

# **The Influence of Technology Readiness on Satisfaction and Destination Loyalty toward Augmented Reality Technologies**

*Completed Research Paper*

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## **Abstract**

*Technology has been changing the travel experience of visitors. Particularly, Augmented Reality is one of the emerging technologies, which widely used in cultural heritage tourism sites. This study is based on a new technology acceptance model and future modified this model to examine the relationship between product beliefs, consumer satisfaction with AR, and destination loyalty in cultural heritage sites. Moreover, this paper examined the role of technology readiness forming travellers' loyalty of destination with a kind of travel technology--AR. The results show that perceived usefulness and perceived ease of use have significant effects on the satisfaction of AR towards the travellers' loyalty of destination. TR is found to have moderating effects on this model.*

**Keywords:** Augmented Reality; Technology acceptance model; Technology readiness; Cultural heritage tourism

## **Introduction**

In the service industry, the interaction between consumers and service provider becomes more diverse and efficient because of the introduction of technology. Especially in the tourism industry, the adoption of tourism technology can greatly improve tourist experience (Wang et al., 2017). However, Non-negligible questions for enterprises to consider in the development and application of new technologies (1) whether it could enhance the economic benefits of tourism for the destination (2) whether it could

identify and meet the satisfaction of tourists (3) whether it could stimulate and improve a sense of destination loyalty (e.g.: generate an access intent or revisit intention to the destination, increase tourists' willingness to recommend a destination).

Among such many tourism technologies, AR becomes the new darling of this industry. AR systems as a kind of simulation technology that calculates the position and angle of the camera image in real time and adds corresponding images, to achieve the set of the virtual world on the screen and interact in the real-world. Previous studies have shown that AR offers opportunities for travellers to change the way to travel (Gretzel et al., 2015). In cultural heritage sites, AR is widely used as a tool that can not only provide a better user experience for tourists but also restore and maintain the integrity of cultural heritage (Chung et al., 2017).

Davis and Bagozzi illuminated by technology acceptance model (TAM) that perceived usefulness strongly affect people's intentions, and perceived ease of use has a small but significant impact on intentions, they added perceived enjoyment to the original TAM and found that it has a significant effect on adoption intentions in the subsequent study (Davis et al., 1989). Previous studies proved that satisfaction is a critical indicator to measure the success of technology adoption. Not only that, it has been evidenced that tourists' satisfaction indicates strongly on tourists' destination loyalty in the tourism industry (Yoon & Uysal, 2005). However, previous studies did not investigate that perceived ease of use, perceived usefulness and perceived enjoyment to AR satisfaction influence in the context of the tourism industry. Therefore, there is a gap in the literature on the effect of AR satisfaction on destination loyalty on the basis of the new TAM model. Technology readiness does influence customer satisfaction (Lin & Hsieh, 2007), which included positive section and section both can affect tourists on mental readiness. Previous studies only testified that tourists' use of and satisfaction with technologies depend on their TR, and TR is a moderator of tourist's attitudes toward and adoption of technologies (Chen & Chen, 2009). However, it is not specified whether applies to AR. Nay, literatures on the moderating effect of TR between AR satisfaction and destination loyalty are limited.

From the above, this study was based on a new technology acceptance model and improved it to examine the relationship between product beliefs, consumer satisfaction with AR and destination loyalty. And investigating the moderating effect of tourists' TR on the relationship between (1) product beliefs and AR satisfaction, and (2) AR satisfaction and destination loyalty.

## **Literature review**

### ***Augmented reality***

AR had been defined as "a technology that allows the superimposition of synthetic images over real images, providing augmented knowledge about the environment in the user's vicinity, which makes the task more pleasant and effective for the user, since the required information is spatially superimposed over all real information related to it". With the development of technology, such as GPS, cameras and internet connections had already delivered tourists more enjoyable and personalized tourism experience in a destination by enhancing smartphone. At the same time, augmented reality also became one of the most emerging technologies, which have been used in the tourism industry, especially in the recent developed cultural heritage tourism sites around the world.

AR for the tourism industry is practical, because AR is used to help tourists better understand their current environment. Most AR systems strengthen the contiguity of space and time by superimposing

virtual information pertinent to physical objects and spaces (Azuma, 2011). The essential advantage is that tourists are able to view unstable information about an object of interest that is placed directly in context. AR applications have changed a lot the way that travellers experienced a destination. Especially, in cultural heritage tourism sites, AR help tourists gain a deeper understanding of the origins of geological heritage. For instance, Lee, Chung, and Jung (2015) assessed the impacts of aesthetics of AR on perceived usefulness, perceived ease of use and perceived enjoyment, and investigated the influence of the cultural differences (South Korea, Ireland). Jung et al. (2016) examined the impacts of AR quality on AR satisfaction, intention to recommend, and the moderating effects of personal innovativeness in the relationships between AR qualities and satisfaction. Despite tourists generally felt novel when they experienced a destination by using AR application, the effects of AR application on destinations and whether AR is the determining factor that causes the tourists to revisit the destinations requires further research. Furthermore, destination loyalty should be explored when tourists had used AR application during their travel experience.

