction is important because accessible tourism research has often emphasized physical access, service adaptation, or technological support, while the emotional consequences of these improvements have received comparatively less empirical attention. Tourism studies have shown that travel experiences may influence happiness and subjective well-being, although such effects depend on the quality, meaning, and emotional intensity of the experience (Nawijn et al., 2010; Nawijn, 2011). For travelers with disabilities, this emotional dimension is particularly relevant because tourism experiences are frequently shaped by uncertainty, dependence on others, communication barriers, and concerns regarding the availability of accessible services.

The construct of happiness is also consistent with Self-Determination Theory, which argues that autonomy, competence, and relatedness are basic psychological needs associated with human motivation and well-being (Ryan & Deci, 2000). In accessible tourism, AI-driven technologies may contribute to these needs by allowing people with disabilities to move more independently, interact more confidently with tourism providers, and participate more fully in travel experiences. From this perspective, happiness is not merely the result of technological convenience, but the emotional consequence of feeling capable, autonomous, and socially included within tourism environments.

This reasoning is further supported by the Happiness Management perspective, which suggests that organizations and technological systems should not only pursue efficiency or productivity but also foster emotional value, human dignity, and positive experiences among stakeholders (Frey & Stutzer, 2002; Ravina-Ripoll et al., 2021; Robina-Ramírez, Ortiz-de-Urbina-Criado, & Ravina-Ripoll, 2023). Applied to tourism, Happiness Management provides a useful framework for understanding how AI-based services can generate value not only by improving accessibility, but also by enhancing the emotional quality of the travel experience.

When individuals with disabilities encounter tourism environments adapted to their specific needs, their sense of belonging, recognition, and personal value tends to increase (Harrow et al., 2020). AI-driven inclusion therefore goes beyond facilitating mobility or communication; it contributes to creating tourism experiences perceived as more respectful, autonomous, and emotionally

positive. In this regard, AI technologies become mechanisms not only of accessibility enhancement but also of emotional empowerment.

One of the main ways in which AI contributes to happiness in tourism is through the promotion of autonomy and independence (Buçinca, Malaya, & Gajos, 2021; del Valle & Lara, 2023). AI-powered navigation systems, intelligent transportation services, and adaptive accessibility applications reduce dependence on external assistance and allow travelers with disabilities to move through destinations with greater confidence and freedom (Mohammed & Watson, 2019). This relationship between autonomy and happiness is theoretically coherent with Ryan and Deci's (2000) argument that autonomy constitutes a basic psychological need linked to well-being and positive human functioning.

AI systems also facilitate highly personalized tourism services by analysing individual preferences, behavioural patterns, and accessibility requirements. Through this process, tourism providers can develop adaptive itineraries, customized accommodation solutions, and personalized recommendations aligned with users' functional needs and travel expectations (Bhuiyan, 2024; Ryndach et al., 2021). This personalization capacity is especially relevant from a happiness perspective because it allows individuals to experience tourism environments that recognize their specific circumstances rather than forcing them to adapt to standardized tourism structures.

Similarly, AI-driven navigation tools provide real-time accessible route recommendations that enable travelers to avoid physical obstacles and navigate unfamiliar environments more safely and efficiently (Scherer, 2011). By reducing uncertainty and travel-related anxiety, these tools may contribute to a greater sense of emotional comfort and perceived control, both of which are closely linked to positive tourism experiences and subjective happiness (Nawijn, 2011; Ryan & Deci, 2000).

Assistive technologies powered by AI, including speech recognition systems, real-time translation tools, and intelligent communication interfaces, also play a critical role in improving tourism experiences for people with disabilities (Ryndach et al., 2021). These technologies facilitate interaction with tourism providers, reduce communication barriers, and decrease the cognitive effort associated with navigating unfamiliar contexts. As a result, tourism experiences become more fluid, less stressful, and emotionally more satisfying.

Finally, AI-driven data analysis allows tourism organizations to continuously refine accessibility strategies and identify evolving user needs through feedback analysis and behavioural monitoring (Bianco, 2021). This capacity for ongoing adaptation enables tourism services to progressively improve their inclusiveness and responsiveness. Consequently, AI-supported tourism systems

may contribute to happiness when they transform accessibility from a merely functional condition into an emotionally meaningful experience of autonomy, recognition, and participation.

2.2 The role of Data-Driven Design (DDD)

Artificial Intelligence (AI) is increasingly transforming the design and management of accessible tourism environments through the use of data analysis, predictive modelling, and adaptive digital systems (Provost & Fawcett, 2013). Within this context, Data-Driven Design (DDD) refers to the use of real-time information, behavioural patterns, accessibility audits, and user feedback to optimize tourism spaces and services according to the specific needs of different users. Rather than relying on standardized accessibility solutions, DDD promotes more adaptive and evidence-based tourism environments capable of responding dynamically to travelers' functional requirements and experiences.

AI utilizes large volumes of data to identify barriers, behavioural patterns, and accessibility deficiencies within tourism facilities (Qin & Chiang, 2019). By analysing mobility flows, interaction patterns, and user feedback, AI systems can detect critical points where accessibility problems emerge and propose improvements based on empirical evidence. This process allows tourism operators and designers to make more informed decisions regarding the configuration of tourism spaces and services.

