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Responsible technology use in tourism: Evaluating tourist guides' digital practices through best-worst method

Munevver Cicekdagi[1+]
Seda Ozdemir Akgul[2]

[1,2]*Selcuk University, Faculty of Tourism, Konya, Turkey.*
[1]*Email: mcicekdagi@selcuk.edu.tr*
[2]*Email: sedaozdemir@gmail.com*

(+ Corresponding author)

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ABSTRACT

The purpose of this study is to analyze tourist guides' awareness of responsible technology use. Conscious utilization of technology not only strengthens guides' professional responsibilities but also enhances the quality of tourists' experiences. It is crucial to determine how, within the guiding profession, criteria of responsible technology such as ethical awareness, data protection, sustainability, and the provision of inclusive and accessible services are prioritized. To this end, the study employs the Best-Worst Method. The findings reveal that ethical awareness and professional responsibility rank as the most significant criteria, whereas awareness of data security assumes a comparatively lower level of importance. Moreover, sustainability and accessibility solutions are identified as areas requiring greater integration by guides. The study proposes expanding ethical and digital security training in the guiding profession, increasing accessible tourism applications, and emphasizing sustainability in technology use. In doing so, it aims to promote more conscious management of digitalization in the tourism sector and contribute to its inclusiveness.

Contribution/Originality: This study is an original work examining tourist guides' responsible use of technology. In this context, professional tourist guides used the Best-Worst Method (BWM) to assign weights to criteria related to responsible technology use. By ranking these criteria in order of importance specifically for the guiding profession, the study offers an innovative contribution to the literature. As such, it serves as a valuable resource for both academic scholarship and sector practices.

1. INTRODUCTION

The rapid development of digital technologies has profoundly transformed industries, economies, and societies. Innovations such as big data, artificial intelligence, and the Internet of Things facilitate the optimization of business processes and enhance decision-making mechanisms, thereby simplifying users' tasks. However, the widespread use of these technologies also underscores the necessity of implementing digital transformation in a responsible and ethical manner (Sachdeva & Sharma, 2024). As information technologies offer beneficial services that increase efficiency in sustainable development, their adoption has expanded across all segments of society. At the same time, this has raised concerns regarding data usage, collection, and compensation, as well as cybersecurity threats and ethical considerations (Adejuwon & Ojeagbase, 2023; Hingle & Johri, 2024). Without proper oversight, rapidly evolving technologies risk exacerbating inequalities and creating negative societal impacts. The inability of technology providers to fully anticipate limitations, the slow pace of governmental regulations, and inequities in digital access further intensify these concerns (Seth, 2019). Consequently, establishing regulatory policies and legal frameworks to ensure the conscientious and ethical use of technology has become critical (Fehlinger, 2023).

The purpose of this study is to examine tourist guides' awareness of responsible technology use. Through this examination, it aims to clarify how the guiding profession should manage the criteria associated with responsible technology use, specifically the ethical use of technological tools, personal data security, accessibility and inclusivity, and sustainability. By identifying any potential shortcomings in tourist guides' responsible technology use, the study seeks to contribute to necessary improvements. Accordingly, it is anticipated that the findings will offer valuable data for policymakers and planners, serving as a roadmap for future enhancements.

- RQ1: Does responsible technology use by tourist guides affect the tourist experience?
- RQ2: What is the role of tourist guides' responsible use of technology in creating awareness of sustainable tourism?
- RQ3: From the perspective of accessible tourism, how can tourist guides use digital solutions to enhance the tourism experience for individuals with disabilities?
- RQ4: Based on the identified criteria, what are the best and worst aspects of tourist guides' technology use?
- RQ5: How do Industry 4.0 and digitalization alter guides' professional responsibilities?
- RQ6: How do tourist guides' levels of ethical awareness and professional responsibility reflect in their conscientious use of technological tools?

With the influence of Industry 4.0 and digitalization, the role of tourist guides is also evolving. Today's guides serve a wide range of travelers, including those with physical disabilities, elderly tourists, and visitors particularly concerned about data security. The use of various digital platforms, artificial intelligence, and mobile applications has introduced new responsibilities. The ethical and conscientious use of these technologies is critical not only for enhancing the tourist experience but also for providing sustainable and accessible services and fulfilling guides' professional responsibilities. A review of the literature, however, reveals a lack of detailed analysis regarding how guides employ digital tools and the extent to which these tools support tourism's accessibility and sustainability goals. Current studies that address the issue of technology with tour guides are mostly about the impact of technological developments on the tour guiding profession, the perceptions and attitudes of the guides (Bourret, Da Re, Juillière, & Fraoua, 2022; Çakmak & Demirkol, 2017; De La Harpe & Sevenhuysen, 2020; Düzgün, 2022; Gül, Ateş, Kabakulak, & Pelit, 2024; Kara, Kurt, & Güler, 2022; Seyitoğlu, Atsız, & Akyuz, 2025) and the use of robots and artificial intelligence in the guiding profession (Lee, 2017; Liu, Lu, & Liu, 2025; Liu, Li, Li, & Liu, 2025; Özalkan, Özkurt, & Ayyıldız, 2022; Yıldız, 2019). The significance of this study lies in its potential to fill this critical gap by offering concrete data on how guides, while performing their professional duties, can employ technology ethically, accessibly, sustainably, and securely. Within this framework, the study utilizes the Best-Worst Method (BWM), one of the multi-criteria decision-making techniques, to evaluate tourist guides' responsible use of technology, thus addressing a previously underexplored area in the literature.

2. LITERATURE REVIEW

2.1. Tourist Guides

Ap and Wong (2001) view tour guides as frontline representatives, suggesting that in this capacity, guides are expected to assume responsibility, educate tourists about the destinations they visit, raise their awareness (Cohen, 1985) effectively promote the destination to the point of influencing tourists' willingness to revisit, ensure hospitality, and shape tourists' perceptions of the environment by making it suitable for their needs. In addition to providing detailed information about the historical, cultural, and geographical characteristics of a destination (Prideaux, 2000), tour guides also serve as bridges between tourists from different cultures, helping to overcome communication barriers and enhance interaction (Buhalis & Law, 2001). While Ap and Wong (2001) refer to tour guides as "frontline performers," Bowie and Chang (2005) characterize them as those who manage the tour or whose primary duty is to provide accurate and detailed information about a given region; Mason (2020) and McKean (1976) describe them as cultural ambassadors; Cohen (1985) calls them guides; Geva and Goldman (1991) consider them key employees influencing the sale of future tours; Hall and Page (2014) label them as experience enablers; and Schmidt (1979) identifies them as individuals who help tourists see objects from a different perspective. However, these attributes mainly offer insights into the various roles of guides.

