

Augmented reality adoption intention among travel and tour operators in Malaysia: mediation effect of value alignment

Syed Shah Alam, Mohammad Masukujjaman, Samiha Susmit, Sumaiya Susmit and Hassanuddeen Abd Aziz

Abstract

Purpose – This study evaluated the determinants of augmented reality (AR) adoption in Malaysia's travel and tour operator sectors through an integrated technology-organization-environmental (TOE) and diffusion of innovation (DOI) model.

Design/methodology/approach – The TOE and DOI were considered the primary theoretical models but are combined and extended by including few additional variables. Data were collected from 220 respondents of travel and tour operating businesses in Malaysia and analyzed by applying PLS structural equation model technique.

Findings – The empirical results established that perceived cost, relative advantages, complexity and compatibility, observability, competitor pressure, value alignment, customer pressure, and trialability are positively connected with the behavioral intention except for external support. The results reveal that value alignment partially mediates the association between relative advantages and behavioral intention, complexity and behavioral intention, compatibility and behavioral intention, perceived cost and behavioral intention except in between trialability and observability.

Originality/value – This research is unique as the value alignment construct is included in the model, and thus it fulfills the literature gap by adding the mediation construct. This study contributes to enhancing AR's understanding of the Malaysian travel and tour operator industry through the lenses of owners or managers. It offers an integrated model that combines the TOE and DOI models, rare in this sector, and can be replicated or extended with validated scales.

Keywords Augmented reality, Adoption intention, Retail store, TOE, DOI

Paper type Research paper

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1. Introduction

Augmented reality (AR) is a computer-generated object that improves the real-world environment, offering context-sensitive information about the user's close surroundings in the combination of image, 3D models and immersive features using the technological appliance, that is, eyeglasses, a desktop, tablet and a smartphone (Yung and Khoo-Lattimore, 2017). It helps marketers market their products creatively (Ng and Ramasamy, 2018). At the same time, AR technology allows users to use it in the virtual and real world. AR technology enriches understanding by including virtual mechanisms such as graphics, digital images or sensations as a novel interaction with the real world (Ng and Ramasamy, 2018). Considering the tremendous potential of AR technology, businesses adopt AR technology to interact with their customer, especially in the tourism sector.

AR's key applications in the tourism sector are seen in the pre-booking, information collecting process, the development of the on-site experience and buying of tourism goods and services,

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seeking and investigating feedback (Ukpabi and Karjaluoto, 2016). AR has been stated to help upsell hotel reservations, travel and tourist attractions to the booking process. It generates emotional connections relative to conventional media such as brochures and videos due to the immediate rapport established between the firm and visitors (Olsson *et al.*, 2013). By modernizing the current offering, AR adds value, and, in exchange, this is intended to exhibit it as more appealing to new markets and maintain existing ones. He *et al.* (2018) confirmed that embracing AR in the tourism destination would boost buyers' attitudes, optimize their mood and enhance positive behavioral purpose. AR enables visitors to visit new areas, delivering valuable and fascinating knowledge to enrich their experience and capture and retain tourists' attention. However, for tourism suppliers to stay competitive and appealing to modern visitors and resolve spillovers, they must adopt AR in their business.

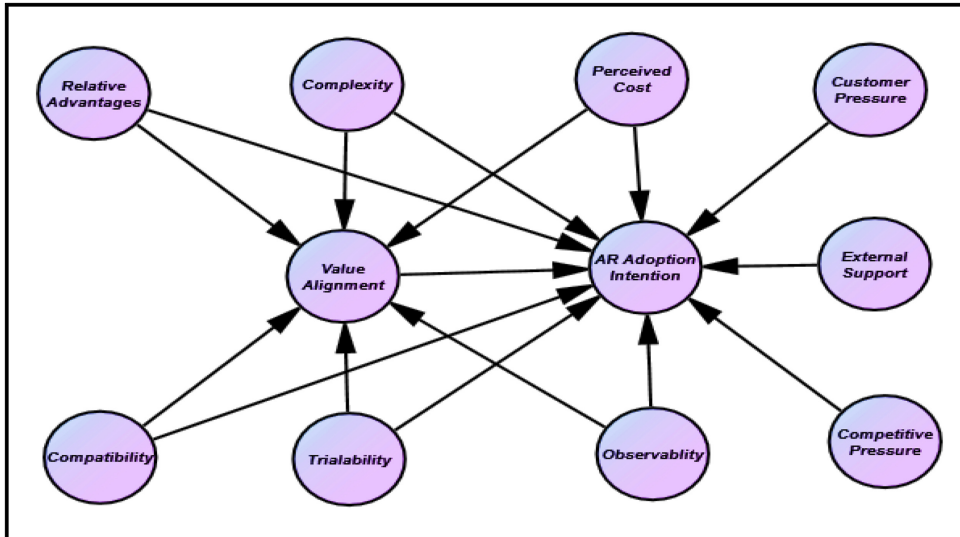
Although the benefit of applying AR in travel and tourism is not deniable, research shows that Malaysians are slow in adopting new technology (Ng and Ramasamy, 2018). According to Lazim and Rahman (2015), retail, tourism, gaming and other sectors slowly adopt AR technology. Malaysian branches of some international companies are applying AR technology for marketing purposes. In both products and services-based, Malaysian companies apply AR technology to market their products and services (Ng and Ramasamy, 2018). Therefore, the usage of AR technology in the tourism sector is much smaller. Malaysian industries have to accept AR technology, which is part of the Fourth Industrial Revolution; otherwise, the Malaysian economy will be slower to their economic development. According to Zulkifli *et al.* (2016), only 44% of Malaysians are familiar with Malaysia's AR technology. Therefore, an effort is needed to enrich our understanding of the AR adoption process that has to be discovered.