AI algorithms process these data to generate actionable insights capable of improving accessibility conditions in tourism environments. For example, AI can support decisions regarding the placement of ramps, elevators, accessible signage, or adaptive service points according to observed user behaviour and accessibility demands. This evidence-based approach is especially relevant in accessible tourism because accessibility needs are rarely homogeneous and often vary according to the type of disability, travel context, and environmental conditions.

Computational modelling powered by AI additionally enables tourism planners to simulate how users with different disabilities may interact with tourism spaces before these environments are physically implemented (Baduge et al., 2022; Pan & Zhang, 2023). Through predictive simulations and digital modelling, tourism operators can evaluate potential accessibility barriers and test alternative spatial configurations aimed at improving usability and user comfort.

AI-driven optimization systems also contribute to improving route planning and spatial organization within tourism facilities (Choi et al., 2024). These technologies can optimize circulation flows, identify more accessible pathways, and strategically distribute tourism services according to users' accessibility requirements. Furthermore, AI can analyse how different

environmental dimensions −such as lighting, signage, noise, or spatial density− interact to influence users' experiences and perceived comfort.

The use of AI within DDD frameworks is not limited to initial tourism planning processes but instead operates as a continuous cycle of adaptation and refinement. AI systems can progressively update accessibility solutions based on new behavioural data and user interactions, allowing tourism environments to evolve according to changing needs and technological developments (Tatineni & Allam, 2024). This adaptive capacity is particularly relevant from a happiness perspective because it allows tourism experiences to become progressively more responsive, personalized, and emotionally comfortable for travelers with disabilities.

Consequently, DDD may contribute not only to improving objective accessibility conditions but also to enhancing users' perceived autonomy, comfort, and inclusion within tourism environments. From this perspective, data-driven accessibility solutions are expected to positively influence the happiness associated with AI-supported tourism experiences among people with disabilities.

H1: The role of Data-Driven Design (DDD) impacts Happiness in Using AI for People with Disabilities in the Tourism Industry (HPD).

2.3 Impact of Smart Device Development on Accessibility in Tourism for People with Disabilities (SDD)

Artificial Intelligence (AI) is playing an increasingly important role in the development of smart devices aimed at improving accessibility within the tourism industry. Through adaptive applications, wearable technologies, intelligent navigation systems, and assistive interfaces, AI-driven smart devices facilitate the participation of people with disabilities in tourism experiences under more autonomous and accessible conditions (Akhtar et al., 2024). These technologies not only improve functional accessibility but also reduce uncertainty, dependence, and perceived travel barriers, dimensions closely associated with more positive tourism experiences.

One of the most relevant applications of AI-driven smart devices involves the development of customized prosthetics and orthotics adapted to users' physical needs and mobility conditions (Akhtar et al., 2024). AI algorithms analyse individual behavioural and biometric data to optimize the functionality, comfort, and usability of these devices, allowing travelers with disabilities to participate more actively in tourism activities and mobility-related experiences.

AI-powered navigation systems also represent a major advance in accessible tourism. These systems provide real-time guidance, adaptive route planning, and accessibility-based recommendations capable of responding to different mobility requirements (Leung, 2022). Smart

navigation applications can identify accessible routes, avoid physical barriers, and integrate information regarding ramps, elevators, or adapted transportation systems, thereby reducing stress and uncertainty associated with unfamiliar environments (Sahoo & Choudhury, 2023).

In addition, many of these systems are integrated with wearable devices and smart sensors capable of providing continuous accessibility feedback during the tourism experience. This real-time adaptive support is particularly relevant because it increases users' perceived control over the travel experience and reinforces feelings of autonomy and confidence.

Smart devices also include AI-driven assistive communication technologies designed to facilitate interaction within tourism environments. Applications such as speech-to-text systems, real-time translation tools, intelligent voice assistants, and augmented reality interfaces help reduce communication barriers and improve access to information for travelers with different disabilities (Leung, 2022). These technologies are especially useful in tourism contexts characterized by linguistic diversity, unfamiliar environments, or complex service interactions.

AI additionally contributes to the personalization of tourism experiences through smart devices capable of analysing users' preferences, previous travel behaviours, and accessibility requirements. This allows tourism providers to offer more adaptive recommendations regarding accommodations, activities, and tourism services, improving users' comfort and perceived suitability of the experience. Smart accommodation systems, including automated lighting, adjustable beds, or voice-controlled environments, also enhance comfort and facilitate more accessible tourism stays.

Artificial intelligence is similarly supporting the development of robotic assistance systems and intelligent accessibility technologies that help people with disabilities move more safely and independently within complex tourism spaces such as airports, museums, or theme parks (Rane, Choudhary, & Rane, 2023). These innovations reinforce the idea that smart devices should not be understood exclusively as technological tools, but also as mechanisms capable of improving autonomy, emotional comfort, and participation within tourism experiences.

From a Data-Driven Design perspective, many of these smart accessibility solutions depend on the continuous collection and analysis of behavioural and environmental data. User interaction patterns, mobility information, and accessibility feedback allow smart devices to progressively adapt their functioning and improve their responsiveness to users' needs. Consequently, DDD is expected to positively influence the development of smart accessibility devices within tourism environments.

H2: The role of Data-Driven Design (DDD) impacts Smart Device Development on Accessibility in Tourism for People with Disabilities (SDD).

