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Co-creation and critical factors for the development of an efficient public e-tourism system

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ABSTRACT

This study identifies the factors that guide the adoption of a public e-tourism system resulting in value co-creation in the UAE. Integrating and comparing factors drawn from the third version of the Technology Acceptance Model (TAM3), the Technology-Task-Fit (TTF) theory, and push-to-use, an Analytic Hierarch Process (AHP) model was implemented with data collected using a structured questionnaire from purposively selected UAE e-tourism experts (N = 15) and analyzed using Microsoft Excel. The findings revealed that usefulness, convenience of use, and push-to-use were the most critical aspects for achieving an efficient public e-tourism system that allows for value co-creation in that order of ranking. The findings also suggest that computer self-efficiency is the most critical factor in effectively establishing an e-tourism system followed by government push-to-use. In conclusion, the findings demonstrate that usefulness and ease-of-use backed by computer self-efficiency, result demonstrability, and output quality are vital for the efficient adoption of a public e-tourism system resulting in value co-creation in the UAE.

1. Introduction

Public systems, which we define as non-private systems that are set up, owned, and controlled by governments through their public entities, agencies, and processes for provision of public services such as visa issuance, tourism development authorities, tourist security, free and accessible public Wi-Fi, and other infrastructure, play a significant role in enabling or inhibiting tourism, particularly in the digital era where customers are important stakeholders in value co-creation. Given that the tourism ecosystem entails "the customer-public–private sector collaboration within the networked system" (Garanti, 2023, p. 469), each of these three sets of key stakeholders is paramount in value co-creation in tourism. This is because the value co-creation concept that generates value for a particular tourism service or product is not the sole responsibility of the firm, but a co-creation of the firm together with other stakeholders (Zhang et al.,2023). Value co-creation refers to the peer-like, collaborative, and joint process of symbolically and materially creating value through multiple actors' voluntary contributions in a reciprocal wellbeing manner (Busser & Shulga, 2018). A practical example of value co-creation in tourism is the website, Makemytrip.com , which allows the tourist to co-design their individual tourism experiences by combining various destinations and destination activities, stay types, and vacation days among others (Sugathan & Ranjan, 2019). Public systems including websites and related infrastructure are a vital component of enabling tourism and value co-creation in tourism more so in the advent of e-tourism, which is the usage of information communications technology (ICT) in the remote provision of tourism services by tourist service providers to prospective tourists/travelers

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(Kazandzhieva & Santana, 2019). This is especially given that value co-creation's preconditions include both "soft smartness" and "hard smartness" (Gretzel & Koo, 2021). While "soft smartness" includes such aspects as creativity, leadership, and innovativeness, examples of "hard smartness" are technology and infrastructure, for example (Gretzel & Koo, 2021), all of which public systems enable and provide for the tourism industry and other industries. To date, the factors influencing the acceptance and usage of public systems to drive value co-creation in e-tourism remain unknown.

In this study, we will focus on e-tourism activities in UAE, which is listed as top 10 countries that are developing smart transport networks and infrastructure to enable e-tourism and this has had notable benefits. For example, the UAE had the second-highest hotel occupancy rate globally at 54.7 percent in 2021 (Seshadri et al., 2023). Value co-creation has become particularly important in the United Arab Emirates (UAE) after the accelerated adoption of digital tools in the wake of the COVID-19 pandemic (Seshadri et al., 2023). There have been significant investments in setting up public e-tourism systems to support tourism in the UAE with local tourism authorities launching initiatives whose aim is to promote the tourism and travel industry (Ministry of Economy (MOEC), 2023). Government tourism authorities, including local departments of tourism across the various emirates, work collaboratively with private sector entities such as hotels and travel agencies at the state level to provide better value and enhance accelerated growth. The Country's tourism authorities are set up to ensure tourism services' quality, optimize the tourism experience, and alignment of hotel classification with service standards and value offered to tourists (MOEC, 2023). The UAE government has further set up public e-tourism systems including official information websites and tourism apps (e.g., Eco Tourism UAE app, Senior navigation app, and Dubai Tourism app) event calendars, and dedicated portals for emirates such as Abu Dhabi (Visit Abu Dhabi), Sharja (Visit Sharjah), Ajman (Ajman Travel), Ras Al Khaimah (Visit Ras Al Khaimah), Fujairah (Tourism in Fujairah), Umm Al Quwain (Visit Umm Al Quwain), and Dubai (Visit Dubai) (The official portal of the UAE Government, 2023b). These systems are part of the four-pillar UAE Tourism Strategy 2031 whose aim is to raise the GDP contribution of the tourism sector annually by AED 27 billion, elevate the UAE ranking among the best tourist destinations in the world, boost competitiveness through attraction of additional investments, and welcome 40 million hotel guests in 2031 (The Official Portal of the UAE Government, 2023a).

Despite such a track record in tourism and concerted efforts to build public e-tourism systems for the enhancement of tourism in the UAE and the acknowledged significance of value co-creation in tourism literature, there is hardly any empirical evidence about the factors that would aid in the adoption of these systems to drive value co-creation. Furthermore, granted there are studies on tourism in the UAE (e.g., Bouchra & Hassan, 2023; Papadopoulou, 2022) hardly is there any literature about UAE public e-tourism systems and the factors that would foster their adoption as enablers of value co-creation.

To bridge this gap, this study aimed to identify the factors that influence adoption of a public e-tourism system resulting in value co-creation in the UAE. The research objectives were 1) to identify factors that influence efficient public e-tourism system implementation and 2) to prioritize these factors by importance while linking them to value co-creation in the digital space. To achieve these two objectives, we employed the technology acceptance model-3 (TAM3), which has been used extensively to investigate technology acceptance behavior (Lai, 2017), and integrated the technology task fit (TTF), which has been used to determine ICT task and technology characteristics (Wu & Chen, 2017). Push-to-use was added as an external variable given that novelty such as that required in value co-creation is often linked to push factors (Blomstervik & Olsen, 2022).

Upon setting the scene in this section, the literature and theoretical background are highlighted. The application of the AHP as the methodology for this study and the analysis precede the discussion of findings and conclusion. Finally, the implications and limitations of this study are disclosed in the last section.

