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The Role of Organizational Innovativeness and Size on Information and Communication Technology (ICT) Adoption During COVID-19: Evidence From the Hospitality Industry

Abstract

This research aims to advance the understanding of the moderating effect of organizational innovativeness (OI) and organizational size on the relationship between Information and Communication Technologies (ICTs) adoption and the technological, organizational, and environmental elements of the Technology- Organization- Environment theoretical framework (TOE) in the hospitality industry during the pandemic. A sample of 502 hotel owners and managers in Greece participated in the e-survey. The results indicated that OI has a moderating effect on the relationship between ICTs and the technology readiness of the hotel. In addition, concerning the size of the hotel, small hotels with 11-50 employees are a moderator on the adoption of ICTs within the environmental uncertainty of the COVID-19 outbreak. Theoretical and practical implications of the outcomes are discussed in this study.

Keywords: organizational innovativeness, hotels' size, moderator, hospitality, COVID-19

1. Introduction

Tourism is considered a key pillar of Greek economic growth. In 2019, travel and tourism accounted for 21.2% of the gross domestic product (GDP) and 10% of the total employment in the country (Zhongming et al., 2020).

Generally, tourism in Greece is a dynamic sector that needs to adapt to the fast-moving worldwide challenges, including the COVID-19 outbreak (Nicola et al., 2020; Pavlatos et al., 2021). At the time of the technological solutions, it became an available and effective way to maintain a connection with the clients as strict measures to avoid human physical contact were applied (Rivera, 2020). In addition, to attract customers to visit their property, hotels concentrate on improving hygiene safety (Shin & Kang, 2020).

For example, branded hotels implemented digital technologies such as cleaning robots and ultraviolet-light technology to reduce health risks for their clients (Sharma et al., 2021). However, despite all this effort, due to the nature of the hospitality sector, it become one of the most affected industries worldwide (Dube et al., 2021). The pandemic forced ICTs adoption, and thus, the hospitality industry has shifted from 'high-touch' and 'low-tech' to 'low-touch' and 'high-tech'(Chen et al., 2021). In financial terms, in Greece, the COVID-19 disruption caused the most significant turnover loss, 57%, over the pre-pandemic era (Hazakis, 2022). However, scholars agree that the pandemic brings up the opportunity through the adoption and implementation of ICTs to overcome the ongoing health crisis and to prepare for future challenges and possible problems (Pizam et al., 2022).

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Prior literature examination revealed that Information and Communication Technologies (ICTs) driven solutions are recognized as the most effective tool to uplift tourism (Navío-Marco et al., 2018). Thus, the increasing pressure to overcome the COVID-19 crisis and provide more sophisticated and tailored services to customers has made the hospitality sector more reliant on ICTs (Garbin Praničević & Mandić, 2020). However, it is also essential for the hospitality sector to constantly consider technology innovations to remain competitive and successful (Siguaw et al., 2006). Mihalič et al. (2013) underlined the essential financial impact of ICT innovation on small-sized hotels, suggesting that over time, an improvement in overall performance is achieved (Mihalič & Buhalis, 2013). In Greece, almost 100% (99,9%) are Small and Medium-sized enterprises (SMEs), especially micro-enterprises (93%), which are defined as the backbone of the Greek economy (Kravariti et al., 2021).

Consequently, the current research sheds an exploratory light on the adoption of ICTs by highlighting the moderating effects of OI and organizational size in micro and small-sized hotels in Greece. The increased popularity of SMEs' and ICTs adoption in the hospitality industry has motivated researchers to explore different factors within the TOE framework to understand the various internal and external elements influencing the adoption and implementation process (Racherla & Hu, 2008). However, there are limited empirical studies on what moderates the effect of the intention to adopt ICTs and the usage of ICTs. The current research is among the first studies of the hospitality industry providing empirical evidence of the moderating effect of OI and organizational size on the relationship between the adoption of ICTs and the TOE framework during the pandemic. Additionally, this research improves the understanding of the conditions that moderate the abovementioned relationship.

2. Theoretical background and hypotheses development

2.1. TOE theoretical framework

In the hospitality literature, the Technology–Environment–Organization (TOE) framework has been applied in several empirical studies (Leung et al., 2015; Wang et al., 2016). The TEO theoretical framework was described in Tornatzky and Fleischer's book *The Processes of Technological Innovation (1990)* (Tornatzky et al., 1990). TOE framework became a long-established method that studies how a firm embraces and implements technology solutions (Zhu et al., 2004).