### ***Technology acceptance model***

The technology acceptance model had been improved by many researchers (Davis, 1989; Davis, Bagozzi and Warshaw, 1989). Previous studies have been conducted by applying TAM related to the user's acceptance of information technology. TAM suggests the chain of Beliefs- attitude- intention- behavior, and the relationship, which was trying to explain and forecast the behaviour of potential users. In addition, various studies suggested that TAM provides a useful foundation for research to investigate the traveller's acceptance of IT.

In marketing, a product is anything that can be offered to a market that might satisfy a want or need (Kotler, 2006). A product can be classified as tangible or intangible. A tangible product is a physical object that can be perceived by touches such as a building, vehicle. An intangible product is a product that can only be perceived indirectly such as an insurance policy, culture and so on. AR is the most emerging technology which has been used in destination experience, when tourists use augmented reality application to experience in virtual environments, which is digital experience, also the intangible product surely.

Beliefs are the consumer's perceptions of how a product or brand performs. Product perception is often biased by preconceived ideas about product properties and is affected by the consumer's judgmental frame of reference. If these preconceived ideas are concerned what the product is, they are called perceptual or analytical expectations or product beliefs (Schifferstein, 2001). When consumers receive information about a product's attributes, the effect they are experiencing on their product evaluations depends on their belief, the product should be judged on the basis of hedonic versus utilitarian criteria. Especially, when tourists find out a new technology, according to the TAM theory, there are three product beliefs should be concerned in our research.

Technology acceptance model suggests two beliefs about an emerging technology perceived usefulness and perceived ease of use, which in determine person's attitude, intention to use it or behaviour when using the technology (Davis, 1989). Perceived usefulness is defined as the degree to which a user believes that using a particular system would enhance his or her job performance, which also positively impacts on the user's intention to use that system. Perceived ease of use is the degree to which one believes that using the technology will be free of effort. According to the development of TAM theory, researchers suggest that belief factors such as usefulness, enjoyment, trust, and performance may

influence one's attitude toward using a technology more strongly than by ease of use (Van der Heijden and Verhagen, 2004). Perceived enjoyment referring to Davis et al. (1992), was conceptualized as visitor's perception of enjoyment of technology use. Thus, the personal factor affecting beliefs about AR is considered in the context of using AR in tourism. In TAM, beliefs about the system are postulated to influence attitudes toward using the system, which is a parallel concept to customer satisfaction. These theories suggest that positive cognitive and affective beliefs about product/service are likely to induce satisfaction (Thong, Hong, and Tam, 2006; Van der Heijden, 2004). Previous studies have demonstrated a close relationship between belief and satisfaction toward information systems. They also proposed that the ease of use, enjoyment, and the relative advantage affect end-user satisfaction with the computing system and that only the relative advantage has a significant result. The purpose of this research is to investigate the acceptance of AR and how product beliefs of AR influence satisfaction with AR, even influence destination loyalty base on the TAM, when visitors use AR at a cultural heritage destination.

### ***AR satisfaction and destination loyalty***

Satisfaction, which can be defined as “the degree to which one believes that an experience evokes positive feelings” (Chen & Chen, 2010, p. 30). Not only satisfaction can measure the level of success and effectiveness about information system critical, but also leads to favourable consumer outcomes of positive Word-Of-Mouth and repurchase intention. When consumers who feel satisfied with the product, they could be willing to tell their family and friends, providing free advertisement and promotion. Among tourist behavioural studies, repeat visitation has been used to assess tourists' destination loyalty (Oppermann, 1998; Pritchard and Howard, 1997). Destination loyalty is operationally defined as the level of tourists' perceptions of a destination as a recommendable place (Chen, 2001).

According to prior studies, user satisfaction predicts e-loyalty, and reuse intention of IT, website revisits, WOM, repeat purchase (Thong, Hong, and Tam, 2006). Satisfaction is among the most influential factor in loyalty within the mobile service context, and if businesses try to develop long-lasting relationships and customer loyalty, they should make sure that the high satisfaction. In the tourism context, satisfaction with travel experiences contributes to destination loyalty. The degree of tourists' loyalty to a destination is reflected in their intentions to revisit the destination and in their willingness to recommend it (Oppermann, 2000). Wu and Liang (2011) also found that the satisfaction reported by tourists who participated in a white-water rafting activity have a significant and positive impact on loyalty. Jung (2015) indicates that intention to the recommendation was significantly affected by AR satisfaction.