2. Literature and underpinning theories

Internet development and application, primarily through the World Wide Web (WWW), have rapidly increased since its inception in1994 (Lin, 2010). According to Internet World Stats (2019), over 4,574 million people had Internet access in 2019, equivalent to 58.67 % of the world's population. Tourism is among the fastest-growing Internet segments (Rayman-Bacchus & Molina, 2001), with travel applications (apps) ranked seventh among the most downloaded apps. Sixty percent of global mobile users have travel apps, and approximately 45 % use them to plan tours (Douglas, 2019). Poon (1993) foretold that "a whole system of ITs is being rapidly diffused throughout the tourism industry and no player will escape its impacts" (n. p.). Therefore, the tourism industry is increasingly reacting to this phenomenon. Many organizations have needed to renovate strategic marketing and management and remodel operational practices to accommodate this technological paradigm shift (Buhalis, 2019). The Internet and virtual market availability have made traditional marketing practices almost obsolete.

The phenomenon gave rise to "e-tourism" or "e-travel" terms that explain tourists' and travelers' behaviors and attitudes toward the Internet and virtual markets (Fryc, 2010). Smart tourism apps that integrate functions to predict and meet tourists' needs have entered the market and changed tourists' behavior. The apps endorse travel routes based on tourists' individual preferences, allowing them to arrive at scenic spots and destinations, discover new things about the area, create relationships, and gratify real-time tourist demands (Leiet al., 2019). Albeit using theory-based general review of literature in exploring the principal customer-based technologies and factors to value co-creation in tourism through artificial intelligence (AI) usage, Solakis et al. (2022) concluded that customers' attitudes, perceptions, trust, hedonic motivations, past experience, social influence, and anthropomorphism were the customer-based factors for value co-creation in tourism when using AI.

Virtual tourism markets through Internet websites and smart tourism apps offer numerous advantages. For example, tourists' use of digital technology has the possibility of saving money and time during vacation preparation (Halkiopoulos & Giotopoulos, 2022). Tourism businesses also benefit from having access to diverse, cost- and time-saving digital marketing technologies through which they can advertise their services and products across different media and tools that suit their business needs (Halkiopoulos et al., 2023). However, online site evaluations have revealed that tourism entities' Internet application has been inefficient (Wan, 2002; Baloglu & Pekcan, 2006). Official public tourism websites are unpopular and do not get tourist attention (Yanet al., 2018), which could impede value co-creation digitally (Ramaswamy & Ozcan, 2018).

2.1. E-tourism, value Co-Creation, and public systems

With the rapid and radical technological shifts and adjustments in consumer behavior, the tourism industry has been impacted significantly by altering management, production, and governance (Kandappan & Neethiahnanthan, 2019). The Internet's role, as the main source of knowledge is gaining significance (Almeida-Santana & Moreno-Gil, 2017; Manap & Adzharudin, 2013), resulting in a very complex and dynamic digital ecosystem, where various platforms and actors interact to provide information and connect with customers (Munar & Jacobsen, 2014). Such interactions often drive value co-creation by involving customers in development of customer-centric innovative services (Jain et al., 2021). In tourism, co-creation has been described as a powerful avenue for the development of meaningful and involving experiences of cultures, places, and services that tourists engage with or encounter during travel (Kastenholz & Warner, 2020). For hospitality and tourism firms, the digital context (especially social media) has emerged as a

space for co-creation that is afforded by digitization and one that allows for big data transformation into actual knowledge (Borges-Tiago et al., 2021). A promulgation of Prahalad and Ramaswamy (2004), value co-creation is traceable to the empowering digital age that enables individual participants in the market to participate actively in the process of co-creating value for the benefit of the entire ecosystem (Payne et al., 2021). In any case, firms find co-creation helpful in identifying consumer needs and means for improving their processes (Lalicic & Weismayer, 2021).

As a value co-creation enabler in tourism, e-tourism is an ICT innovation that involves a web-based or software application platform that allows tourists, businesses, and the public sector to network with each other by distributing knowledge and communicating (Masri et al., 2020; Kazandzhieva & Santana, 2019). It also delivers products and services to tourists (David-Negreet al., 2018). Numerous studies have examined how mobile technology affects social media, with a specific focus on the travel industry (Liang et al., 2017; Leung et al., 2013), whereas others have provided a more non-specific overview of e-tourism progression (Buhalis & Law, 2008; Navío-Marco et al., 2018).

Kastenholz and Werner (2020) explicated the significance of co-creating meaningful, involving, and appealing experiences for cultural heritage in tourism through digital spaces using noncommercial destination information as a way of promoting visitor/tourist curiosity. Fotis et al. (2012) established that consumer-generated content is deemed more trustworthy than content generated by mass media, public sector websites, or travel agents. Shulga et al. (2021) found that trust was both a significant value co-creation outcome and an antecedent that is reciprocal in nature. Despite their significant contribution to our understanding of co-creation in e-tourism, these studies were focused on private-sector tourism entities outside the Arab world with little or no attention to the role played by public-sector entities. This is despite the significance of the experiential value that online social contacts co-create through established social contacts online (Daisy et al., 2020) even in tourism (Shulga et al., 2021).

Resultantly, whatever influences tourists to use non-public websites and applications to seek information and how the public sector and public tourism entities can become the first go-to information point for tourists remains unclear. This is particularly missing in the context of the UAE, despite the significant government investments in tourism and technologically advanced public systems and infrastructure to support the tourism sector as envisioned in the UAE Tourism Strategy 2031 (The official portal of the UAE Government, 2023a). Yet, developments that enable value co-creation in tourism including applications that enable tourists to organize and plan their trips with in-destination tourism sites that can be accessed through public transport, cycling and interactive walking tracks, digital tours, intelligent accessibility tools for persons with disabilities, digital city guides, and digital tours, as embedded in tourism services and products (Garanti, 2023) are also available through public systems.

The public sector is a critical player in pushing technology into the UAE market. For example, in 2003, the m-government was initiated in the UAE by His Highness Sheikh Mohammed Bin Rashid Al Maktoum to deliver comprehensive services to the UAE population via a one-time login from any location (Cherrayil, 2014). In 2015, 337 (96.3 %) of essential UAE public services made an impertinent shift to m-services and m-government (Emirates247, 2015). Cherrayil (2014) noted that an essential UAE m-government objective is to offer the best services at reduced costs and to enhance overall accessibility and efficiency (Cherrayil, 2014).