The solid theoretical structure, steady observational infrastructure, and reliability to apply numerous technological novelties have enabled TOE to stand out amongst many other theories (Awa et al., 2016; Oliveira & Martins, 2010). This research adopts TOE as a suitable framework for developing a hypothesized conceptual model that investigates the adoption and implementation of ICTs and the moderating effect of OI and organizational size in the hospitality sector. Figure 1 presents the hypothesized conceptual model of the current study, and Appendices A, B, and C analytically show the items of the model. The TOE framework is an organization-level theory that explores the extent of adoption of a firm by examining three elements. These three elements are the technological context, the organizational context, and the environmental (Depietro et al., 1990).

2.2. ICTs in the hospitality industry

During the COVID-19 pandemic, ICTs managed the situation in the hospitality industry. Indeed, many hotels have adopted ICTs to ensure their existence (Goh & Baum, 2021). De Kervenoael et al. (2020), examining the period of the COVID-19 outbreak, found a considerable impact in the acceptance of service robots, accomplishing a shift from human to technology communications to eliminate the human psychical touch (De Kervenoael et al., 2020; Tussyadiah, 2020). ICTs send, receive, and process information, including the required software, hardware, middleware, storage, and technological devices (Zuppo, 2012). ICTs

play a significant role in the hospitality industry as, for instance, they enable more efficient transmittance of information, facilitate communication, empower transactions and enhance customer relationship management (Garbin Praničević & Mandić, 2020). Furthermore, ICTs offer access to hospitality product information anytime and anywhere, for example, via mobile applications and web technologies (Buhalis, 2003). Especially during the pandemic, integrating ICTs in the hospitality sector offers solid potential for performance (Effendi et al., 2020). Adopting hotel ICTs can be successfully achieved when their technology readiness is accomplished (Nikopoulou et al., 2023).

2.3. The moderating role of organizational innovativeness

Organizational innovativeness (OI) has been transforming businesses, including the hospitality industry, in fundamental ways (Khan et al., 2020). Contemporary literature considers OI a core element of companies (Ruvio et al., 2014). In terms of definition, OI refers to the creation and implementation of novel products, ideas or processes within the firm and has demanding requirements in terms of infrastructure and organizational characteristics (Gopalakrishnan & Damanpour, 1997; Kessler et al., 2015). Different conceptualizations of OI are critical to a firm's innovation success (Werlang & Rossetto, 2019). Sommer et al. (2017) define OI as the tendency and capability of a business to adopt and implement innovation (Sommer et al., 2017). In contrast, innovation seems to be the intention to innovate new products or services (Damanpour, 1991). The increased popularity of OI is perceived in the business literature (Ruvio et al., 2014). Singuaw et al. (2006) suggested that OI directly and indirectly influences the hotels' performance and ensures long-term growth and success (Siguaw et al., 2006). Currently, investing in OI equals higher productivity, even though it could occasionally come across difficulties from employees or customers, training outlays and, undeniably, a significant financial cost (Mihalič & Buhalis, 2013). Overall, previous studies revealed that technology readiness and innovativeness potential form the basis for exhibiting digital transformation (Moldabekova et al., 2021). In addition, Phuong et al. (2015) suggested that cloud computing as an advanced technology innovation is positively affected by the technology readiness and innovativeness as organizational factors of the TOE framework within SMEs (Phuong et al., 2015).

On this basis, the following hypotheses are proposed:

H1: *The degree of OI moderates the relationship between the ICTs adoption and implementation of the TOE framework, such as technology readiness increases the positive effect of ICTs adoption upon high innovation groups.*

2.4. The moderating role of organization size

According to the European Commission definitions, micro-enterprises employ less than ten employees and comprise 97,3% of Greek businesses. Small enterprises employ 11-50 employees, and medium-sized enterprises 51- 250 employees. Prior literature defined that organization size is consistently referred to as the number of employees, as defined in the current study (Lippert & Govindarajulu, 2006; Racherla & Hu, 2008). According to Zhu et al. (2004), structural characteristics, including organizational size, play a critical role in organizations' ICTs adoption and implementation process (Zhu et al., 2004). Additionally, organization size is a predictor (Damanpour, 1992). However, previous studies offered conflicting outcomes regarding the impact of size on ICT adoption (Racherla & Hu, 2008) and the pursuit of innovation (Baldridge & Burnham, 1975). A smaller firm is more flexible and requires less communication and coordination to achieve a task (Zhu et al., 2004). On the other hand, smaller firms have constraints on financial and technical resources and are unwilling to risk novel and unknown technologies (Lippert & Govindarajulu, 2006). Overall, the literature examination revealed that the environmental context depends on contextual conditions such as the industry's structure, the competitive pressure, the government regulations and the macroeconomic context (Depietro et al., 1990). In the current study, the focus is on the environmental uncertainty because of the