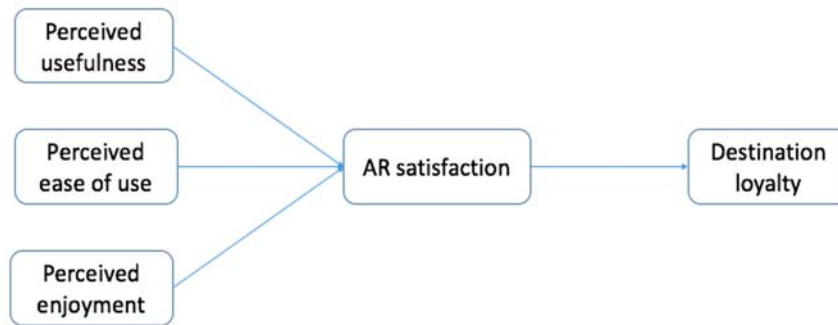
Thus, by incorporating TAM, we test the relationships between satisfaction with AR and destination loyalty. This study proposed the below model of AR satisfaction and destination loyalty (Figure 1). This formed the basis of the following hypothesis:

*Hypothesis 1: Perceived usefulness has a positive impact on the AR satisfaction.*

*Hypothesis 2: Perceived ease of use has a positive impact on the AR satisfaction.*

*Hypothesis 3: Perceived enjoyment has a positive impact on the AR satisfaction.*

*Hypothesis 4: Satisfaction with AR has a positive impact on the destination loyalty.*



**Figure 1. Main Research Model**

### ***Moderating effect of travellers' technology readiness***

TR, refers to the propensity for tourist to embrace and use new technology in the context of tourism (Parasuraman, 2000). TR also is a personality trait, which measures one's orientation to technologies. Travellers have the different level of tolerance when they evaluated service. Especially, the difference of traveller's characteristics may affect their evaluation when they use technologies and services, a moderation effect of travelers' characteristics had been suggested. Technology readiness also influences user's beliefs, perceptions or expectation about technologies, based upon which travelers evaluate their technology-related experience (Chung et al., 2015). As to the AR technology, in the tourism industry, there are many travelers who have great curiosity when they first use AR technology. They have a lot of interest in the technological experience brought by AR technology and feel very novel. But after the first use, the feeling of novel will be greatly reduced, even in the high satisfaction of AR technology at destination, also not necessarily for travelers to visit again have a positive impact, on this basis, the traveler's technology readiness level may also affect the relationship between the satisfaction with AR and destination loyalty.

TR is a multidimensional construct that captures both the optimism and innovativeness (positive) and discomfort and insecurity (negative) mental readiness for technological innovations (Parasuraman, 2000). Optimism refers to a positive attitude toward technology and a belief in increased control, flexibility, and efficiency in one's life. Optimism is associated with customers' perceived ease of use and usefulness of technology-enabled services positively, and also increase the customer's satisfaction (Thong, Hong, and Tam 2006). Innovativeness represents a tendency of a person to be a technology pioneer. Research also suggests that innovativeness positively relates to museum visitors' perceived impact of technology on consumption experience and is also related to the subsequent revisiting behavior through enhancing one's affinity with technology. According to the previous study, we suggest the following hypotheses (Figure 2):

*Hypothesis 5: Optimism moderates the proposed set of relationships in Figure 1.*

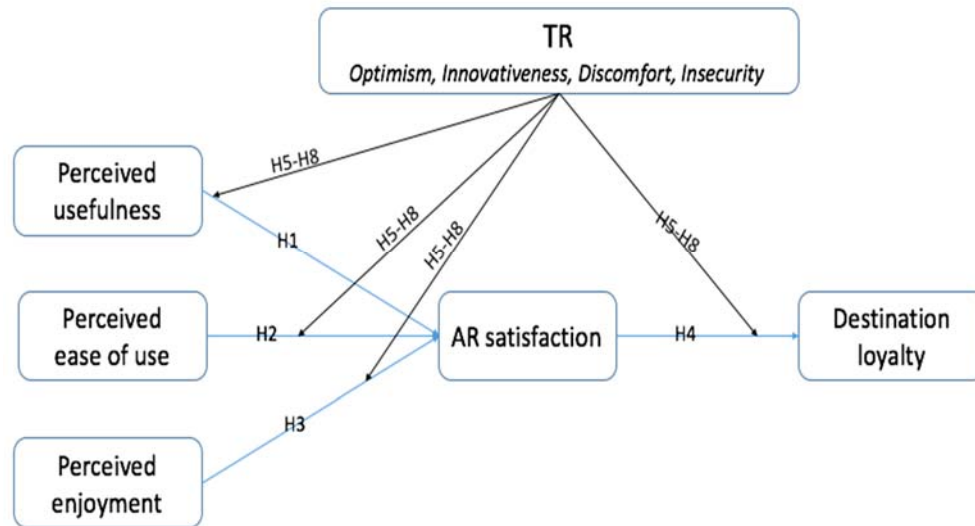
*Hypothesis 6: Innovativeness moderates the proposed set of relationships in Figure 1.*

