

Determinants of Blockchain Technology Adoption in Small and Medium Hospitality and Tourism Enterprises

Abstract

This study examines the determinants of blockchain technology adoption in small and medium hospitality and tourism enterprises. This study also investigates the moderating effect of technology optimism. Results from a sample of 550 enterprises indicate that technological factors (i.e., relative advantage and compatibility), organizational factors (i.e., top management support, organizational readiness, and employee blockchain technology knowledge), and environmental factors (i.e., competitive pressure, customer pressure, and government support) positively affect intention to adopt blockchain technology. These relationships are moderated by technology optimism. Interestingly, perceived complexity and adoption cost are insignificant determinants of blockchain technology adoption. This study contributes to the literature by explaining the underlying mechanism and boundary conditions (i.e., managers' technology optimism) under which technological, organizational, and environmental factors predict the adoption of blockchain technology among small and medium hospitality and tourism enterprises. Moreover, the findings provide implications for hospitality and tourism managers in adopting and implementing blockchain technologies.

Keywords: smart tourism, blockchain, technology adoption, small and medium hospitality and tourism enterprises, TOE framework, DOI theory.

1. Introduction

Smart tourism has emerged as a pivotal trend in the hospitality and tourism sector (Buhalis et al., 2022; Chen et al., 2021; Elshaer & Marzouk, 2022), playing a crucial role in sustainable hospitality and tourism development (Bulchand-Gidumal, 2022; Talwar et al., 2023). It has garnered increasing attention in academia and practice, with various conceptualizations (Gelter et al., 2022). However, there is a pressing need for more comprehensive explanations to advance the current understanding of smart tourism and its implications for hospitality and tourism stakeholders (Ye et al., 2021; Zvaigzne et al., 2023).

Smart tourism technologies offer high connectivity, enjoyment, comfort, interaction, personalization, and value co-creation, elevating distinctive tourists' experiences (Elshaer & Marzouk, 2022; Hsu, 2024; Jeong & Shin, 2020; Kim & Chen, 2019). These technologies encompass a wide range of tools, including ubiquitous computing and Internet of things, cloud computing, ubiquitous connectivity through Wi-Fi, near-field communication, radio-frequency identification, sensors, mobile connected devices, smartphones, virtual reality, beacons, augmented reality, blockchain, mobile applications, integrated payment methods, smart cards, public websites, or social network sites (Chen, 2023; Gretzel et al., 2015; Gursoy et al., 2022; Huang et al., 2017; Zhang & Jin, 2023). Among these smart tourism technologies, blockchain technology, which is “a collection of data and transactions recorded chronologically, tracked through a network of distributed public ledgers – and hence is sometimes referred to as Distributed Ledger Technology” (Nam et al., 2021, p. 455) has been recently acknowledged as a network-based technology (Cozzio et al., 2023) which can foster smart tourism.

From the organizational perspective, blockchain technology can shape SMEs' internationalization (Rakshit et al., 2022), allow tourism businesses to manage multiple transactions (e.g., sales, operations, finance, and administration) while being able to deal with external stakeholders, including the government (Nam et al., 2021), and act as a platform connecting the tourists with attractions in a reliable way (Luo & Zhou, 2021). Nevertheless, there is a dearth of research on the adoption of blockchain technology in hospitality and tourism enterprises, as the extant literature on blockchain technology for tourism purposes remains very conceptual (Luo & Zhou, 2021; Nam et al., 2021).

Furthermore, current smart tourism technology adoption research has paid more attention to the destination and individual levels than the organizational level (Pizam et al., 2022). A few research studies have explored how tourists adopt different information and communication technologies to maximize their travel experiences (e.g., Jeong & Shin, 2020; Kirova & Vo-Thanh, 2019). Previous studies also investigated how a specific destination implements smart tourism technologies (e.g., Nam et al., 2021). The literature largely lacks studies on the intention to adopt smart tourism technologies (e.g., blockchain technology) at the organizational level, especially in small and medium hospitality and tourism enterprises (SMHTEs), which are vital to promoting innovation and driving economic development, especially in developing countries (Chege & Wang, 2020; Wu et al., 2022). This is a surprising gap, given that research on innovation adoption should

focus on organizations rather than individuals (Tornatzky and Klein, 1982). In the tourism and hospitality industry, SMHTEs should be the mainstream research on technological innovation because of their prominent role in the growth of this sector (Binder, 2019). Therefore, exploring the motivations for SMHTEs to adopt smart tourism technologies is critical; nevertheless, how this adoption would play out for SMHTEs has not yet been discovered.

Digital technology adoption in SMEs is generally driven by external and internal factors (Kumar et al., 2023), which can be explained by theories such as the Technology-Organization-Environment (TOE) framework, Diffusion of Innovation (DOI) theory, resource-based theory, and institutional theory. The TOE framework developed by Tornatzky et al. (1990) has been found to have greater strength than other models, as it provides a holistic examination of digital technology adoption drivers and compares various dimensions of drivers (Qalati et al., 2020). While previous studies on digital technology adoption at the firm level have employed either the TOE framework or the DOI theory, scholars have recently suggested a combination of both (e.g., Basloom et al., 2022; Pizam et al., 2022; Shahadat et al., 2023). Indeed, they argued that the combination of these two theories provides a sound theoretical framework for studying the adoption of technology by organizations because it highlights the influence of both internal and external factors. Nevertheless, research using both theories to explain the adoption of smart tourism technologies (e.g., blockchain technology) remains limited at the organizational level.