COVID-19 outbreak. Previous studies revealed that an environment lack of certainty could negatively affect the adoption of ICTs (Chong & Olesen, 2017; Li et al., 2011). In addition, Effendi et al. (2020) suggested that firms with high uncertainty, such as COVID-19, are reluctant to adopt innovative ICTs (Effendi et al., 2020). Based on the above discussion, the following hypotheses are proposed:

H2: *Organizational size moderates the relationship between the adoption of ICTs and implementation of the TOE framework, such as small hotels (11-50 employees) decreasing the positive effect of ICT adoption upon environmental uncertainty.*

3.1. Materials and method

The survey was conducted between September and November 2020 under the auspices of the Greek Ministry of Tourism. All members of the Hellenic Chamber of Hotels were invited to join the study, and the final online questionnaire was completed by 502 hotel owners, managers, and Chief Executive Officers (CEOs) through Google Drive Forms. At the time of the research, the COVID-19 outbreak took place, leading most hotels to eliminate their operation (Chan et al., 2021). More analytically, 15% of the hotels were closed, and the rest were under limited process. Finally, the response rate of the research was 10%. All the responses collected were valid and usable, and the participation was voluntary and anonymous. The respondents completed a "five-point Likert scale" ("1=strongly disagree" to "5=strongly agree") (Bodoff & Ho, 2016).

All items are provided in Appendix A, B and C. Concerning the measures, 'Technology Readiness' was measured by 22 items by Gill et al. (2016)(Gill & VanBoskirk, 2016). 'Financial Resources' were measured by a three-item scale from Wiklund and Shepherd (2005) and Story, Boso, and Cadogan (2015) (Story et al., 2015; Wiklund & Shepherd, 2005). Furthermore, 'Environmental uncertainty' was measured by three questions and 'ICTs' was measured by eight questions that explored the digital technologies adopted by the hotels during the COVID-19 pandemic. Lastly, 'organizational innovativeness' was measured by 21 items of Ruvio et al. (2014) (Ruvio et al., 2014) and the number of employees with one item question. All measures were self-reported.

The research demographics are reported in Table 1. A structural equation model was used to assess the moderating effect of innovation groups (low vs high) and the number of employees (1-10 vs 11-50 vs ≥ 51) on the relationship between technological, organizational, environmental context and adoption of digital technologies in the hospitality industry.

Table 1
Sample demographics

		Frequency	Percentage (%)
Position	Owner	278	55.4
	CEO	134	26.7
	Senior executive	58	11.5
	Other	32	6.4
Hotel category	Independent hotel	430	85.6
	Member of a big chain hotel	20	4.0
	Member of a small chain hotel	52	10.4
Geographical region	Thrace	4	0.8
	Macedonia	75	14.9
	Thessaly	34	6.8
	Epirus	22	4.4
	Central Greece	42	8.4
	Peloponnese	50	10.0
	Crete	70	13.9
	Ionian Islands	102	20.3
	Aegean Islands	103	20.5

Table 1 ***(continued)***

Stars	5	18	3.6
	4	101	20.1
	3	177	35.3
	2	133	26.5
	1	73	14.5
Number of employees	1-10	245	48.8
	11-50	171	34.1
	51-250	73	14.5
	> 250	13	2.6
Rooms quantity	Less than 200 rooms	452	90.0
	200 - 399 rooms	35	7.0
	400 - 699 rooms	10	2.0
	More than 700 rooms	5	1.0
Annual income	< 2 million euros	245	48.8
	2-10 million euros	172	34.3
	11-50 million euros	77	15.3
	More than 50 million euros	8	1.6
Operation mode	Full year	200	39.8
	Seasonal	302	60.2

3.2. Structural and measurement model

Concerning the measurement model, the assumption of discriminant validity was tested using the Fornell and Larcker criterion and the Heterotrait– Monotrait ratio of correlations (HTMT) (Hair et al., 2019). The results showed that the correlation coefficients among constructs were lower than the square root of each AVE value (Hair et al., 2019)(Table 2) and HTMT values were lower than 0.80 (Henseler et al., 2015), so the discriminant validity between constructs was established (Table 3). Table 4 reflects the statistically significant relationships between technological, organizational, and environmental elements and the adoption and implementation of digital technologies in the hospitality industry. Environment (b=-0.096, p=0.001) was negatively associated with digital technologies, while Financial Resources (b=0.081, p=0.044) and Technology Readiness (b=0.600, p <0.001) were positively significantly associated with ICTs. The coefficient of determination (R2) was calculated and was equal to 0.42 (Hair Jr et al., 2021). The Stone-Geisser's Q2 value of ICTs (Q2=0.415) was more significant than zero, indicating that the predictive relevance of the model is established (Hair Jr et al., 2021).