Discomfort defined as lack of control perceived by a person when using a technology, and a sense of being overwhelmed by it. Discomfort which from the psychological aspect, is the significant process that mediates the interactive effect of employee rapport behaviour and use of technology on service evaluation. Insecurity refers to distrust and scepticism toward a technology. Discomfort and insecurity

can lead to distrust of new technologies, at the same time also lead to low perceived functionality and usefulness (Lu, Wang, and Hayes 2012). As such, the following hypotheses were proposed:

*Hypothesis 7: Discomfort moderates the proposed set of relationships in Figure 1.*

*Hypothesis 8: Insecurity moderates the proposed set of relationships in Figure 1.*



**Figure 2. Research Model**

## Research Methodology

The survey is conducted in a Korean context. A total of 145 questionnaires are collected at a heritage site scene for this survey. All measurement scale items were obtained directly from previous studies. A 7-point, Likert-type scale was used for all the measurement scale items, with anchors ranging from 1, strongly disagree, to 7, strongly agree.

To validate the proposed research model, a survey was conducted at Deoksugung Palace. Deoksugung Palace is one of the royal palaces in Korea and has over one million visitors annually. All respondents received a gift certificates worth KRW5,000 (about USD 5) as a reward for participation. A total number of 145 questionnaires were used for this study. Female respondents (64.8%) outnumbered male respondents (35.2%). Almost half of the respondents (46.2%) fell into the 20-29 years old bracket. Respondents who were attending university/college or who had university degrees or higher comprised a majority of the sample (74.4%). In terms of occupations, students were the largest proportion (60.0%), office workers comprised the second largest proportion (13.8%). More importantly, only 33.1% of respondents have not used AR in the past.

## Analysis and Result

To test the proposed research model, this study employed a structural equation modelling approach to test the hypotheses, as shown in Figure 1. The two-step approach advanced by Anderson and Gerbing (1992) was used for data analysis. First, testing the validity of the measurement model and then test the structural model and the research hypotheses.

**Table 1. Measurement model resulting from confirmatory factor analysis**

Latent Variable	Indicators	Factor loadings	AVE	Composite reliability	Cronbach's $\alpha$
Usefulness (PU)	PU1	0.889	0.817	0.95	0.946
	PU2	0.961			
	PU3	0.894			
	PU4	0.869			
Ease of use (PEOU)	PEOU1*	–	0.760	0.91	0.905
	PEOU2	0.828			
	PEOU3	0.902			
	PEOU4	0.889			
Enjoyment (ENJ)	ENJ4	0.802	0.758	0.93	0.925
	ENJ3	0.889			
	ENJ2	0.882			
	ENJ1	0.905			
AR satisfaction (SAT)	SAT1	0.843	0.783	0.92	0.905
	SAT2*	–			
	SAT3	0.842			
	SAT4	0.964			
Destination loyalty (LOY)	LOY1	0.841	0.739	0.89	0.890
	LOY2	0.807			
	LOY3	0.927			
	LOY4*	–			

Note: AVE, average variance extracted. \*The item was deleted after confirmatory factor analysis.

### **Measurement Model**

Confirmatory factor analyses (CFA) used AMOS 25.0 for testing the measurement model. CFA involves the revision of measurement model by dropping items that share a high degree of residual variance with other items. Three items were dropped due to this reason. Model fit for the measurement model is good (Chi-square = 221.203,  $df=109$ ,  $p<0.001$ ; goodness-of-fit index = 0.855; adjusted goodness-of-fit index = 0.797; normed fit index = 0.907; comparative fit index = 0.950). Emphasizly, alpha level be set to 0.10 ( $p<0.10$ ).

**Table 2. Discriminant validity**

	PU	PEOU	ENJ	SAT	LOY
PU	0.904				
PEOU	0.558**	0.872**			
ENJ	0.789**	0.648**	0.871		
SAT	0.589**	0.605**	0.610**	0.885	
LOY	0.267**	0.319**	0.310**	0.320**	0.859

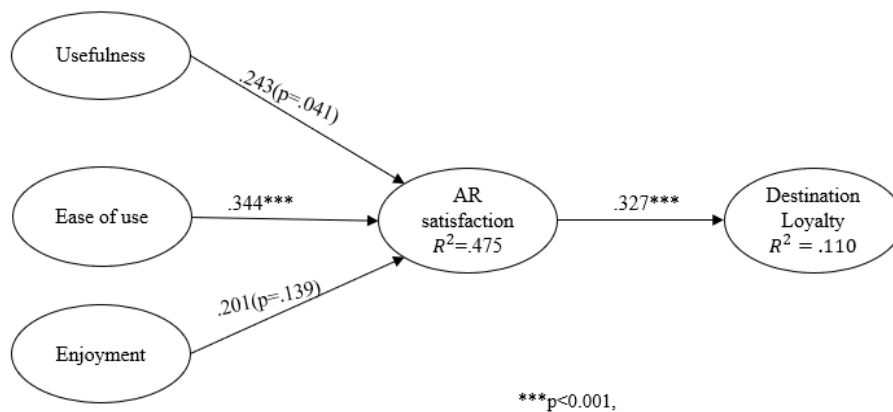
\*\*  $p<0.1$

Convergent validity was evaluated through the strength and significance of loadings, the AVE (average variance extracted) and the reliability estimates. As Table 1 shows, all factor loadings were satisfactory ( $>.80$ ), and all indicators are statistically significant ( $p<.001$ ). Furthermore, the composite reliability and Cronbach's Alpha was larger than  $.80$  and all AVEs were greater than  $.70$ . Therefore, according to Fornell and Larcker in 1981, the convergent validity of the constructs is supported.