Furthermore, because smart devices reduce uncertainty, improve autonomy, facilitate communication, and enhance personalized accessibility support, they are also expected to contribute positively to the happiness associated with AI-supported tourism experiences among people with disabilities.

H3: Smart Device Development on Accessibility in Tourism for People with Disabilities (SDD) impacts Happiness in Using AI for People with Disabilities in the Tourism Industry (HPD).

2.4. AI-driven simulators and virtual environments (SVE)

Artificial intelligence (AI) is increasingly being incorporated into virtual simulations and immersive environments aimed at improving accessibility within tourism contexts (Almufareh et al., 2024; Jiang, Meltzer, & Zhang, 2024). These technologies allow travelers with disabilities to interact with digital representations of destinations, accommodations, and tourism services before undertaking physical travel experiences, facilitating trip planning under safer and more predictable conditions.

Virtual reality (VR) environments and AI-supported simulators can recreate hotels, museums, transportation systems, or urban tourism routes, enabling users to evaluate accessibility conditions in advance (Nicola-Gavrilă, 2023). For travelers with mobility, visual, or cognitive impairments, this preliminary interaction with the destination may reduce uncertainty associated with unfamiliar environments and improve decision-making processes regarding accommodation choices, route planning, or activity participation (Müller et al., 2022).

Previous studies have shown that simulated environments may help users identify potential accessibility barriers before travelling, particularly in situations where conventional tourism information provides only limited or overly standardized descriptions of accessibility conditions (Wongvibulsin et al., 2020). In this sense, AI-driven simulations do not simply reproduce tourism spaces digitally; they also provide a mechanism through which users can anticipate difficulties, compare alternatives, and adapt travel expectations more realistically.

AI-driven simulators additionally allow tourism operators to analyse behavioural interactions within virtual environments and detect recurrent accessibility problems that may not emerge through traditional evaluation systems (Pavlopoulos, Rachiotis, & Maglogiannis, 2024). The analysis of interaction patterns, navigation behaviour, or user feedback can contribute to refining tourism services and improving accessibility-related decision-making processes.

Research on virtual environments has also highlighted their potential to increase users' confidence and familiarity with tourism settings before travelling physically (Carlson, 2023). Previewing accessible routes, spatial distributions, or transportation systems may reduce anxiety and reinforce perceptions of autonomy among travelers with disabilities (Ford, 2021). This

anticipatory dimension is particularly relevant in tourism experiences where uncertainty regarding accessibility conditions frequently influences destination choice and travel participation.

At the same time, the functioning of these virtual systems depends heavily on continuous data collection and adaptive learning processes. User interaction data, accessibility preferences, and behavioural responses allow AI systems to progressively improve simulation accuracy and personalization capabilities (Nicola-Gavrilă, 2023). Consequently, Data-Driven Design (DDD) may play an important role in strengthening the effectiveness and adaptability of AI-driven simulators and virtual environments.

H4: The role of Data-Driven Design (DDD) impacts AI-driven Simulators and Virtual Environments (SVE).

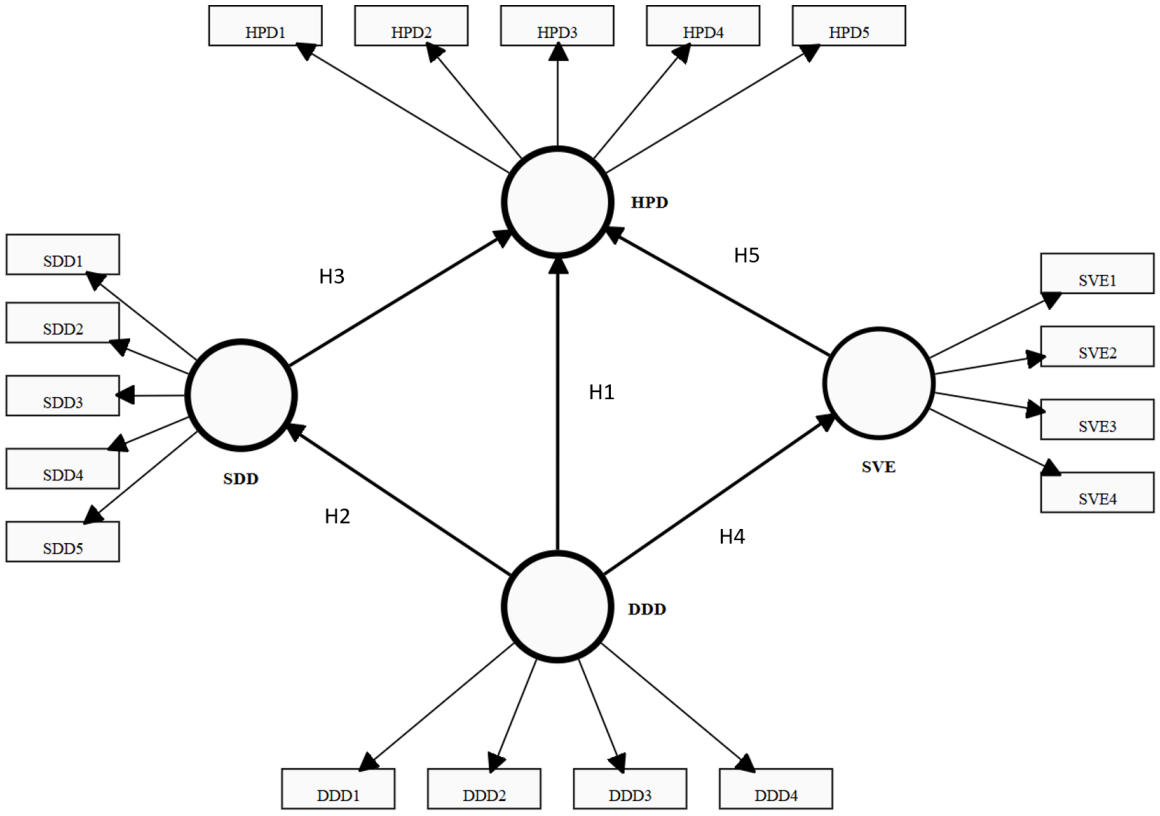
Given their capacity to improve travel preparation, reduce uncertainty, and facilitate more autonomous tourism planning, AI-driven simulators and virtual environments may also contribute positively to the happiness associated with AI-supported tourism experiences among people with disabilities.