Furthermore, optimism toward technology is regarded as a positive appreciation of technology and a belief that it provides people with increased control, flexibility, and efficiency (Parasuraman & Colby, 2015). It plays a moderating role in the link between subjective well-being and behavioral intention in tourism virtual reality from the customer's viewpoint (Kim et al., 2020) or in the relationship between technology acceptance dimensions (perceived usefulness and perceived ease of use) and intention to use the open and distance learning technology from the employee's perspective (Rahim et al., 2022). Similarly, technology optimism significantly moderates the association between students' perceived behavioral control (or attitude toward weblog learning) and their intention to opt for it (Chao & Yu, 2019). Surprisingly, there is a lack of studies on the moderating role of technology optimism on the links between TOE factors and intention to adopt technology from the manager's standpoint. Yet, any strategic decision or investment within an organization is always under the approval of top managers, and technology adoption often requires an enormous investment in equipment, management skills and knowledge,

and other intangible and tangible assets (Weinman, 2015). Hence, we argue that manager's optimism toward blockchain technology may moderate the impact of various TOE factors on the intention to adopt blockchain technology. Furthermore, investigating boundary conditions in hospitality and tourism research is strongly recommended, as it may lead to a better interpretation of the baseline association and progression of the current theoretical foundation (Rasoolimanesh et al., 2021).

Therefore, this study fills the above research gaps by exploring factors affecting SMHTEs' adoption of blockchain technology through the TOE framework and DOI theory lens and the moderating role of technology optimism on the relationship between various TOE factors and intention to adopt blockchain technology. Accordingly, our study aims to address the following research questions:

1. What factors affect SMHTEs' adoption of blockchain technology?
2. Do managers' optimism toward technology moderate the relationships between the influencing factors and SMHTEs' intention to adopt blockchain technology?

The study focuses on blockchain technology adoption by SMHTEs in Vietnam. In this developing country, smart tourism has only appeared in the past few years but has attracted much attention from government and tourism stakeholders. The Vietnamese government has been promoting the development of smart tourism through the development of technology applications for tourism management. Concretely, the Vietnamese Ministry of Culture, Sports, and Tourism has mobilized significant efforts to gradually introduce blockchain technology into tourism activities (Ngo, 2022).

This research makes several contributions to the extant literature on the adoption of smart tourism technologies, including blockchain technology. First, to the best of the authors' knowledge, this study is one of the first to examine the various factors affecting blockchain technology adoption at the organizational level, particularly in SMHTEs. This study, therefore, provides fresh and helpful insights for SMHTEs, which are the key actors driving the hospitality and tourism industry's development, in adopting and utilizing blockchain technology to enhance customer experience. Second, this study develops and validates a novel blockchain technology adoption model by combining different theoretical backgrounds (i.e., the TOE framework and the DOI theory) and mobilizing optimism toward technology as a moderating variable. This model, therefore, highlights the underlying mechanism and boundary conditions (i.e., managers' levels of

optimism toward technology) under which TOE factors affect the adoption of blockchain technology. This study's unique model addresses the importance of moderation analysis in hospitality and tourism research (Rasoolimanesh et al., 2021) and can serve as a theoretical basis for future studies on smart tourism technology adoption. Third, this research extends current knowledge about the adoption of smart tourism technology in developing countries by focusing on Vietnam. Smart tourism in these countries, especially in rural areas, remains relatively unpopular (Torabi et al., 2023; Zhu & Shang, 2021); hence, more research in this context is needed (Adnan et al., 2020). Unlike previous studies showing that top management support is the most vital factor among organizational factors (e.g., Pizam et al., 2022) and that perceived competitive pressure is the strongest among environmental factors (e.g., Cruz-Jesus et al., 2019), this study demonstrates the importance of organizational readiness and government support in triggering blockchain technology adoption by SMHTEs in a developing country.

2. Theoretical background and hypothesis development

2.1. TOE framework and DOI theory

The TOE framework (Tornatzky et al., 1990) has been widely used to examine technology acceptance at the organizational level (e.g., Pizam et al., 2022). This framework constitutes technological, organizational, and environmental dimensions. Hossain and Quaddus (2011) proposed that the TOE framework is one of the few that attempts to move toward the socio-economic features while recognizing the interplay of technology development and the organization's conditions involving the necessary business and organizational reconfiguration shaped by the industry environment. The TOE framework has demonstrated broad applicability and descriptive power across numerous technological, industrial, and cultural contexts, including blockchain technology adoption (e.g., Ganguly, 2022).

The extant literature also identifies common determinants of innovation adoption, including relative advantage, perceived compatibility, and perceived complexity (Pacheco-Bernal et al., 2020), which can be explained by the DOI theory (Rogers, 1995). The DOI theory describes how the nature of innovation (e.g., new technologies) and its compatibility with adopters affect its adoption rate and diffusion (Chatterjee et al., 2023). It can also be applied to the adoption of organizational innovation that predicts organizational outcomes (Oliveira & Martins, 2010). Table

1 summarizes selected empirical studies that employed the TOE framework and/or the DOI theory over the past twenty years, from 2001 to 2022.

Insert Table 1 about here.

Given the complexity of innovative technology adoption, several recent studies have combined the TOE framework with the DOI theory to comprehensively explain such adoption by organizations (e.g., Basloom et al., 2022; Pizam et al., 2022; Shahadat et al., 2023). This combination is grounded on the argument that the technological component in the TOE framework includes the knowledge of innovation characteristics from the DOI theory. Moreover, while the TOE model offers a sound theoretical framework in explaining the organizational context of innovation adoption, the DOI theory effectively identifies the factors enabling organizations to adopt innovation (Smits et al., 2023). Notably, a systematic literature review of blockchain applications in hospitality and tourism by Jain et al. (2023) suggests that more empirical research should be conducted from the innovation diffusion perspective to support its widespread adoption. Thus, this study integrates the TOE framework and the DOI theory in which the technological component includes compatibility, perceived security, complexity, relative advantage, and perceived adoption cost. Top management support, satisfaction with the existing system, and employees' blockchain technology knowledge make up the organizational component. The environmental component includes competitive pressure, customer pressure, and government support. Additionally, optimism toward technology was incorporated as a moderator of the relationships between the technological, organizational, and environmental components and the intention to adopt blockchain technology. To the best of the authors' knowledge, this study is among the first to combine the TOE framework and the DOI theory to explain blockchain technology adoption from the manager's perspective, enabling a holistic understanding of the factors affecting an organization to adopt blockchain technology. The current study responds to the call for more work to apply different theoretical frameworks and incorporate moderating analysis to advance hospitality and tourism research (Gursoy, 2018; Rasoolimanesh et al., 2021) and comprehensively explain the underlying mechanism of digital technology adoption (e.g., via moderation analysis) (Nguyen et al., 2024).

