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Portuguese visitors' **attitudes towards technology**: A segmentation analysis

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Abstract | New digital dynamics are being triggered within the tourism ecosystem with direct consequences on visitors' experiences, which are gradually becoming mediated by emerging and disruptive technologies. However, little is known about visitors' positioning towards technologies and their impact. This study aims to explore the existence of groups with distinct attitudes towards technology, as well as their characteristics. A segmentation analysis was carried out to identify clusters with different attitudes towards technology. Data was collected through a survey by questionnaire with Portuguese residents that have travelled for tourism purposes. A total of 390 questionnaires were analysed and a solution of three clusters with distinct attitudes towards technology emerged. Statistically significant differences were found among the three groups according to visitors' motivation towards technology, perceived ease of use, perceived usefulness, and sociodemographic variables. This research explores visitors' attitudes towards technology, during their tourism experiences, being one of the first attempts to segment visitors according to these attitudes. The focus on artificial intelligence is also an added value due to the emerging relevance of this technology tool. The study offers a novel vision of the use of technology in tourism through the visitor lens, while presenting an understanding of distinct segments, providing valuable insights for both academics and decision-makers.

Keywords | Attitudes towards technology, segmentation analysis, artificial intelligence, tourism, visitor experience

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1. Introduction

The tourism sector is nowadays being embraced by new and emerging technologies associated with the Industry 4.0. This new era is marked by an intelligent value-chain formed by machines and devices, supported by cutting-edge technologies, that exchange information, communicate among themselves and make decisions autonomously and independently (Posada et al., 2015; Xu et al., 2019; Tussyadiah et al., 2020; Rodrigues, Stevic & Breda, 2022). Despite the close and almost exclusive relation with the industrial sector, the fourth industrial revolution also encompasses great challenges and opportunities for other economic activities, particularly in the tourism sector (Ivanov et al., 2021). There is a growing belief that technology might be a great asset for the tourism industry by re-thinking business models and re-designing operations while emerging as a potential convenience for visitors' experiences (Loureiro, 2018; Lukanova & Ilieva, 2019).

In this regard, the recent pandemic context prompted the adoption of digital technologies at a higher pace, with several businesses moving their operations online and many starting their digital transformation path. According to EIB (2023), around 53% of European firms have invested in the digitalisation of their businesses in response to COVID-19, while 68% have done the same in the United States (US). From 2019 to 2022 there was a progressive investment and implementation of digital technologies, specifically advanced robotics, Internet of Things (IoT), big data, and artificial intelligence (AI). Although being argued that the COVID-19 crisis required tourism companies to become more digital-oriented, the fact is that the sector has not yet been able to capture the full potential of digitalisation (OECD, 2021), particularly when compared to other economic sectors. For instance, the EIB (2023) report shows that tourism companies ranked 8th among 12 sectors regarding investment in digital technologies, being the second to last sector regarding the use of these technologies. Nevertheless, digitalization is pushing tourism into new and often unpredictable directions. Digital technologies, including AI, augmented reality (AR), virtual reality (VR), IoT, and blockchain, are altering the sector's paradigm and entailing relevant implications for business operations (ILO, 2022; OECD, 2021). Across these emerging technologies, AI is gaining increasing attention at the latest.

AI is a versatile technology with applications in several economic sectors, from healthcare systems, pharma and medical products, financial services, transportation, electronics, and telecommunications to tourism. According to the latest reports (e.g., IBM, 2022; PwC, 2017; Zhang et al., 2022), managers believe that implementing AI tools into their businesses encompasses great advantages. This belief seems to have been materialized in recent times through gradual investments and implementation of AI solutions. For instance, Zhang et al. (2022) reported a total investment in AI, in 2021, of 176.47 billion US dollars, an increase of 163% and 48%, when compared to 2019 and 2020, respectively. Consequently, this increased investment represented a growth in AI adoption around 12%, in comparison with 2020 (Zhang et al., 2022), a tendency maintained in 2022, with 13% of organizations being more likely to adopt AI than in 2021 (IBM, 2022).

Turning the spotlight to the tourism sector, AI is progressively playing a role and shaping the way the sector operates (Huang et al., 2022; Tussyadiah et al., 2020), with several AI devices and applications being implemented in distinct contexts (Chi et al., 2022). For instance, chatbots are being adopted by hospitality and airline companies (e.g., Jiménez-Barreto et al., 2021; Pillai & Sivathanu, 2020), search and booking engines are commonly used by hotels, restaurants, and other tourism services (e.g., Huang et al., 2022), the adoption of service robots is boosting, particularly in the hospitality context (e.g., Roque et al., 2023; Çalli et al.,

2022; Ivanov, Webster & Garenko, 2018; Ivanov, Webster & Seyyedi, 2018), and virtual assistants are also used by individuals to support decision-making on different issues, such as travel, accommodation, or attractions (Ferreira et al., 2022). This gradual adoption of AI tools entails several benefits and challenges, already illustrated by Ivanov and Webster (2017), Samara et al. (2020), and Grundner and Neuhofer (2021). The study by Ivanov and Webster (2017) indicates that implementing AI tools entails financial (e.g., cost savings, increased sales, improved employees' productivity) and non-financial benefits (e.g., enhanced service quality, added value for visitors, allocate staff to other less-time consuming tasks, solve lack of manpower) for a company. On the other hand, it also involves monetary costs regarding the acquisition and maintenance of equipment, software purchase, training employees, and/or hiring specialized collaborators. Moreover, implementing technological tools without properly understanding employees' and customers' digital literacy may lead to resistance from both parties. Another study by Samara et al. (2020) identified four major challenges related to AI adoption: technical challenges reflect issues related to data collection and algorithmic bias; financial and business challenges concern costs, return on investment and commercial matters; regulatory challenges involve questions pertaining to privacy and safety; and socio-ethical challenges are related to job loss and acceptance of AI topics. In their turn, Grundner and Neuhofer (2021) provide a vision more centred on the impacts of AI to the users. On the negative side, the authors highlight the overlapping role of AI in the visitor's experience, which might create a certain distance between the visitor, the destination, and the remaining stakeholders. On the other side, AI might contribute to a more individualized and personalized visitor experience by improving it from the beginning until the end of the journey.