Table 2
Fornell-Larcker

	Environment	Financial resources	Technology readiness	Digital technologies
Environment	1			
Financial resources	-0.390	1		
Technology readiness	-0.116	0.285	1	
Digital technologies	-0.198	0.290	0.635	1

Table 3
HTMT ratio

	Environment	Financial resources	Technology readiness
Environment			
Financial resources	0.390		
Technology readiness	0.116	0.285	
Digital technologies	0.198	0.290	0.635

Table 4
Structural model

	b	t-value	p
Environment -> Digital technologies	-0.096	2.598	0.001
Financial resources -> Digital technologies	0.081	2.022	0.044
Technology readiness -> Digital technologies	0.600	21.083	<0.001

3.3. Moderating effects' results

Multi–group permutation tests were conducted to test the moderating effects of OI and the number of employees (Henseler et al., 2009). The interaction effect of OI was tested on the relationship between the technological, organizational, and environmental context of the hotels and ICTs (second-order formative construct), as graphically exhibited in Figure 1. Furthermore, two groups of OI were formed using the median as the cut-off threshold (high and low innovation groups). Multi-group analysis (MGA) was an appropriate method as the moderator 'number of employees' was a categorical variable. Furthermore, OI was a continuous moderator converted into an absolute to apply MGA (Rasoolimanesh et al., 2021).

The results of the MGA are presented in Table 5; the environment element establishes a significantly negative relationship with ICTs in low and high innovation groups, while technological and organizational features develop a very positive relationship with ICTs in low and high innovation groups. Moreover, statistically significant differences were found between the two groups regarding technological factors. This indicates that innovation moderates the relationship between the technical characteristics and the adoption of digital solutions. The findings of the research supported the formulated hypotheses.

Finally, the multi-group analysis with several employees as a moderator variable revealed that technological factors were positively correlated with ICTs in hotels with 1-10 employees, 11-50 employees, and more than 51 employees. Organization was not a significant element for digital technologies in any of the three groups. On the other hand, the environment was a statistically substantial construct for adopting and implementing ICTs in hotels with 11-50 employees and more than 51 employees. Statistically significant differences were observed among the two groups regarding environmental variables, as hotels with 1-10 and 11-50 employees harm adopting digital technologies. Hotels with 11-50 employees have a stronger relationship between environment construction and ICT adoption and implementation process than hotels with 1-10 employees (Table 6 - 8).

Lastly, the strength of the moderating effect was evaluated using the effect size f2 (Rasoolimanesh et al., 2021). The impact of moderator variable OI was small on the relationship between technology readiness and ICTs adoption as the f2 was equal to 0.006. Further, the effect of the number of employees was medium on the relationship between the environment and ICTs (f2=0.009). (Chin et al., 2003; Rasoolimanesh et al., 2021). Table 9 presents the effect sizes of the moderators. Figures 2 and 3 illustrate a better understanding of the moderating effects of OI and organizational size.

Figure 1
Hypothesized conceptual framework

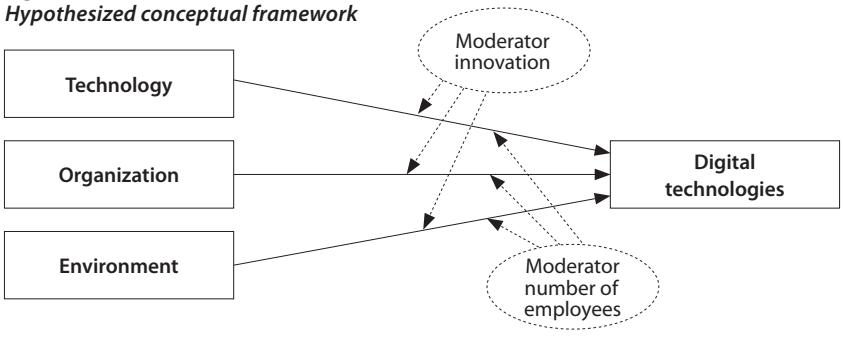

Table 5
PLS multi-group test results according to innovation group

	Low		High		Difference (low vs high)	
	b	t-value (p)	b	t-value (p)	diff (b)	t-value (p)
Environment	-0.103	2.058 **(0.040)**	-0.174	3.037 **(0.003)**	0.071	0.974 (0.331)
Financial resources	0.097	1.634 (0.103)	0.052	0.895 (0.371)	0.045	0.543 (0.587)
Technology readiness	0.488	10.361 **(<0.001)**	0.618	12.079 **(<0.001)**	-0.129	1.912 **(0.051)**

Figure 2
Moderating effect of innovation in the relationship of technology readiness on ICTs