2.2. Underpinning theoretical frameworks

The TAM theoretical models have been accepted extensively in research explaining technological factors that affect technology usage behavior in tourism given their parsimonious nature (Collado-Agudo et al., 2023) and have evolved from the original TAM (Davis et al., 1989) through TAM2 (Venkatesh & Davis, 2000) to TAM3 (Venkatesh & Bala, 2008). However, the TAM models are about behavior towards technology in general and do not consider technology suitability at the task fitness level. To overcome this limitation, we employed TAM3, which is used extensively to establish technology acceptance behavior (Lai, 2017) added the TTF to examine individual characteristics that may affect this technology's influence at task-fitness level. TTF is also used to identify information technology tasks and technological characteristics (Wu & Chen, 2017). Still, both TAM3 and TTF may not fully account for non-technology factors that nudge an individual toward using a certain technology for a particular task from an internal motivation perspective. To remedy this, we also added push-to-use factor from the push–pull framework (Crompton, 1979; Dann, 1981), which has been recommended by Chen (2019) for understanding the factors that influence customers to adopt new services. The push factors are largely considered internal factors (Bayih & Singh, 2020) and, thus, we considered tourists' push-to-use public systems in e-tourism as a variable to examine the effect of non-technology-related factors' on technology acceptance behavior.

2.2.1. Technology acceptance model (TAM)-3

Davis et al.'s (1989) technology acceptance model (TAM) uses Fishbein and Ajzen's (1977) reasoned action theory to forecast information system tolerability; it was the first model to explain individual behavior in technology use. TAM asserts that such acceptability is founded on perceived usefulness (PU) and perceived ease-of-use (PEOU). Although TAM has been validated in research, it explains only a portion of the variance in the outcome variable. Therefore, the initial model has undergone refining by numerous authors to identify factors that are fundamental to PEOU and PU (Davis, 1989; Davis et al., 1989). TAM was extended to TAM2 by Venkatesh and Davis (2000), who added the variable "usefulness" to explain better technology use, reasons (Wu et al., 2011).

TAM3 was developed by Venkatesh and Bala (2008) using system features, individual differences, social influence, and facilitating circumstances, which have PU and PEOU elements (Lai, 2017). TAM3 added a more detailed ease-of-use explanation and is the most recent and widely used TAM. We used TAM3 in this study because of its simplicity, universality, and better explanatory power for the two main factors (usefulness and ease-of-use). We considered the main factors to be *useful* (with principles: image, subject to the norm, output quality, result certitude, and job significance) and *ease-of-use* (with principles: the view of external control, computer anxiety, computer self-efficiency, objective usability, perceived enjoyment, and computer playfulness) (Fig. 1). The integration of the TTF was useful in assessing usage impacts and investigating the match between task, technology, and individual characteristics, as reviewed in the next section.

2.2.2. Technology task fit (TTF)

Goodhue and Thompson (1995) developed TTF to evaluate information technology's role in performance, assess the impacts of usage, and establish the match between task and technology characteristics (Wu & Chen, 2017). The TTF factors are three: task, technology, and individual characteristics. Task fit includes consideration characteristics, such as features that may make an individual rely on exclusive data facets (Goodhue *et al.,* 1995). Technology fit includes hardware, software, data, and end-user support (training and help lines) (Goodhue *et al.,* 1995). Personal traits, such as computer experience, motivation, and training, determine how effectively and efficiently users exploit technology (Goodhue *et al.,* 1995). Aljukhadar et al. (2014) noted that TTFs have been subjected to extensive research and applied to many information systems. We considered whether TTF task characteristics have the same effect as TAM's usefulness and whether TTF's technological characteristics have the same effect as TAM's ease-of-use. The criteria were individual characteristics, and the sub-criteria were computer experience, training, and motivation.