To exam the discriminant validity, this study needs to compare the square root of the AVE for each construct with the correlations between each construct and the other constructs. If the square root of AVE of the constructs are greater than the intercorrelations between constructs in each case, then the evidence of discriminant validity can be provided. As Table 2 shows, discriminant validity is provided.

### ***Structural model***

The model fit indices for the structural model provided evidence of a good model fit (Chi-square = 225.267; Degrees of freedom = 112; goodness-of-fit index =  $.852$ ; adjusted goodness-of-fit index =  $.798$ ; Normed fit index =  $.906$ ; comparative fit index =  $.950$ ). According to Falk and Miller in 1992, when an individual  $R^2$ s is greater than the recommended level  $.10$ , the paths' significance associated with these variables was examined. As Figure3 shows, the exception of H3( $\beta=.201$ ,  $p=.139$ ), H1, H2 and H4 are supported by the path analysis results.



**Figure 3. Path analysis result**

The variables of Usefulness, Ease of use and Enjoyment explained 47.5% of the variance in AR Satisfaction, and AR Satisfaction explained 11.0% of the variance in Destination Loyalty. Hypotheses 1,2 and 3 postulated Usefulness, Ease of use and Enjoyment positive impact on AR satisfaction. Ease of use ( $\beta=.344$ ,  $p<.001$ ) and Usefulness ( $\beta=.243$ ,  $p=.041$ ) have a positive significant impact on AR satisfaction. However, the path from Enjoyment to AR satisfaction is not significant ( $\beta=.201$ ,  $p=.139$ ). Thus, H1 and H2 were supported. Hypothese4 postulated AR satisfaction positive impact on Destination Loyalty. Based on the result of data analysis, AR satisfaction impact on Destination Loyalty ( $\beta=.327$ ,  $p<.001$ ). Therefore, H4 was supported.

### ***Test for Moderating Effects of TR***

The method was used to test the moderating effects of TR called hierarchical moderated regression analyses (HRMA) which suggested by Cohen and Cohen. This is divided into two parts, the first part described the relationship between TR and the relation of Usefulness, Ease of use, enjoyment and AR



satisfaction. And the second part described the relationship of TR between AR satisfaction (Part A) and Destination Loyalty (Part B). Then, the analysis results were classified and summarized according to the four categories of TR: optimism, innovativeness, discomfort and insecurity. The results are shown as Table 3, Table 4, Table 5 and Table 6.

**Table 3. Moderated regression analysis of the effect of Optimism on Figure2**

	PART A				PART B			
Dependent variable	AR satisfaction				Destination Loyalty			
		Model 1	Model 2	Model 3		Model 1	Model 2	Model 3
Independent variables	Usefulness	0.290***	0.288**	0.349**	AR satisfaction	0.230**	0.167*	0.168*
	Ease of use	0.289***	0.289***	0.213**				
	Enjoyment	0.227**	0.226*	0.191*				
Moderating variables	Optimism		0.005	0.005	Optimism		0.210*	0.239*
Interactions	Usefulness ×Optimism			-0.272*	AR satisfaction ×Optimism			0.048
	Ease of use ×Optimism			0.152*				
	Enjoyment ×Optimism			0.193				
	$R^2$	0.443***	0.443	0.472*	$R^2$	0.076***	0.109*	0.114
	$\Delta R^2$	0.443***	0	0.029*	$\Delta R^2$	0.076***	0.032*	0.005
	Adjusted $R^2$	0.431***	0.427	0.445*	Adjusted $R^2$	0.070***	0.096*	0.095