Advancements in technology and the transformations they bring to everyday life underscore the need for everyone in the service sector to adapt. The issue of making technology use beneficial for tour guides has emerged as an important topic, with scholars advocating for the inclusion of supportive tools for guides in bundled applications and for the proliferation of such apps (Işık & İşçen, 2020).

In modern tourism, integrating technology has enabled guides to employ more interactive and engaging methods of presenting information (McKercher, 1999). Nowadays, guides use systems consisting of headsets and microphones to facilitate communication, along with slideshows, compasses, navigation devices, tablets, personal digital assistants, smartphones, adventure cameras, and various navigational apps on phones (Şen, 2020).

2.2. Responsible Technology Use

With the growing impact of technological advancements on humanity, the tourism sector must adapt to meet the expectations of the new generation of travelers. In their study, Narvaez Rojas, Alomia Peñafiel, Loaiza Buitrago, and Tavera Romero (2021) emphasize the inevitability of transforming tourism services to align with the concept of a "new and advanced human," which is anticipated to emerge in tandem with technological developments. Sigala (2020) similarly points out that digitalization has radically changed the tourism experience, noting that people now demand services that are more personalized, interactive, and sustainable. In the same vein, Buhalis (2003) and Buhalis and Law (2008) argue that the revolutionary impact of digital transformation on customer experience compels the sector to develop more flexible structures and innovative models. Furthermore, De La Harpe and Sevenhuysen (2020) indicate that, thanks to advances in technology, tourists can now thoroughly research tourist guides, websites, and tour operators at no cost, leading to more varied tour programs and guided tours. This has enabled direct communication between tourists and guides without intermediaries and allowed travelers to design their own itineraries. Weiler and Black (2015) reinforce this view by illustrating how technological progress helps guide the meeting of visitors' individual preferences. According to UNWTO (2021), technological innovations are also shaping sustainable tourism policies, with the organization stressing the importance of revising strategic plans to accommodate this new understanding of humanity. Against this backdrop, it is evident that tourism must continually update its offerings with innovative service models and implement strategic actions centered on digitalization in order to keep pace with evolving customer expectations.

In their study, Stilgoe, Owen, and Macnaghten (2013) address the responsible use of technological innovations, emphasizing that innovation processes should consider not only technical and economic aspects but also social, ethical, and environmental dimensions. This approach aims to enable stakeholders' active participation while continually evaluating the ethical and social implications of innovation. Similarly, Von Schomberg (2013) underlines the critical role of ethical values in the vision of responsible research and innovation. Jobin, Ienca, and Vayena (2019) show that values such as transparency, accountability, fairness, privacy, and autonomy lie at the core of responsible technology practices that different institutions and countries adopt for the ethical use of artificial intelligence. In the same vein, Floridi and Cowls (2019) argue that responsible technology use, guided by the principles of beneficence, non-maleficence, autonomy, justice, and explicability, can foster social benefits. While Mittelstadt, Allo, Taddeo, Wachter, and Floridi (2016) highlight the significance of non-maleficence and autonomy in the ethical considerations of algorithms, Winfield and Jirotka (2018) claim that ethical governance in AI and robotic systems is achievable through accountability and transparency. Recent technological advances in the tourism sector must align with responsible technology principles and also meet customer needs, thus contributing to a sustainable future.

The increasing importance of responsible technology in the tourism sector carries the potential to both enrich visitor experiences and minimize social and environmental impacts. As digital tools and AI applications become more prevalent, tourism stakeholders must manage technology in line with both ethical and sustainable principles (Floridi & Cowls, 2019). Incorporating values such as transparency, accountability, fairness, and privacy into digital platforms in tourism can bolster tourist confidence and satisfaction, ultimately providing a long-term competitive advantage for the industry (Jobin et al., 2019). Moreover, adopting responsible technology practices facilitates guides, marketers, destination managers, and reservation systems in meeting next-generation expectations while leveraging digitalization in an ethical, eco-friendly manner (Buhalis & Law, 2008; Weiler & Black, 2015). Hence, the responsible use of technology supports the realization of sustainability principles in tourism, laying a foundation for innovative and conscientious service models that benefit both local communities and visitors (Winfield & Jirotka, 2018).

3. METHODOLOGY

In this study, the Best Worst Method (BWM) was employed to determine which criteria are emphasized and which are lacking in the responsible use of technology among tourist guides. BWM is one of the most recently introduced techniques among pairwise comparison methods (Alsharkawy, Hamdy, & Marzouk, 2025). Over the past five years, BWM has been used to solve real-world problems in many fields, including tourism, transportation, education, supply chain management, energy, performance evaluation, communications, healthcare, manufacturing, banking, technology, and investment. In some studies, BWM is applied on its own, while in others, it is integrated with various methods such as fuzzy TOPSIS, VIKOR, MAIRCA, fuzzy COPRAS, PROMETHEE, ELECTRE, and MABAC (Pamučar, Ecer, Cirovic, & Arlasheedi, 2020). In addition, BWM has been used in diverse areas such as risk and enabling innovation ranking, social sustainability, ranking of research and development projects, and marketing strategy analysis (Mondal, Singh, & Gupta, 2025).

There are several key reasons for choosing this method in the present study. First, BWM is robust against changes in ranking; in other words, minor shifts in the relative importance of criteria do not significantly affect the results. Second, the method's clarity and straightforward design enable decision-makers and stakeholders to more readily interpret the criterion weights and accept the outcomes (Cicekdagi, Ayyildiz, & Akkoyunlu, 2023). Because BWM requires fewer comparisons between criteria only relative to the best and worst criteria, it avoids contradictory responses between pairs and thereby enhances the study's consistency (Ayyildiz & Taskin Gumus, 2021; Pamučar et al., 2020; Yucesan, Mete, Serin, Celik, & Gul, 2019). Moreover, it delivers reliable and balanced results compared to other multi-criteria decision-making methods. Finally, its suitability is underscored by its ability to reveal which aspects of tourist guides' technology use are underperforming and need improvement.