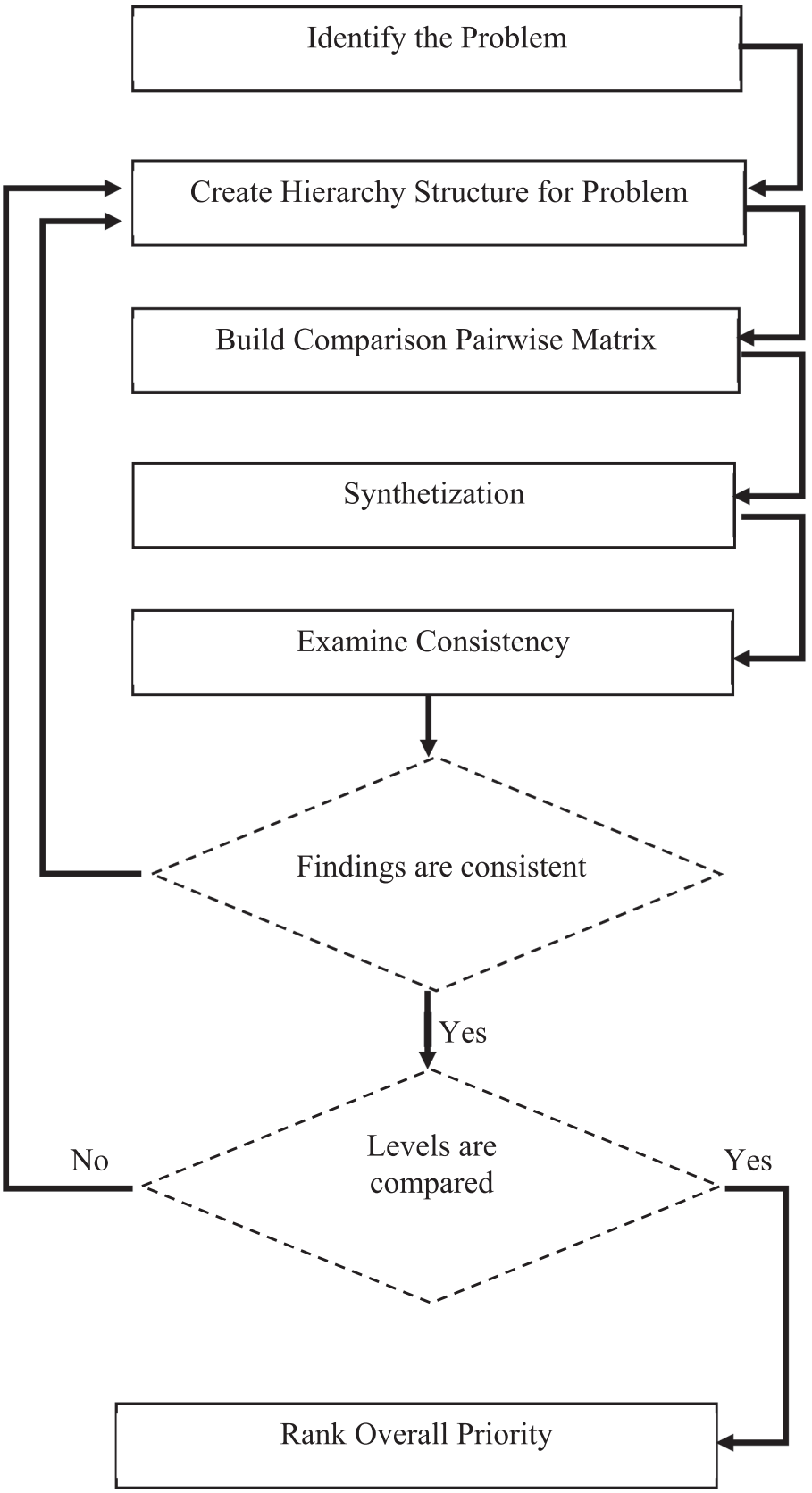

Fig. 1. AHP method applied.

The "motivation" characterization has evolved across a number of diverse researchers. Whiseand Rush (1988) defined it as individuals' desire to do something in a way that satisfies their needs. Motivation is perceived as a peripheral factor that encourages different actions to achieve particular objectives (More and Miller, 2014). Fulleret al. (2017) described motivation as one's tenacity, concentration, and direction toward attaining a specific objective. Kianet al. (2014) identified three vital elements defining employee motivation: effort, needs, and objectives.

The present study focused on individual needs, including technology's cost and benefits, which Melenhorstet al. (2006) found were important motives for technology use. Privacy and security needs also influence technology use (Saadi et al., 2017).Therefore, discretion and apparent security are essential components of innovative technology (Chang & Kannan, 2002; Kumar & Sinha, 2007).Safety and confidentiality are also vital to mobile technology-users prefer technology that can be trusted (Suoet al., 2013). According to Kumar and Sinha (2007), observed security motivates innovative technology because it offers comfort and financial safety and enhances technology protection and dependability. Therefore, we included computer experience, training, cost, benefits, privacy, and security as individual characteristics subcriteria (Fig. 1). Given the established significance of push factors in motivating tourists to consume/purchase a certain technology or service (Blomstervik & Olsen, 2022), push-to-use drawn from the push–pull theory was a necessary factor for determining consumption of public e-tourism services and engaging in co-creation, as described in the next section.

2.2.3. *Push-to-Use*

Push-pull theory is used to explain a project's success or failure (Zmud, 1984). Fundamental motivations behind technology-push–demand-pull novelty have inspired innovation investigators. The push case posits that science drives innovation that propels technology and its associated uses. The pull perspective identifies user demand as the main factor and maintains that applications, marketplaces, and consumers are fundamental drivers of innovation (Chidamber & Kon, 1993). Many researchers have used the push and pull theory in process innovation in knowledge (Zmud, 1984), service technology (Teigeler & Sunyaev, 2019), strategic research and development investment (Leibowicz, 2016), and developing new intelligent services (Geumet al., 2016). Therefore, having already integrated TAM3 with TTF, the push-to-use factor was added.

Public e-government systems such as 'The official portal of the UAE Government' could are beneficial to tourism development. A case study of the Sultanate of Oman by Al Salmi et al. (2016) revealed that e-government participation by the citizenry affects e-tourism engagement positively when implemented correctly as to link up different e-services that support tourism. According to Patelis et al. (2005), while e-government has excellent potential to enrich and proliferate relations between citizens, businesses, and the public sector, its full potential in the tourism industry is yet to be established. Demonstrating the push factors that influence efficient public e-tourism system implementation and prioritizing these factors by importance while linking them to digital value co-creation in this research could potentially benefit the public tourism agencies, tourism authorities, and governments to understand and focus on the factors that could increase the popularity of official e-tourism public sources and agencies among tourists.

Technology providers and companies also push technology into the market to commercialize novel expertise effectively, whether or not demand exists (Brem, 2008). As one such novelty, e-tourism aims to provide cost-effective web-based tools for tourism providers and destination supervisors that allow consumers to search, compare, book, and purchase tourism products (Pantano & Di Pietro, 2013).

As another push factor, travelers are often presumed to be online before, during, and after a trip (Hjalager & Jensen, 2012). Consequently, mobile devices have increasingly replaced personal computers for online tasks such as finding neighboring restaurants, booking hotels, or browsing the Internet (Husson & Ask, 2011). Given the three push-to-use factors, we defined three-factor push-to-use sub-criteria (government, technology provider, and situation) in this study (Fig. 2) to undertake the AHP.

Previous studies analyzed the sequence of ideas presented in the literature, starting with the development and application of the Internet, especially the World Wide Web, and its growing connection with the tourism industry. This has required many organizations to make strategic changes in marketing and management, as well as adapt operational practices to accommodate this technology shift. Studies have mainly focused on the TAM3 model, which is widely used to understand technology acceptance behavior. The analysis also includes identification of the underlying factors for PEOU and PU, as well as the rationale behind the use of the three TTF factors for the task, technology, and individual characteristics. The interest here is focused on linking the theory of Push-to-Use as well and its effective role in the proliferation of relations between citizens, companies and the public sector, and its full potential in the tourism industry has not yet been established.

3. Research methods

We employed quantitative research methods based on the analytic hierarchy process (AHP) illustrated in Fig. 1 to identify and highlight factors that affect the efficient implementation of a public e-tourism system and co-creation in the UAE. The AHP is useful in aiding decision-making in tourism particularly where the number of decision factors is huge (Božić et al., 2018), to identify and rank the factors associated with implementing a public e-tourism system efficiently.