H5: AI-driven Simulators and Virtual Environments (SVE) impact Happiness in Using AI for People with Disabilities in the Tourism Industry (HPD).

2.5. Research Model

Based on the theoretical relationships discussed above, the proposed research model examines the influence of Data-Driven Design (DDD) on Smart Device Development (SDD), AI-driven Simulators and Virtual Environments (SVE), and Happiness in Using AI for People with Disabilities in the Tourism Industry (HPD). The model also evaluates the effects of SDD and SVE on perceived happiness within accessible tourism experiences. Figure 1 presents the conceptual model proposed in this study.

Figure 1. Model



Source: own elaboration

3. Methodology

3.1. Preliminary research

The methodology for this study followed a structured approach. Through the Secretariat of State for Social Rights, we have obtained a list of the 50 leading disability associations in Spain. The Secretariat's role is the development of policies related to disability and social welfare. It coordinates the Spanish Disability Strategy and promotes the rights of people with disabilities. Within this ministry, the General Directorate of Disability Policies is directly responsible for promoting inclusive policies and supporting the entities that work in this field (see Table 1).

Table 1. Disability Care Centers

Centro de Atención a la Discapacidad La Princesa (Madrid)	Centro Ocupacional ANIDI (Sevilla)
Fundación ONCE (Madrid)	Fundación TAS (Sevilla)
Centro de Día ASPACE Madrid (Madrid)	Centro de Día Ntra. Sra. del Carmen (Sevilla)
Centro de Rehabilitación Laboral Nueva Vida (Madrid)	Centro de Discapacitados Afanas (Cádiz)

Source: Secretaría de Estado de Derechos Sociales

In June 2024, an invitation letter was sent to all centers for disabled individuals. In the same letter, each center was asked to provide the number of employees in order to determine the total population of workers. The total number of employees across all centers amounted to 3,870.

Simultaneously, and through a random selection process in June, we contacted five centers to define and verify the most relevant variables that contribute to the happiness of disabled individuals in the tourism sector. We also examined the role of Artificial Intelligence (AI) in improving the services offered at tourist destinations for disabled individuals. After determining the four constructs that were identified in the literature review, seven indicators were proposed for each construct. Two online sessions were held to refine some of these indicators and to adjust the wording of others. In the end, a total of 17 indicators were approved. Based on these findings, the questionnaire was drafted.

Before launching the final questionnaire, a preliminary pretest phase was conducted with professionals from five disability care centers selected through a random procedure. This exploratory stage aimed to assess the relevance, clarity, and contextual adequacy of the proposed constructs and indicators associated with AI, accessibility, and happiness in tourism environments. Two online sessions were organized with participating professionals to discuss the wording, conceptual coherence, and practical applicability of the indicators included in the instrument.

This preliminary stage was considered especially important given the complexity and heterogeneity associated with disability-related tourism experiences. Minor wording modifications and conceptual adjustments were introduced following participants' feedback in order to improve comprehensibility and content validity. After this refinement process, a final set of 17 indicators distributed across four constructs was retained for the study.

The decision to survey employees and professionals working in disability care centers rather than directly surveying tourists with disabilities responded to both methodological and practical considerations. These professionals accumulate extensive experience regarding accessibility barriers, inclusion needs, emotional concerns, and tourism-related difficulties commonly experienced by people with disabilities. Consequently, they were considered qualified informants capable of providing informed evaluations regarding the role of AI in improving accessibility and tourism experiences.

Additionally, the participating centers included individuals with highly heterogeneous disability profiles, including mobility, sensory, and cognitive impairments. This diversity created important challenges for designing a fully standardized questionnaire capable of guaranteeing equivalent interpretation and response reliability across all potential participants. For this reason, employees

and professionals working directly with these groups were selected as the most appropriate respondents for the present study.

At the end of July, the appropriate number of questionnaires was sent via Google Doc to each center. By the end of July, a total of 455 employees from 50 centers had responded. After reviewing the number of respondents, we sent a second follow-up letter to increase the response rate. By the end of August, the total number of responses increased to 796 questionnaires. Among these, we discarded 16 questionnaires due to incomplete responses. Therefore, the final sample consisted of 780 completed questionnaires.