According to Rezaei (2016), a panel of between five and fifteen experts is sufficient to ensure consistency in the Best–Worst Method (BWM). Consequently, the present study draws on data provided by nine actively employed professional tourist guides (n = 9). The guides were recruited through the Association of Turkish Tourist Guides (TUREB) using a purposive snowball sampling strategy, an approach that is non-probabilistic in nature. In purposive snowball sampling, the researcher first selects information-rich participants who meet predetermined criteria and then asks these participants to recommend others with similar characteristics until theoretical saturation is reached (Creswell & Poth, 2018). For this study, explicit inclusion criteria required each guide to have a minimum of three years of field experience and to make regular use of technological tools. The Best–Worst comparison instrument was designed in Google Forms. Following cognitive interviews with two guides, ambiguous wording was refined. Data were collected via an online survey during January–February 2025; each session lasted approximately 30 minutes. The responses were subsequently analyzed with the Excel BWM Solver add-in.

3.1. Best–Worst Method (BWM)

BWM, introduced to the literature by Rezaei, (2015), is employed in multi-criteria decision-making (MCDM) problems to determine the relative importance of different criteria by incorporating decision-makers' preferences (Rezaei, 2016). Under this approach, domain experts first identify the best (most important) and the worst (least important) criteria. They then compare all remaining criteria against these two extremes. Through this process, the weighted significance of each criterion is established, thereby reducing inconsistencies and complex data while simplifying the decision-making process for evaluators.

BWM steps are listed as follows (Rezaei, 2015).

Step 1. Determine the criteria you will use in making decisions. $(C_1, C_2, \ldots, C_n)$.

Step 2. Determine the criteria that are best (important) and worst (unimportant) for you.

Step 3. Give a number between 1 and 9 (1 - equally important, 3 - moderately more important, 5 - highly important, 7 - much more important, 9 - extremely important). In this way, a vector that moves from the best to the others is reached. This vector, called Best-Others (AB), should be as follows.

$$A_B = (a_{B1}, a_{B2}, \ldots, a_{Bn})$$

Each a_{Bj}, in vector AB represents the preference of best criterion B over criterion j.

Also, a_{BB}= 1. This means that the most important criterion will be compared with itself.

Step 4. Give a number between 1 and 9 to determine the status of the worst criterion you have chosen relative to all other criteria.

$$A_w = (a_{1W}, a_{2W}, \ldots, a_{nW})^T$$

In this vector, each a_{JW} indicates criterion j's preference over the worst criterion W.

a_{WW} = 1. This means that the worst criterion will be compared with itself.

Step 5. Find the optimal weights for each criterion.

(w1 *, w2*, ……... wn*).

The optimal weight for the criteria is $\frac{w_B}{w_j}= a_{Bj}$ and $\frac{w_J}{w_W}= a_{jW}$ for each $(w_1^*, w_2^*, \ldots, w_n^*)$ pair, respectively. There must be values of j, $\left|\frac{w_B}{w_j} - a_{Bj}\right|$, $\left|\frac{w_j}{w_W} - a_{jW}\right|$ where the maximum absolute differences are minimized, which is translated into the following min–max model.

$$\min \max_j \left\{ \left|\frac{w_B}{w_j} - a_{Bj}\right|, \left|\frac{w_j}{w_W} - a_{jW}\right| \right\} \tag{1}$$

subject to

$$w_j \geq 0, \text{for all j} \tag{2}$$

$$\textstyle\sum_{j=1}^{n} w_j = 1 \tag{3}$$

This mathematical model can be represented:

$$\min \ \zeta \tag{4}$$

subject to.

$$\left|\frac{w_B}{w_j} - a_{Bj}\right| \leq \zeta, \text{for all j} \tag{5}$$

$$\left|\frac{w_j}{w_W} - a_{jW}\right| \leq \zeta, \ \text{for all j} \tag{6}$$

The 4 main criteria and 25 sub-criteria stated above (see Table 1) were evaluated by 9 experts and calculated by formulating them in the Solver add-on using the BWM Solvers Microsoft Excel add-in.

3.2. Case Application

In this study, the focus was on evaluating tourist guides. As the Best-Worst Method (BWM) requires expert opinions, efforts were made to reach tourist guides who actively use technology both during their tours and in their personal lives. For this purpose, one of the purposive sampling techniques, namely the snowball sampling method, was employed. Through snowball sampling, nine volunteer tourist guides who actively participate in tours in different regions of Turkey were recruited. These professional tourist guides each had between 3 and 20 years of experience in the field.

3.3. Evaluation Criteria

A criterion table was created to identify the core competencies of tourist guides regarding responsible technology use. In developing these criteria, a literature review, expert opinions, and sectoral needs were taken into account. First, academic studies focusing on digitalization in tourism, ethical awareness, data privacy, sustainability, accessibility, and related areas were examined to determine prominent factors in the use of technology within the tourism industry. Subsequently, consultations were held with expert tourism scholars and experienced tourist guides. Based on these discussions, the scope of the criteria was adjusted to align with the needs of the field. The finalized main and sub-criteria are presented in Table 1.

Table 1. Main and sub-criteria evaluations of tourist guides.

Number	Criterion
C1	Ethical awareness and professional responsibility
C1.1	Knowledge of ethical concepts and professional standards
C1.2	Awareness of the risks of misuse of technological tools
C1.3	Personal curiosity or basic vocational training competence
C1.4	Observing tourist rights and the accuracy of information when using technological tools
C1.5	Having knowledge on accuracy, copyright, reliability when sharing digital content
C1.6	Paying attention to copyright or content accuracy
C1.7	Having knowledge and experience that can guide colleagues in the sector in this field
C2	Personal data privacy and security
C2.1	Protecting tourists' personal data (e.g., phone, e-mail)
C2.2	Ability to use encryption and secure applications to protect tourist information
C2.3	Knowledge of guidance institutions' guidelines for personal data protection
C2.4	Expert or highly aware of personal data protection and cybersecurity
C2.5	Ability to develop sample applications in the collection, storage and destruction of tourist data
C3	Sustainability and environmental awareness
C3.1	Caring about the impact of technology use on the environment or society
C3.2	Awareness of resource consumption such as paper, energy, etc.
C3.3	Providing systematic information to tourists on this issue
C3.4	Combining technology with environmental awareness (e.g., electronic ticket, digital brochure)
C3.5	Creating awareness on issues such as carbon footprint or respect for nature during the tour process.
C3.6	Integrating innovative technologies into the monitoring and tour program with a focus on sustainability
C3.7	Designing inclusive applications that will guide other guides, companies, or tourists
C4	Accessibility and inclusion
C4.1	Awareness of the concept of accessibility
C4.2	Being able to use technological solutions that appeal to disabled tourists or special needs
C4.3	Being able to use some basic level applications (e.g., translation application) and make special precautions/Adjustments for disabled tourists
C4.4	Using translation tools for different languages regularly
C4.5	Being aware of applications that guide hearing or visually impaired tourists and being careful to use them
C4.6	Being able to prepare special digital materials according to different types of disabilities