Visitors engage with AI throughout the journey on multiple ways and on different stages (Lukanova & Ilieva, 2019). In this regard, several studies have been investigating the individual attitude concerning the adoption and use of new technologies, with special insight to AI and robots (e.g., Akdim et al., 2021; Ayyildiz et al., 2022; Chi et al., 2022; Ivanov et al., 2018a,b; Webster & Ivanov, 2021). Similarly, many theories and models have been applied to explain these acceptance behaviours towards technology, contributing to the identification of distinct factors determining these attitudes, particularly the technology acceptance model (TAM) and the technology readiness index (TRI) (e.g., Abou-Shouk et al., 2021; Blut & Wang, 2020; Huang, 2022; Parasuraman, 2000; Pillai & Sivathanu, 2020; Rosman et al., 2023; Said et al., 2023). Despite the valuable contributions of these studies, there is almost no literature addressing the segmentation topic concerning individual attitudes towards AI and robots. To fulfill this research gap, the present study conducts a segmentation analysis based on the mentioned attitudes, aiming to explore potential heterogeneity among visitors' attitudes when interacting with specific forms of AI (e.g., self-check-in kiosks, service robots, robot concierges, chatbots) during a tourism trip, using both TAM and TRI as theoretical frameworks. Based on a case study applied in Portugal, this study aims to answer the following two research question: Is there significant differences among visitors concerning their attitudes towards technology? and, if so, What are the main characteristics differentiating them? Following a segmentation analysis approach, this study pretends to differentiate visitors according to their interaction with technology and characterize them according to distinct features such as motivation towards technology, perceived ease of use, perceived usefulness, and sociodemographic variables.

The findings of this research are expected to contribute to both academia and managers. On one side, segmentation studies on visitors' attitudes towards technology are scarce, giving space

to the emergence of new research. The present study fills this gap in the academic literature and provides valuable insights to deepen knowledge on how different visitors perceive technology and the added value that technology can exert in a tourism experience. On the other hand, this is crucial for destination managers to acquire the necessary information to effectively deal with technology on a destination basis: first, by knowing to what extent they can introduce technological solutions within the destination and, secondly, comprehending which groups are willing to accept and able to manage technological tools during their experience.

2. Theoretical framework

2.1. Artificial intelligence in the tourism sector

Although the first reference to AI dates from the 1950s (Turing, 1950), it was only recently that this technology emerged as one of the major disruptive technologies in the world (Lu, 2021). Despite the hype around the topic, its definition remains ambiguous, and a sense of vagueness subsists in the literature. AI concerns smart behaviours that usually replicate or surpass human tasks with efficacy and efficiency (Nilsson, 1998). In detail, one can think of AI from two distinct perspectives (Russell & Norvig, 2010): a human-centred approach, where an intelligent system's behaviour is evaluated according to its similarity to thinking and/or acting like humans; and a rationalist approach, in which a system is expected to operate autonomously and perform in the right way. More than that, based on determined amounts of data, introduced by humans, or retrieved by itself, AI enables machines and objects to acquire and develop specific abilities that will work in favour of "organizational and/or societal goals" (Lu, 2021).

One of the most common forms of AI is robots. A robot is a machine that can function on its own, either by complying with manual commands, performing pre-determined programs, or undertaking actions guided by principles established through AI technology (Lu, 2021). More recently, service robots have gained popularity (Ivanov & Webster, 2020): medical robots represent the most important subclass of service robots (Husty & Hofbaur, 2017) and customer-facing service robots are used in multiple areas (Lee, 2021). These robots may be physical, virtual or holographic (Grundner & Neuhofer, 2021; Wirtz et al., 2018), depending on their function.

In the tourism field, the use of service robots is also gaining momentum, with examples ranging from robotic service delivery (Wirtz et al., 2018), virtual assistants, booking platforms, and self-check-in kiosks (Lu et al., 2019; Russell & Norvig, 2010), to fully automated hotels (Tung and Au, 2018; Lukanova & Ilieva, 2019; Ivanov & Webster, 2019). There is a huge range of opportunities and benefits resulting from the implementation of AI in the tourism sector, although contrary opinions arguing that it might replace human jobs (Ivanov et al., 2018a). Among the great potentialities associated with its adoption are face recognition, tailored services, predictive behavioural methods, language translators and audio tours (Samala et al., 2020). For instance, chatbots, natural conversation robots, are used by airlines, airports, and hotels to facilitate communication with guests and improve the guests' experience (Pillai & Sivathanu, 2020; Samala et al., 2020); robotic concierges can help guests by providing information and, due to their embodiment, perform physical tasks like pointing (Shin & Jeong, 2020; Ivanov et al., 2017); and delivery robots are used in hotels and restaurants to ease customer's experience (Ivanov, Webster & Seyitoğlu, 2023).

According to Lukanova and Ilieva (2019), the guest cycle influences the type of robots the guests interact with, thus influencing their atti-

tude towards them. In the pre-arrival and post-trip phases, guests interact mostly with chatbots and AI platforms (Lukanova & Ilieva, 2019; Tung & Law, 2017). During the trip, visitors interact mostly with physical AI, including cleaning robots, front desk robots and self-check-in kiosks (Ivanov & Webster, 2017; Lukanova & Ilieva, 2019). Therefore, this paper argues that it is necessary to comprehend how AI influences visitors' overall travel experience to explore visitors' positive or negative attitudes towards technology.