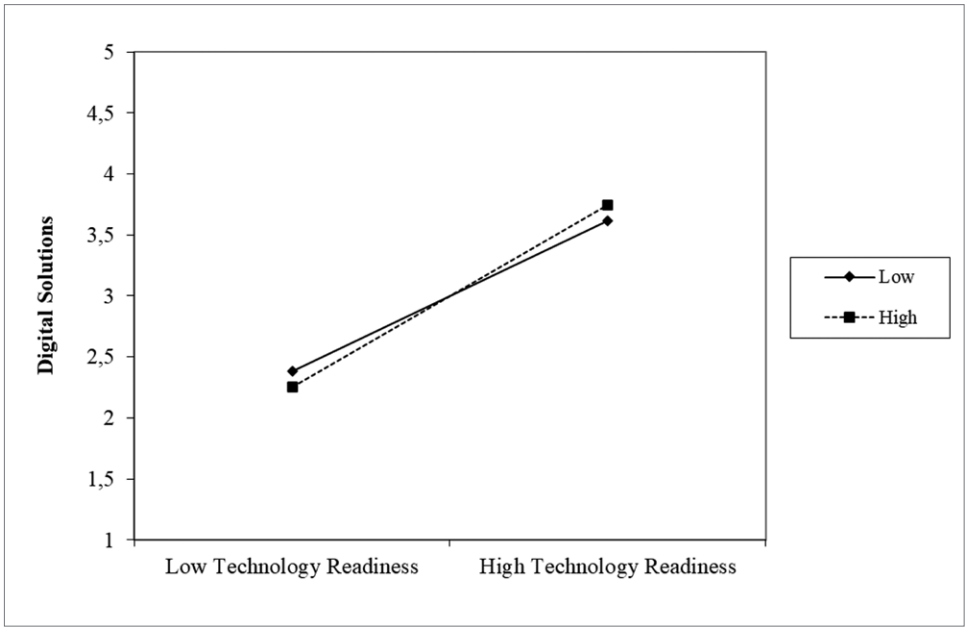

Table 6
PLS multi-group test results according to the number of employees

	1-10		11-50		≥51	
	b	t-value (p-value)	b	t-value (p-value)	b	t-value (p-value)
Environment	-0.063	1.192 (0.234)	-0.258	3.954 **(<0.001)**	-0.194	2.245 **(0.025)**
Financial resources	0.067	1.136 (0.256)	-0.082	1.264 (0.207)	0.015	0.159 (0.874)
Technology readiness	0.619	14.534 **(<0.001)**	0.534	11.151 **(<0.001)**	0.656	11.291 **(<0.001)**

Table 7
Differences between the groups according to the number of employees

	Difference (1-10 vs 11-50)		Difference (1-10 vs ≥51)		Difference (11-50 vs ≥51)	
	diff (b)	p-value	diff (b)	p-value	diff (b)	p-value
Environment	0.195	**2.429 (0.016)**	0.132	1.276 (0.203)	-0.064	0.612 (0.541)
Financial resources	0.149	1.802 (0.072)	0.053	0.501 (0.616)	-0.096	0.893 (0.373)
Technology readiness	0.085	1.346 (0.179)	-0.038	0.48 (0.631)	-0.122	1.545 (0.124)

Figure 3
Moderating effect of the number of employees in the relationship of technology readiness on ICTs