\*\*\*=p<0.001 \*\*=P<0.05 \*=p<0.1

As Table 3 shows, In Part A, the addition of interaction terms to main effect relationship significantly improved the amount of variance explained for the AR satisfaction,  $\Delta R^2=0.029$ ,  $p<0.1$ . Three key determinants of AR satisfaction—usefulness ( $\beta=0.349$ ,  $p<0.05$ ), ease of use ( $\beta=0.213$ ,  $p<0.05$ ) and enjoyment ( $\beta=0.191$ ,  $p<0.10$ ) — all remained significant even after the variance was partitioned accordingly. Further, optimism explained a nonsignificant value in the model2 and model3  $\beta=0.005$ , ns,  $\beta=0.005$ ,ns.The interaction term Usefulness×Optimism and Ease of use×Optimism was significantly related to AR satisfaction,  $\beta=-0.272$ ,  $p<0.10$ ,  $\beta=0.152$ ,  $p<0.10$ . In contrast, the interaction term of enjoyment and optimism was not significantly related to AR satisfaction,  $\beta=0.193$ , ns. That means optimism was a pure moderator in the usefulness-AR satisfaction relationship and in the ease of use-AR satisfaction relationship, but there is no effect in the enjoyment-AR satisfaction relationship. In Part B, the addition of the interaction terms to the original model did not significantly increase the amount of variance explained for destination loyalty,  $\Delta R^2=0.005$ , ns, there was no interaction effect between AR satisfaction and destination loyalty(  $\beta=0.048$ , ns). However, the standard regression coefficients of the optimism both are significant in the model2( $\beta=0.210$ ,  $p<0.10$ ) and model3( $\beta=0.239$ ,  $p<0.10$ ), which means, optimism does not act as a moderator but as an independent antecedent of destination loyalty. Therefore, the results provided partial support for H5.

Follow by the same analysis procedure as hypothesis 5, as the Table 4 shows, the results provide partial support for H6. Table 5 indicated that discomfort was a quasi-moderator in the AR satisfaction-

destination loyalty relationship, the results provide partial support for H7. Moreover, Table 6 insecurity was an independent antecedent of destination loyalty. Hence, H8 was not supported.

**Table 4. Moderated regression analysis of the effect of Innovativeness on Figure2**

	PART A				PART B			
Dependent variable	AR satisfaction				Destination Loyalty			
		Model 1	Model 2	Model 3		Model 1	Model 2	Model 3
Independent variables	Usefulness	0.290**	0.280**	0.279**	AR satisfaction	0.230**	0.225***	0.227***
	Ease of use	0.289***	0.288***	0.297***				
	Enjoyment	0.227**	0.225**	0.191*				
Moderating variables	Innovativeness		0.036	0.048	Innovativeness		0.022	0.022
Interactions	Usefulness ×Optimism			-0.070	AR satisfaction ×Innovativeness			0.022
	Ease of use ×Optimism			0.136*				
	Enjoyment ×Optimism			0.224**				
$R^2$		0.443***	0.444	0.470*	$R^2$	0.076***	0.077	0.079
$\Delta R^2$		0.443***	0.001	0.026*	$\Delta R^2$	0.076***	0.001	0.002
Adjusted $R^2$		0.431***	0.428	0.443*	Adjusted $R^2$	0.070***	0.064	0.059

\*\*\*=p<0.001    \*\*=P<0.05    \*=p<0.1

**Table 5. Moderated regression analysis of the effect of Discomfort on Figure 2**

	PART A				PART B			
Dependent variable	AR satisfaction				Destination Loyalty			
		Model1	Model 2	Model 3		Model 1	Model 2	Model 3
Independent variables	Usefulness	0.290**	0.284**	0.289**	AR satisfaction	0.230**	0.238***	0.240***
	Ease of use	0.289***	0.276***	0.274***				
	Enjoyment	0.227**	0.256**	0.280**				
Moderating variables	Discomfort		-0.128*	-0.168**	Discomfort		0.153**	0.234**
Interactions	Usefulness ×Discomfort			0.132*	AR satisfaction ×Discomfort			-0.178**
	Ease of use ×Discomfort			-0.081*				
	Enjoyment ×Discomfort			0.071				
$R^2$		0.443***	0.455*	0.473	$R^2$	0.076***	0.102**	0.155**
$\Delta R^2$		0.443***	0.012*	0.018	$\Delta R^2$	0.076***	0.026**	0.053**
Adjusted $R^2$		0.431***	0.440*	0.446	Adjusted $R^2$	0.070***	0.090**	0.138*

\*\*\*=p<0.001    \*\*=P<0.05    \*=p<0.1

**Table 6. Moderated regression analysis of the effect of Insecurity on Figure 2**

Dependent variable	PART A				PART B			
		AR satisfaction			Destination Loyalty			
		Model 1	Model 2	Model 3		Model 1	Model 2	Model 3
Independent variables	Usefulness	0.290**	0.304**	0.348**	AR satisfaction	0.230**	0.226***	0.228***
	Ease of use	0.289***	0.288***	0.269***				
	Enjoyment	0.227**	0.229**	0.211**				
Moderating variables	Insecurity		-0.077	-0.082	Insecurity		0.086*	0.079*
Interactions	Usefulness ×Insecurity			-0.023	AR satisfaction ×Insecurity			0.021
	Ease of use ×Insecurity			0.102				
	Enjoyment ×Insecurity			-0.039				
	$R^2$	0.443***	0.448	0.457	$R^2$	0.076***	0.085	0.086
	$\Delta R^2$	0.443***	0.005	0.009	$\Delta R^2$	0.076***	0.009	0.001
	Adjusted $R^2$	0.431***	0.432	0.429	Adjusted $R^2$	0.070***	0.072	0.067