Previous research has investigated the importance of AR for tourism from several viewpoints, for instance, cross-cultural (Jung *et al.*, 2018), stakeholder (tom Dieck and Jung, 2017), unique experience creation (Tussyadiah *et al.*, 2018), organizational (Cranmer *et al.*, 2016), tourist (tom Dieck *et al.*, 2016) and business model (Cranmer *et al.*, 2018). Such studies indicate that the implementation of AR in tourism will produce enhanced interactions and boost visitors' perceptions and behavioral intentions (He *et al.*, 2018). AR's implementation is also deemed essential for market profitability, creativity and enhancement of existing goods and services (Hassan and Rahimi, 2016). Nonetheless, studies investigating the importance of AR with a particular emphasis on the tourism suppliers' viewpoint are rare. In particular, why Malaysian tourism suppliers have struggled in the diffusion of AR technologies rapidly remains untouched.

Numerous studies applied diffusion of innovation (DOI) theory at the firm-level technology adoption context, which shows that innovation diffusion is mainly based on the system's technological factors and users' insights (Al-Zoubi, 2013). Other external factors such as competitive pressure, customer pressure and external support may affect adoption decisions for AR technology in an organizational context (Al-Zoubi, 2013). Likewise, using the technology-organization-environmental (TOE) model may be plausible in this research context. Researchers argued that combinations of these models provide comprehensiveness in adoption research (Piaralal *et al.*, 2015). Past studies combined the theories to examine the adoption of an enterprise system (Ramdani *et al.*, 2009), cloud computing (Alshamaila *et al.*, 2013) and broadband mobile (Chiu *et al.*, 2017). According to Thong (1999), information technology and its characteristics are changing very fast; therefore, it is not appropriate to use a single theoretical model. Researchers argued that to understand complicated technology better, it would be essential to combine more than one theoretical model (Oliveira and Martins, 2011). Therefore, we combined both DOI and TOE theory and developed an integrated model (Figure 1).

The current research contributes by applying two factors theory in examining the technological and environmental factors to a better and more in-depth understanding of AR's adoption intention in the travel and tour-operating sector, especially in Malaysian perspectives. So far, the combined model of DOI and TOE to study AR's adoption from the tourism perspective is rare. Chandra and Kumar (2018) integrated both the models but only used a single construct (relative advantages) in e-commerce industry perspectives. The present study used all the constructs of DOI in the tourism

Figure 1 Research model



context. Besides, the study contributes to offering value alignment in the model as a mediator, which will help reduce knowledge gaps in the literature. Thus, this will enrich the body of knowledge with the empirical results for future replications.

2. Literature review

2.1 Empirical study on AR in tourism and entertainment industry

The application of AR has been used in many tourism and hospitality industries. [Do et al. \(2020\)](#) researched mobile AR apps in tourism and found enjoyment and satisfaction as significant factors for their adoption. [Kourouthanassis et al. \(2015\)](#) studied AR in tourists in Greece, where they found pleasure, arousal, dominance, personal innovativeness and price value are a predictors of adoption. There have been studies on entertainment study researched on AR technology in the entertainment industry. [Li et al. \(2020\)](#) explored perceived benefits; satisfaction and perceived risk affect buying intention. Likewise, [Shin \(2019\)](#) found that immersion, social presence, confirmation, utility, hedonism and satisfaction are significant factors in knowing the behavioral intention of using AR ([Appendix](#)).

2.2 Theoretical background

Researchers categorized adoption into corporate, group/team and individual levels ([Liu et al., 2008](#)). The theories like theory of planned behavior (TPB), theory of reasoned action (TRA), unified theory of acceptance and use of technology (UTAUT), although they are used for individual-level research, are less accepted in an organizational context ([Oliveira and Martins, 2011](#); [Liu et al., 2008](#)). In contrast, DOI and TOE are widely used to examine technology adoption in an organizational context ([Gangwar et al., 2014](#); [Al-Zoubi, 2013](#)).

2.2.1 TOE and DOI model. TOE stands on the three main facets (e.g. technological, organizational and environmental) affecting a firm's innovative technology adoption – matching our research objectives, three reasons for taking TOE for this study. Firstly, it is an advanced model integrated with the environmental construct, whereas the DOI framework is constructed from the technology and organizational perspective to explain innovation adoption ([Gangwar et al., 2014](#)). T-O-E framework is more holistic and size and industry friendly offers sound theoretical foundation and empirically validated in previous study ([Hwang et al., 2015](#)). The TOE model has been applied in the

tourism literature in various settings, including reservation system hotel adoption (Wang *et al.*, 2016), e-commerce use (Chang *et al.*, 2015), the introduction of mobile technology into travel agencies (Lin, 2016) and the adoption in hospitality organizations of electrical customer service management (eCRM) systems (Racherla and Hu, 2008).

In contrast, Rogers (1962) summarized many studies in the area of the industry, medicine and anthropology and developed a model called diffusion of innovation (DOI) (Chiu *et al.*, 2017). Rogers (1995) indicates that five main determinants of an innovation's perceived attributes explain 49–87% of the adoption rate variance. These five characteristics (relative advantage, compatibility, complexity, trialability and observability) are critical to innovation diffusion, success or failure (Rogers, 1995; Yang and Lee, 2019). Due to its robustness, the DOI model has been widely used in various areas of information technology adoption research, such as mobile enterprise applications (van den Berg and van der Lingen, 2019), mobile banking (Al-Jabri and Sohail, 2012) and broadband mobile (Chiu *et al.*, 2017). Apart from its robustness, it portrays only a direct relationship within the theoretical model (Plsek and Greenhalgh, 2001), limiting its reliance solely to predict complex behavior. According to Dibra (2015), Rogers' theory on DOI is the most suitable theoretical model for understanding factors that influenced the incorporation of sustainability in tourism businesses.

2.2.2 Conceptual model and constructs development. *2.2.2.1 Technological factors.* The technological factors include cost, complexity (ease of use), compatibility; trialability, observability and relative advantage are as follows.

2.2.2.2 Perceived cost. Cost is one of the most critical factors affecting technology adoption (Alam *et al.*, 2011). The cost of developing a program for AR, maintenance, and upgrade of website and availing the services to the consumers are the main costs incurred for web-based activities (Luam and Lin, 2005). According to Hayes (2012), high cost is involved in technology implementation. Thereby small businesses are reluctant to use an IT-based program. Although high costs are involved in implementing IT, businesses without the latest technology go far behind their competitors in this digital era. Therefore, the following hypothesis is postulated:

H1. Perceived cost has a significant negative effect on AR technology adoption intention.