2.2. Attitude towards technology

Despite the hype created around technology and AI after the pandemic (Binesh & Baloglu, 2023) and the increasing adoption of service robots in the tourism sector (Ivanov et al., 2023), the literature addressing consumers' attitudes towards the use of technology in tourism remains scarce (Ayyildiz et al., 2022). Furthermore, most studies found in this field tend to analyse visitors' attitudes in the context of hospitality services (e.g., Akdim et al., 2021; Ayyildiz et al., 2022; Chi et al., 2022; Ivanov et al., 2018a,b), meaning that there are gaps in the literature still to be solved, particularly regarding visitors' attitudes along their journey. Besides the hospitality sector, the study of visitors' attitudes towards robots and/or AI has been addressed in fields such as passenger transportation (Chi et al., 2022; Webster & Ivanov, 2021), restaurants (Akdim et al., 2021), or online travel assistants (Martin et al., 2020).

Independently of the context, a common observation among the literature addressing visitors' attitudes about the adoption of AI and robots by tourism services is that there is receptivity for such. In this regard, most studies exploring the topic in the hospitality setting have analogous results. For instance, Ivanov et al. (2018a) found that young Russian adults tend to show a positive attitude regarding robot implementation by hotels, although showing a preference for human employees. In this case, participants showed greater openness to the use of robots in areas such as reception and housekeeping, more specifically in functions concerning luggage handling, payments, information provision, and taking customers' orders. On the contrary, guests were less receptive to receiving services assisted by robots in areas such as restaurants, security, and well-being (e.g., massages). In parallel, the study by Ivanov et al. (2018b) explored Iranian guests' perceptions about the introduction of robots and AI in hospitality, with similar results. The participants showed a positive attitude towards being served by robots in a hotel. The results point out that people see advantages in being served by robots, particularly in tasks such as information provision in different languages or providing more accurate information when compared with human employees. Simultaneously, respondents also perceived the introduction of robots as having a positive impact on memorable, enjoyable, and exciting experiences. Resembling results were found in Ayyildiz et al.'s (2022) study. Exploring the attitudes of hotel customers from different origins towards services delivered by robots, the authors found that guests tend to have a generally positive attitude towards service robots, even though they exhibit more positive attitudes towards human staff, as also found by Ivanov et al. (2018a). Despite their agreement regarding adopting service robots, participants hesitate when it comes to being served by robots.

Introducing the adoption of AI and robots and the subsequent attitudes by visitors in other sectors besides hospitality, the study by Chi et al. (2022) examined visitors' attitudes towards the use of AI in airlines and hospitality, analysing potential differences in visitors' willingness to accept AI in both contexts. Overall, the results show that tourists are more willing to accept AI in airline services than in hospitality, as they tend to establish a greater emotional bond with hospitality services due to the value of human interaction. Contrarily, air-

line services are viewed as more functional and, thus, more suitable for AI applications, meaning that visitors are more prone to use AI when seeking utilitarian services. In the case of Webster and Ivanov (2021), the authors examined users' perceptions concerning the robotization of several transportation-related activities, by looking at dimensions such as reliability, safety, usefulness, advantages and disadvantages. The results suggest a positive attitude towards the implementation of robots to perform specific tasks, specifically those related to information provision (e.g., ticket prices, departures/arrivals, seat availability), cleaning services, check-in, and robotic car key delivery. In turn, Akdim et al. (2021) evaluated tourists' attitudes concerning service robots in hotels and restaurants. The study identified both positive and negative attitudes toward robots. The first ones mostly referred to robots' capacity to enhance visitors' experience, attract enthusiasts and arouse curiosity, release employees from repetitive and time-consuming tasks, save costs and engage in low price services that do not require human interaction. On the other side, visitors perceive robots as impersonal, inflexible, susceptible to failure and malfunctions, and representing a threat to employees by replacing them and eliminating their jobs. The study also concluded that in both restaurant and hotel environments, customers have a clear preference for human interaction rather than being served by robots, matching the findings of the above-mentioned studies (e.g., Ayyildiz et al., 2022; Chi et al., 2022; Ivanov et al., 2018a).

2.3. Segmentation studies based on attitudes towards technology

Market segmentation studies are very popular in the tourism context as they represent the possibility to identify specific characteristics of a group of visitors (Stanford, 2014; Zografos & Allcroft, 2007), thus enabling decision-makers to define appropriate and tailored marketing strategies, according to the needs of each segment (Dolnicar, 2007).

Despite the added value of this approach, only a few studies applied a segmentation-based analysis in the context of visitors' perception of technology during a travel experience, with emphasis on Benckendorff et al. (2005), Errichiello et al. (2019), and Ivanov et al. (2018b). Studying visitors' perceptions concerning the use of technology in a tourism context, Benckendorff et al. (2005) identified two clusters (*high-tech* and *high-touch*) with distinct views about the application of technologies during travel experiences. However, when analyzing potential differences between the clusters and their attitudes towards technology, no significant differences were reported. On the other side, Errichiello et al. (2019) segmented visitors concerning the experience of cultural attractions through VR tools. For this purpose, a segmentation approach based on visitors' perceptions and attitudes towards VR applications was implemented, resulting in a solution of three clusters – *enthusiasts*, *moderates*, and *skeptics*. Accordingly, enthusiasts have a more positive feeling about experiences mediated by technology, while the remaining clusters have a different positioning, doubting its added effects. Regarding the attitudes towards service robots, the segmentation study by Ivanov et al. (2018b) concluded the existence of two segments with distinct attitudes – *high-techies* and *high-touchies*. The results showed that participants within the high-techies cluster showed a more positive attitude concerning service robots in hotels when compared with the guests from the other group, who were found to be reluctant about robots and preferring human delivered services. The limited literature exploring attitudes towards technology, particularly AI and robots, reinforces the value of the present study on a field lacking further developments.