3.3.1. C1: Ethical Awareness and Professional Responsibility

As digitalization gains increasing importance in the tourism sector, the use of technological tools has also expanded. Having knowledge of ethical awareness when employing these technologies is a key factor in providing reliable and responsible services (Floridi & Cowls, 2019; Jobin et al., 2019). Several studies underscore the significance of knowledge and experience in developing ethical responsibility and professional standards. According to Buhalis (2003), sharing knowledge and experience with colleagues helps instill a holistic understanding of ethical responsibility throughout the industry. Similarly, Buhalis and Law (2008) emphasize that knowledge and experience gained through the use of technological tools contribute, whether negatively or positively, depending on the context to the broader dissemination of ethical awareness and professional responsibility. Gretzel, Sigala, Xiang, and Koo (2015) highlight that strengthening ethical standards via knowledge and experience acquired through the integration of technological tools into the tourism sector is crucial, particularly when such insights are shared among colleagues. Being aware of the risks associated with the misuse of technological tools is critical for developing competencies supported by personal curiosity and fundamental professional training. In the tourism field specifically, safeguarding tourist rights, ensuring the accuracy of information when using technological tools, respecting copyright in digital content sharing, and guaranteeing the reliability of the content are paramount for the transparency and accountability of the sector (Mittelstadt et al., 2016; Winfield & Jirotka, 2018).

3.3.2. C2: Personal Data Privacy and Security

Information and Communication Technologies (ICT) are bringing about changes in the traditional methods and processes of the hospitality sector (Pipyros & Liasidou, 2025). However, along with the advantages offered by these new digital technologies come various cybersecurity challenges. System and human vulnerabilities can be exploited by malicious hackers (Chatzigeorgiou, Kasnesis, & Toumanidis, 2019). Today, the concept of security extends beyond protecting lives and property; digital data and issues such as cyberattacks have also become integral to the notion of security (Hayta, 2021). The incorporation of systems like artificial intelligence, augmented reality, cloud computing, and robotics into travel, accommodation, and food and beverage processes introduces risks to personal data, leading to concerns regarding cybersecurity and privacy (Aseer et al., 2025; Çark & Akyürek, 2021; İbiş, 2019; Karaş, 2024; Kayıkçı & Bozkurt, 2018). A lack of technological literacy among users can further exacerbate these issues (Aseer et al., 2025). With the widespread adoption of ICT, increasing breaches of privacy are now considered criminal offenses according to penal codes (İbiş & Batman, 2014). The protection of personal data is not just a legal obligation; securely processing and storing users' sensitive information is also vital for ensuring their safety (Schneier, 2015). Colin Michael Hall and Ram (2020) identify six key privacy-related themes in tourism: protecting tourists' personal space, respecting the privacy of host communities, the impact of ICT on privacy in the tourism sector, general data protection and privacy laws, the privacy of employees in the tourism sector, and ensuring privacy in the design of hospitality facilities. Shortcomings in areas such as anonymizing, encrypting, and strictly controlling access to personal data pose a threat to data security. Various national and international standards have been established in this regard, including those developed by the U.S.-based National Institute of Standards and Technology (NIST), the European Union Agency for Cybersecurity (ENISA), the General Data Protection Regulation (GDPR), the Council of Europe's Budapest Convention (Convention on Cybercrime), and ISO/IEC 27001 Information Security Management System (Yıldırım, 2025). Additionally, hotels, guesthouses, and similar businesses, as well as those providing short-term rentals, also bear specific responsibilities for safeguarding personal data (Altınkan, 2025). Accommodation facilities often share policies detailing their privacy commitments, principles, scope of personal information, conditions for data sharing, and the security systems in use with customers to earn their trust (Türeli, Davras, & Dolmacı, 2015).

Based on the above information, it is clear that personal data privacy and security hold increasing significance within the tourism industry. Existing studies, however, appear to focus more on personal data privacy and security in accommodation and travel businesses, while there has been no direct research on tourist guides who interact with tourists on a one-on-one basis throughout their journeys. Tourist guides are not merely information providers; they are professionals responsible for protecting tourists' personal data (e.g., passport information, payment details, personal preferences) processed in digital databases belonging to guides or businesses. Safeguarding personal data is crucial for earning the trust of tourists. Within the scope of responsible technology use, a tourist guide who respects visitors' privacy is expected to help them experience a more comfortable, secure, and enjoyable trip.

3.3.3. C3: Sustainability and Environmental Awareness

At the core of sustainable tourism lies the principle of minimizing negative impacts while maximizing positive ones (Weaver, 2006). In the tourism sector, sustainability plays a critical role in preserving natural resources, reducing environmental impacts, and safeguarding the interests of local communities. While Buhalis (2003) and Buhalis and Law (2008) highlight the important role of digitalization in promoting sustainable practices in tourism, Gretzel et al. (2015) note that smart tourism provides innovative technological solutions for monitoring and mitigating environmental indicators. Recent UNWTO (2021) reports further underline how digital transformation in tourism applications can reduce resource consumption, enhance energy efficiency, and lower carbon footprints, emphasizing the essential part such technological advances play in environmental sustainability. These applications not only support efforts to maintain the ecological balance of tourism destinations but also serve to raise tourists' environmental awareness through systematic information exchange. Moreover, integrating sustainable tourism into strategic planning, backing innovative technologies with monitoring systems, and disseminating knowledge through comprehensive training programs all contribute to heightened environmental consciousness throughout the sector (Dredge & Jenkins, 2011; UNWTO, 2017; Weaver, 2006). In their assessment of the environmental effects of digital applications in tourism, Gössling, Scott, and Hall (2013) reveal that these technological transformations have a lower environmental footprint than traditional methods. Likewise, Ioannides and Gyimóthy (2016) stress the critical role digital technologies play in making tourism experiences more eco-friendly and resource-efficient, thereby demonstrating that digitalization in tourism not only enhances operational efficiency but also forms part of broader strategic efforts to preserve ecological balance.