As shown in Fig. 1, the AHP research process in this study was organized in six main hierarchical steps and began with the identification of the problem, which was about the lack of evidence about the factors that influence the adoption of public systems in e-tourism. The hierarchy structure of the problem was then created in the second step and followed by the building of a comparison pairwise matrix in the third step. The synthetization process of the factors related to the adoption of public systems in e-tourism followed in the fourth step and the consistency of these factors in the data was then undertaken to inform the findings in the fifth. Any inconsistency in the findings led to the repeat of the process from the creation of the hierarchy structure for the problem until consistency in findings was achieved. Thereafter, the comparison of the various levels emerging from the consistent findings followed and the process would revert to the creation of the hierarchy structure for the problem (second step) until saturation of the comparison of the levels of findings after which the overall ranking in order of priority was performed in the sixth step.

Data was obtained from web-based and mobile application development experts with experience in the UAE public-sector tourism industry. The questionnaire uses a nine-point scale, as Saaty (2008) recommended. Data were from web-based and mobile application development experts from the UAE Department of Culture and Tourism collected using a structured questionnaire with three sections reflecting the TAM3, TTF, and push factors. The experts were chosen based on their diverse knowledge of the UAE e-tourism sector, which was vital for reaching decisions about the priority of indicators in prioritizing public e-tourism factors by their influential significance among users. Initially, 21 key experts were identified purposively as potential participants in this study, but some ($n = 4$) declined and others ($n = 2$) were unavailable to participate during the data collection period resulting in a sample of 15 experts ($N = 15$). The AHP methodology works with small samples and that explains the preference for expert opinion over surveys (Cheng and Li, 2001; Drakeet al., 2013).

Data analysis was performed in Microsoft Excel. The respondents were mainly male ($n = 11$) and had at least nine years of experience with web-based and mobile applications in the UAE tourism industry. In addition, they were involved in strategic operations and decision-

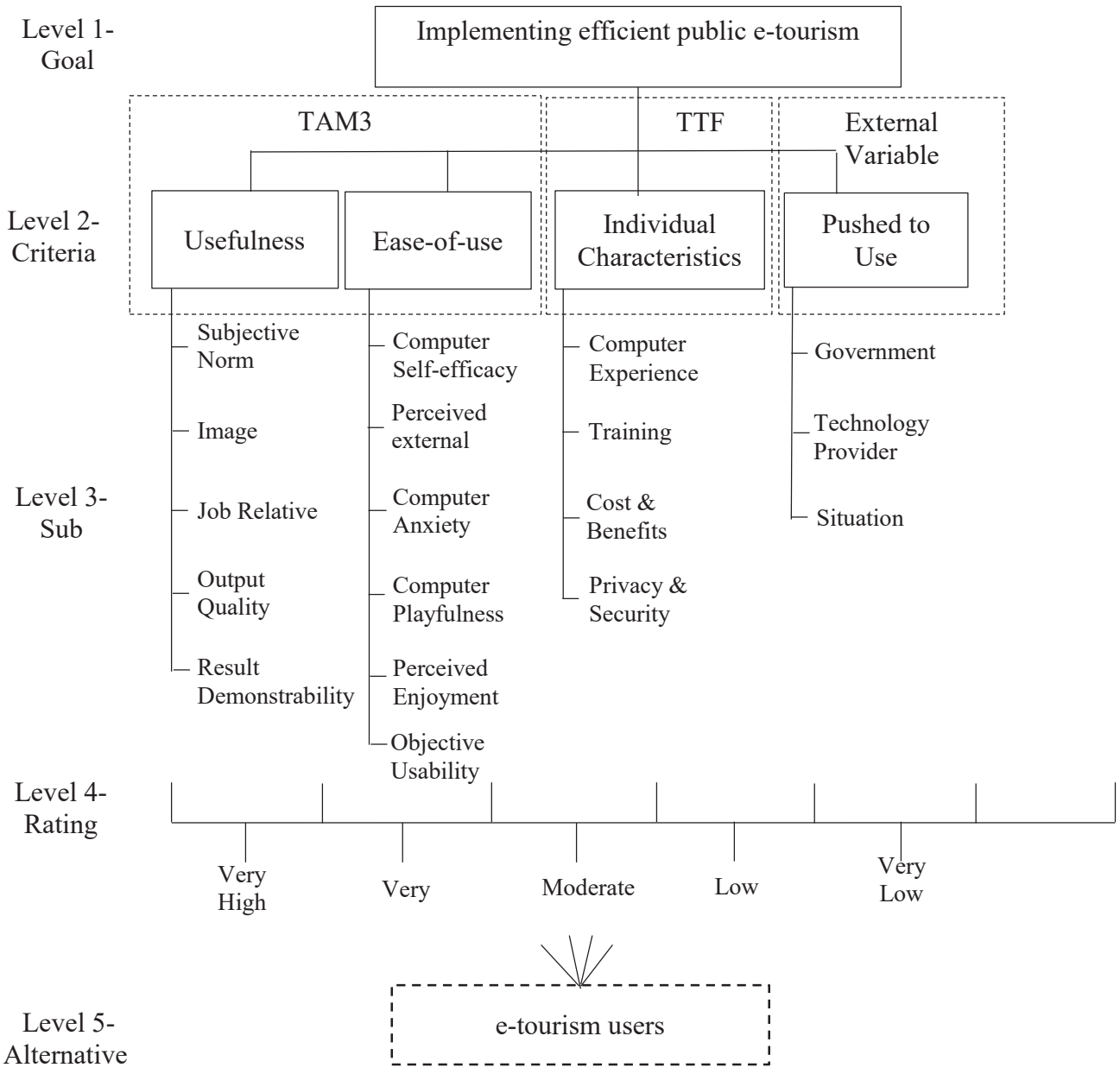

Fig. 2. Efficient implementation of public e-tourism hierarchy.

making at managerial level and above. The Saaty (1990) scale was used in the face-to-face structured interviews with the experts to rank their prioritization/importance of the TAM, TTF, and push factors and sub criteria. As Saaty (2008) recommended, we applied the geometric mean method to integrate autonomous pairwise comparison verdicts and acquire harmony pairwise comparison verdict matrices.