2.4. Factors influencing attitudes towards technology

Several approaches have been used in the literature to measure technology adoption/acceptance, with a special focus on the Technology Acceptance Model (TAM) and the Technology Readiness Index (TRI). When it comes to measuring attitudes towards technology, the technology acceptance model (TAM), proposed by Davis (1986), is one of the most common and influential frameworks (Yoruk et al., 2023). The model assumes that two constructs - perceived ease of use and perceived usefulness - determine whether the user accepts or rejects technology (Davis, 1986). This theoretical model intends to explain and predict what makes people engage or not with technology, addressing the two main factors that affect an individual's intention to use technology (Davis, 1986, 1989). In accordance, perceived usefulness can be described as the perception of the value of a specific technology to improve one's performance in a certain context, while perceived ease of use means the degree of difficulty of adopting a technology perceived by each individual (Davis, 1986). This model has been used in countless studies (e.g., Carter & Bélanger, 2005; Del Giudice et al., 2023; Granić & Marangunić, 2019; Yuan et al., 2023), exploring users' adoption of technology in distinct fields as education, e-government, construction industry, human resource management, or tourism. In the tourism context, this model has also been applied to measure the attitudes of hotel guests towards the intention to use service robots (Abou-Shouk et al., 2021; Huang, 2022; Rosman et al., 2023; Said et al., 2023), visitors' intention to use chatbots when planning tourism trips (Pillai & Sivathanu, 2020), consumer behaviour concerning service robots in restaurants (Seo & Lee, 2021), or customers' attitudes regarding the adoption of robots in travel agencies (Abou-Shouk et al., 2021). The Technology Readiness Index (TRI) is also broadly used to measure users' attitudes towards technology (Blut & Wang, 2020; Parasuraman, 2000). Technology readiness is defined as "people's propensity to embrace and use new technologies for accomplishing goals in home life and at work" (Parasuraman, 2000, p. 308). Contrary to the TAM, which is based on two determinants to assess one's attitude towards technology, the technology readiness construct comprises four dimensions – optimism, innovativeness, discomfort, and insecurity – to measure users' general readiness towards technology (Blut & Wang, 2020; Parasuraman, 2000). Due to the recognized value of both TAM and TRI to obtain a great picture concerning individual attitudes towards new technologies, the present research is anchored on their theoretical framework.

2.5. Motivation toward technology

Motivation is a psychological conception that simplifies the realization behind a given action, allowing one to anticipate behaviours (Shin & Jeong, 2021). This means a person's beliefs are oftentimes more important than an experience, and their motivation towards a specific topic will determine thoughts and actions. According to Park et al. (2007), the motivation to use technology is one of the most relevant variables in its success. Authors believe there is a significant positive impact between motivation towards technology and adoption intention (Park et al., 2007; Lu et al., 2019; Shin & Jeong, 2021). In this regard, evidence suggests that people demonstrating higher motivation towards technology tend to be more prone to use and engage with technology. For instance, according to Lu et al. (2019), greater motivation for technology enhanced guests' willingness to use service robots in hotels. Likewise, Shin and Jeong (2021) also indicate that travellers' motivations encourage their attitudes towards augmented reality applications during a tourism journey. Hence, this study attempts to deepen knowledge on this subject by understanding if motivation cha-

racterizes segments with higher and positive attitudes towards technology.

2.6. Perceived Ease of Use and Perceived Usefulness

The Perceived Ease of Use (PEOU) variable, developed by Davis (1986) for the TAM, is defined as the extent to which a person believes that using a system will not require any physical or mental effort. Likewise, Perceived Usefulness (PU), used in the same model, is the extent to which a person believes that using a system will enhance his/her performance and productivity. Both variables are thought to positively impact technology adoption, with studies showing their direct influence on users' intention to adopt or interact with new technology (Abou-Shouk et al., 2021; Huang, 2022; Peng et al., 2012; Rosman et al., 2023; Said et al., 2023). Huang (2022) concluded that PEOU and PU positively impacted elderly guests' intention to use service robots in hotels. Rosman et al. (2023) used a modified version of the TAM to investigate the attitudes of hotel guests towards the implementation of service robots and the impact of technology on visitors' decision-making. The results support the hypothesis theorizing that perceived ease of use positively influences customers' booking intention. The positive effect of both PU and PEOU on users' willingness to interact with robots was also observed in Said et al. (2023), using a double case study approach in two hotels from Japan and the USA.

Based on these insights, it is expected that those segments with greater attitudes towards technology will have higher perceptions regarding the ease of use and usefulness of AI and robots. These findings confirm the traditional results of TAM that both the PU and EOU of robots positively affect customers' attitudes towards robots' adoption. (Abou-Shouk et al., 2021; Peng et al., 2012) Thus, it is assumed that PEOU and PU influence the willingness to accept technology during the travel experience (Peng et al., 2012).

2.7. Sociodemographic profile

Sociodemographic variables, namely culture, age, gender, and level of education, have been associated with users' attitudes toward technology in multiple studies and fields (Cruz-Cárdenas et al., 2019; Xu et al., 2019; Tung & Law, 2017; Ivanov, Webster and Garenko, 2018; Ivanov, Webster, Seyyedi, 2018; Connor & Siegrist, 2010). Nonetheless, the way these characteristics influence users' attitudes is still unclear.

Li et al. (2010 cited by Tung and Law, 2017) found significant differences between the way Asian participants (Chinese and Korean) and European participants (German) engaged with robots, with the first group perceiving robots as more trustworthy and enjoyable to use. This suggests that nationality might influence people's perception of technology.

Age has also been discussed as a predictor of users' attitudes toward technology. Ivanov et al. (2018a), Tung and Law (2017), and Heerink (2011) indicate that younger respondents are more willing to interact with technology/robots. In line with these results, the study by Benckendorff et al. (2005) concluded that older visitors were also associated with the segment less likely to perceive technology as an added value during the on-site experience. On the other hand, Ivanov et al (2018b) suggest that younger participants were less willing to interact with robots when compared to participants over 30 years old. Finally, Martins and Costa's (2021) study found no differences between age groups. Beyond suggesting that age is a variable with implications in the attitudes toward technology, these studies also indicate some contradictions that need further clarification.