This process enabled the systematic collection of information regarding the perceived role of AI in improving accessibility, inclusion, and tourism-related happiness for people with disabilities. The perspectives provided by employees and professionals working directly within disability support contexts also contributed to strengthening the practical and contextual relevance of the proposed model.

3.2. Indicators

Based on the literature review and the preliminary exploratory phase conducted with disability care professionals, the study operationalized four constructs through reflective indicators adapted from previous research on AI, accessibility, and inclusive tourism**.**

Table 2. Constructs and Indicators

Constructs	Indicators	Authors
The Role of Happiness in Using AI of People with Disabilities in the Tourism Industry (HPD)		
HPD1	Inclusive and accessible AI-supported tourism environments foster feelings of belonging, dignity, and positive emotional experiences among travelers with disabilities.	Bhaskar, Baruch, & Gupta, 2023; Harrow, et all., 2020; Sahoo, & Choudhury, 2023
HPD2	Autonomy and independence: AI-powered navigation systems promote independence, reducing reliance on assistance, enhancing happiness.	Buçinca, Malaya, & Gajos, 2021; del Valle, & Lara,. 2023; Mohammed & Watson, 2019
HPD3	Personalized services: AI analyzes preferences to provide personalized tourism experiences adapted to users' accessibility and emotional comfort needs.	Bhuiyan, 2024; Ryndach et al., 2021

HPD4	Assistive technologies: Assistive technologies reduce communication barriers and travel-related stress, contributing to more comfortable and emotionally positive tourism experiences.	Ryndach et al., 2021; Scherer, 2011.
HPD5	Data-driven refinement: AI-driven service refinement improves accessibility responsiveness and contributes to more satisfying and inclusive tourism experiences.	Núñez, Gómez-Pulido, & Ramírez, (2024); Semwal, et al., (2024).
Impact of Smart Device Development on Accessibility in Tourism for People with Disabilities (SDD)		
SDD1	Customized prosthetics and orthotics: AI-driven smart devices improve comfort and functionality, enhancing accessibility and participation in tourism.	Akhtar, et al., 2024; Liu, et al., 2022
SDD2	AI-powered navigation systems: Provide real-time guidance and adaptive routing to facilitate independent travel for disabled individuals.	Sahoo, S. K., & Choudhury, B. B. (2023)
SDD3	Assistive technology applications: AI applications bridge communication gaps, aiding interaction and providing essential information in accessible formats.	Leung, 2022; Sahoo, & Choudhury, 2023
SDD4	Personalized travel experiences: AI analyzes preferences to tailor recommendations, improving comfort and satisfaction for disabled travelers.	Buhalis, & Amaranggana, 2015); Leung, 2022
SDD5	Real-time accessibility feedback: Smart devices provide continuous information regarding accessible routes, services, and tourism facilities.	Leung, 2022; Rane, Choudhary & Rane, 2023
The role of Data-Driven Design (DDD)		
DDD1	Data analysis: AI processes large datasets to inform design decisions and identify areas needing improvement.	Provost, & Fawcett, 2013; Qin, & Chiang, 2019

DDD2	Predictive modeling: AI-driven simulations allow designers to visualize space interactions before construction.	Baduge, 2022; Pan, & Zhang, 2023
DDD3	Optimization algorithms: AI ensures space configurations maximize accessibility and improve facility layout efficiency.	Alavi, et al., 2024; Choi, et al., 2024
DDD4	Continuous feedback: AI gathers real-time data to iteratively refine designs, adapting to evolving accessibility needs.	Tatineni, & Allam, 2024
AI-driven simulators and virtual environments (SVE)		
SVE1	Virtual exploration: AI-driven simulators allow users to experience tourist destinations and accommodations in a controlled setting.	Almufareh, et al., 2024; Jiang, Meltzer & Zhang, 2024
SVE2	Pre-visit planning: Virtual environments enable disabled travelers to assess accessibility features before making physical visits.	Müller, K., 2022
SVE3	Data-driven refinement: AI analyzes behavior data to suggest personalized modifications or new services for better accessibility.	Nicola-Gavrilă, 2023; Wongvibulsin, et., 2020
SVE4	Enhanced confidence: AI-powered simulations help travelers preview accessible routes and amenities, increasing independence and reducing anxiety.	Carlson, 2023; Ford, 2021; Pavlopoulos, Rachiotis, & Maglogiannis

Source: own elaboration

4. Results

In structural equation modeling (SEM), the internal (inner) and external (outer) models are key components. The internal model represents the relationships between latent variables, depicting hypothesized causal paths. It focuses on the structural relationships and theory testing. The external model, also known as the measurement model, defines how latent variables are measured through observed indicators. It specifies the relationships between latent constructs and their indicators, addressing reliability and validity issues. As Hair et al. (2017) note, "The measurement model specifies how latent variables or hypothetical constructs are measured in

terms of observed variables" (p. 11). Chin (1998) emphasizes the importance of both models, stating, "The inner model specifies the relationships between unobserved or latent variables, whereas the outer model specifies the relationships between latent variables and their associated observed or manifest variables" (p. 313).