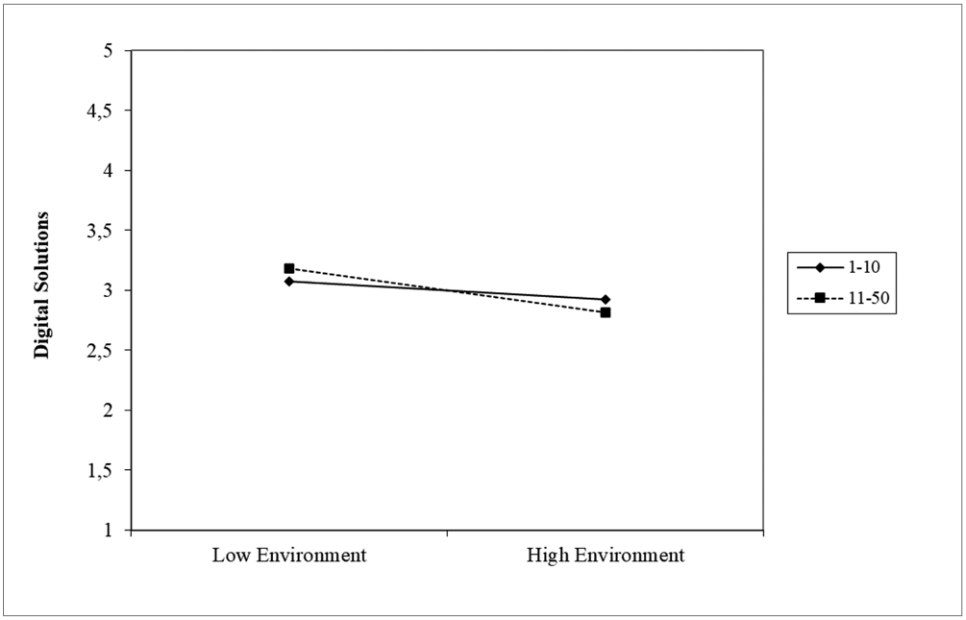

Table 8
Hypotheses development

Moderator variables	Hypothesis direction	b	t-value	p-value
OI				
Environment -> ICTs	-	-0.103	1.975	0.049
Group -> ICTs	+	0.000	0.000	1.000
Group*Environment -> ICTs	-	-0.071	0.886	0.376
Group*Technology readiness -> ICTs	+	0.130	1.810	0.071
Group*Technology resources -> ICTs	-	-0.045	0.554	0.580
Technology resources -> ICTs	+	0.097	1.783	0.075
Technology readiness -> ICTs	+	0.618	11.592	0.000
Number of employees				
Environment -> ICTs	-	-0.077	1.473	0.141
Group -> ICTs	+	0.000	0.000	1.000
Group*Environment -> ICTs	-	-0.106	2.119	0.035
Group*Technology readiness-> ICTs	-	-0.009	0.201	0.841
Group*Technology readiness -> ICTs	-	-0.071	1.356	0.176
Technology resources -> ICTs	+	0.053	0.960	0.337
Technology readiness -> ICTs	+	0.603	13.657	0.000

Table 9
Effect sizes of moderators

Moderator	f-square
OI *Environment	0.002
OI* Financial resources	0.001
OI*Technology readiness	0.006
Employees *Environment	0.009
Employees * Technology readiness	0.000
Employees * Financial resources	0.004

4. Discussion and future research

This research developed a conceptual model that explores the moderating effects of OI and organizational size between ICTs and the TOE framework's technological, organizational, and environmental context (Figure 1). These moderating effects present a new perspective on ICT adoption in the hospitality sector. Hotel managers with high OI scores are affecting the relationship between technology readiness and the extent of adoption of ICTs. Previous studies suggested that top management considers ICTs do not contribute to the fulfilment of the firm's strategic objectives (Racherla & Hu, 2008). On the other hand, various researches highlighted that the influence of top management is significant concerning the adoption of ICT innovation, such as customer relationship management (CRM) and extensive data analysis (Gonzalez et al., 2019; Jaber & Simkin, 2017). Hence, technological advances could not commence without the commitment of the hotels' management team (Winata & Mia, 2005). Given the top management-level paradox concerning the adoption of ICTs and technology innovation, a gap is identified in theoretical and practical knowledge. The current study brings into the equation the technology readiness element within the technological context of the TOE framework and the moderating influence of OI in the ICT adoption and implementation process. Pham et al. (2018) stated that technology readiness is positively related to client satisfaction, which, in the long run, ensures operational growth and success of the hotel (Pham et al., 2018). This study demonstrated a possible trend highlighting that hotel owners and managers perceiving higher innovation scores will be more likely to adopt ICT when they have already achieved technology readiness at the operational level.

Indeed, the current study is developed from the hotel management perspective, with only a few papers conceived from a holistic point of view that considers the clients' perspectives (Gonzalez et al., 2019). Thus, it might be interesting for future research to explore the moderating influence of OI and hotel size on TOE theoretical framework and ICT adoption from the customer's standpoint and compare the results.

In addition to the moderators, the findings revealed that the organizational size of the hotel was also a moderator on the relationship between environmental uncertainty and the likeliness to adopt and implement ICT within the hotel. Testing the hypothesis revealed that hotels with 11-50 employees are likelier to adopt fewer ICTs when operating in an unstable environment than hotels with 1-10 employees (Figure 3). Furthermore, the findings practically mean that the COVID-19 outbreak has led micro hotels to adopt more ICTs than small hotels. However, both are reluctant to adopt and implement ICT in the COVID-19 period. However, previous studies suggested that micro hotels have greater environmental exposure than larger ones, influencing their survival (Vivel-Búa et al., 2019). This study identifies that micro-sized hotels have transformed their flexibility during the pandemic and are likelier to adopt ICT than small hotels. Thus, COVID-19 should be reconsidered as an opportunity to accelerate the ICT transformation within the hospitality sector. Indeed, COVID-19 provided building blocks for restructuring the hotel industry and designing future strategic improvements (Mensah & Boakye, 2023).