3.3.4. C4: Accessibility and Inclusion

Tourism is a right for everyone to enjoy (McCabe, 2020). In cultural tourism, accessibility aims to ensure that individuals can benefit from cultural heritage and related services on an equal footing. Achieving this objective necessitates the elimination of physical, economic, cognitive, and digital barriers, thereby creating an inclusive environment in which all individuals can freely engage (Vujičić et al., 2023). The tourism industry serves a diverse consumer base, a significant portion of which is composed of individuals with disabilities (Buhalis & Darcy, 2010). This group may also include older travelers or individuals temporarily affected by physical limitations, such as those experiencing reduced mobility after an accident. People with disabilities generally prefer to maintain independence; however, when they do need assistance, they often prefer professional support rather than relying on family or friends (Rubio-Escuderos, García-Andreu, & Ullán de la Rosa, 2025). For those with special access needs in terms of mobility, vision, hearing, and cognitive functions, more inclusive designs are essential, incorporating equal travel opportunities along with relevant information and mediation. Only in this way can individuals with disabilities access suitable tourism services, products, and environments and travel independently, ultimately ensuring equal and dignified participation in tourism activities (Darcy & Dickson, 2009; Eichhorn & Buhalis, 2011). Fernández-Díaz, Jambrino-Maldonado, Iglesias-Sánchez, and de las Heras-Pedrosa (2023) outline the fundamental dimensions of accessible tourism. One-dimensional physical accessibility encompasses the environment, buildings, infrastructure, and access to informational resources. Another dimension of digital accessibility covers websites, mobile applications, social media, and other platforms and documents. While the convergence of technology and tourism offers vast opportunities for the industry, addressing accessibility issues is paramount to ensure that all travelers can experience a satisfying and equitable journey. Although the use of Industry 4.0 technologies in tourism paves the way for innovative solutions, the universal accessibility of these innovations is key to creating a more inclusive and enriching travel experience (Vujičić et al., 2023). In this context, various mobile applications help integrate visually impaired travelers into society, improve communication for those with hearing impairments, assist both adult and child travelers with speech limitations, locate accessible restrooms and parking spaces, provide accessible tourism platforms for disabled visitors, offer aids for limited hand mobility, and deliver GPS services for the visually impaired (Topsakal, 2018).

With the emergence of the Tourist 5.0 "super-smart tourist concept, the expectations of professional tourist guides encompassing Generation Z have started to shift (9). Tourist guides play a critical role in ensuring accessibility and inclusivity through responsible technology use. During tours, guides should employ digital solutions that cater to individuals with visual disabilities (such as audio descriptions and GPS navigation), those with hearing impairments (such as visual and written information), and those with physical disabilities (such as accessible routes and mobile applications). By doing so, they can provide an equitable tourism experience for everyone, transforming themselves into professionals who, through conscientious use of technology, contribute to a more inclusive tourism landscape.

3.4. Weight Determination by BWM

In this study, we first aim to determine the criteria weight. For this purpose, experts are consulted to evaluate the criteria. As aforementioned, each expert selects both the most important (best) criterion and the least important (worst) criterion. Then, pairwise comparisons between the best and worst criteria are performed. Table 2 shows the pairwise comparisons for each expert.

Table 2. Pairwise comparisons for the main criteria.

Expert	Best	Worst	A_B	A_w^T
E1	Sustainability and environmental awareness	Ethical awareness and professional responsibility	(9,5,1,5)	(1,5,9,5)
E2	Ethical awareness and professional responsibility	Accessibility and inclusion	(1,2,3,9)	(9,8,7,1)
E3	Ethical awareness and professional responsibility	Personal data privacy and security	(1,9,3,2)	(9,1,8,7)
E4	Ethical awareness and professional responsibility	Personal data privacy and security	(1,9,3,4)	(9,1,5,7)
E5	Sustainability and environmental awareness	Personal data privacy and security	(2,9,1,3)	(7,1,9,6)
E6	Accessibility and inclusion	Sustainability and environmental awareness	(3,3,9,1)	(4,3,1,9)
E7	Ethical awareness and professional responsibility	Accessibility and inclusion	(1,6,2,8)	(9,2,7,1)
E8	Ethical awareness and professional responsibility	Sustainability and environmental awareness	(1,3,9,5)	(9,6,1,3)
E9	Accessibility and inclusion	Personal data privacy and security	(2,9,3,1)	(3,1,2,9)

Table 3 shows the answers given by 9 different decision-makers were analyzed along with the criteria weights, final weights, Input-Based CR (IB), Associated Threshold (AT), and Reliability. If Input-Based CR (IB) < Associated Threshold (AT), it means the ratios are considered to be consistent. Based on this rule, all expert assessments appear to be consistent.

Table 3. Main criteria weights and reliability for each expert.

Expert /Criteria	C1	C2	C3	C4	Input-based CR (IB)	Associated threshold (AT)	Reliability (IB<AT)
E1	0.056	0.153	0.637	0.153	0.222	0.268	Acceptable
E2	0.477	0.289	0.192	0.042	0.166	0.268	Acceptable
E3	0.471	0.039	0.196	0.294	0.208	0.268	Acceptable
E4	0.550	0.045	0.231	0.173	0.263	0.268	Acceptable
E5	0.283	0.045	0.484	0.188	0.125	0.268	Acceptable
E6	0.195	0.195	0.057	0.552	0.041	0.268	Acceptable
E7	0.533	0.103	0.308	0.056	0.107	0.252	Acceptable
E8	0.583	0.227	0.054	0.136	0.125	0.268	Acceptable
E9	0.238	0.063	0.175	0.524	0.041	0.268	Acceptable
Final weight	0.376	0.129	0.260	0.235	0.144	0.266	Acceptable

As shown in Table 3, the most important criterion for evaluating tourist guides is "Ethical Awareness and Professional Responsibility," with a weight of 0.376. It is followed by "Sustainability and Environmental Awareness" (0.260) and "Accessibility and Inclusion" (0.235). Among the four main criteria, the least important is "Personal Data Privacy and Security," which has a weight of 0.129.

Table 4 shows the pairwise comparisons for each expert of the sub-criteria of C1.

Table 4. Pairwise comparisons for sub-criteria of C1.