2.2.2.3 Relative advantage. According to Agarwal and Prasad (1997), the relative advantage is perceived as a firm's benefits compared to previously performing a similar task. Researchers identified that relative advantage is an essential predictor of innovation adoption and usage (Moghavvemi *et al.*, 2012; Alam *et al.*, 2011). In the context of the AR technology benefits, it would be predictable that online retailers who viewed AR technologies are beneficial would likely adopt AR technology. Based on the above discussion, we proposed the *H2*:

H2. Relative advantage has a significant effect on the adoption intention of AR technology among online retailers.

2.2.2.3.1 Complexity. Lin and Ho (2010) define complexity as the innovation that is challenging to understand and complex to use. Rogers' complexity concept is comparable to Davis' perceived ease of use. It will decrease the adoption rate and negatively affect innovation adoption if it is not easy to use. Alam *et al.*'s (2011) study confirmed that ease of use significantly affects SMEs' e-commerce adoption intention. According to Selamat *et al.* (2009), people accept any technology when they find it easy to use. We expect that the adoption of AR technology is easy to use by online retailers. According to established empirical support and rationale, we hypothesize:

H3. Complexity (ease of use) has a significant effect on AR technology adoption intention among online retail store.

2.2.2.3.2 Compatibility. According to Rogers (1995), compatibility is the degree to which information technology innovation is viewed as compatible with the existing company's value, future adopters' needs and previous experience. Researchers found that compatibility positively affects Internet banking adoption intention (Kolodinsky *et al.*, 2004) and information technology (Alam *et al.*, 2011). The compatibility of new technology with the above idea either prompts or

delays the organization's adoption rate. When online retailers find that the existing technology is compatible with AR technology, it is highly possible to adopt it. We propose the hypothesis based on the above discussion:

H4. Compatibility has a significant positive influence on the adoption intention of AR technology.

2.2.2.3.3 Trialability. According to [Moore and Benbasat \(1991\)](#), trialability is defined "as the degree to which it is possible to try using the IT innovation." Reducing the uncertainty of the technology trial facility may have a significant impact. According to [Karahanna et al. \(1999\)](#), the trialability possibility of innovation may reduce uncertainty and risk using new technology. The importance of trialability will decrease if the user experiences the technology ([Moghavvemi et al., 2012](#)). We assume that online retailers have the opportunity to try AR technology before adopting it. Based on the above rationale, we hypothesize:

H5. The trialability has a significant influence on online retailer's intention to adopt AR technology.

2.2.2.3.4 Observability. Observability refers to the idea that the functionality of using AR technology can be communicated to others, observed and measured ([Moore and Benbasat, 1991](#)). Usage of AR technology aims to allow customers to see the usability of the product from a different angle. The result will be viewed to customers; for example, using AR for the cloth-buying process, customers can try the dress virtually and see it from a different angle with a real-life feature. AR technology offers customers to try the product according to their needs to increase observability. According to [Quinting et al. \(2017\)](#), observability has a significant positive effect on technology adoption intention. Therefore, we develop the *H6*:

H6. Observability has a significant positive effect on the adoption intention of AR technology.

2.2.2.4 Environmental factors. Among the various environmental factors, competitive pressure, customer pressure and external support were chosen.

2.2.2.4.1 External pressure. Stakeholder pressure is one of the most essential predictors of innovation diffusion, comprising competitive pressure and customer pressure that affect information technology adoption intention among businesses. Researchers ([El-Gohary, 2012](#); [Wanyoike et al., 2012](#); [Matikiti et al., 2018](#)) found empirically that companies accept new technology when they find that other competitors are using the same technology. In contrast, the researchers identified that customer pressure among the significant stakeholder significantly influences enterprises' green adoption ([Weng et al., 2015](#)) and is a critical predictor of it ([Zhang et al., 2020](#)).

H7. Pressure from competitors significantly affects AR adoption intention.

H8. Pressure from customers significantly affects AR adoption intention.

2.2.2.4.2 External support. According to [Ungan \(2005\)](#), external support is considered the support that comes from outside the firm, and it will influence the firm's decision-making process, precisely when the company accepts new technology ([Paydar et al., 2014](#)). [Wu and Subramaniam \(2009\)](#) stated that the greater possibility of accepting new technology happens when support comes from the external body. According to [Rogers \(2003\)](#), expertise comes from a third party; a suitable policy of standard and powerful partners is the main body providing external support. Thus, we develop the hypothesis:

H9. External support has a significant positive effect on AR adoption intention.

2.2.2.5 Value alignment. According to [Zhang et al. \(2016\)](#), users accept innovation and technology if they find value and belief similar to their own. [Yang and Lee \(2019\)](#) found that value alignment can foster significant outcomes, including adoption intention. [Kleijnen et al. \(2009\)](#) stress that when users consider using innovation, relative advantage, compatibility and observability positively influence value creation. On the contrary, researchers such as [Min and Kim \(2015\)](#) and [Calisir et al. \(2014\)](#) confirmed that cost and complexity negatively affect value alignment. None of these studies identify whether value alignment mediates the relationship between relative advantage,

compatibility, complexity, cost, trialability, observability and adoption intention. Only [Yang and Lee \(2019\)](#) tried to examine the mediating effect of these technological constructs and adoption intentions, and thus this study develops the following hypotheses:

- H10.* Value alignment has a significant effect on the adoption intention of AR technology among online retailers.
- H11.* Value alignment mediates the relationship between relative advantage and AR technology adoption intention.
- H12.* Value alignment mediates the relationship between complexity (ease of use) and AR technology adoption intention.
- H13.* Value alignment mediates the relationship between compatibility and AR technology adoption intention.
- H14.* Value alignment mediates the relationship between trialability and AR technology adoption intention.
- H15.* Value alignment mediates the relationship between observability and AR technology adoption intention.
- H16.* Value alignment mediates the relationship between cost and AR technology adoption intention.