2.2. Hypotheses development

2.2.1. *Technological characteristics*

The characteristics of technology determine its adoption success (Tornatzky et al., 1990; Rogers, 1995). Hospitality and tourism firms should consider key features of contemporary technologies (e.g., blockchain) to maximize their potential (Rajaguru, 2024). Informed by previous research, this study examines perceived compatibility, perceived security, perceived complexity, relative advantage, and perceived adoption cost as the technological characteristics that explain blockchain technology adoption by SMHTEs.

2.2.1.1. Perceived compatibility

Rogers (1995) defined compatibility as the degree to which an innovation is consistent with an organization's existing values and experiences. Prior studies highlighted the significant impact of compatibility on new technology adoption in an organization (e.g., Almaiah et al., 2022; Chittipaka et al., 2023). Compatibility is the most critical characteristic of the innovation process in SMEs, with the high level of perceived compatibility related to the increased intention to adopt new ideas or technologies (Shah Alam et al., 2011). In the context of information and digital technologies, the significant influence of compatibility on information and digital technology adoption in SMEs has been identified (e.g., Ramdani et al., 2013). The extant literature shows that SMEs are less likely to apply technology innovation if they perceive these technologies unsuitable to their products or services, their way of doing business, the strategies of business partners, and their organizational culture (Alraja et al., 2022). This leads to the following hypothesis:

H1: Perceived compatibility is positively associated with the intention to adopt blockchain technology.

2.2.1.2. Perceived security

Perceived security reflects the awareness of a technology's security in an organization and the availability of industry standards and regulations concerning such technology (Chau et al., 2021). Within the smart tourism technology research area, perceived security is proposed as the safety of data and systems while adopting this technology (Huang et al., 2017). Extant literature has found a positive effect of perceived security on technology adoption (e.g., Capistrano et al., 2023). Scholars have highlighted that perceived security is the primary concern for technology adoption in SMEs (Ghobakhloo et al., 2011). This aligns with No and Kim's (2015) statement that security is a core attribute of smart tourism technologies. Thus, the following hypothesis is proposed:

H2: Perceived security is positively related to the intention to adopt blockchain technology.

2.2.1.3. Complexity

Perceived complexity reflects the degree to which an innovation is perceived as difficult to understand and use (Roger, 1995). Generally, the complexity of innovation is negatively related to its adoption and implementation (Tornatzky & Klein, 1982). Specifically, high complexity confuses adopters and causes difficulty using technology, adversely influencing adoption decisions (Slade et al., 2015). The complexity of robotic technology hinders hotel's adoption of this technology (Pizam et al., 2022). Saberi et al. (2019) found that SMEs would feel anxious when they have little control over the outcome of the blockchain system due to its complexity and immaturity security challenges. Consequently, SMEs will be less likely to employ this new technology if it is either complex or incompatible with the existing process (Maroufkhani et al., 2023). Thus, the following hypothesis is posited:

H3: Perceived complexity is negatively associated with the intention to adopt blockchain technology.

2.2.1.4. Relative advantage

Relative advantage addresses the extent to which an innovation is expected to be more beneficial to a firm than other existing tools (Ramdani et al., 2013). In hospitality and tourism, blockchain technology offers potential benefits and advantages, including automation, traceability, authenticity, transparency, and convenience (Jain et al., 2023). It is widely accepted that if the relative advantage of adopting innovation outweighs the risks, SMEs are more likely to employ this innovation for their organizations (Iranmanesh et al., 2023). Thus, this study assumes that if SMHTEs are aware of the relative advantages of smart tourism technologies (e.g., blockchain), they may have a greater intention to adopt them. Therefore, H4 is suggested as follows:

H4: Relative advantage is positively related to the intention to adopt blockchain technology.

2.2.1.5. Perceived adoption cost

Perceived adoption cost is the relative cost to the benefits of technology adoption, including the technology setup cost, the technological maintenance cost, and the cost of training employees to use such technology (Chau et al., 2021). Perceived adoption cost negatively influences the

intention to adopt robotic technologies in the hotel industry (Pizam et al., 2022) or digital technology adoption within SMEs (Shahadat et al., 2023). When considering implementing innovative technologies, SEMs are often subjected to severe resource constraints, especially financial constraints, leading to their caution on investment in technology adoption (Chau et al., 2021). Thus, the following hypothesis is suggested:

H5: Perceived adoption cost is negatively associated with the intention to adopt blockchain technology.

2.2.2. Organizational characteristics

According to Tornatzky et al. (1990), organizational characteristics include internal factors that impact innovation adoption. The TOE framework highlights the tangible and non-tangible factors that affect the adoption of technology by organizations (Wong et al., 2020). The literature suggests that top management support, organizational readiness, employee knowledge of information systems, and satisfaction with the existing system may affect an organization's adoption of innovation.

2.2.2.1. Top management support

Top management support is essential to ensure the commitment of resources and the cultivation of organizational climate (Lin, 2017). It concerns the management's involvement, enthusiasm, motivation, and encouragement toward adopting technologies (Ramdani et al., 2009). Top management support positively affects the organization's intention to embrace social commerce (Abed, 2020) or robots (Pizam et al., 2022). In the context of SMEs, top management support can generate a favorable environment to facilitate technology adoption by creating an appealing vision of how the adoption will benefit the business, overcoming any member resistance to the change, and providing the strategic directions to achieve it (Eze et al., 2021). As such, H6 is proposed:

H6: Top management support is positively associated with the intention to adopt blockchain technology.