\*\*\* p<0.001, \*\* P<0.05, \* p<0.1

## Discussion and Conclusion

This study advances the understanding of the impact, which is satisfaction with AR on the destination loyalty toward a specified destination. And the moderating effect of tourists' TR on the relationship between product beliefs, AR satisfaction, and destination loyalty. Key finding includes confirmation that product beliefs (perceived usefulness, perceived ease of use) of augmented reality is positively associated with their satisfaction with AR, which affects their destination loyalty (H1, H2, H4). Partially confirming hypotheses 5 and 6, the results suggest that optimism and innovativeness positively moderate the relationship between product beliefs and satisfaction with AR, but not satisfied with AR – destination loyalty relationship. The technology readiness of a user to accept new technology is an important matter in the usage of state-of-the-art technology, such as augmented reality (1). More optimistic and innovative travellers weight technology-enabled service offerings as more important in service or product consumption than those less optimistic and innovative about technologies (Wang, So, and Sparks, 2014). As to the core elements of evaluation of travellers, which about AR product, the efficiency, convenience, and flexibility may influence more. As the evaluation of AR product tends to be more objective and based on the functional attributes of AR, it may be less subject to the influences of attitude and emotion. According to the results, it is obvious that if an AR user is satisfied with the AR product, he or she will have an intention to revisit the destination or recommend to their family and friends, which indicate the destination loyalty.

This study provides support for a moderating effect of discomfort, which influences the relationship between satisfaction with AR and destination loyalty, but security has no moderating effect of all relationship in the conceptual framework of this study (hypotheses 7 and 8). As one of the emerging

technologies that are used in the travel experience of tourist, AR is the novel and fancy technology. Thus, there are discomfort may bring to the users when travellers use the AR product to experience a destination. At the same time, a key factor of using AR is the esthetic response caused by the synthesis of its virtual objects in the real world. That is mean that people using AR have necessarily accepted visual appeal as a stimulus factor (Chung et al, 2015).

With the continuous development and progress of science and technology, the safety performance of science and technology products has been greatly improved, and many users no longer take a large proportion of security considerations when using emerging technology. Further, with the travellers' increasing familiarity with the technology environment, a belief that major security issues have been addressed more.

### **Implication and limitation**

Both theoretical and practical implications have been provided by the findings of this study. First of all, from the theoretical perspective, it previous studies associated with AR almost focused on medical scieand education domain. As to the field of tourism, mapping, mobile devices, APPs (augmented reality application), experience economy, and aesthetic experience have been researched. According to the previous studies about tourism, the full potential of AR technology for travel has not yet been widely researched and investigated. This study attempted to empirically explain the satisfaction with AR, especially, focusing on the product for tourists, and destination loyalty for a real-heritage destination. The findings show that usefulness and ease of use are the most significant factors for tourists when they use AR product during the travel experience. Therefore, in this study, by including TAM and product beliefs, it has tried to understand satisfaction with AR and destination loyalty, and the results of this study have verified that beliefs of AR product are important when tourists evaluate AR and the intention that revisit and recommend to others. Additionally, this study suggests the moderating effects of TR for the main relationship between product beliefs, AR satisfaction, and destination loyalty. The study of TR's role in shaping AR satisfaction, by focusing on product beliefs, leading up to satisfaction and the consequent behavioural outcomes. This study delineates how satisfaction may be conditioned on TR in series influence when tourists use AR technology at a cultural heritage site, providing greater insight into ways of enhancing tourists' destination loyalty.

As a practical implication, the findings show that product beliefs of augmented reality are positively associated with their satisfaction with AR, which affects their destination loyalty. Therefore, it is recommended that developers can pre-educate AR to improve the AR's popularity and related experience of the potential users before the new application is promoted. And, the design should be developed such that the efficiency, convenience, and flexibility to facilitate people's use of the emerging technology. To develop the AR satisfaction and destination, the design and development should focus on perceived usefulness and ease of use. To be specific, the marketers and designers should make the AR product tend to focus on the information contents to improve practicality and convenience. Further, the results show that the insecurity has not been an important element when tourist use a new technology. Due to the development of science and technology, safety performance has been continuously enhanced. Even though, the marketers and system developers also should pay attention to make sure the safety of AR applications.

This study has some limitations and recommendations for future research. First, this study did not mention and attention to the design of user interface and easy navigation. However, previous studies

have proven that they both are key factors for the continued utilization of an application. Thus, the interface design and easy navigation of the AR application can be studied as a variable in future research. The random examples were consisted of young people and those who were willing to try an emerging technology during travel experience. And, this investigation was conducted in cultural heritage sites, and the effects of AR must be different in the other types of destination. Finally, the beliefs, which are researched in this study also have some limitations. There are also many products beliefs should be concerned when investigating satisfaction and destination loyalty of tourists. Thus, future research should find more product beliefs about AR and verify these points.