Several studies state that males perceive robots as easier to use (e.g., Ivanov et al., 2018a, Hee-

rink, 2011), which is related to the fact that they have more experience with technology. However, studies by Ayyildiz et al. (2022) and Martins and Costa (2021) showed that female respondents were more interested in interacting with robots. This is consistent with the findings of Benckendorff et al. (2005), identifying female tourists as more prone to have a positive attitude concerning technology use during a travel experience. Again, these conclusions indicate that gender might influence the users' attitudes towards technology.

Differently, the segmentation study of Errichiello et al. (2019) identified no differences between groups with distinct attitudes towards technology on variables such as age, education, or age, indicating that sociodemographic variables do not influence visitors' attitudes.

3. Methods

3.1. Data collection

A survey by questionnaire was designed to collect data, based on the original TAM, and additional variables that could influence technology acceptance were included. The established target population included all Portuguese-speaking residents in Portugal, over 18 years old, and that had travelled (domestically or abroad) for tourism purposes at least once within the last 3 years. A non-probabilistic convenience sampling approach was adopted. Data was collected between November and December 2020 via an online questionnaire. The questionnaire was developed using Google Forms and in the Portuguese language, subsequently validated by a group of specialized researchers whose inputs were considered to design the instrument's final version. Taking into consideration the pandemic situation of that time and to have a decent spatial distribution of the respondents through Portugal, the link to the questionnaire was disclosed online, on several social media pages and groups, such as LinkedIn and Facebook.

The questionnaire was designed to assess visitors' attitudes towards technology, particularly their perception regarding the use of robots and automation in the tourism sector. Thus, participants were first asked about their attitudes towards technology, based on 13 items adapted from the Technology Readiness Index (e.g., Parasuraman, 2000) and the Technology Readiness Index 2.0 (Cruz-Cárdenas et al., 2019), using an agreement scale ranging from 1 – "strongly disagree" to 5 – "strongly agree". A second group examined participants' acceptance of technology based on the original TAM (e.g., Davis, 1986, 1989; Park et al., 2007; Pillai & Sivathanu, 2020; Sox et al., 2016). To do so two key categories were included, the PEOU and the PU. The PEOU was measured through a 5-point Likert-type scale (from 1- strongly disagree to 5- strongly agree), using 8 items. In turn, an agreement scale (from 1- strongly disagree to 5- strongly agree) was also adopted to measure participants' PU, using 9 items retrieved from the literature. An additional section of the questionnaire examined the respondents' motivation towards technology based on four items retrieved and adapted from previous work by Park et al. (2007), using a four-point Likert-type scale ranging from 1 – "not important" to 4 – "very important". Finally, sociodemographic variables were considered, including age, gender, place of residence, level of education, and monthly income.

A total of 404 questionnaires were retrieved. However, 14 did not meet the criteria to be included in the analysis, as 13 corresponded to respondents who did not live in Portugal, and 1 was filled by a participant under 18 years old. Thus, a total of 390 responses were considered valid and included in the analysis.

3.2. Data analysis

A hierarchical cluster analysis, using Ward's method and the squared Euclidean distance was

carried out to identify segments with distinct attitudes towards technology. To do so, the items examining visitors' attitudes and positioning regarding technological solutions were used as input variables. A one-way analysis of variance (ANOVA) with Scheffe's post hoc tests was used to verify potential significant differences among the clusters. Segments were later characterized and compared on several characteristics – motivation towards technology, perceived ease of use, perceived usefulness, and sociodemographic profile – using ANOVA and Chi-square tests.

4. Findings and discussion

4.1. Segments of attitudes towards technology

The sample was segmented using visitors' attitudes towards technology as the input variable. The dendrogram and agglomeration schedule generated by the hierarchical cluster analysis showed an optimum solution for three clusters with distinct attitudes towards technology. Statistically significant differences were observed in all the items measuring this variable (Table I): cluster 1 is composed mainly of individuals for whom technology is part of their daily lives, showing great familiarity with technology use and considering that it helps improve society's quality of life. Interestingly, perhaps due to their ability to deal with technology, they also consider that technical support is somehow inappropriate and that some technological solutions were not built for everyone. Following this characterization, the cluster was labelled as *technology enthusiasts*. On the opposite side, cluster 3 shows lower technological readiness, while considering technology a nefarious issue in people's life, justified by their perception of a high level of dependency. Simultaneously, this lack of personal ability led the segment to feel more insecure concerning online business solutions. Thus, the cluster was labelled *reluctant technology users*. Cluster 2 is the one with minor representation within the sample (23.8%). They show a more neutral position regarding the effects of technology on the quality of life and technology readiness. On the other hand, they demonstrate minor worries regarding people's dependency on technology compared with the other segments, which might explain their minor concerns about technology security issues. For these reasons, cluster 2 was labelled as *technology trusters*.

These results found a parallel with the results of Errichiello et al. (2019) and Ivanov et al. (2018b). First, the *technology enthusiasts'* segment is grounded on the enthusiasts' group of Errichiello et al. (2019), by showing a positive attitude toward technology in general. This is also equivalent to Ivanov et al. (2018b) findings, identifying a group of visitors with positive attitudes towards service robots both in general and in hotel contexts. In its turn, the reluctant technology users share characteristics with the two less keen clusters found in Errichiello et al. (2019) and the *high-touchies* segment of Ivanov et al. (2018b), as they tend to show more cautious thoughts about technology. Additionally, the present results are contrary to those found by Benckendorff et al. (2005), where no differences among the two-cluster solution were identified. Given the temporal distance of the studies and the increasing diffusion of technological solutions both in everyday life and in the tourism context, the disparity among results suggests an increment in both resistance and acceptance of technology that might be caused, among others, by distinct levels of digital literacy. However, the data collected is not sufficient to confirm this assumption, leading to conjecture about the existence of additional reasons that should be further explored.