3.1. *Overview of the analytic hierarchy process*

The AHP was developed by Saaty (1970) to analyze simple and complex challenges by structuring managerial decision-making in order of importance. It is a Multi-Criteria Decision Making (MCDM) methodology for decision-making that involves qualitative, quantitative, or combined qualitative/quantitative factors (Calabrese et al., 2019; Saadi et al., 2017; Ahmad & Hussain, 2017). AHP uses pairwise comparisons and is dependent on expert opinion to derive priority scales (Hussain et al., 2016). The process focuses on a judgment's inconsistencies (Vinodh & Joy, 2012) whereby the decision-maker adopts a structured approach to solve a challenge by breaking down issues into multiple levels and prioritizing them. The number of hierarchy levels determines a problem's complexity (AlJaberi *et al.,* 2017). The AHP Model.

The primary AHP stage (Level 1) entails problem identification, which was about identifying the factors that guide the adoption of a public e-tourism system resulting in value co-creation in the UAE. Level2 identifies and develops an AHP hierarchy model for technology acceptance criteria and an external variable. The main criteria were based on integrating TAM3, TTF, and Push-to-Use theories to include usefulness, ease-of-use, individual characteristics, and push-to-use. In Level 3, the main criteria is followed by discrete sub-criteria (Fig. 2).

The next phase of AHP instituted pairwise comparisons among the criteria. To extrapolate this comparison, the nine-point scale suggested by Saaty (2008) was followed (see Table 1). For instance, when usefulness was evaluated as having moderate significance compared to ease-of-use, then the rating of the former was "3″and ease-of-use was rated at 1/3.

After pairwise comparison and matrices formulation, consistency

Table 1
Pairwise comparisons 1–9 scale.

Intensity of importance	Definition	Explanation
1	Equal importance	Two criteria contribute to the objective equally.
3	Moderate importance	Experience and judgment favor one over the other slightly.
5	Strong importance	Judgment and experience favor one over the other strongly.
7	Very strong importance	A criterion is preferred over the other very strongly, and its dominance manifests in practice.
9	Extreme importance	The importance of one over the other is affirmed in the highest order possible.
2,4,6,8	For comparison between the above values	Used to signify compromise judgments between the priorities highlighted above.

was checked because decisions should not be based on low consistency judgments appearing to be random (Saaty, 1990). The CI (consistency index) was computed based on the formula below suggested by Saaty (1990):

Whereby λ max signifies the highest Eigenvalue of each matrix whereas n represents the number of elements in the matrix. The consistency ratio (*CR)* was later used to determine if a matrix exhibits sufficient consistency. This is the CI ratio to the RI (random index), which is the matrix's CI of randomly generated comparisons.

Table 2 (Saaty, 1990) presents the RI for differently sized matrices,n. If the CR equals or is less than 0.10, the discrepancy is acceptable (Saaty, 1990).

Table 3 shows a pairwise comparison of the four principal criteria utilizing geometric analysis. The next phase entails unfolding the relative primacies of the criteria (last column of Table 3) by defining the priority vectors. Priority vectors were calculated by introducing the consistency principle (Saaty,1990), which postulates that $a_{ik} = a_{ij} * a_{jk}$. Research has subsequently advocated for using a certain case of the consistency matrix formed by the elements $a_{ik} = w_i/w_k$, whereby w_i and w_j constitute the elements of the priority weight vector that corresponds to the i and j criteria respectively.

4. Results

In applying consensus pairwise comparison assessment metrics for each survey respondent, this study used a geometric mean as opposed to an arithmetic mean to integrate individual or independent pairwise evaluation judgments. Table 3 shows the geometric means of the main criteria influencing efficient implementation of a public e-tourism system in the UAE. The respondents determined that usefulness was the most important attribute, with a 41 % priority weight, followed by ease-of-use (37 %). The push-to-use priority weight was 17 %, ranking third in importance, and individual characteristics were the least important attributes, with a priority weight of 5 %. The main criteria consistency ratio (CR) was 0.04, considered acceptable below the 0.1 threshold (Saaty, 1990).

The pairwise sub-criteria comparisons based on the respondents' consensus are indicated in Table 4. Each criterion was broken into sub-criteria in Level 2, resulting in five usefulness sub-criteria: subject to the norm, image, demonstrability, job-related, and output quality. The sub-criteria ranking was relative job importance (priority weight of 30 %), followed by result demonstration (23 %), quality output (22 %), and subject to the norm (18 %), with a minor being image (7 %). The usefulness sub-criteria CR was acceptable (0.04).

Ease-of-use had six sub-criteria (Table 5), ranked: computer self-efficiency (44 %), objective usability (23 %), and perceived external control (14 %). The other sub-criteria were weighted below 10 %. The ease-of-use sub-criteria CR was acceptable (0.05).

Table 6 displays the four sub-criteria for individual characteristics pairwise comparisons. Training was ranked highest in importance, with a 43 % priority weight and was succeeded by computer experience (30 %). Cost-benefits and privacy-security ranked last, at 18 % and 10 %, respectively. The ease-of-use sub-criteria CR was acceptable (0.03).

As shown in Table 7, push-to-use had three sub-criteria, with the government ranked highest (74 %), and followed by the technology provider (17 %). The situation was the lowest (9 %). The ease-of-use sub-criteria CR was acceptable (0.03).

5. Discussion and conclusion

Technological transformation has an extraordinary influence on tourism and the hospitality industry, emphasizing the need to change how products and services are delivered to meet consumer and global market expectations (Borges-Tiago et al., 2021). Involving the consumer in co-creating value is vital in the digital era (Jain et al., 2021) being an avenue for development of meaningful engagements in tourism (Kastenholz & Warner, 2020) and, particularly within the digital setting (Borges-Tiago et al., 2021). This can only be achieved when both consumers and service providers contribute to value co-creation through the digital space in a reciprocating manner (Shulga et al.,2021). Through co-creation in the digital space, travelers and e-tourism agents have led to virtual market growth in the tourism industry and public-sector tourism entities should lead this change. Hence, it is essential to understand consumer behavior in mobile device applications and create trust, which can develop interactions for value co-creation by businesses and customers through "digital clienteling" (Jain et al.,2021), resulting in a tailored and fulfilling tourism experience (Neuhofer et al., 2014). Such an approach would require to be built on trust where customers trust public sector e-tourism platforms and the public sector reciprocates this trust for customer co-creation and this would get more trust even as it fosters co-creation of value in tourism (Shulga et al., 2021).