A. External model

4.1. Loading

Loading help assess how well an indicator reflects a latent variable. According to Hair et al., 2017, high loadings (typically above 0.7) indicate that the observed variable strongly represents the latent construct, contributing significantly to model validity. Smart PLS is a popular software tool for PLS-SEM analysis, used especially in exploratory research for its flexibility with complex models, small sample sizes, and formative indicators.

Table 2. Outer Loadings

	DDD	**HPD**	**SDD**	**SVE**
DDD1	0,902			
DDD2	0,874			
DDD3	0,777			
DDD4	0,844			
HPD1		0,916		
HPD2		0,847		
HPD3		0,805		
HPD4		0,784		
HPD5		0,849		
SDD1			0,881	
SDD2			0,893	
SDD3			0,833	
SDD4			0,809	
SDD5			0,887	
SVE1				0,886
SVE2				0,853

SVE3				0,872
SVE4				0,707

Source: own elaboration

4.2. Validity and reliability

Validity and reliability are key concepts in evaluating measurement models. Cronbach's alpha assesses internal consistency, showing how closely related items are as a group, with values above 0.7 considered acceptable for reliability (Hair et al., 2017). Composite reliability (rho_a) and (rho_c) provide more accurate estimates of reliability by accounting for the differing contributions of indicators, with values above 0.7 also indicating strong reliability (Henseler et al., 2016). Average variance extracted (AVE) measures convergent validity, determining the amount of variance captured by a construct in relation to the variance due to measurement error. An AVE above 0.5 indicates good convergent validity, meaning the construct explains more than half of the variance in its indicators (Fornell & Larcker, 1981).

Table 3. Validity and reliability

	Cronbach's alpha	**Composite reliability (rho_a)**	**Composite reliability (rho_c)**	**Average variance extracted (AVE)**
DDD	0,872	0,886	0,913	0,724
HPD	0,896	0,898	0,924	0,708
SDD	0,913	0,916	0,935	0,742
SVE	0,850	0,866	0,900	0,693

Source: own elaboration

4.3. Discriminant validity

Heterotrait-monotrait ratio (HTMT) compares correlations between indicators of different constructs (heterotrait) to correlations between indicators within the same construct (monotrait). The HTMT matrix provides a visual representation of these comparisons. Key indicators include the HTMT ratio (ideally below 0.85 or 0.90 for good discriminant validity), confidence intervals (should not include 1), and permutation tests for group comparisons. HTMT addresses limitations of traditional methods like the Fornell-Larcker criterion and is more sensitive in detecting discriminant validity issues, especially with highly correlated constructs. By examining the HTMT

matrix, researchers can identify potential discriminant validity problems and ensure that their constructs are truly distinct from one another in their measurement model.

Table 4. Heterotrait-monotrait ratio (HTMT)

	DDD	**HPD**	**SDD**	**SVE**
DDD				
HPD	0,753			
SDD	0,701	0,694		
SVE	0,741	0,747	0,824	

Source: own elaboration

The f-square (f^2) in Structural Equation Modeling (SEM) measures the effect size of an independent latent variable on a dependent latent variable, quantifying the impact of changes in the predictor variable. It is calculated as the ratio of the change in R^2 to the unexplained variance. Values of f^2 are interpreted as small (0.02), medium (0.15), or large (0.35), indicating the strength of the effect. In our case the impact of DDD in SDD is large (0,676) as well as DDD in SVE (0,748). This means that Data-Driven Design has a significant and substantial influence on both the development of smart devices and AI-driven simulators and virtual environments, which are critical for enhancing accessibility in tourism for people with disabilities. These large f^2 values highlight the crucial role of Data-Driven Design in shaping and improving these aspects, underscoring its importance in advancing accessibility.

Table 5. f square

	DDD	**HPD**	**SDD**	**SVE**
DDD		0,158	0,676	0,748
HPD				
SDD		0,039		
SVE		0,062		

Source: own elaboration

B. Inner modeling

The inner model in Structural Equation Modeling (SEM) represents the relationships between latent variables (constructs) in a theoretical model. It specifies how these constructs influence each other, typically using regression-like paths. The inner model contrasts with the outer model,

which focuses on the relationships between latent variables and their observed indicators. The inner model evaluates the strength and direction of these relationships, often using path coefficients.

4.4. Path coefficients

The coefficient of determination (R^2) in Structural Equation Modeling (SEM) quantifies how much of the variance in a dependent variable is explained by independent latent variables. According to Chin (1998), R^2 values are classified as substantial (0.67 or higher), moderate (0.33–0.66), and weak (0.19 or below). This measure indicates the explanatory power of the model, with higher values reflecting a better fit. R^2 (HPD)= 0.549, indicating that approximately 54.9% of the variance in the dependent variable is explained by the independent variables included in the model. This suggests a moderate to strong level of explanatory power.

Path coefficients in Structural Equation Modeling (SEM) quantify the strength and direction of the relationships between latent variables. These coefficients are standardized estimates representing the effect of one variable on another within the model (Hair et al., 2010). Bootstrapping with 5,000 subsamples was conducted to assess the significance and robustness of the structural relationships. According to Table 7, all proposed relationships were positive and statistically significant ($p < 0.001$), providing empirical support for H1 (DDD → HPD), H2 (DDD → SDD), H3 (SDD → HPD), H4 (DDD → SVE), and H5 (SVE → HPD). Data-Driven Design (DDD) showed significant positive effects on both Smart Device Development (SDD) and AI-driven Simulators and Virtual Environments (SVE), while SDD and SVE also positively influenced Happiness in AI-Supported Tourism Experiences (HPD).