3. Research design and sample

Data were collected from travel and tour operators based on the convenience sampling technique in Malaysia with help from our colleagues and students. The respondents for this study were the owners or top-level managers of the travel and tours operating SME businesses. These people involved in decision-making as it operates with fewer staff. We prepared a list of companies operating travel and tour operators in Malaysia through the Internet and sent them an email with a Google form link to fill up. From 360 emails sent, utilizing our personal influences where possible, we received 220 responses. Since the survey was conducted during COVID-19 pandemic (in January 2021), we could not conduct the paper-based survey. The online-based survey was used to confirm the respondents' anonymity and increase their responses ([Richman et al., 1999](#)). To reduce the chances of missing responses, an online questionnaire was developed in a way that respondents have to answer all questions.

3.1 Measurement

PEOU was measured from [Alam et al.'s \(2018\)](#) and [Huang and Liao's \(2015\)](#) study. The customer pressure scale was measured from the [Wanyoike et al.'s \(2012\)](#) study in this research. Competitor pressure was measured according to the study of [Wanyoike et al. \(2012\)](#). Attitude and behavioral intention scales were developed based on the studies of [Alam et al. \(2018\)](#) and [Alam and Sayuti \(2011\)](#). The cost was measured based on the study of [Alam et al. \(2011\)](#). External support was measured from the [Paydar et al.'s \(2014\)](#) study. All items in this research were modified to suit this research. This study's variables were measured using a 5-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. All the constructs of this study were operationalized as reflective constructs.

3.2 Common method bias

According to [Podsakoff et al. \(2003\)](#), common method variance can be tested using a few techniques such as Harman's one-factor test, the respondents' confidentiality, clarity of items or questions and wording questions in reverse. This study used [Harman's \(1976\)](#) common method bias employing exploratory factor analysis. Assessing samples adequacy for factor analysis KMO

(Kaiser-Meyer-Olkin) was used, and the results show that all the values were above 0.5 in the diagonal of the matrix and the KMO coefficient value was 0.848. Moreover, an unrotated factor analysis technique was used to find that all factors loaded separately, and no single factor accounted for more than 50%. These results indicate that there were 11 factors loaded with eigenvalues more than one, and the first factor explained about 38.7%, and thus we can conclude that there is no issue of common method bias in this research. [Lowry and Gaskin \(2014\)](#) and [Podsakoff et al. \(2003\)](#) argued that there is a common method bias if a single factor explains more than 50% variance.

3.3 Analysis of the data

The proposed model of this study was tested using a Smart-PLS package of 3. Variance-based PLS-SEM (partial least square structural equation modeling) technique was used in the present study to test the hypotheses. According to [Ringle et al. \(2010\)](#), to determine the causal relationship in the most often Smart-PLS path modeling technique, direct and indirect relationships are used. PLS-SEM researchers can get a significant association rather than examining the goodness of fit of the model. Nowadays, PLS-SEM has gained massive attention from various research fields, including marketing, strategic management, operations management and human resource management ([Ringle and Sarstedt, 2016](#)). A two-step approach was used to test the model: (1) inner model or measurement model and (2) outer model or structural model ([Ringle et al., 2005](#)). In measuring the model, we checked the construct's validity and reliability, and the structural model determined the path coefficient and their significance.

4. Measurement model analysis

In this study, the measurement model is shown in [Figure 2](#). Before testing the structural model, the measurement model was tested. [Table 1](#) shows the outer loading, composite reliability values, Cronbach's alpha and average variance extracted (AVE).