2.2.2.2. Organizational readiness

Organizational readiness refers to the availability of the needed organizational resources for innovation adoption (Iacovou et al., 1995). Chau et al. (2021) considered organizational readiness

as the technological, financial, and human resources available in organizations for technology adoption, reflecting technological, financial, and human resources readiness. While technological readiness indicates organizations' accessibility to information and communication technology resources for technology adoption (Chau et al., 2021), financial readiness is regarded as the availability of financial resources (Pham et al., 2011). Moreover, Kurnia et al. (2015) suggest that human resources readiness is seen as the availability of information technology experts for technology adoption in organizations.

For SMEs, one of the significant obstacles to implementing new technologies is that they often do not have sufficient resources (Kumar et al., 2023), even if managers perceive technology adoption as necessary. As a result, organizational readiness is essential in adopting various innovative technologies or predicts successful adoption in SMEs (Ghobakhloo et al., 2011; Sastararaji et al., 2022). In line with these findings, this research suggests H7 as the following:

H7: Organizational readiness is positively related to the intention to adopt blockchain technology.

2.2.2.3. Satisfaction with the existing information and communication technology system

Satisfaction with the existing information and communication technology system reflects the outcome of its use, generating a comfortable feeling and a positive attitude (Winnie, 2014). The level of satisfaction with the existing system often determines the level of openness to change (Chau & Tam, 1997). Research has shown that firms with low satisfaction with the current systems are more open to finding new ways to enhance performance or effectiveness (e.g., Gastaldi et al., 2022). A high level of satisfaction with the existing systems negatively impacts the adoption of cloud enterprise resource planning systems in SMEs (Christiansen et al., 2022). Thus, we propose the following hypothesis:

H8: Satisfaction with the existing system is negatively related to the intention to adopt blockchain technology.

2.2.2.4. Employee blockchain technology knowledge

In general, employee information technology knowledge refers to their understanding of information technology through practice and training (Chau et al., 2021). Extant studies have demonstrated that the degree of employees' information technology knowledge significantly

affects the adoption of technological innovation in organizations (e.g., Ali et al., 2022). Employees favor adopting technology when they have sufficient technology expertise (Kurnia et al., 2015). Thus, if SMEs' employees are knowledgeable about information technology, businesses are more willing to adopt technological innovations (Ifinedo, 2012; Saratchandra et al., 2022). We suggest the following hypothesis:

H9: Employee blockchain technology knowledge is positively related to the intention to adopt blockchain technology.

2.2.3. Environmental characteristics

Environmental characteristics are external factors that can either enhance or impede innovation adoption (Teo et al., 2009). The three most important environmental factors, including perceived competitive pressure, perceived customer pressure, and perceived government support, are identified through extant literature.

2.2.3.1. Perceived competitive pressure

Perceived competitive pressure reflects the degree to which an organization is affected by competitors (Porter, 1985). Perceived competitive pressure leads an enterprise to employ innovative technology to avoid decline (Zhu et al., 2003). Porter and Millar (1985) claimed that innovation adoption can enable an organization to gain competitive advantages in either cost or differentiation. Competitive pressure positively affects the adoption of customer relationship management (e.g., Cruz-Jesus et al., 2019) or blockchain (e.g., Hashimy et al., 2023). Under intense competition, SMEs would feel pressure to adopt smart technologies to be competitive when their competitors have adopted such technologies (Sastararuji et al., 2022). Thus, we propose the following hypothesis:

H10: Competitive pressure is positively associated with the intention to adopt blockchain technology.

2.2.3.2. Perceived customer pressure

Adopting innovative technologies often stems from companies' belief that their customers expect them to do so (Abed, 2020). As a primary stakeholder, customers place significant pressure on SMEs to innovate (Chatzoglou & Chatzodes, 2016). Studies have revealed that customer pressure

significantly affects the organization's adoption of technology, such as robots (e.g., Pizam et al., 2022) or augmented reality (Alam et al., 2022). Thus, the following hypothesis is proposed:

H11: Customer pressure is positively related to the intention to adopt blockchain technology.

2.2.3.3. Government support

Government support concerns a government's policies, initiatives, and incentives to encourage technology adoption (Malik et al., 2021). It can be defined as the commitment and assistance from the authority to foster the spread of information and communication technology innovation (Ifinedo, 2012). Prior studies on information and communication technology adoption indicated a strong impact of government support on technology adoption, especially in developing countries (e.g., Deng et al., 2022; Lutfi et al., 2022). Government support is crucial for adopting innovative technology in SMEs (Ghobakhloo et al., 2011). Therefore, the following hypothesis is developed:

H12: Government support is positively associated with the intention to adopt blockchain technology.

2.2.4. Technology optimism as a moderator

Technology optimism is defined as a positive view of technology and a belief that it offers people increased control, flexibility, and efficiency in their lives (Parasuraman & Colby, 2015). Lin and Chang (2011) discovered that technology optimism positively moderated the relationships between perceived ease of use, perceived usefulness, and intention to use self-service technology. In education, technology optimism moderates the relationships between perceived ease of use and perceived usefulness and intention to use open distance learning technology (Rahim et al., 2022). In the travel and tourism context, Kim et al. (2020) validated the moderating role of technology optimism on the relationships between travelers' authentic experience, subjective well-being, and intention to adopt tourism virtual reality. Adopting innovative technology (e.g., blockchain) often requires an enormous investment in equipment, management skills and knowledge, and other intangible and tangible assets (Weinman, 2015), which needs approval and support from top management. If managers are optimistic about blockchain, they will likely support its adoption. We, therefore, argue that the effect of various TOE factors on intention to adopt blockchain technology may be moderated by managers' optimism toward blockchain technology, which enables us to suggest the following hypothesis:

H13: Manager's technology optimism positively moderates the relationships between perceived compatibility (a), perceived security (b), perceived complexity (c), relative advantage (d), perceived adoption cost (e), top management support (f), organizational readiness (g), satisfaction with the existing system (h), employee blockchain technology knowledge (i), perceived competitive pressure (j), perceived customer pressure (k), and government support (l) and the intention to adopt blockchain technology.

Figure 1 illustrates the research model.

Insert Figure 1 about here.