Expert	Best	Worst	A_B	A_w^T
E1	Awareness of the risks of misuse of technological tools	Having knowledge and experience that can guide colleagues in the sector in this field	(7,1,8,5,7,6,9)	(3,9,2,3,3,4,1)
E2	Knowledge of ethical concepts and professional standards	Personal curiosity or basic vocational training competence	(1,3,9,4,6,7,8)	(9,7,1,6,2,3,4)
E3	Knowledge of ethical concepts and professional standards	Paying attention to copyright or content accuracy	(1,4,3,2,5,9,7)	(9,7,8,6,4,1,3)
E4	Having knowledge of accuracy, copyright, reliability when sharing digital content	Paying attention to copyright or content accuracy	(6,3,4,5,1,9,8)	(4,7,6,5,9,1,2)
E5	Knowledge of ethical concepts and professional standards	Awareness of the risks of misuse of technological tools	(1,9,4,5,4,6,6)	(9,1,4,3,6,3,3)
E6	Having knowledge and experience that can guide colleagues in the sector in this field	Awareness of the risks of misuse of technological tools	(2,8,4,3,2,3,1)	(7,1,6,4,7,7,8)
E7	Knowledge of ethical concepts and professional standards	Awareness of the risks of misuse of technological tools	(1,7,3,2,4,5,5)	(7,1,6,4,2,3,3)
E8	Having knowledge and experience that can guide colleagues in the sector in this field	Personal curiosity or basic vocational training competence	(2,3,9,2,4,5,1)	(5,4,1,5,3,2,9)
E9	Observing tourist rights and accuracy of information when using technological tools	Personal curiosity or basic vocational training competence	(2,3,9,1,3,4,5)	(8,7,1,9,7,6,5)

Table 5. Sub-criteria weights and reliability for each expert (C1).

Expert /Criteria	C1.1	C1.2	C1.3	C1.4	C1.5	C1.6	C1.7	Input-based CR (IB)	Associated threshold (AT)	Reliability (IB<AT)
E1	0.089	0.480	0.077	0.124	0.089	0.103	0.038	0.208	0.351	Acceptable
E2	0.430	0.174	0.037	0.131	0.087	0.075	0.065	0.319	0.351	Acceptable
E3	0.347	0.109	0.146	0.219	0.088	0.029	0.063	0.263	0.351	Acceptable
E4	0.085	0.169	0.127	0.102	0.417	0.036	0.064	0.222	0.351	Acceptable
E5	0.417	0.034	0.133	0.106	0.133	0.089	0.089	0.208	0.351	Acceptable
E6	0.179	0.027	0.090	0.119	0.179	0.119	0.287	0.285	0.340	Acceptable
E7	0.339	0.037	0.140	0.210	0.105	0.084	0.084	0.261	0.314	Acceptable
E8	0.177	0.118	0.035	0.177	0.089	0.071	0.333	0.041	0.351	Acceptable
E9	0.199	0.133	0.028	0.327	0.133	0.100	0.080	0.222	0.351	Acceptable
Final weight	0.251	0.142	0.090	0.168	0.147	0.078	0.122	0.225	0.346	Acceptable

As shown in Table 5, the most important sub-criterion is "Knowledge of ethical concepts and professional standards" (0.251), followed by "Observing tourist rights and ensuring the accuracy of information when using technological tools" (0.168), "Having knowledge of accuracy, copyright, and reliability when sharing digital content" (0.147), "Awareness of the risks of misuse of technological tools" (0.142), **"**Having knowledge and experience that can guide colleagues in the sector" (0.122), and "Personal curiosity or basic vocational training competence" (0.090), whereas the least important is "Paying attention to copyright or content accuracy" (0.078).

Table 6 shows the pairwise comparisons for each expert of the sub-criteria of C2.

Table 6. Pairwise comparisons for sub-criteria of C2.

Expert	Best	Worst	A_B	A_w^T
E1	Ability to use encryption and secure applications to protect tourist information	Protecting tourists' personal data (e.g., phone, e-mail)	(9,1,6,3,6)	(1,9,3,6,3)
E2	Protecting tourists' personal data (e.g., phone, e-mail)	Ability to develop sample applications in the collection, storage and destruction of tourist data	(17,2,3,9)	(9,3,5,4,1)
E3	Protecting tourists' personal data (e.g., phone, e-mail)	Expert or highly aware of personal data protection and cybersecurity	(1,3,2,9,6)	(9,7,8,1,2)
E4	Knowledge of guidance institutions' guidelines for personal data protection	Ability to use encryption and secure applications to protect tourist information	(2,9,1,4,5)	(8,1,9,6,5)
E5	Ability to use encryption and secure applications to protect tourist information	Knowledge of guidance institutions' guidelines for personal data protection	(4,1,9,4,5)	(4,9,1,3,6)
E6	Ability to use encryption and secure applications to protect tourist information	Ability to develop sample applications in the collection, storage and destruction of tourist data	(6,1,5,4,8)	(2,8,4,5,1)
E7	Expert or highly aware of personal data protection and cybersecurity	Protecting tourists' personal data (e.g., phone, e-mail)	(5,4,3,1,2)	(1,2,3,5,4)
E8	Protecting tourists' personal data (e.g., phone, e-mail)	Expert or highly aware of personal data protection and cybersecurity	(9,8,7,1,2)	(1,2,3,5,4)
E9	Knowledge of guidance institutions' guidelines for personal data protection	Protecting tourists' personal data (e.g., phone, e-mail)	(9,2,1,3,4)	(1,8,9,7,5)

Table 7. Sub-criteria weights and reliability for each expert (C2).

Expert /Criteria	C2.1	C2.2	C2.3	C2.4	C2.5	Input-based CR (IB)	Associated threshold (AT)	Reliability (IB<AT)
E1	0.042	0.518	0.110	0.220	0.110	0.125	0.306	Acceptable
E2	0.432	0.063	0.283	0.189	0.033	0.166	0.306	Acceptable
E3	0.425	0.180	0.270	0.034	0.090	0.166	0.306	Acceptable
E4	0.271	0.039	0.446	0.136	0.109	0.222	0.306	Acceptable
E5	0.166	0.499	0.037	0.166	0.133	0.291	0.306	Acceptable
E6	0.130	0.390	0.156	0.195	0.130	0.214	0.295	Acceptable
E7	0.072	0.118	0.158	0.416	0.237	0.200	0.230	Acceptable
E8	0.067	0.075	0.086	0.469	0.302	0.166	0.306	Acceptable
E9	0.037	0.252	0.417	0.168	0.126	0.166	0.306	Acceptable
Final weight	0.182	0.237	0.218	0.221	0.141	0.191	0.296	Acceptable

As shown in Table 7, the highest-priority sub-criterion is "Ability to use encryption and secure applications to protect tourist information" (0.237), followed by "Being an expert or highly aware of personal data protection and cybersecurity" (0.221), "Knowledge of guidance institutions' guidelines for personal data protection" (0.218), and "Protecting tourists' personal data (e.g., phone, e-mail)" (0.182). Among the five sub-criteria, the least important is "Ability to develop sample applications for the collection, storage, and destruction of tourist data" (0.141).