Table 1 | Clusters' profile based on attitudes towards technology

	Total sample	Cluster 1 Technology enthusiasts	Cluster 2 Technology trusters	Cluster 3 Reluctant technology users	ANOVA	
	(N = 390)	149	93	148		
	100%	38.2%	23.8%	37.9%		
	Mean	**Mean**	**Mean**	**Mean**	**F**	**p-value**
Other people come to me for advice on new technologies	3.07	**3.87**[2]	2.73[1]	2.49[1]	85.867	**0.000**
In general, I am among the first in my circle of friends to acquire new technology when it appears	2.59	**3.65**[3]	2.24[2]	1.76[1]	218.439	**0.000**
I can usually figure out new high-tech products and services without help from others	3.06	**4.08**[3]	2.61[2]	2.30[1]	179.550	**0.000**
I keep up with the latest technological developments in my areas of interest	3.39	**4.28**[2]	2.85[1]	2.84[1]	115.131	**0.000**
People are too dependent on technology to do things for them	4.02	4.14[2]	3.29[1]	**4.35**[2]	48.170	**0.000**
Too much technology distracts people to a point that is harmful	3.79	3.75[2]	2.92[1]	**4.37**[3]	76.114	**0.000**
Technology lowers the quality of relationships by reducing personal interactions	3.81	3.80[2]	2.81[1]	**4.45**[3]	84.828	**0.000**
New technology contributes to a better quality of life	4.05	**4.32**[3]	4.08[2]	3.75[1]	20.292	**0.000**
Technology gives people more control over their daily lives	3.45	**3.83**[2]	3.55[2]	3.00[1]	29.622	**0.000**
Technology makes me more productive in my personal life	3.77	**4.19**[3]	3.75[2]	3.36[1]	34.605	**0.000**
Technical support lines are not helpful because they explain things in terms I don't understand	2.85	**3.13**[2]	2.31[1]	2.91[2]	19.727	**0.000**
Sometimes, I think that technology systems are not designed for use by ordinary people	2.66	**3.00**[3]	2.23[1]	2.60[2]	13.491	**0.000**
I do not feel confident doing business with a place that can only be reached online	2.75	2.68[2]	2.12[1]	**3.22**[3]	27.929	**0.000**

4.2. Segments characterization

ANOVA and Chi-square tests were then employed to examine how the three clusters differ in aspects related to motivation towards technology, perceived ease of use, perceived usefulness, and sociodemographic variables.

Generally, the participants tend to show a positive, though nearly neutral, motivation towards technology (Table II). Then, the analysis demonstrates statistically significant differences among the three clusters. For instance, *Technology enthusiasts* demonstrate higher motivation toward technology, meaning that participants within this segment are more likely to adopt technologies in their daily lives, recognizing the added value of using and keep learning about technology. This is consistent with the previous analysis, as the segment is also extremely familiar with the use of technology, identifying benefits from its implementation in a daily context. These findings are also in line with authors Lu et al. (2019), Park et al. (2007), and Shin and Jeong (2021) that describe motivation as one of the most important variables for technology adoption. Both clusters 2 and 3 have similar positions, in this case, showing lesser motivation. This was expected for cluster 3 but it is a surprising result for *technology trusters*. Although perceiving technology as trustworthy, one possible reason behind a slight motivation towards it might be because visitors in this group perceive to take less enjoyment and/or practical benefits from technology (Shin & Jeong, 2021). Perhaps expanding the analysis to include other categories of motivations (e.g., hedonic, utilitarian) would be valuable to better understand and characterize these distinct groups of visitors.

The overall sample tends to agree that using technology involves minor efforts and improves individual performance when conducting a certain activity (Table III). However, the results prove the existence of statistical differences among the segments. Differences were found on all items measuring the participants' PEOU of technology, except for the item related to the unexpected behaviour of machines (Table III). Respondents in the *reluctant technology users* group indicate major obstacles when interacting with automatic machines than the remaining segments. Contrarily, beyond showing minor issues when dealing with technology, both clusters 1 and 2 indicate how easily they use technology for their benefit. These findings

are somehow validated by previous studies (e.g., Abou-Shouk et al., 2021; Huang, 2022; Peng et al., 2012; Rosman et al., 2023; Said et al., 2023) in which PEOU positively influenced the adoption of technology. This is somehow an expected outcome because if prior works proved that PEOU triggered a more positive attitude towards technology, then those demonstrating a negative attitude are expected to apply more effort, both mental and physical, and to realize greater difficulties when dealing with technology. Therefore, it is presumed that visitors with a positive perception regarding the use of technology are more likely to have a positive attitude towards it, which is the case in both clusters 1 and 2.

Table 2 | Visitors' motivation towards technology

	Total sample	**Cluster 1**	**Cluster 2**	**Cluster 3**	**ANOVA**	
		Technology enthusiasts	Technology trusters	Reluctant technology users		
	(N = 390)	149	93	148		
	100%	38.2%	23.8%	37.9%		
Motivation towards technology	**Mean**	**Mean**	**Mean**	**Mean**	**F**	**p-value**
Keep up with technology	3.22	**3.52**[2]	2.99[1]	3.05[1]	31.061	**0.000**
Save time using technology	3.31	**3.48**[2]	3.20[1]	3.20[1]	8.591	**0.000**
Learn more about technology	3.21	**3.46**[2]	3.12[1]	3.01[1]	21.079	**0.000**
Help others to use technology	3.16	**3.35**[2]	3.03[1]	3.05[1]	9.740	**0.000**