This research shows that the main factors affecting the implementation of public e-tourism systems are usefulness and ease-of-use, which are the main TAM factors. Chapman and Dilmperi (2022) identified ease-of-use and usefulness as essential elements of brand value co-creation among online communities in consistency with previous studies. It also explains why TAM is widely used to evaluate technology acceptance behavior (Lai, 2017). The final AHP step identified a global priority weight for an alternative pairwise comparison (Fig. 2), which was determined through multiplication of the sub-criteria ranking by the priority matrix of the main criteria (Saaty, 1990). Computer self-efficiency (17 %), result demonstrability (12 %), and output quality (9 %) were the most critical usefulness sub-factors, which underscores the importance that public tourism agencies have to pay on ensuring that the public e-tourism systems that they design and introduce to the public deliver quality results that meet the expectations of the public. However, such result demonstrability and output quality may never be appreciated fully if the users (public/tourists) are not efficient in using the public e-tourism systems that are designed and promulgated by public tourism agencies/institutions. This is consistent with the TAM3

Table 2
Random index.

N	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.00	0.52	0.89	1.11	1.25	1.35	1.40	1.45	1.49

N = the number of factors.

Table 3
Geometric means of pairwise *main criteria* comparisons.

	Usefulness	Ease-of-use	Individual characteristics	Push to use	Priority vector
Usefulness	1.00	1.60	5.43	3.45	0.41
Ease-of-use	0.63	1.00	8.00	4.45	0.37
Individual Characteristics	0.18	0.13	1.00	0.13	0.05
Push to use	0.29	0.22	7.69	1.00	0.17

CR = 0.04 < 0.10 (acceptable).

Table 4
Geometric means of pairwise *usefulness* sub-criteria comparisons.

	Subject to the norm	Image	Job relative	Output quality	Result demonstrability	Priority vector
1. Subject to the norm	1.00	2.00	0.31	2.28	0.94	0.18
2. Image	0.50	1.00	0.14	0.15	0.65	0.07
3. Job relative	3.23	7.14	1.00	2.03	0.33	0.30
4. Quality of output	0.44	6.67	0.49	1.00	1.80	0.22
5. Result demonstrability	1.06	1.54	3.03	0.56	1.00	0.23

CR = 0.04 < 0.10 (acceptable).

Table 5
Geometric means of pairwise *ease-of-use* comparisons.

	Computer self-efficiency	Perceived external control	Computer anxiety	Computer playfulness	Perceived enjoyment	Objective usability	Priority vector
1. Computer self-efficiency	1.00	6.4	5.64	5.6	6.8	4.06	0.44
2. Perceived external control	0.16	1.00	2.87	4.40	5.40	0.32	0.14
3. Computer anxiety	0.18	0.35	1.00	3.25	3.31	0.13	0.09
4. Computer playfulness	0.18	0.23	0.31	1.00	1.60	0.15	0.05
5. Perceived enjoyment	0.15	0.19	0.30	0.63	1.00	0.53	0.05
6. Objective usability	0.25	3.13	7.69	6.67	1.89	1.00	0.23

CR = 0.05 < 0.10 (acceptable).

Table 6
Geometric means of pairwise *individual characteristics* sub-criteria comparisons.

	Computer Experience	Training	Cost & benefits	Privacy & Security	Priority Vector
1. Computer Experience	1.00	0.66	4.23	1.30	0.30
2. Training	1.52	1.00	3.83	2.68	0.43
3. Cost & benefits	0.24	0.26	1.00	0.65	0.10
4. Privacy & Security	0.77	0.37	1.54	1.00	0.18

CR = 0.04 < 0.10 (acceptable).

Table 7
Geometric means of pairwise *push to use* sub-criteria comparisons.

	Government	Technology provider	Situation	Priority vector
1. Government	1.00	7.00	6.00	0.74
2. Technology provider	0.14	1.00	2.87	0.17
3. Situation	0.17	0.35	1.00	0.09

CR = 0.03 < 0.10 (acceptable).

factors for ensuring optimal technology acceptance and use comprising system features and facilitating circumstances (Venkatesh & Bala, 2008). Job relativity (12 %) and objective usability (9 %) were the essential ease-of-use sub-factors.

The findings attributed to the push-to-use factors revealed that the government sub-factor (12 %) was the most important (Fig. 3). Push-to-use by the government was third in the global priority weight; the respondents suggested that the public sector should take control of e-tourism. Given that the UAE government has demonstrated willingness and ability to enhance efficiency in the m-government services (Cherrayil, 2014) is an indication that dedicating similar effort would likely deliver an efficient public e-tourism system.

The public sector can lead in technology implementation, as demonstrated in the case of the UAE (Cherrayil, 2014; The official portal of the UAE Government, 2023b). However, as shown in this study, public sector entities should first consider their web-based and mobile tourism applications 'usefulness and ease-of-use before encouraging tourists to use them. We recommend that tourism bodies establish an e-tourism or e-traveler program using machine learning (ML) or artificial intelligence (AI) technology that helps consumers alter products and services to suit their needs based on their experiences as a way of contributing to the value co-creation in the digital context (Payne et al.,2021). This would entail gaining access to pertinent intelligence needed to arrange trips and make suggestions for appraising products and services based on consumers' knowledge and travel experiences (Borges-Tiago et al.,2021). An ML system can also help tourists identify places (such as tourist attractions, local markets, and restaurants), products, and services (such as transportation tickets or locations); offer visual information about the location, and alter the tour plan automatically as needed. This technology will boost efficiency and create more "wow" factors that attract attention to the platform. This voluntary and involuntary digital contribution by travelers and tourists would enable new forms of value co-creation (Skandalis, 2023) through dynamic exchange capabilities (Siaw & Sarpong, 2021) in tourism services (Chapman & Dilmperi, 2022). Public-sector entities can then promote (push) digital tourism technology to support e-tourism by advertising it to increase awareness and use among tourism consumers in the UAE. The effective combination of usefulness, the convenience of use, and