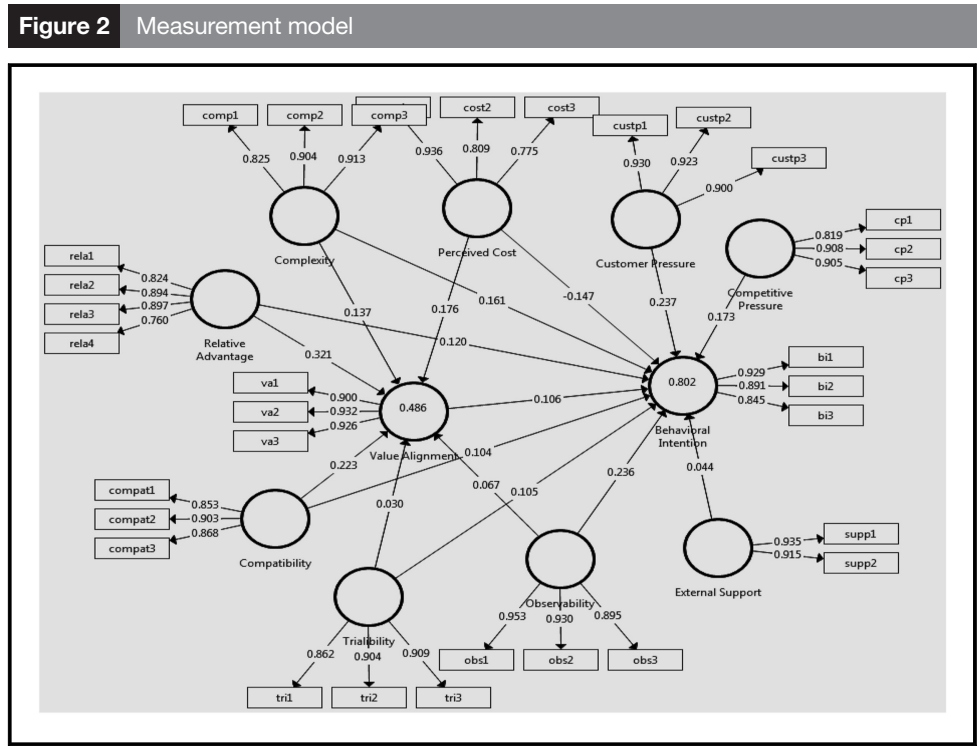


Table 1 Factor loadings and reliability statistics

Constructs	Items	Loadings	AVE	Composite reliability	Cronbach's alpha	rho_A	BI	VIF	VA
Behavioral intention	bi1	0.929	0.790	0.919	0.867	0.871			
	bi2	0.891							
	bi3	0.845							
Competitor pressure	cp1	0.819	0.771	0.910	0.853	0.880	1.508		
	cp2	0.908							
	cp3	0.905							
Complexity	Comp1	0.825	0.778	0.913	0.856	0.858	1.493	1.380	
	Comp2	0.904							
	Comp3	0.913							
Compatibility	com1	0.853	0.766	0.908	0.847	0.851	1.885	1.691	
	com2	0.903							
	com3	0.868							
Customer pressure	custp	0.930	0.842	0.941	0.906	0.908	2.479		
	custp2	0.923							
	custp3	0.900							
External support	es1	0.935	0.855	0.922	0.831	0.841	1.464		
	es2	0.915							
Observability	obs1	0.953	0.858	0.948	0.917	0.923	2.022	1.739	
	obs2	0.930							
	obs3	0.895							
Perceived cost	pc1	0.936	0.710	0.879	0.811	1.045	1.342	1.250	
	pc2	0.809							
	pc3	0.775							
Relative advantage	rela1	0.824	0.715	0.909	0.866	0.878	2.360	2.000	
	rela2	0.894							
	rela3	0.897							
	rela4	0.760							
Triability	tri1	0.862	0.795	0.921	0.871	0.874	1.445	1.430	
	tri2	0.904							
	tri3	0.909							
Value alignment	va1	0.900	0.845	0.943	0.908	0.909	2.054		
	va2	0.932							
	va3	0.926							

4.1 Convergent validity

Supporting [Ringle et al. \(2012\)](#), this study's result indicates that all factor loading values more than 0.70 (ranging from 0.760 to 0.953) exceed the suggested threshold value of 0.7 ([Hair et al., 2016](#)) and indicating convergence validity. Our research further tested convergent validity by assessing AVE, between 0.597 and 0.898, which exceeds the threshold value of 0.50 ([Hair et al., 2010](#)). Therefore, we can conclude that there was convergent validity of the scale.

4.2 Reliability

Reliability was tested by assessing Cronbach's alpha and composite reliability values. The Cronbach's alpha value ranged from 0.811 to 0.917 (see [Table 1](#)), and the value of composite reliability ranged from 0.879 to 0.941, which is greater than the threshold value of 0.7 ([Hair et al., 2016](#)). Hence, it demonstrates a satisfactory level of reliability.

4.3 Discriminant validity

Heterotrait-monotrait ratio (HTMT) and Fornell-Larcker criterion were used to assess discriminant validity. According to the Fornell-Larcker approach ([Fornell and Larcker, 1981](#)), the square root of each construct's AVE value should be more than its highest correlation with any other construct of a model ([Hair et al., 2016](#)). As shown in [Table 2](#), each construct's square root of AVE is more

remarkable in the model than the correlation value. As the Fornell-Larcker criterion cannot reliably detect the lack of discriminant validity in common research situations (Henseler *et al.*, 2015), the HTMT is also tested here. The HTMT value (see Table 3) of all the constructs was less than the conservative threshold value of 0.85, ensuring the discriminant validity (Henseler *et al.*, 2015; Hair *et al.*, 2016). Thus, discriminatory validity is not an issue for this study.

4.4 Testing multicollinearity and coefficient of determination (R^2)

As suggested by Kleinbaum *et al.* (1988), one effective technique, including the evaluation of variance inflation factor (VIF), was used to decide the presence of multicollinearity among independent variables in this research. The regression analysis outcome shows that the VIF ranges from 1.250 to 2.479, indicated in between 1 and 5 (Zuur *et al.*, 2010) (see Table 3 and Figure 2). This concludes that multicollinearity is not the issue in this research.

Santosa *et al.* (2005) proposed a need to measure the model's explanatory powers by ascertaining the endogenous variable's coefficient of determination (R^2). Since the R^2 value of this study's endogenous constructs is more significant than 0.26, it indicates that the model has a strong explanatory power (Chin, 1998).

5. Structural model analysis

The hypotheses of this research and the structural model have been evaluated using path coefficient and effect size (f^2) based on the recommendation of Hair *et al.* (2016). In this research, we used 5,000 bootstrap subsamples from 233 cases to analyze the findings' significance. A 5%

Table 2 Fornell-Larcker correlation matrix

	BI	CP	Comp	Compat	Custp	ES	Obs	PC	Rela	Tri	VA
BI	0.889										
CP	0.607	0.878									
Comp	0.567	0.326	0.882								
Compat	0.645	0.433	0.410	0.875							
Custp	0.767	0.496	0.477	0.589	0.918						
ES	0.453	0.370	0.221	0.396	0.448	0.925					
Obs	0.707	0.445	0.301	0.549	0.635	0.335	0.926				
PC	0.193	0.265	0.128	0.265	0.247	0.303	0.227	0.843			
Rela	0.699	0.463	0.485	0.532	0.611	0.474	0.569	0.311	0.846		
Tri	0.457	0.336	0.267	0.299	0.365	0.242	0.382	0.406	0.444	0.892	
VA	0.630	0.431	0.435	0.542	0.584	0.436	0.465	0.380	0.612	0.373	0.919

Note(s): BI = behavioral intention, CP = competitive pressure, CUST = customer pressure, ES = external support, PC = perceived cost, comp = complexity, Compat = compatibility, Tri = trialability, Obs = observability, Rela = relative advantage, VA = value alignment

Table 3 HTMT approach and coefficient of determination

	BI	CP	Comp	Compat	Custp	ES	Obs	PC	Rela	Tri	VA	R^2
BI	–											0.802
CP	0.693	–										–
Comp	0.659	0.376	–									–
Compat	0.751	0.503	0.479	–								–
Custp	0.867	0.550	0.540	0.672	–							–
ES	0.533	0.425	0.258	0.468	0.512	–						–
Obs	0.792	0.493	0.338	0.621	0.698	0.379	–					–
PC	0.181	0.282	0.144	0.287	0.255	0.306	0.202	–				–
Rela	0.799	0.523	0.558	0.616	0.683	0.560	0.630	0.315	–			–
Tri	0.519	0.385	0.306	0.346	0.406	0.278	0.416	0.456	0.507	–		–
VA	0.709	0.481	0.494	0.618	0.644	0.500	0.506	0.398	0.686	0.417	–	0.486

level of significance is considered in testing the structural model and projected hypotheses. The confidence interval report was further analyzed along with the t -values (1.96) and p -values (0.05) to examine the significance of the proposed hypothetical relationship.