Table 6. Path coefficients

	Original sample (O)	**2.5%**	**97.5%**	**T statistics (|O/STDEV|)**	**P values**
H1: DDD -> HPD	0,370	0,306	0,437	11,135	0,000***
H2: DDD -> SDD	0,635	0,586	0,682	26,169	0,000***
H4: DDD -> SVE	0,654	0,615	0,693	32,646	0,000***
H3: SDD -> HPD	0,204	0,110	0,305	4,090	0,000***
H5: SVE -> HPD	0,263	0,178	0,346	6,187	0,000***

*****, denotes a significance level of p < 0.001, indicating a highly significant result.**
****, denotes a significance level of p < 0.01, showing a moderately significant result.**
***, denotes a significance level of p < 0.05, indicating a significant result.**

Source: own elaboration

The Standardized Root Mean Square Residual (SRMR) in Structural Equation Modeling (SEM) measures the difference between observed and predicted correlations, providing an indication of model fit. SRMR values range from 0 to 1, with lower values representing better fit. Typically, values below 0.08 are considered acceptable, while values less than 0.05 suggest a good fit (Kline, 2015). SRMR helps identify potential misfit in the structural model by focusing on residuals. In our case, the value of SRMR is 0,07 so it is acceptable.

In relation to the study on AI's role in improving inclusion for people with disabilities in the tourism industry, Table 6 shows that Data-Driven Design (DDD) is more effective in explaining the dependent variable (0.248), *Happiness in Using AI of People with Disabilities in the Tourism Industry (HPD), than other independent variables like *Smart Device Development on Accessibility in Tourism for People with Disabilities (SDD) (0.129) and *AI-driven simulators and virtual environments (SVE)* (0.172).

This higher explanatory power can be attributed to DDD's dynamic and adaptive nature. DDD leverages real-time data and feedback from users to develop personalized and constantly evolving solutions, creating a more tailored experience for disabled travelers. By directly addressing their specific needs and preferences, DDD enhances their sense of inclusion, autonomy, and overall satisfaction with tourism services. This personalized approach contributes more significantly to happiness than generalized accessibility improvements like SDD or SVE, which offer essential but less tailored benefits.

While SDD and SVE improve accessibility and enjoyment, their contribution is more static and does not continuously adapt to individual user preferences in the same way DDD does. The iterative nature of DDD ensures that tourism services remain highly responsive and personalized, offering disabled travelers a smoother, more enjoyable experience. This ongoing refinement and customization explain why DDD better captures the variance in HPD, ultimately leading to greater happiness and satisfaction.

Table 7. Variance explained of the constructs

	Coeficient of Determination R2	**Direct Effect**	**Correlation**	**Variance explained**
HPD	0,549			
SDD		0,204	0,630	0,129
SVE		0,263	0,653	0,172
DDD		0,37	0,671	0,248
Total				0,549

SDD	0,403			
DDD		0,635	0,635	0,403
SVE	0,428			
DDD		0,654	0,654	0,428

Source: own elaboration

5. Discussion

The findings of this study reinforce the growing body of research suggesting that Artificial Intelligence (AI) may substantially contribute to improving accessibility and inclusion within tourism environments for people with disabilities. More specifically, the results indicate that Data-Driven Design (DDD), Smart Device Development (SDD), and AI-driven Simulators and Virtual Environments (SVE) positively influence happiness in AI-supported tourism experiences, although their explanatory capacities differ considerably across the proposed relationships.

The strong influence of DDD on both accessibility-related dimensions and happiness is particularly relevant. This finding supports previous studies emphasizing the importance of adaptive and data-driven tourism systems capable of responding dynamically to users' needs and behavioural patterns (Provost & Fawcett, 2013; Qin & Chiang, 2019). However, the present study extends prior research by showing that the contribution of DDD is not limited to operational accessibility improvements but also affects the emotional dimension of tourism experiences. In line with the Happiness Management perspective (Ravina-Ripoll et al., 2021), the results suggest that AI-driven personalization and continuous service adaptation may reinforce feelings of autonomy, comfort, and inclusion among travelers with disabilities.

The results also confirm the relevance of AI-powered accessibility technologies in promoting greater independence during tourism experiences. AI-driven navigation systems, intelligent routing applications, and adaptive mobility solutions reduce dependence on external assistance and facilitate safer interactions with unfamiliar environments. These findings are consistent with Mohammed and Watson (2019) and Leung (2022), who identified intelligent accessibility systems as key mechanisms for improving autonomous participation within tourism and public service contexts. From a psychological perspective, this relationship may also be interpreted through Self-Determination Theory, according to which autonomy constitutes a central dimension of positive human functioning and well-being (Ryan & Deci, 2000).

Similarly, the positive effects associated with smart accessibility devices support previous research emphasizing the value of AI-driven personalization in tourism environments (Bhuiyan, 2024; Buhalis & Amaranggana, 2015). Smart devices capable of adapting recommendations,

accommodation settings, or communication systems to users' accessibility requirements appear to contribute positively to the perceived quality of tourism experiences. Nevertheless, although SDD showed significant effects on happiness, its explanatory power was lower than that associated with DDD. This result suggests that isolated technological solutions may be less influential than integrated accessibility systems capable of continuously adapting to users' changing needs and contextual conditions.