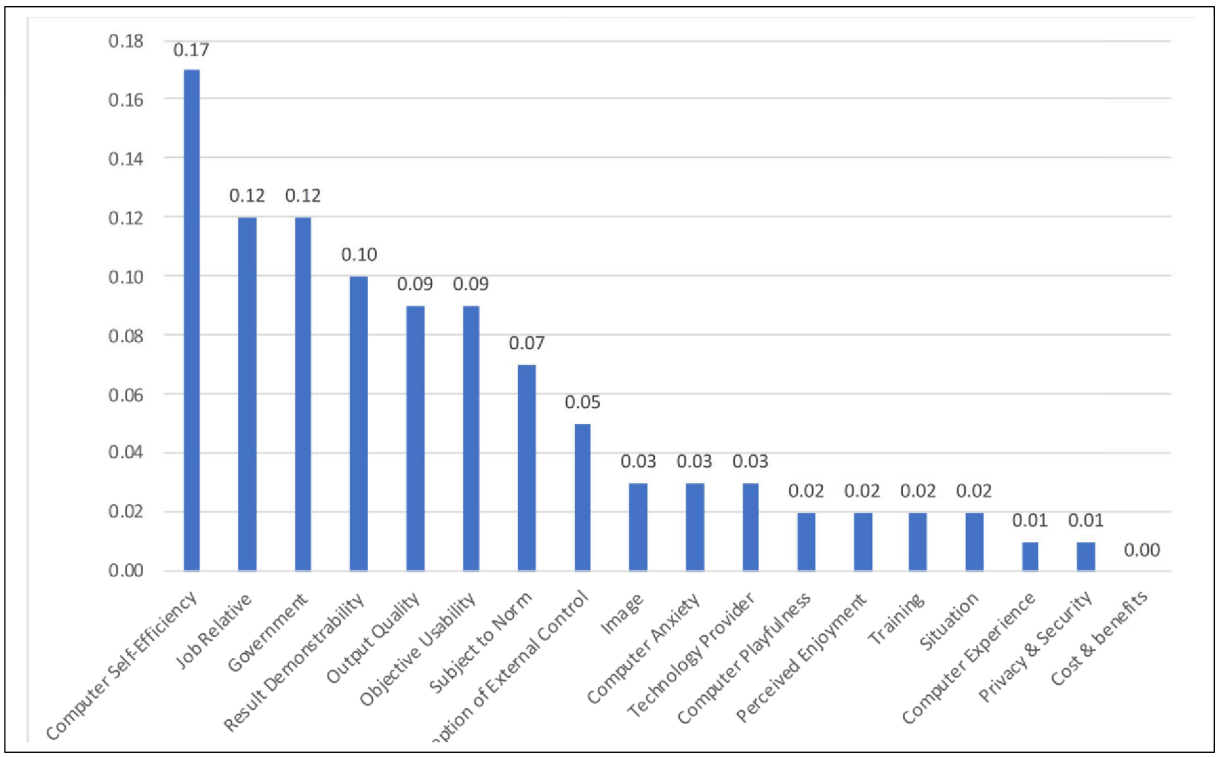

Fig. 3. Global priority of all sub-criteria.

push-to-use together with enhanced consumer (tourist) computer self-sufficiency and government push-to-use in a public e-tourism system would foster reciprocated value co-creation by both tourism consumers and service providers. In conclusion, this study's findings demonstrate that usefulness and ease-of-use backed by computer self-efficiency, result demonstrability, and output quality are vital for the adoption of a public e-tourism system resulting in value co-creation in the UAE.

6. Discussion

6.1. Theoretical implications

This study's main contributions are to literature one-tourism and value co-creation through the introduction of a framework that applies AHP to examine the primary factors and sub-criteria that influence the efficient implementation of a public e-tourism system in the UAE that promotes digital value co-creation. The findings show that technology ease-of-use and usefulness are essential elements for efficiently implementing technology, aligning with TAM (Davis et al., 1989; Lai, 2017; Putra & Samopa, 2018). The findings also show that technology will be effective if the public sector pushes its use (Teigeler & Sunyaev, 2019) and this would foster value co-creation within the tourism sector bearing in mind the ever-evolving digital ecosystem (Borges-Tiago et al., 2021; Lalicic & Weismayer, 2021).

This study also contributes to theory by extending the theoretical application of TAM3, TTF, and push factors from the push–pull theory in tourism research by deriving the factors attributed to these theories and subjecting them to an AHP methodology for ranking by priority. In doing so, this study creates a pathway that other researchers beyond just e-tourism and value co-creation in e-tourism could emulate to demonstrate the robustness in research that integrating these three theories and their aspects/factors yields. Such robustness is further enhanced by showing how the various factors from the three theories compare against each other in terms of priority.

6.2. Practical implications

These findings have practical implications for public sector e-tourism decision-makers in that they can identify the most influential factors to popularize official public e-tourism sources among the general public. Software developers in the public tourism sector can then, for example, incorporate the most influential TAM3, TTF, and push factors to design and build more efficient systems that the general public and tourists will accept and trust enough to engage with and contribute to voluntarily and/or involuntarily in co-creating value for e-tourism in the UAE. In addition, this study's findings offer decision-makers a resource to understand the priority criteria that contribute to an efficient implementation of public e-tourism – one that promotes value co-creation where tourists and travelers contribute to the process of brand co-creation of public e-tourism within the dynamic and complex digital ecosystem. Ultimately, this would contribute towards accelerating the realization of the UAE Tourism Strategy 2031 and the envisioned overall economic diversification of the country.

6.3. Research limitations

The geographical scope of this study was limited to the UAE. Studying other countries, including other Middle Eastern countries, may yield mixed results because of cultural differences. After all, the cultural heritage that tourists create across different destinations when they interact with other cultures differs significantly and could add value to e-tourism within the digital context (Kastenholz & Warner, 2020). Additionally, this study's primary findings were informed exclusively by expert opinion and this may have been subjective. Further studies could collect data from individual users to understand their preferences better. Finally, the study focused on the TAM3 and TTF theories, with an additional push-to-use variable and this may have limited the robustness of the findings. Future studies could include other theories and variables in their models and employ a different analytical approach to inform the public e-tourism and value co-creation discourse.

CRediT authorship contribution statement

Ahmed Abdulla Alharmoodi: Writing – original draft, Methodology, Formal analysis. **Mehmood Khan:** Writing – original draft, Validation, Conceptualization. **Charilaos Mertzanis:** Visualization, Methodology, Investigation. **Shivam Gupta:** Writing – review & editing, Project administration. **Patrick Mikalef:** Writing – review & editing, Supervision, Conceptualization. **Vinit Parida:** Writing – review & editing, Supervision, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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