As depicted in Table 4, nine hypotheses were supported at 5% significant level out of ten direct relationships projected. The outcomes showed that the perceived cost ($\beta = -0.147, t = 4.050, p = 0.00$), relative advantages ($\beta = 0.120, t = 2.206, p = 0.027$), complexity ($\beta = 0.161, t = 3.229, p = 0.001$), compatibility ($\beta = 0.104, t = 2.489, p = 0.013$) and trialability ($\beta = 0.105, t = 2.931, p = 0.003$) were connected positively with behavioral intention, supporting the hypotheses H1, H2, H3, H4 and H5. As suggested, observability ($\beta = 0.236, t = 4.141, p = 0.00$), competitor pressure ($\beta = 0.173, t = 4.625, p = 0.000$) and customer pressure ($\beta = 0.237, t = 3.640, p = 0.000$) are positively linked with the behavioral intention indicating H6, H7 and H8 are significant. H9 is rejected which anticipated the positive relationship of external support ($\beta = 0.044, t = 1.291, p = 0.197$) with behavioral intention. However, the value alignment ($\beta = 0.106, t = 2.656, p = 0.008$) is found to have positively related to the behavioral intention, supporting H10.

The f^2 is an additional tool of R^2 for analyzing the effect size test, which measures the effect of an independent variable on the dependent variable. Although R^2 is sensitive to the number of variables that is not an issue in this study, it used numerous variables to improve the robustness of the analysis. The f^2 values greater than 0 and 0.02, 0.15 and 0.35 denote a small, average or extensive exogenous effect on an endogenous variable accordingly (Cohen, 1988). This study concludes that the entire endogenous constructs have a small effect on behavioral intention (see Table 4).

5.1 Testing the mediating effect of value alignment

The bootstrapping method was used to analyze the mediation effect of value alignment on the relationship between relative advantages, complexity, compatibility, trialability, observability and perceived cost on behavioral intention based on suggestions of Hair et al. (2013) and Hayes and Preacher (2010). It is unnecessary to assume the products' sampling distributions or the indirect effect in the bootstrapping method (Hair et al., 2013; Hayes and Preacher, 2010). The mediating effect was tested with Smart-PLS 3.0 with 233 cases and 5,000 subsamples.

From the study results (Table 5), it is clear that value alignment mediates the association between relative advantages and behavioral intention ($\beta = 0.034, t\text{-value} = 2.399, \text{at } p < 0.05$), complexity and behavioral intention ($\beta = 0.056, t\text{-value} = 2.477, \text{at } p < 0.05$), compatibility and behavioral intention ($\beta = 0.024, t\text{-value} = 2.018, \text{at } p < 0.05$), as well as perceived cost and behavioral intention ($\beta = 0.032, t\text{-value} = 1.987, \text{at } p < 0.05$) supporting H11, H12, H13 and H16. The mediation effect is partial as direct (β_{XY}) and indirect relationships ((β_{XM}) and (β_{MY})) was found significantly with the inclusion of mediator in all cases. However, trialability ($\beta = 0.003$,

Table 4 Structural model and hypothesis testing result

Hypothesis	STD beta	STD error	t-values	p-values	2.5%	97.5%	Significance (p < 0.05)	f ²
H1: COST → BI	-0.147	0.036	4.050	0.000	-0.217	-0.075	Supported	0.081
H2: RELA → BI	0.120	0.054	2.206	0.027	0.021	0.231	Supported	0.031
H3: COMPEX → BI	-0.161	0.050	3.229	0.001	0.067	0.262	Supported	0.088
H4: COMPAT → BI	0.104	0.042	2.489	0.013	0.017	0.182	Supported	0.029
H5: TRI → BI	0.105	0.036	2.931	0.003	0.032	0.173	Supported	0.038
H6: OBS → BI	0.236	0.057	4.141	0.000	0.134	0.358	Supported	0.139
H7: CP → BI	0.173	0.037	4.625	0.000	0.098	0.246	Supported	0.100
H8: CUST → BI	0.237	0.065	3.640	0.000	0.105	0.357	Supported	0.114
H9: ES → BI	0.044	0.034	1.291	0.197	-0.024	0.111	NS	0.007
H10: VA → BI	0.106	0.040	2.656	0.008	0.027	0.182	Supported	0.028

Note(s): BI = behavioral intention, CP = competitive pressure, CUST = customer pressure, ES = external support, PC = perceived cost, Compex = complexity, Compat = compatibility, Tri = trialability, Obs = observability, Rela = relative advantage, VA = value alignment

Table 5 Mediating effect of value alignment

Hypotheses	Relationships	Beta	Standard error	t-value	p-value	Decision
H11	RELA → VA → BI	0.034	0.014	2.399	0.018	Partial mediation
H12	COMPLEX → VA → BI	0.056	0.018	2.477	0.015	Partial mediation
H13	COMPAT → VA → BI	0.024	0.012	2.018	0.044	Partial mediation
H14	TRI → VA → BI	0.003	0.007	0.448	0.654	No mediation
H15	OBS → VA → BI	0.007	0.008	0.844	0.399	No mediation
H16	COST → VA → BI	0.032	0.011	1.987	0.041	Partial mediation

t -value = 0.448, at $p = 0.654 > 0.05$) and observability ($\beta = 0.056$, t -value = 2.477, at $p = 0.399 > 0.05$) do not mediate the association between value alignment and behavioral intention. Therefore, we reject H14 and H15.