## References

- Anderson, R. E., and S. S. Srinivasan. 2003. "E-satisfaction and E-loyalty: A Contingency Framework." *Psychology & Marketing* (20:2), pp.123–138.
- Azuma, R., Billinghurst, M., & Klinker, G. (2011). Special section on mobile augmented reality. *Computers & Graphics* (35:4), pp. vii–viii.
- Anderson JC, Gerbing DW. 1992. Assumptions and comparative strengths of the two-step approach. *Sociological Methods & Research* (20:3), pp.321-333.
- Chen,S.-C.,H.-H.Chen,and M.-F. Chen. 2009. "Determinants of Satisfaction and Continuance Intention towards Self-Service Technologies." *Industrial Management & Data Systems* 109 (9): 1248–63.
- Chen, C. F., & Chen, F. S. 2010. Experience quality, perceived value, satisfaction and behavioral intentions for heritage tourists. *Tourism Management*, (31), pp.29-35.
- Chung, N., H. Han, and Y. Joun. 2015. "Tourists' Intention to Visit a Destination: The Role of Augmented Reality (AR) Application for a Heritage Site." *Computers in Human Behavior*, 50, pp.588–599.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), pp.319–340.
- Davis, F. D, Bagozzi RP, Warshaw PR. 1989. User acceptance of computer technology: a comparison of two theoretical models. *Management Science*, 35(8), pp.982–1003.
- Davis, F.D, and Richard P. Bagozzi , Paul R. Warshaw. 1989"User Acceptance of Computer Technology:AComparison of Two Theoretical Models", *Management Science*, 35:8, pp.982-1003
- Fornell C, Larcker D. 1981. Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1): pp.39-50.
- Gretzel, U., H. Werthner, C. Koo, and C. Lamsfus. 2015. "Conceptual Foundations for Understanding Smart Tourism Ecosystems." *Computers in Human Behavior* ,50:5, pp.58–63.
- Lin, J.S.C. and Hsieh, P.L..2007 "The influence of technology readiness on satisfaction and behavioral intentions toward self-service technologies", *Computers in Human Behavior*, 23(3), pp.1597-1615.
- Jung, T., M. C. Tom Dieck, H. Lee, and N. Chung. 2016. "Effects of Virtual Reality and Augmented Reality on Visitor Experiences in Museum." Paper presented at: Information and Communication Technologies in Tourism 2016, Bilbao, Spain, February 2–5.
- Jung, T., M. C. Tom Dieck, H. Lee, and N. Chung. 2015. "Examining the cultural differences in acceptance of mobile augmented reality: Comparison of South Korea and Ireland" rom book Information and Communication Technologies in Tourism 2015: Proceedings of the International Conference in Lugano, Switzerland, February 3 - 6, 2015 (pp.477-491)

- Kotler, P., Armstrong, G., Brown, L., and Adam, S. (2006) Marketing, 7th Ed. Pearson Education Australia/Prentice Hall.
- Oppermann, M. 1998, "Destination threshold potential and the law of repeat visitation", *Journal of Travel Research*, 37(2), pp.131-137.
- Oppermann, M. 2000. Tourism destination loyalty. *Journal of Travel Research*, 39(1), 78–84.
- Pritchard, M.P. and Howard, D.R. 1997. "The loyal travel: examining a typology of service patronage", *Journal of Travel Research*, (35:4), pp. 2-10.
- Parasuraman, A. 2000. Technology Readiness Index (TRI) a multiple-item scale to measure readiness to embrace new technologies. *Journal of Service Research*, (2:4), pp.307–320.
- Schiffstein H.N.J. 2001. "Effects of product beliefs on product perception and liking". In: Frewer L, Risvik E, Schiffstein H (eds) Food, people and society: a European perspective of consumers' food choices. Springer Verlag, Berlin.
- Thong, J. Y., S. J. Hong, and K. Y. Tam. 2006. "The Effects of Post- Adoption Beliefs about the Expectation-Confirmation Model for Information Technology Continuance." *International Journal of Human-Computer Studies* 64 (9): pp.799–810.
- Van der Heijden, H. 2004. "User Acceptance of Hedonic Information Systems." *MIS Quarterly* (28:4), pp.695–704.
- Wang, Y., K. K. F. So, and B. A. Sparks. (2014). "What Technology- Enabled Services Do Air Travelers Value? Investigating the Role of Technology Readiness." *Journal of Hospitality & Tourism Research* 1–26. doi:10.1177/1096348014538050.
- Wu, C. H. –J., & Liang, R. –D. (2011). The relationship between white-water rafting experience formation and customer reaction: A flow theory perspective. *Tourism Management*, (32), pp.317–325.
- Wang, Y., Kevin.K, Beverley A. 2017 "Technology Readiness and Customer Satisfaction with Travel Technologies: A Cross-Country Investigation" *Journal of Travel Research*, (56:5), pp.563–577.