Table 8 shows the pairwise comparisons for each expert of the sub-criteria of C3.

Table 8. Pairwise comparisons for sub-criteria of C3.

Expert	Best	Worst	A_B	A_W^T
E1	Integrating innovative technologies into the monitoring and tour program with a focus on sustainability	Combining technology with environmental awareness (e.g., electronic ticket, digital brochure)	(6,6,6,9,6,1,6)	(4,4,4,1,4,9,4)
E2	Awareness of resource consumption such as paper, energy, etc.	Combining technology with environmental awareness (e.g., electronic ticket, digital brochure)	(2,1,3,9,2,4,4)	(3,9,5,1,7,8,6)
E3	Combining technology with environmental awareness (e.g., electronic ticket, digital brochure)	Designing inclusive applications that will guide other guides, companies, or tourists	(4,2,6,1,5,3,9)	(6,8,3,9,4,7,1)
E4	Combining technology with environmental awareness (e.g., electronic ticket, digital brochure)	Designing inclusive applications that will guide other guides, companies, or tourists	(2,3,4,1,5,6,9)	(8,7,6,9,5,4,1)
E5	Caring about the impact of technology use on the environment or society	Providing systematic information to tourists on this issue	(1,4,9,7,4,3,5)	(9,6,1,3,6,8,5)
E6	Integrating innovative technologies into the monitoring and tour program with a focus on sustainability	Combining technology with environmental awareness (e.g., electronic ticket, digital brochure)	(8,4,3,9,8,1,3)	(3,4,5,3,1,8,6)
E7	Creating awareness on issues such as carbon footprint or respect for nature during the tour process	Creating awareness on issues such as carbon footprint or respect for nature during the tour process	(4,2,7,2,1,3,4)	(2,4,1,4,7,3,2)
E8	Creating awareness on issues such as carbon footprint or respect for nature during the tour process	Designing inclusive applications that will guide other guides, companies, or tourists	(8,8,8,7,9,2,1)	(2,2,2,3,1,4,5)
E9	Integrating innovative technologies into the monitoring and tour program with a focus on sustainability	Providing systematic information to tourists on this issue	(3,4,9,7,8,1,6)	(8,6,1,2,3,9,4)

Table 9. Sub-criteria weights and reliability for each expert (C3).

Expert /Criteria	C3.1	C3.2	C3.3	C3.4	C3.5	C3.6	C3.7	Input-based CR (IB)	Associated threshold (AT)	Reliability (IB<AT)
E1	0.099	0.099	0.099	0.038	0.099	0.467	0.099	0.208	0.351	Acceptable
E2	0.159	0.299	0.130	0.023	0.194	0.097	0.097	0.319	0.351	Acceptable
E3	0.111	0.223	0.074	0.330	0.089	0.149	0.024	0.208	0.351	Acceptable
E4	0.213	0.142	0.107	0.351	0.085	0.071	0.030	0.222	0.351	Acceptable
E5	0.385	0.124	0.030	0.071	0.124	0.166	0.099	0.222	0.351	Acceptable
E6	0.074	0.148	0.198	0.119	0.066	0.198	0.198	0.250	0.351	Acceptable
E7	0.086	0.172	0.044	0.172	0.326	0.115	0.086	0.047	0.314	Acceptable
E8	0.066	0.066	0.066	0.075	0.058	0.262	0.408	0.166	0.351	Acceptable
E9	0.240	0.160	0.028	0.068	0.060	0.365	0.080	0.208	0.351	Acceptable
Final weight	0.159	0.159	0.086	0.138	0.122	0.210	0.125	0.206	0.347	Acceptable

In Table 9, "Integrating innovative technologies into the monitoring and tour program with a focus on sustainability" stands out as the dominant sub-criterion (0.210). A step below, two items share equal weight "Caring about the impact of technology use on the environment or society" and "Awareness of resource consumption such as paper, energy, etc" (each 0.159). Mid-range priorities follow: "Combining technology with environmental awareness (e.g., electronic tickets, digital brochures)" (0.138), "Designing inclusive applications that will guide other guides, companies, or tourists" (0.125), and "Creating awareness of issues such as carbon footprint or respect for nature during the tour process" (0.122). Anchoring the list, "Providing systematic information to tourists on this issue" receives the lowest weight (0.086), marking it as the least critical among the seven sub-criteria.

Table 10 shows the pairwise comparisons for each expert of the sub-criteria of C4.

Table 10. Pairwise comparisons for sub-criteria of C4.

Expert	Best	Worst	A_B	A_W^T
E1	Being able to use technological solutions that appeal to disabled tourists or special needs	Being able to use some basic level applications (e.g., translation application) and make special precautions/adjustments for disabled tourists	(5,1,9,5,5,5)	(5,9,1,5,5,5)
E2	Being able to use some basic level applications (e.g., translation application) and make special precautions/adjustments for disabled tourists	Using translation tools for different languages regularly	(2,2,1,9,6,5)	(5,7,9,1,4,4)
E3	Being able to use some basic level applications (e.g., translation application) and make special precautions/adjustments for disabled tourists	Being aware of applications that guide hearing or visually impaired tourists and being careful to use them	(3,5,1,2,9,3)	(2,4,9,6,1,7)
E4	Being aware of applications that guide hearing or visually impaired tourists and being careful to use them	Using translation tools for different languages regularly	(3,4,5,9,1,6)	(8,6,6,1,9,3)
E5	Awareness of the concept of accessibility	Being able to prepare special digital materials according to different types of disabilities	(1,2,4,5,3,9)	(9,3,4,5,6,1)
E6	Being aware of applications that guide hearing or visually impaired tourists and being careful to use them	Being able to prepare special digital materials according to different types of disabilities	(3,2,6,2,1,8)	(6,7,3,7,8,1)
E7	Being aware of applications that guide hearing or visually impaired	Using translation tools for different languages regularly	(3,2,5,8,1,2)	6,7,3,1,8,7)

Expert	Best	Worst	A_B	A_W^T
	tourists and being careful to use them			
E8	Awareness of the concept of accessibility	Being able to prepare special digital materials according to different types of disabilities	(1,8,8,2,8,9)	(9,2,2,3,2,1)
E9	Being able to use technological solutions that appeal to disabled tourists or special needs	Using translation tools for different languages regularly	(2,1,3,9,4,5)	(8,9,7,1,6,5)

Table 11. Sub-criteria weights and reliability for each expert (C4).