6. Discussion

The study used a holistic research model, affecting entrepreneurs' value alignment and adoption intention, developed based on Rogers' DOI theory and TOE model and later tested the model empirically with H16 with six suggested mediating relationships. The study's findings suggest that the two-factor theory in examining the technological and environmental factors predicts better understanding of AR adoption intention in Malaysia's tourism business. All the factors (except fourth) are confirmed and offered the necessary support exhibited in Figure 2. The DOI and TOE constructs were found statistically significant and appeared with a strong resemblance in the comprehensive model. The study also offers informative details outlined below based on the research framework.

First, a significant association was found in this research between customer pressure and behavioral intention. Competitor pressure is another critical predictor affecting AR adoption intention among retailers in Malaysia, consistent with the previous studies (Wanyoike et al., 2012; El-Gohary, 2012) conducted on SMEs in tourism. Thus, the higher the possibility of adopting AR by competitors, the higher the SMEs' propensity to accept it as far as their existence is concerned. The other environmental factor, external support, is surprisingly found insignificant regarding the relationship to behavioral intention to use AR. That is because travel agencies in Malaysia are not receiving products from one supplier, and not all suppliers accept technology into their business. The other possible reason may be that Malaysia's government has not yet established an institution supporting this technology implementation in businesses. This study's result is inconsistent with that of previous studies done by Wanyoike et al. (2012), El-Gohary (2012) and Matikiti et al. (2018).

Second, this study's results confirmed that perceived cost has a significant negative effect on behavioral intention. This result aligns with the previous research on virtual reality technology (Jang and Park, 2019; Yang and Lee, 2019). System development for providing AR facilities needed some infrastructure and systems, which incur extra costs for the retailers. Similarly, observability is the extent to which the innovation is visible and has a maximum effect on behavioral intention among the other variables' minor effects. Our findings suggest that complexity has a negative effect on the behavioral intention concerning the innovation factors. The results align with the earlier observations on innovation literature (Kleijnen et al., 2009).

Third, the current findings have shown that relative advantages are a significant determinant of the intent to embrace AR, consistent with earlier research (Amaro and Duarte, 2015; Lu et al., 2011). On the contrary, complexity is the hindrances, which impede the adoption decision complied with the previous research on information systems (Phipps et al., 2013). *Fourth*, this research found a significant positive relationship between AR's compatibility and behavioral intention compatible with the prior research (Lee et al., 2011; Pham and Ho, 2015). This indicates that the higher the AR product to users, the higher will be the behavioral intention. Similarly, Innovation trialability allows users to feel comfortable and gain confidence over it. The present study follows the past study of Wang (2014) and implies that allowing trialability of augment realities, technology will allow Malaysians to enhance their willingness.

Fifth, the current research has found that value alignment is a significant determinant of the decision to follow AR. The outcome shows that retail stores' adoption intent is motivated by an alignment of value with increased truth, as created by a perception of AR properties. The analysis results reflect previous research, suggesting that perceived value for new ICT adoption is a significant predictor (Chen *et al.*, 2018). It demonstrates the critical role of the value alignment in AR acceptance for the ultimate experience. Finally, according to the result, value alignment mediates partially between technological factors (relative advantages and behavioral intention, complexity and behavioral intention, compatibility) and behavioral intent except for trialability and observability in the Malaysian tours and travel sectors. These results support Yang and Lee's (2019) empirical findings in the Chinese crowdfunding context.

7. Theoretical implications

This research's theoretical contribution to academia is threefold: a new context, a new model and new findings. It contributes to the tourism and hospitality management literature by exploring relevant factors that affect AR technology adoption in SMEs.

Concerning the new context, research in the augmented reality (AR) from the travel and tourism perspective is limited for a comprehensive understanding. First, prior research on AR adoption has looked at it from the standpoint of consumers, ignoring organizational outlook. The current study emphasizes the importance of studying technology adoption from an organizational standpoint. Future research could look into the organizational context of new technology acceptance and adoption. The research adds to information system insights by understanding how this novel technology is accepted and adopted within organizations. Second, this study caters to the perspective of Malaysia, which could be the foundation stone for similar developing country's research to follow the factor to enhance the diffusion of this technology rapidly. Third, this model was tested in the travel agency's acceptance of AR, which can be applied to other new IT adoption contexts, such as the adoption intention of artificial intelligence. Researchers can extend or replicate in the future as this research has its measurement scales validated by PLS statistical analysis.

As for a new model, the present study offered a comprehensive model combining the TOE and DOI models, rare in this sector. This study relies on the TOE framework to emphasize the technology and organizational perspective simultaneously. It also integrates the DOI model constructs like relative advantages, compatibility, complexity, trialability and observability as technology-specific factors that may affect AR adoption. In addition, perceived cost is also borrowed from the literature as technological characteristics. External support is proposed to include the functional perspective and organizational capabilities. Inspired by Wanyoike *et al.* (2012), this study proposes customer and competitor pressures that influence the adoption of AR technology in tourism sectors.

Regarding the new findings, this study brought value alignment construct (VA) in the model, and thus it fulfills the literature gap by empirically establishing it as a mediation construct. The study also compares these findings to the previous AR technology adoption factors and shows how these findings differ and are differently interpreted from past research. Like previous study this study confirmed that external support was insignificant. It indicates the newness of this study. Likewise, VA did not mediate between trialability and observability, thus future studies can test further in similar situations.

8. Practical implications

The outcomes of the analysis provide essential management lessons that can support administrators and policymakers in various ways. First, the practitioners could realize the role of value alignment in mediating behavioral intention with other factors. Buying AR technology is not just watching advertisements and then going to collect it. The entrepreneurs will buy or use when they feel those products enhance the firm's value by adoption. However, AR suppliers' managers can inform the specific experience articulated in the latest technology, describing the level of consumer value proposition given. That will enable us to interact explicitly and match the technology to their specific needs.

Second, external support did not function as expected in the proposed model. Since this could be due to the unavailability of supporting institutions for implementing the latest technology in businesses, the Malaysian government and its responsible body should care for this missing aspect to materialize the upcoming Fourth Industrial Revolution. We also suggest a future study to understand why this feature, which is usually necessary to introduce innovation, is unsuitable for AR adoption. However, the suppliers should also set up various customer service centers nearby for a stain-free AR experience.