Table 3 | Visitors' perceived ease of use

	Total sample	**Cluster 1**	**Cluster 2**	**Cluster 3**	**ANOVA**	
		Technology enthusiasts	Technology trusters	Reluctant technology users		
	(N = 390)	149	93	148		
	100%	38.2%	23.8%	37.9%		
Perceived ease of use	Mean	Mean	Mean	Mean	F	p-value
A lot of times I get confused with automatic machines	2.78	2.68[1]	2.43[1]	**3.09**[2]	13.599	**0.000**
I make frequent mistakes when using automatic machines	2.53	2.42[1]	2.27[1]	**2.80**[2]	10.110	**0.000**
My interaction with automatic machines is usually frustrating	2.36	2.20[1]	2.30[1,2]	**2.57**[2]	5.877	**0.000**
Interacting with automatic machines requires a lot of my mental effort	2.37	2.15[1]	2.26[1]	**2.66**[2]	11.118	**0.000**
I find it easy to get machine to do what I want	3.23	**3.39**[2]	3.29[1,2]	3.02[1]	5.622	**0.004**
The automatic machines I use tend to behave unexpectedly	2.45	2.40	2.36	2.57	2.715	0.067
I find it complicated to use automatic machines	2.46	2.37	2.33	2.64	3.681	**0.026**
I find it easy to remember how to execute tasks on an automatic machine	3.51	**3.70**[2]	3.53[1,2]	3.30[1]	5.954	**0.003**

Globally, participants agree about the utility of technology in a tourism trip context (Table 4). Then, when exploring how the three clusters perceived technology usefulness, differences are noticed between them. *Technology enthusiasts* and *technology trusters* are more likely to validate the value of technology during a tourism trip when compared with the respondents in cluster 3 (Table 4). This is particularly true for aspects of trip control, time-saving, and standards of needs. This indicates that for these two groups technology is an added value in a tourism context as it makes tasks easier and improves the experience. On the other hand, cluster 3 is more unenthusiastic about the efficacy of the technology, perhaps even dismissing using it. Moreover, this segment has a negative view regarding the worthwhileness of technology in enhancing the overall experience.

Thus, a similar inference regarding the PEOU can be established, meaning that those with an adverse position towards technology are also more likely to understand technology as something trivial and inconsequential for their tourism journey. These results align with prior works (e.g., Cruz-Cárdenas et al., 2019; Huang, 2022; Peng et al., 2012; Said et al., 2023) in which PU was seen as a predictor of technology acceptance. This is justified because those with higher awareness about technology value are also those with the most optimistic attitude towards it.

Table 4 | Visitors' perceived usefulness

	Total sample	**Cluster 1**	**Cluster 2**	**Cluster 3**	**ANOVA**	
		Technology enthusiasts	Technology trusters	Reluctant technology users		
	(N = 390)	149	93	148		
	100%	38.2%	23.8%	37.9%		
Perceived usefulness	Mean	Mean	Mean	Mean	F	p-value
Travelling would be hard without technology	3.38	3.52^{2}	**3.57^{2}**	3.11^{1}	6.040	**0.003**
Technology gives me more control over my trips	3.78	**4.01^{2}**	3.94^{2}	3.45^{1}	13.772	**0.000**
Automatic machines improve my performance on trips	3.33	**3.62^{2}**	3.49^{2}	2.93^{1}	20.332	**0.000**
Technology meets my travel-related needs	3.58	**3.81^{2}**	3.65^{2}	3.31^{1}	11.513	**0.000**
Using automatic machines saves me time	3.65	**3.91^{2}**	3.73^{2}	3.32^{1}	14.430	**0.000**
Using automatic machines allows me to do tasks quicker	3.73	**3.95^{2}**	$3.76^{1,2}$	3.48^{1}	9.375	**0.000**
Automatic machines support critical aspects of my trips	3.29	**3.58^{2}**	3.32^{2}	2.97^{1}	16.051	**0.000**
Using automatic machines improves the quality of my trips	3.34	**3.68^{2}**	3.44^{2}	2.92^{1}	25.231	**0.000**
Automatic machines make my trips easier	3.46	**3.68^{2}**	3.56^{2}	3.18^{1}	11.128	**0.000**

Table 5 | Visitors' sociodemographic profile

	Total sample	**Cluster 1**	**Cluster 2**	**Cluster 3**				
		Technology enthusiasts	**Technology trusters**	**Reluctant technology users**				
	(N = 390)	149	93	148				
	100%	38.2%	23.8%	37.9%				
					Chi-square test		ANOVA	
					χ^2	p-value	F	p-value
Gender					32.282	**0.000**		
Female	67.7	51.0	**82.8**	**75.0**				
Male	32.3	**49.0**	17.2	25.0				
Education					4.767	0.092		
Higher education or lower	24.2	28.4	16.1	25.0				
Bachelor's degree or higher	75.8	71.6	83.9	75.0				
Monthly income					8.902	0.541		
635 €	11.0	11.4	8.6	12.2				
635€ - 999€	29.7	23.5	32.3	34.5				
1000€ - 1499€	27.4	28.9	28.0	25.7				
1500€ - 1999€	11.0	13.4	8.6	10.1				
≥2000€	9.7	12.8	8.6	7.4				
Age	38.98	40.15	36.97	39.06			1.710	0.182

The total sample is characterised predominantly by female respondents (67.7%), with an average age of 38.98 years, well-educated individuals with a bachelor's or higher graduation (75.8%), and individuals with a monthly income between 635€ and 1499€ (57.1%). Major differences are reported relating to the gender composition of the segments. Table V shows that the *technology*

enthusiasts' segment is quite balanced, while *technology trusters* and *reluctant users* are mainly composed of female respondents. Cluster 1 is also the one with the higher number of male participants. The present results are similar and confirm those of Ivanov et al. (2018a) and contradict the findings by Ayyildiz et al. (2022), Martins and Costa (2021), and Benckendorff et al. (2005), indicating that females have a positive and greater attitude towards technology than men. Consistent with the findings of Errichiello et al. (2019), no statistically significant differences are observed for the remaining variables (education, income, and age). However, these results do not go along with previous studies (e.g., Benckendorff et al., 2005; Heerink, 2011; Ivanov et al., 2018a; Ivanov et al 2018b; Tung and Law, 2017) in which age appeared as a variable influencing visitors' attitudes facing technology. This might be partially attributed to the fact that this study was limited to a homogeneous sample concerning the country of origin of the respondents.