5. Theoretical and practical implications

Theoretically, this study sheds light on the circumstances that reinforce the relationship between the technology, organization, and environment context and the effects of OI and organizational size on the adoption of ICTs during the pandemic in the hospitality sector. In particular, the adopted OI multidimensional construct provides accurate conclusions compared to unidimensional scales (Ruvio et al., 2014). As OI is considered a vital contributor to a firm's operational performance (Gopalakrishnan & Damanpour, 1997), the current study presents a more many-sided view of the moderating effect of OI. Thus, the findings show a more comprehensive knowledge of OI. This suggests that managers with high innovation levels and the hotel's technology readiness are likelier to adopt ICT within the turbulent COVID-19 environment.

For policymakers, owners, and managers in the hospitality industry, considering the moderating effect of OI and organizational size, the outcomes provide evidence that could help them make informed decisions and strategically plan their future growth and success. Indeed, the practitioners with the study's evidence should consider how to encourage the development of an innovation culture and increase innovation-related technologies and processes in their business practices as this ensures the ICT adoption and implementation in the business (Mihalič & Buhalis, 2013). In addition, the study offers a substantial base for the hotels' future strategy design concerning the post-COVID-19 crisis recovery. Moving a step further, the outcomes of this study provide some helpful perceptions, taking into consideration COVID-19 and advancing the literature concerning the pandemic.

Indeed, the current outcomes elucidate the role of the top management that scored highly in terms of OI in boosting the adoption and implementation of ICTs. This is consistent with higher business performance (Turulja & Bajgoric, 2018). Managers should be aware of the importance of innovation as a trigger even when technology readiness is accomplished. The results also imply a negative influence of the COVID-19 uncertainty, especially for medium-sized hotels, regarding adopting ICTs. The result partially aligns with Kam-Sing Wong (2014), who stated that environmental turbulence is a constraint or an opportunity for firms (Kam-Sing Wong, 2014). However, with OI in the equation, the hotel could achieve better overall performance as OI boosts the adoption and implementation of ICT.

Furthermore, micro and small hotels show incompetence in achieving advantages from the share market (Mihalič & Buhalis, 2013). On the other hand, higher-scale hotels that are part of an international chain perform managerial attitudes towards ICT innovations integration. Prior literature examination suggested that ICT is one of the most effective ways to achieve rapid and cost-effective communication with business partners and clients and ensure long-term development and growth (Garbin Praničević & Mandić, 2020). In this case, as micro and small-sized hotels are less likely to adopt and implement ICT because of the COVID-19 turbulence, it is vital to be aware of this outcome to process the gap with more technologically advanced hotels. Hence, policymakers could design programs and incentives to boost micro- and small-sized awareness or create funding to offer business opportunities and changes concerning ICT adoption.

6. Limitations and conclusions

The study has methodological limitations that provide avenues for further research. Firstly, this research has been restricted to analyzing the moderating effect of OI and organizational size. Future research could investigate ICT combined with other moderatos such as operation mode, type of hotel and star rating, which are proven to affect the hotels' overall performance (Leung et al., 2015). These results might be attributed to the various impacts and scenarios by comparing the findings. Furthermore, longitudinal studies could also be designed to investigate the impact and moderator role of OI and size in the post- and recovery COVID-19 era to expand the findings and apply various perspectives. Secondly, the generalizability limits could be identified as this study is limited in exploring the hypothesized conceptual model, including hotels in Greece. Hence, cross-cultural research could provide scholars with helpful insights into hospitality management and confidence for future research integration (Sharma & Weathers, 2003).

Another potential limitation is the current sample's internal factors and individual characteristics, such as skills, experience, temperament and motives, that potentially influence the owner's and managers' behavior and could result in critical-informant bias (Hughes & Preski, 1997). Lastly, the online questionnaire measured subjective assessments of OI and TOE elements, although multiple questions were applied to minimize bias (Gauvin & Sinha, 1993). However, the study chooses to survey the decision makers, who are, in this case, the hotel owners and managers, as they have the final purchase power (Oliveira & Martins, 2010). Despite the current limitations, the study contributes to understanding and suggesting essential effects of the OI and

organizational size moderating towards ICT adoption within the TOE framework in the hospitality industry during the pandemic.

The COVID-19 pandemic triggered technological challenges and changes that would take place for years. Therefore, regardless of its severe drawbacks, this crisis is a driver to change (Mikac & Kravaršćan, 2021). In this context, the hospitality sector has witnessed changes ranging from essential digital technologies to infrastructure, leading to digital contactless accommodation (Mayor-Vitoria, 2023). Thus, the pandemic is setting the line to follow technological trends and redesign future digital strategies in the post-COVID-19 era. Therefore, the current research can provide valuable practical evidence relevant to the hotel sector.