3. Methodology

3.1. Research instruments

All the measurements in this research were adopted from previous research on the adoption of innovative technology based on the TOE framework and the DOI theory. Additionally, some alterations were made to match the research context. Specifically, the intention to adopt blockchain technology was assessed using the three-item scale adapted from Pizam et al. (2022). Technology optimism was measured with twelve items adapted from Parasuraman and Colby (2015). The measurements of independent variables in the integrated TOE and DOI framework were adapted from previous studies (Huy et al., 2012; Pizam et al., 2022; Sayginer & Ercan, 2020). Respondents' answers were recorded on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). To ensure the face and validity of the content, five researchers in hospitality and tourism were invited to review the constructs and items. Next, the questionnaire was piloted with 15 managers of SMHTEs to mitigate any possible confusion and was then reformulated based on their feedback before the official survey. Several screening questions were used to verify the eligibility of respondents, i.e., job positions and the number of employees in the firm. All the scales are detailed in Table 2.

3.2. Sampling and data collection

This study obtained data from chief executive officers and top managers in SMHTEs operating in tourism- and travel-related services such as hotels and restaurants, travel agencies, tourism operating services, tourist guide services, and other related services. A list of 1,060 SMHTEs

compiled by the Vietnam Tourism Association (VTA) and the Vietnam Association of Small and Medium Enterprises (VINASME) was used to identify potential respondents.

Data collection was carried out from November 2021 to June 2022. In the first stage, from November 2021 to March 2022, we approached senior managers of SMHTEs at tourism- and hospitality-related seminars and conferences to request them to complete the questionnaire on the spot. For those who preferred to answer after the events, we sent an online questionnaire to their email addresses. Through these two approaches, we received 287 complete responses. In the second stage, from April to June 2022, the online questionnaire was sent to 600 email addresses of potential respondents, excluding the organizations whose senior managers were invited to answer the questionnaire in the first stage. Thanks to the endorsement from VTA and VINASME, we obtained 263 complete responses. The final sample was 550 questionnaires.

3.3. Data analysis

SPSS version 26.0 was used to check data quality and generate descriptive statistics. Moreover, the partial least squares (PLS) method implemented in SmartPLS 4.0.7.6 was used to test the research model for two main reasons. First, with the non-parametric approach based on ordinary least squares regression, PLS-SEM is required to optimize explained variance because it has a better level of statistical power under similar conditions, compared with covariance-based structural equation modeling (CB-SEM) (Reinartz et al., 2009). Second, PLS is helpful for formative constructs (Hair et al., 2022). Third, this research aims to understand the predictive validity of independent variables suggested in the integrated TOE and DOI framework. Hence, following Peng and Lai (2012), PLS was privileged in this study. It should also be noted that this study controlled the potential influence of respondents' characteristics (i.e., educational level, firm size, age, and gender) on the dependent variable (i.e., intention to adopt blockchain technology).

4. Findings

4.1. Respondents profile and data screening

Among 550 respondents, 367 (66.72%) are males, approximately double the number of females (n=183, 33.28%). This could indicate that men account for a higher percentage of management roles in Vietnamese SMHTEs. Most respondents (54%) hold a Master's degree (n=297), 41.64% hold a Bachelor's degree (n=229), and 4.36% have a PhD degree (n=24). It suggests that managers

often have a high level of education. Also, 58.91% of respondents are in the age group of 30–49 (n=324), compared to 35.82% older than 49 years old (n=197), and 5.27% of them are under 30 years old (from 18 to 29) (n=29).

Regarding the firm size, measured by the number of employees, 57.63% (n=317) of SMHTEs employ between 50 and 100 people, while 42.37% (n=233) hire less than 50 employees. The firm size was divided into two sub-groups according to Decree 80/2021/ND-CP from the Vietnamese government about SMEs in the tourism and hospitality industry.

The results of the Shapiro-Wilk test indicated that p-values were greater than 0.05, confirming the normality of the data (Ghasemi & Zahediasl, 2012). Following Armstrong and Overton (1977), an independent sample t-test was performed to examine the non-response bias. There was no significant difference in the critical measures regarding the first and fourth quartiles of responses, suggesting no non-response bias in the data. Furthermore, the multicollinearity issue was investigated. The results showed that the maximum inner variance inflation factor value was inferior to the threshold of 3, indicating that multicollinearity was not a critical issue.

4.2. Common method bias

Despite applying procedural remedies (such as design and validation of the questionnaire, closed-ended questions, and respondents' anonymity), common method bias (CMB) can be an issue that distorts the research results (Podsakoff et al., 2003). Thus, the Harman single factor was initially utilized to evaluate the CMB statistically (Ringle & Sinkovics, 2009). An unrotated factor solution of the principal component analysis revealed that no single factor explained the majority of variance (the first factor merely accounted for 12.4% of the total variance, which is less than the threshold value of 50%), suggesting no CMB in this study (Podsakoff et al., 2012).

4.3. Measurement model

Following Hair et al. (2022), we examined Cronbach's alpha, composite reliability (CR), convergent validity, and discriminant validity to test the reliability and validity of the measures. Table 2 shows that the construct's reliability is good since CR and Cronbach's alpha values exceeded 0.70 (Hair et al., 2022). The average variance extracted (AVE) values ranged from 0.582 to 0.822, exceeding 0.50. The loadings of the items (from 0.604 to 0.934) were above 0.50, while

their corresponding t-values were above 1.96 to be significant at the 5% level (2-tailed test). All these results indicate adequate reliability and convergent validity for the constructs in this study.

Insert Table 2 about here.

Next, we assessed the constructs' discriminant validity by computing the Heterotrait-Monotrait (HTMT) ratios. Table 3 shows the results of the HTMT assessment, indicating sufficient discriminant validity with the highest HTMT value of 0.567, below 0.85, as suggested by Kline (2015). Thus, the measurement model provided a satisfactory discriminant validity of the constructs.

Insert Table 3 about here.