Expert /Criteria	C4.1	C4.2	C4.3	C4.4	C4.5	C4.6	Input-Based CR (IB)	Associated Threshold (AT)	Reliability (IB<AT)
E1	0.117	0.488	0.043	0.117	0.117	0.117	0.222	0.333	Acceptable
E2	0.218	0.218	0.371	0.034	0.073	0.087	0.208	0.333	Acceptable
E3	0.120	0.237	0.361	0.181	0.028	0.072	0.166	0.333	Acceptable
E4	0.188	0.141	0.113	0.033	0.430	0.094	0.291	0.333	Acceptable
E5	0.400	0.187	0.120	0.096	0.160	0.035	0.222	0.333	Acceptable
E6	0.170	0.255	0.085	0.255	0.170	0.064	0.178	0.315	Acceptable
E7	0.175	0.053	0.105	0.088	0.316	0.263	0.178	0.315	Acceptable
E8	0.505	0.069	0.069	0.228	0.069	0.059	0.097	0.333	Acceptable
E9	0.230	0.377	0.153	0.033	0.115	0.092	0.222	0.333	Acceptable
Final weight	0.236	0.225	0.158	0.118	0.164	0.098	0.198	0.329	Acceptable

As shown in Table 11, the highest-weighted sub-criterion is "Awareness of the concept of accessibility" (0.236), followed by "Ability to use technological solutions that meet the needs of disabled tourists or those with special requirements" (0.225); "Awareness of, and careful use of, applications designed for hearing- or visually impaired tourists" (0.164); "Ability to use basic applications (e.g., translation apps) and make special adjustments for disabled tourists" (0.158); and "Regular use of translation tools for different languages" (0.118), whereas the lowest-weighted sub-criterion is "Ability to prepare specialized digital materials for different types of disabilities" (0.098).

4. CONCLUSION

In the conducted Best-Worst Method (BWM) analysis, Ethical Awareness and Professional Responsibility emerged as the most significant criterion for tourist guides' responsible use of technology. This finding aligns with the literature (Buhalis, 2003; Floridi & Cowls, 2019; Jobin et al., 2019), which underscores that ethical principles, professional standards, and transparency are critical for delivering sustainable and accountable service through digital platforms. Furthermore, the rank order of Sustainability and Environmental Awareness and Accessibility and Inclusion suggests that the digitalization process in tourism must consider not only efficiency but also environmental impacts and the needs of individuals with disabilities (Gretzel et al., 2015; Vujičić et al., 2023; Weaver, 2006). Although Personal Data Privacy and Security received a relatively lower overall weight, its importance cannot be underestimated. With the proliferation of digital platforms in contemporary tourism applications, it is imperative that guides handle tourists' data securely and ethically (Chatzigeorgiou et al., 2019; Colin Michael Hall & Ram, 2020).

At the sub-criterion level, the emphasis on abiding by professional ethical codes and standards exemplified by "Knowledge of ethical concepts and professional standards" being highly ranked, indicates that guides must first strengthen their own professional competencies to ensure the responsible use of technology. This finding also highlights the need to incorporate more specific concerns, such as "Paying attention to copyright or content accuracy," within the scope of responsible technology use. Similarly, in matters of Sustainable Tourism and Accessible Tourism, integrating technology enables guides to achieve objectives such as conserving natural resources, reducing carbon footprints, and delivering inclusive tourism services, for example, through electronic ticketing, digital brochures, or specialized applications for people with disabilities (Ioannides & Gyimóthy, 2016; Topsakal, 2018; UNWTO, 2021).

Although digital transformation offers numerous benefits, it also carries certain risks. This study examines these benefits and risks within the context of responsible technology use. Demonstrating how responsible technology use is incorporated into the practices of the tourist guiding profession provides guidance for researchers and sector professionals interested in this field. Based on the study's findings, it is concluded that technological advancements should be emphasized in guide training programs, awareness should be raised regarding the benefits and risks of technology, and relevant plans and policies should be implemented. Through these measures, the tourism sector can see the widespread adoption of service models that are inclusive, accessible, conscious, secure, and aligned with ethical principles.

4.1. Practical Implications

This research offers concrete outcomes on tourist guides' responsible use of technology and provides recommendations that can significantly contribute to sectoral practices. The criteria prioritized using the BWM serve as guiding principles for guides adapting to the digitalization process. The prominence of ethical and professional responsibility criteria highlights the need to incorporate topics such as personal data protection, the reliability of digital content, and copyright into training programs, thereby raising professional standards among guides. Moreover, various technological solutions aimed at reducing carbon footprints and technology-based models that facilitate the tourism experience for individuals with disabilities could be designed for integration into guiding services. Taking the study's findings into account, tourism sector managers and professional organizations could create a guide outlining fundamental principles and standards for the digital tool usage of tourist guides, thereby establishing a technology use model that is more trackable and measurable. Ultimately, these efforts would improve service quality and enhance the overall tourist experience.

4.2. Theoretical Implications

This study presents a novel theoretical framework at the intersection of tourism, technology management, and ethics by revealing the multidimensional nature of responsible technology use in tourist guiding. Although the effects of digital transformation on the tourism sector have often been examined, there is a lack of comprehensive analyses that consider ethical, sustainability, data security, and accessibility dimensions together in the context of tourist guides' technology use. Drawing on a set of criteria identified through the Best-Worst Method (BWM), the study offers a unique conceptualization of responsible technology use within the guiding profession. By highlighting the strengths and weaknesses of tourist guides in this area, the findings can guide future research across a broad range of topics, including tourism education, professional standards, policy development, destination management, and digital platform design, ultimately deepening the discourse on responsible technology in both theoretical and practical terms. In this sense, the research not only introduces an innovative conceptual framework to the domain of tourist guiding but also makes a valuable theoretical contribution by providing a multidisciplinary perspective that integrates digitalization and ethical discussions within tourism.

4.3. Limitations and Suggestions for Future Research

This study employed the Best-Worst Method (BWM) to analyze tourist guides' awareness of responsible technology use. Future research could broaden the scope of these findings by recruiting more extensive participant groups and incorporating additional analytical methods such as DEMATEL or Fuzzy TOPSIS, thereby generating more comprehensive results. Observational or experimental studies on how guides use technology in practice would allow for a deeper assessment of real-world applications. Furthermore, examining tourists' perceptions of guides' digital competencies could shed light on the impact of responsible technology use on the overall tourist experience.

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