The findings related to AI-driven simulators and virtual environments also deserve particular attention. Virtual accessibility simulations and immersive tourism previews appear to reduce uncertainty and improve users' confidence before travelling physically. This result is aligned with previous studies highlighting the capacity of virtual environments to facilitate anticipatory adaptation and reduce anxiety associated with unfamiliar tourism settings (Carlson, 2023; Wongvibulsin et al., 2020). In accessible tourism contexts, where uncertainty regarding real accessibility conditions frequently shapes destination choices and travel participation, these technologies may provide an important source of emotional reassurance and perceived control.

Another relevant finding concerns the relationship between AI-supported accessibility and happiness. While previous accessible tourism studies have predominantly focused on physical accessibility or service adaptation, the present research highlights the importance of considering emotional outcomes associated with technological inclusion. In this sense, happiness should not be interpreted merely as momentary satisfaction, but rather as a broader emotional response associated with autonomy, reduced stress, perceived dignity, and inclusive participation during tourism experiences (Nawijn, 2011; Ryan & Deci, 2000).

Overall, the results suggest that AI may contribute to accessible tourism not only through functional improvements but also through the creation of tourism experiences perceived as more autonomous, adaptive, and emotionally positive. Consequently, the study reinforces the idea that the future development of accessible tourism should move beyond purely infrastructural approaches and increasingly incorporate adaptive, data-driven, and user-centered technological systems capable of responding to both accessibility requirements and emotional dimensions of the travel experience.

6. Conclusions

The findings of this study suggest that Artificial Intelligence (AI) may play an important role in improving accessibility, inclusion, and happiness within tourism experiences for people with disabilities. More specifically, the results indicate that Data-Driven Design (DDD), Smart Device Development (SDD), and AI-driven Simulators and Virtual Environments (SVE) positively

contribute to more adaptive and accessible tourism environments, although their explanatory capacities differ across the proposed relationships.

Among the analysed dimensions, DDD showed the strongest influence on happiness in AI-supported tourism experiences. This result reinforces the relevance of adaptive and data-driven accessibility systems capable of continuously responding to users' needs, preferences, and behavioural patterns. Unlike static accessibility solutions, DDD allows tourism services to evolve dynamically according to real-time feedback and accessibility-related interactions, contributing not only to functional accessibility improvements but also to more autonomous and emotionally positive tourism experiences.

The study also highlights the importance of AI-powered assistive technologies and smart accessibility devices in reducing communication barriers and facilitating independent mobility during travel experiences. Technologies such as intelligent navigation systems, adaptive communication tools, and personalized accessibility services appear to improve users' confidence, comfort, and interaction with tourism environments. In this regard, the results support the idea that accessible tourism should not be understood exclusively from an infrastructural perspective, but also as an experience shaped by emotional comfort, perceived autonomy, and inclusive participation.

Similarly, AI-driven simulators and virtual environments emerged as relevant mechanisms for reducing uncertainty associated with tourism planning and destination accessibility. Virtual accessibility simulations allow users to preview tourism spaces before travelling physically, facilitating more informed decisions and improving confidence regarding accessibility conditions. This anticipatory dimension may be particularly important for travelers with disabilities, whose tourism experiences are frequently conditioned by concerns related to mobility, accessibility reliability, and environmental uncertainty.

From a practical perspective, the findings suggest that tourism operators should increasingly incorporate adaptive AI-driven systems capable of personalizing accessibility services and continuously refining tourism experiences according to users' feedback. The implementation of intelligent accessibility technologies, real-time navigation systems, virtual accessibility previews, and AI-supported communication tools may contribute to more inclusive tourism environments while also improving users' emotional experiences and perceived quality of service.

The study additionally contributes to accessible tourism research by incorporating happiness as a relevant outcome variable within AI-supported tourism contexts. While previous studies have primarily focused on accessibility conditions or service adaptation, the present research suggests that emotional dimensions such as autonomy, reduced anxiety, confidence, and perceived

inclusion should also be considered when evaluating the effectiveness of AI-driven tourism solutions for people with disabilities.

The study nevertheless presents several limitations. First, the sample was limited to disability care centers located in Spain, which may restrict the generalizability of the findings to other institutional or cultural contexts. Second, the research relied on the perceptions of professionals working in disability support environments rather than directly surveying travelers with disabilities. Although this methodological decision was justified by the heterogeneity of disability profiles represented in participating centers, future research should complement these findings through direct analyses involving tourism users with different types of disabilities. Third, the study focused specifically on DDD, smart devices, and virtual simulations, without considering other emerging AI-related technologies that may also influence accessible tourism experiences.

Future research could expand the geographical scope of the sample and examine differences associated with specific disability profiles, tourism contexts, or cultural environments. Additional studies may also explore the role of emerging technologies such as augmented reality, generative AI systems, or advanced wearable devices in shaping accessible tourism experiences. Finally, longitudinal approaches would be especially useful for analysing how the long-term implementation of AI-driven accessibility systems influences users' perceived happiness, autonomy, and tourism participation over time.

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