4.4. Structural model

4.4.1. Direct effects

Table 4 provides direct effects, estimates, t-statistics, p-values, and 95% confidence interval bias corrected (CIBC). The f^2 effect size for each direct effect ranged from 0.04 to 0.54, above the cut-off value of 0.02 (Hair et al., 2022). These findings revealed that the structural model is good in effect size.

The explanatory power of the structural model was examined by the coefficients of determination (R^2 values), which reflects the quality of the variables included in the model (Hair et al., 2022). In this study, the intention to adopt blockchain technology is an outcome, and its overall R^2 value was 0.735, which is substantial in behavior-related research (Henseler et al., 2009). This result implies that independent variables jointly explain 73.5% of the variance in intention to adopt blockchain technology.

When testing the hypotheses, we computed the β coefficients of the paths between the variables in the model and the corresponding t-values of coefficients using 5,000 bootstrapping times. As indicated in Table 4, H3, H5, and H8 were not empirically supported. The other nine hypotheses were supported since the path coefficients were statistically significant at the 5% and 1% significance levels, and the 95% CIBC did not include zero. Interestingly, respondents' characteristics (i.e., educational level, firm size, age, and gender) did not significantly impact the dependent variable (i.e., intention to adopt blockchain technology).

Insert Table 4 about here.

Concretely, all the environmental factors, including perceived competitive pressure, perceived customer pressure, and government support, directly impacted the intention to adopt blockchain technology with the strongest effect from government support ($\beta_{12} = 0.390$, $t_{12} = 6.502$) (H12). Next, the relationships between most of the organizational factors, including top management support ($\beta_6 = 0.345$, $t_6 = 5.438$), organizational readiness ($\beta_7 = 0.424$, $t_7 = 7.687$), and employee blockchain technology knowledge ($\beta_9 = 0.147$, $t_9 = 3.023$) and intention to adopt blockchain technology were significant, supporting H6, H7, and H9. Contrary to our expectation, satisfaction with the existing system was not significantly related to the intention to adopt blockchain technology ($\beta_8 = -0.124$, n.s.); thus, H8 was not supported. Furthermore, among the technological factors, relative advantage ($\beta_4 = 0.401$, $t_4 = 6.309$) had the strongest influence on intention to adopt blockchain technology (H4), followed by perceived security ($\beta_2 = 0.333$, $t_2 = 5.089$) (H2) and perceived compatibility ($\beta_1 = 0.228$, $t_1 = 4.621$) (H1). Meanwhile, the remaining two technological factors, namely perceived complexity ($\beta_3 = -0.105$, n.s) and perceived adoption cost ($\beta_5 = -0.116$, n.s), were not significantly associated with the intention to adopt STTs; thus, H3 and H5 were rejected.

4.4.2. Moderation testing

We adopted the recommendation of Hair et al. (2022) to assess the moderating role of technology optimism on the effect of various TOE factors on intention to adopt blockchain technology (H13a to H13l). As shown in Table 5, the effects of perceived compatibility ($\beta_{13a} = 0.112$; $p < 0.05$), relative advantage ($\beta_{13d} = 0.173$; $p < 0.01$), top management support ($\beta_{13f} = 0.203$; $p < 0.05$), organizational readiness ($\beta_{13g} = 0.145$; $p < 0.05$), employee blockchain technology knowledge ($\beta_{13i} = 0.114$; $p < 0.05$), perceived competitive pressure ($\beta_{13j} = 0.038$; $p < 0.05$), perceived customer pressure ($\beta_{13k} = 0.024$; $p < 0.05$), and government support ($\beta_{13l} = 0.206$; $p < 0.01$) on intention to adopt blockchain technology were moderated by technology optimism, supporting H13a, H13d, H13f, H13g, H13i, H13j, H13k, and H13l. When considering the interaction effect, the f^2 effect size indicates how much the moderation contributes to explaining the endogenous construct (Hair et al., 2022). In the case of this study, the f^2 effect size had values ranging from 0.108 to 0.307,

indicating medium and large effects (Hair et al., 2022). Meanwhile, technology optimism did not significantly moderate the effects of perceived security, perceived complexity, perceived adoption cost, and satisfaction with the existing system on intention to adopt blockchain technology. Thus, H13b, H13c, H13e, and H13h were not supported (Table 5).

Insert Table 5 about here.

5. Discussion of findings

5.1. Technological components

The findings reveal that the intention of SMHTEs to adopt blockchain technology was enhanced by *perceived relative advantage* and *compatibility*. These results are consistent with previous studies on new technology adoption (Abed, 2020; Chau et al., 2021; Chittipaka et al., 2023). Hospitality and tourism managers often thoroughly consider how blockchain technology generates advantages for their organizations, such as increased profitability, improved customer experience, and a new revenue stream. Besides, they will adopt blockchain technology if they perceive it as suitable for their existing information and communication technology infrastructures and organizational values and practices. Additionally, managers' *perceived security* of blockchain technology increases their willingness to adopt it. Since this could be seen as the result of an increase in both customers' and organizations' perception of information security, blockchain technology with a high degree of security would be preferred to adopt in organizations (Capistrano et al., 2023).

However, *perceived complexity* and *perceived adoption cost* were found to have an insignificant impact on the intention to adopt blockchain technology by SMHTEs, which is in line with Lai et al.'s (2018) study on the adoption of big data analytics in logistics and supply chain management, but contradictory with Pizam et al. (2022). It should be noted that blockchain technology has attracted increasing attention from hospitality and tourism companies (Jain et al., 2023), and managers may think that their organizations and staff will not encounter difficulties absorbing smart technologies because of their increasing democratization (Vo-Thanh, Zaman, et al., 2022). Moreover, the rapid development of smart technologies has led to a significant decrease in the acquisition cost of such technologies, making them less expensive for SMHTEs. Another possible explanation is that the perceived benefits of blockchain technology adoption may outweigh the perceived cost and difficulty of adopting it; hence, SMHTEs would optimize their

limited resources by adopting such technology to serve their strategic objective (Chau et al., 2021; Pizam et al., 2022; Vo-Thanh, Zaman, et al., 2022).