Third, this study's results indicate that operating costs and complexity are key factors that influence entrepreneurs' value alignment in line with AR acceptance. Concerning overhead expenses, administrators are also advised to introduce incentives to minimize escalated service charges or offer service bundles to get aspiring entrepreneurs. Managers should suggest, for example, delivering various packages of after-sales services and free installation charges.

Fourth, the paper stresses the promise of AR and the role of senior management in putting it into practice. If the organization's top management is committed and concentrated on using technology and has clarity on value formation and new implementation methods, adoption will be more receptive, and outcomes will be achieved.

Fifth, competitive pressure and customer pressure are two external pressures that have been found to have a notable impact on behavioral intent. Managers and owners ought to have a procedure in place (opinion pool, feedback solicitation, reaction testing) to understand client expectations regarding products and their delivery. It will assist them in customer acquisition as well as keeping existing ones informed. They should also constantly reassess their competitive advantages and make immediate improvements.

Besides, the present paper also contributes to the future of tourism. This paper will guide managers and policymakers in the tourism sector to see the factors required to bring AR technology in this sector, shaping the future of tourism. Likewise, since AR will turn around the future of the travel and tourism industry with improved technologies, the demand for up-to-date AR technology will be high in the future. This paper indicates that the customer pressure and competitive pressure toward up-to-date technology are pertinent to the future survival in the tourism industry, and this will provide essence to be well informed about the changing technology and their adoption.

9. Conclusion, limitation and recommendation for future research

The outcomes showed that the perceived cost, relative advantages, complexity and compatibility, observability, competitor pressure, value alignment, customer pressure and trialability are positively connected with the behavioral intention, while external support is not related to behavioral intention. In addition, value alignment partially mediates the association between relative advantages and behavioral intention, complexity and behavioral intention, compatibility, behavioral intention, as well as perceived cost and behavioral intention except for trialability and observability.

While the current research gives pragmatic as well as theoretical contributions, there are drawbacks. The study has limitations. It does not include the social norm construct because this is not an individual behavior. However, peer influence and celebrity endorsement have an enormous effect on the usage decision for any technology. Through using celebrities and peers in product demos and commercials, advertisers can demonstrate the innovation, interactivity and vividness of AR applications as a core value proposition. Therefore, we suggest including social norms in future studies. In addition, like all cross-sectional analyses, this study offers a precise glimpse during the survey. Given the rapid technical progress, this study's results need to be revisited as technology progresses. More specifically, studies may be performed in an experimental design laboratory environment in which researchers observe AR technologies first-hand. An experimental test design will give researchers more insight into the particular AR attributes affecting brand interaction.

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Appendix Questionnaire

Relative advantage (**Lou et al., 2017**)

- Using augmented reality (AR) is beneficial to our company
- Using AR allows me to handle the customer more efficiently
- Using AR allows me to handle the customer easily
- Using AR is more useful for handling customer

Compatibility (**Lou et al., 2017**)

- AR is compatible with my business
- Using AR fits well with the way I handle my customer
- Using AR to conduct business fits into my business dealing

Complexity (**Alam et al., 2018; Huang and Liao, 2015**)

- I think the AR application is easy
- I think it is very simple to learn how to use augmented reality application
- I think it does not require much effort to use an augmented reality application

Observability (**Lou et al., 2017**)

- I have difficulty telling others about the results of using AR
- I could communicate to others the consequences of using AR
- The results of using AR is apparent to me

Trialability (**Lou et al., 2017**)

- Before deciding on whether or not to adopt AR, I would be able to use it on a trial basis
- Before deciding on whether or not to adopt AR, I would be able to try it out properly
- I would be permitted to use AR on a trial basis long enough to see what it can do

Value alignment (**Karahanna et al., 2006**)

- Using augmented reality fits the way I view the world
- Using augmented reality fits my values about how to conduct online business
- Using augmented reality in keeping with my business values

Cost (**Alam et al., 2011**)

- The initial setup cost is high
- Incur extra cost for hiring IT staff
- Assessing cost and benefits is difficult

Pressure from competitors (**Wanyoike et al., 2012**)

- Our competitors have adopted AR technology
- Our competitors are doing well in using AR technology
- Customers prefer online retailers who use AR technology

Pressure from customers (**Wainyoike et al., 2012**)

- Our customers expect us to use AR technology
- Our customers demand that we use AR technology
- The use of AR technology is something that would make the customer happy

External support (**Paydar et al., 2014**)

- The existing policy related to AR applications is quite suitable to support the adoption
- The government assists and supports the retail organizations to adopt AR application

Behavioral intention (**Authors proposition**)

- I intend to adopt AR in my business
- I think it will be worth it for me to adopt AR
- Soon regularly I will adopt AR

Table A1 Empirical literature in the augmented reality in tourism and entertainment industry

Source	Context and country	Methods/ Sample	Variable found significant
Cranmer et al. (2020)	AR in UK tourism	15 Managers/ Thematic	Epistemic, marketing, tourist, economic and organizational value
Li et al. (2020)	AR in Pokémon Go games online	11,335 Participates	Perceived benefits, satisfaction, perceived risks
Do et al. (2020)	Mobile AR apps in tourism	PLS-SEM/479	Enjoyment, satisfaction
McLean and Wilson (2019)	AR in mobile applications in the UK	SPSS/441 consumers	Brand management
Lee et al. (2019)	AR in the entertainment industry in South Korea	SEM-AMOS/ 350 people	Perceived usefulness, attitude, perceived enjoyment
Rauschnabel et al. (2017)	AR in Pokémon Go games in German	SPSS/642 players	Social norms, benefits: flow, socializing, image
Shin (2019)	AR in video games around the world	SEM/250 participants	Immersion, social presence, confirmation, utility, hedonism, satisfaction
Kourouthanassis et al. (2015)	AR in tourist in Greece	Smart-PLS/105 tourist	Pleasure, arousal, dominance, personal innovativeness, price value

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