5. Conclusion

It is undeniable the growing significance of technology in every feature of today's society. And tourism is likewise the case. The constraints triggered by the COVID-19 pandemic guided the tourism industry to (s)low levels of activity and compelled the authorities to rethink development models and innovative ways to face new and unknown challenges. Nonetheless, and as evidenced in previous crises, the sector has a unique capacity to regenerate the global economy, specifically due to its multiplier effect and the inherent contribution to the recovery of other sectors. In particular, one argues that the revival of tourism activity and its associated dynamics might be boosted by the implementation of technologies. For instance, countries such as Portugal, Ireland, Chile, Estonia, and Singapore developed innovative digital approaches to step up the gradual challenges resulting from the pandemic crisis (UNWTO, 2020), while specific technologies, such as artificial intelligence, robotics, augmented reality and virtual reality were adopted as tools to counter the negative impacts (Seyitoğlu & Ivanov, 2022).

Technologies are already starting to shape the way consumers behave, as well as how tourism experiences are designed (Sigala, 2018). However, if a person is willing to spend money or to engage in a non-traditional tourism experience driven by new technologies is still to discover and deserves careful debate, due to ethical and privacy issues, as well as because previous technological innovations (e.g., hospitality robots) failed their purpose (Buhalis, 2020). For these reasons, studies exploring how visitors deal with technology, their expectations, perceptions, and satisfaction are mandatory. The present study, employing a segmentation analysis based on visitors' attitudes towards technology, pretended to add valuable contributions to this discussion.

Significant implications arise from this study. The authors concluded there are three different clusters, *technology enthusiasts*, *technology trusters*, and *reluctant technology users*, with different attitudes towards technology. The first group has a more positive attitude towards technology, perceiving it as useful and easy to use, and also having great motivation towards it. The second group is still positive about technology use, finding it easy to use and useful, but showing less motivation towards it. The third and final group is not motivated towards technology use nor finds it easy to use or useful. Statistical differences were also found in sociodemographic variables, namely that cluster 1 has the highest percentage of male respondents, though, age did not seem to influence the clusters' distribution.

This paper has contributed with both theoretical and practical inputs. Theoretically, it is one of the few segmentation studies in this field and

the first to consider the Portuguese population. The solution of three clusters with distinct attitudes towards technology match and support the findings of some previous studies (e.g., Errichiello et al., 2019; Ivanov et al., 2018b). Then, the study also offers valuable contributions to the literature by extending knowledge on how perceptions about technology's usefulness and user-friendliness can be convenient in categorizing different groups, thus demonstrating the importance of previous models and theories (e.g., TAM, TRI) in clarifying individual attitudes regarding technology. Simultaneously, this study is also innovative by providing new insights into how the above-mentioned clusters can be characterized according to their motivation and sociodemographic variables. Specifically observing sociodemographic variables, the study finds both support and refutes prior research on the influence of variables such as gender, education, income, and age. For instance, the present findings indicate that females tend to have a more cautious attitude towards technology, unlike previous studies (e.g., Ayyildiz et al., 2022; Benckendorff et al., 2005) indicating females as those revealing a greater predisposition for technology adoption. Then, contrary to other studies (e.g., Benckendorff et al., 2005; Heerink, 2011; Ivanov et al., 2018a; Ivanov et al 2018b; Tung & Law, 2017) no statistically significant differences were found among the groups in terms of education and age. Additionally, this study also tried to verify if segments could be characterized according to their monthly income. Even though no significant differences were found, this study extended knowledge by adding a sociodemographic variable that has been neglected in the literature. Once the results indicate that only gender was different between the three groups and contradictions were found in comparison with previous research, future studies should try to extend knowledge on the influence of sociodemographic variables, perhaps by using additional variables or it can be assumed that demographic variables are not a consistent measure to distinguish visitors with different attitudes towards technology.

In practical terms, the findings will help destination managers to recognize their consumers, and thus allow a correct adaptation of the technology at the destination to their target audience. Besides, results will give managers the tools to understand to what extent technological solutions can be introduced at the destination and to conduct personalized marketing strategies to different publics, according to their attitudes. Considering the results obtained, tailored AI solutions could be designed to fit each segment profile, create different experiences for each group, and provide alternatives for those who find technology hard to use or even harmful. Managers should, however, keep in mind that the appearance of the robots, as well as the activities they perform, may influence users' attitudes, and start with machine-like robots paired with human options. This solution will allow for the distinct segments to be kept, enhancing the experience of those who find technology exciting, while also keeping the 'reluctant technology users' satisfied. As technology keeps evolving and users' attitudes towards it keep getting more defined, managers are more likely to feel the need to separate these groups; however, for the time being, and considering the costs associated with the implementation of AI, managers should consider serving all different segments.

Regarding the limitations of the study, the sample is composed of only Portuguese participants and Tung and Law (2017) and Benckendorff et al. (2005) suggest there might be differences between nationalities, so a more diverse sample could offer more reliable results. Also, the education level of participants could have been considered and should be included in future studies. Besides, the data collection was online, which could limit the number and diversity of people participating. Additionally, this study was based on the original Technology Acceptance Model (Davis, 1986), not considering more recent approaches, like the TAM2

(Venkatesh and Davis, 2000) or the ETAM (Wang & Sun, 2006), possibly not considering other factors that could also influence technology acceptance and thus would help to better characterize and categorize segments with distinct attitudes, that should be considered if future investigations. Future research should also deepen the influence of sociodemographic variables in technology acceptance, namely nationality, considering the already mentioned contradicting results. Likewise, even though the monthly income of respondents did not classify as a predictor for users' attitudes toward technology, future research should consider this variable to understand if it could be considered a universal result or if there are peculiarities in different countries/regions.

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