5.2. Organizational components

This study found that *top management support*, *organizational readiness*, and *employee blockchain technology knowledge* significantly enhanced the intention to adopt blockchain technology in SMHTEs, which echoes prior studies (e.g., Wang et al., 2016; Lu et al., 2021). Specifically, top managers are often responsible for strategic planning and decision-making related to smart technology adoption. They can comprehend the benefits of blockchain technology for the sustainable development of their businesses and, thus, are willing to show their support for such smart technology adoption by allocating adequate financial and administrative support (Oliveira et al., 2014; Lai et al., 2018). SMHTEs that are financially, technically, and strategically ready are more likely to adopt blockchain technology since the resources necessary for such adoption are available already (Orji et al., 2020). Adequate knowledge of blockchain technology by employees can also facilitate the intention to adopt such technology from managers. Indeed, employees directly utilize such technology and contribute to speeding up its deployment. As highlighted by Vo-Thanh, Zaman, et al. (2022), from a manager's viewpoint, mental effort from staff and staff training are among the primary barriers to smart technology adoption. Thus, employees' good knowledge of blockchain technology can reassure managers that they should adopt it. Moreover, employees' mastery of blockchain technology helps lower their potential anxiety when handling such technology and consequently enhances customer satisfaction.

Interestingly, the study indicated that *satisfaction with the existing information and communication technology system* did not significantly influence its intention to adopt blockchain technology. To a certain extent, this result contradicts the long line of research, which shows that firms with low satisfaction with the existing information and communication technology system are more open to adopting new technologies (Christiansen et al., 2022; Gastaldi et al., 2022). However, this contradictory finding suggests that once a new technology gains in popularity and its competitive advantage is evident, the imperative for tourism organizations to adapt to such technology seems obvious to them despite their preference for the existing information and communication technology system.

5.3. Environmental components

The findings showed that SMHTEs that perceived more *pressure from competitors* and *customers* were more likely to adopt blockchain technology, which aligns with previous studies (e.g., Lorente-Martínez et al., 2020; Orji et al., 2020). The competitive pressure from the digitalized business environment motivates hospitality and tourism firms to adopt innovative technologies (e.g., blockchain) to stay ahead of their competitors and develop sustainably (Hashimy et al., 2023; Jain et al., 2023). Furthermore, such blockchain technology allows SMHTEs to offer new tourist experiences, share intensive information, and enable value co-creation with customers, which meets customer expectations and maintains the relationship with them (Gretzel et al., 2015).

The study also revealed the importance of *government support* toward SMHTEs' adoption of blockchain technology, supporting previous studies (e.g., Deng et al., 2022; Lutfi et al., 2022). Government incentives and regulation guidelines might make SMHTEs fully aware of the imperative of digital tools for all aspects of society (Ghobakhloo et al., 2011). With government support regarding developing advanced management skills and encouraging SMHTEs to use disruptive technologies (e.g., blockchain technology), they are more willing to integrate these technologies into their activities.

5.4. Moderating role of technology optimism

The findings asserted that *technology optimism* positively moderated the relationships between perceived compatibility (H13a), relative advantage (H13d), top management support (H13f), organizational readiness (H13g), employees' blockchain technology knowledge (H13i), competitive pressure (H13j), customer pressure (H13k), and government support (H13l) and intention to adopt blockchain technology. Specifically, the positive effects of technological, organizational, and environmental factors on intention to adopt blockchain technology are stronger when tourism managers are optimistic about the contribution of this disruptive technology to improving professional and personal issues. These findings extend those in previous studies by Lin and Chang (2011) and Rahim et al. (2022), implying that technology optimism catalyzes the adoption of blockchain technology in tourism organizations.

6. Theoretical contributions and practical implications

6.1. Theoretical contributions

Previous smart tourism technology adoption research merely focuses on the individual (tourists) (e.g., Jeong and Shin, 2020; Kirova and Vo-Thanh, 2019) and destination levels (e.g., Nam et al., 2021), while studies at the organizational level are largely missing (Pizam et al., 2022). In addition, there is a dearth of research into the adoption of blockchain technology among small and medium hospitality and tourism enterprises (SMHTEs), especially in developing countries. This study makes important contributions to the extant literature on smart tourism technology adoption by explaining the intention of SMHTEs to adopt blockchain technology in a developing country (i.e., Vietnam). It is among the first to investigate the organizational intention to adopt this disruptive technology to foster smart tourism, given that current research on blockchain technology and smart tourism has merely examined the potential and challenges of this technology (Nam et al., 2021) and remains very conceptual (Luo and Zhou, 2021). This study offers novel findings that the intention of SMHTEs to adopt blockchain technology relies not only on the characteristics of digital technologies but also on other determinants related to the organization and its external environment.

Notably, this study proposes and validates a unique model that integrates the TOE framework (Tornatzky et al., 1990) and the DOI theory (Rogers, 1995), which can serve as a framework for predicting the intention to adopt smart tourism technologies in general and blockchain technology. Previous studies have utilized the TOE framework to investigate the adoption of various technologies such as robot technology (Pizam et al., 2022), e-procurement systems (Teo et al., 2009), electronic supply chain management system (Lin, 2014), and mobile hotel reservation system (Wang et al., 2016). Based on the DOI theory (Rogers, 1995), this study's model considers technological characteristics, including perceived compatibility, perceived security, complexity, relative advantage, and perceived adoption cost as determinants of SMHTEs' adoption of blockchain technology. Also, building upon the functional perspective of top managers (e.g., Wang et al., 2016), the capability perspective of an organization (Zhu et al., 2003), and the technology resource perspective of an organization (Pizam et al., 2022), this study highlights the role of top management support and organizational readiness in predicting SMHTEs' adoption of smart tourism technologies (i.e., blockchain technology). Furthermore, this study includes two additional variables to the organizational component (satisfaction with the existing information and communication technology system and employee blockchain technology knowledge) to enrich the model. Additionally, instead of focusing on perceived competitive pressure only (e.g., Pizam

et al., 2022; Wang et al., 2016), this study incorporates perceived customer pressure and government support as the environmental features influencing SMHTEs' blockchain technology adoption. This is inspired by the perspective of competitive pressure (Shamout et al., 2022), the DOI theory (Rogers, 1995), the perspective of information-processing needs (Xie et al., 2022), and the fact that this study was conducted in a developing country, where the role of the government in building the information and communication technology infrastructure and in supporting SMEs is highly crucial (e.g., Lutfi et al., 2022).