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Appendix A

Items of the model

Constructs	Items
TECHNOLOGY READINESS *Culture*	TRC1.The business strategy is based on digital technologies
	TRC2.Business management supports the digital strategy of the business
	TRC3.We have the proper staff to manage digital technologies in the business
	TRC4.We invest in the training of our staff for the use of digital technologies
	TRC5.The management of the company communicates its digital strategy to the staff of the company
	TRC6.The company takes all necessary actions to support innovation
	TRC7.We want to enhance our customers' experience by utilizing different service channels (e.g., through a website, call centre, social media, etc.)
TECHNOLOGY READINESS *Organization*	TROR1.We commit the necessary resources (human and / or financial) to design, redefine and execute our digital strategy
	TROR2.Our staff has the necessary digital skills to use information and communication systems
	TROR3.Our company follows specific procedures for the management of our information systems
	TROR4.We use digital channels to communicate with our business partners (e.g., suppliers, banks, etc.)
TECHNOLOGY READINESS *Technology*	TRTECH1.We have set a specific budget for the supply/upgrade of our digital infrastructure and systems
	TRTECH2.Our business is flexible in changes related to its digital strategy
	TRTECH3.Our company uses and utilizes modern information systems and infrastructures
	TRTECH4.Our company evaluates the performance of its information systems and infrastructures in terms of their contribution to the achievement of business goals
	TRTECH5.Our company utilizes feedback from its customers to reshape its digital strategy
	TRTECH6.Our company uses digital technologies to promote innovation and collaboration with its staff
TECHNOLOGY READINESS *Insights*	TRIN1.Our company has set clear and quantitative targets for measuring the success of its digital strategy
	TRIN2.Every employee of the company understands how their performance is related to specific corporate digital goals
	TRIN3.Our business staff understands how physical and digital channels work together to achieve the desired result
	TRIN4.The views of the company's customers are used to develop new digital services
	TRIN5.We use the experience from the implementation of our digital actions in the shape of our digital strategy
ORGANIZATION *Financial resources*	FIN1.If we need financial help for our business activities, we can receive them
	FIN2.We have financial resources to finance our business initiatives
	FIN3.We can obtain financial resources in a short period to support the operation of our business
ENVIRONMENT *Environment uncertainty*	EN1. The next season will be ominous due to COVID-19
	EN2. In the turbulence of COVID-19, future investment planning is difficult
	EN3. There is a possibility of bankruptcy because of COVID-19

Appendix B

Items of the model

Constructs	Items
ORG_INN_1	Innovation is promoted in our business
ORG_INN_2	In our business, the administrative staff can solve the problems related to the provision of our services
ORG_INN_3	Our company tries to develop new services every tourist season
ORG_INN_4	In our business, our ability to work creatively is respected by top management
ORG_INN_5	Company management staff are encouraged to apply original approaches in solving business problems
ORG_INN_6	Our company develops new responses to everyday problems
ORG_INN_7	Top management provides adequate support to staff to develop new services/ideas
ORG_INN_8	Our company adequately responds to changes and competition challenges
ORG_INN_9	Executives are always looking for new ways to deal with business problems
ORG_INN_10	The company sets realistic goals
ORG_INN_11	The company effectively ensures that executives and employees have the same vision for the future
ORG_INN_12	The company communicates its strategy to all employees
ORG_INN_13	The company forms a realistic vision for the future for all departments and employees
ORG_INN_14	The company believes that it is worth the risk as it can bring greater rewards
ORG_INN_15	The company encourages the development of innovative services even though it knows that many will fail
ORG_INN_16	The business often takes a big risk
ORG_INN_17	The company does not prefer a conservative and secure strategy
ORG_INN_18	Executives are constantly looking for new business opportunities
ORG_INN_19	Executives often take the initiative in an effort to shape the environment for the benefit of the business
ORG_INN_20	Executives are usually the ones who introduce/suggest innovative services to the company
ORG_INN_21	Managers often take the initiative to introduce/propose new (e.g. more streamlined or automated) business processes

Appendix C

Items of the model

Digital technologies	Items
Website	Enrich the website with information on COVID-19 policy (e.g., prevention program, cancellation policy, frequently asked questions about COVID-19)
Social media	Social media campaign/publication series to inform hotel guests concerning COVID-19 policy
Mobile and tablet applications	Development of customer service applications on mobile and tablet (e.g., mobile check-in, communication with the staff via mobile)
QR	QR codes to avoid using printed material (e.g., menu scanning, brochure codes, etc.)
Remote control systems	Remote control systems (e.g., virtual TV remote control, touchless digital menu)
Advanced policy management	Advanced policy management (e.g., personalized, or dynamic pricing)
CMR	Advanced customer management systems to improve customer communication and loyalty (CMR)
AI	Advanced artificial intelligence systems (e.g., robotics systems, guest chatbots, demand forecasting systems)

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