This study's model also examines the moderating effect of technology optimism. While technology optimism has been found to moderate the relationships between cognitive-behavioral factors and intention to adopt new technologies within organizations (e.g., Lin and Chang, 2011; Kim et al., 2020; Rahim et al., 2022), its moderating role has not yet been investigated in smart tourism technology adoption studies (e.g., blockchain technology). Empirical evidence shows the direct effect of technology optimism on an organization's technology adoption (e.g., Ali et al., 2022). Recent research found that technology optimism indirectly affects organizations' technology adoption through TOE factors (Hradecky et al., 2022). Meanwhile, the current study demonstrates that technology optimism moderates the relationships between most TOE factors and intention to adopt blockchain technology within organizations. Thus, unlike previous studies, this study highlights under what circumstances the relationships between various TOE factors and intention to adopt blockchain technology in SMHTEs occur. Theoretically, this study's unique model contributes to the literature on smart technology adoption by enriching the TOE framework and DOI theory and highlighting technology optimism as a moderator on the relationships between TOE factors and intention to adopt smart technologies (i.e., blockchain technology).

This study discovers the strong effects of relative advantage (technological factor), organizational readiness (organizational factor), and government support (environmental factor) on intention to adopt blockchain technology. Previous studies demonstrated that top management support is the most decisive factor among organizational factors (e.g., Pizam et al., 2022) and that perceived competitive pressure is the strongest among environmental factors (e.g., Cruz-Jesus et al., 2019). Meanwhile, this study reveals the importance of organizational readiness and government support in triggering the adoption of blockchain technology among SMHTEs. This finding may be consolidated by the context of Vietnam, where the government is in the process of improving laws and policies that aim to upgrade the infrastructures and improve human resources

for the development of information and communication technologies, which is highly crucial for smart technologies adoption in general and blockchain technology adoption in particular. This finding corroborates previous studies in emerging countries highlighting the vital role of the government in supporting SMEs to adopt innovative technology (e.g., Lutfi et al., 2022). Meanwhile, in developed countries, customer and competitiveness factors are more obvious (e.g., Cruz-Jesus et al., 2019; Hashimy et al., 2023).

6.2. Practical implications

This study brings practical implications to SMHTE managers, tourism and hospitality technology businesses, and policymakers to promote the adoption of smart tourism technologies in general and blockchain technology in developing countries. Its findings show that relative advantage and top management support positively affect SMHTEs' intention to adopt blockchain technology. Thus, it is essential to increase the support of top management, for example, by presenting them with convincing proposals that detail the potential and unique benefits of adopting blockchain technology, which should outweigh their risks (Iranmanesh et al., 2023). Hospitality technology vendors should also create plans to support hotel managers in understanding how hotels could adopt and implement blockchain technology (Kurnia et al., 2015). This may also increase the hotel managers' optimism about blockchain technology, fostering their intention to adopt it. Given the essential role of organizational readiness, SMHTEs must prepare for the availability of technological, financial, and human resources to initiate blockchain-enabled smart tourism (Chau et al., 2021).

This study also demonstrates that employees' knowledge of blockchain technology positively affects SMHTEs' intention to adopt blockchain technology. Thus, SMHTEs should train their staff about blockchain technology, how blockchain technology works, and the benefits it can bring to the business and employees. SMHTEs should also indicate the benefits of blockchain technology through various communication channels, which may help alleviate employees' concerns about blockchain technology adoption. Technology businesses and SMHTEs should collaborate to develop a training program for employees on how to use blockchain technology and the steps for effective adoption of blockchain technology. Finally, preparing high-quality human resources for deploying smart technologies is necessary for firms to leverage the benefits of such smart technologies to meet customers' strict requirements or the competitive environment.

From the policy perspective, this study shows that government support positively affects SMHTEs' intention to adopt blockchain technology. In the Vietnamese context, the government has recently approved the National Digital Transformation Program by 2025, with an orientation toward 2030. This initiative is expected to help accelerate digital transformation through changes in awareness and enterprise strategies, as well as incentives toward digitalizing businesses, administration, and production activities. The government should seek to promote SMHTE managers' understanding of the importance of smart tourism technologies while investing in human resources to implement such technologies (e.g., blockchain technology). Moreover, the government should encourage the adoption of this specific technology within SMHTEs by making it a national priority. Finally, the government should issue regulations supporting the adoption of blockchain technology within SMHTEs.

7. Limitations and suggestions for future research

This study has some limitations that should be addressed in future research. First, this study did not explore possible interactions between the constructs in the TOE framework. Thus, future research should test the interactive effects of technological, organizational, and environmental factors on organizations' intention to adopt blockchain-based smart tourism in general and smart tourism technologies in particular. Second, data about technological, organizational, and environmental factors and SMHTEs' intention to adopt blockchain technology were collected using a self-reporting survey, which might lead to data and social desirability biases. Thus, future research should employ experimental methods to address those issues. Third, this study did not investigate whether and how the nature of SMHTEs (e.g., public versus private) impacts the intention to adopt blockchain technology. Hence, further research should accommodate this, for example, by conducting multigroup analyses. Finally, although this research is novel, it partially examined the factors that affect SMHTEs' intention to adopt blockchain technology in a specific context of a developing country. Future research can extend the model validated in this study by incorporating other factors, such as socio-cultural factors, and collecting data in different country contexts.

Disclosure statement

The authors reported no potential conflict of interest.

Informed consent

All participants gave their informed consent for inclusion before participating in the study.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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