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Research Paper

Factors influencing Gen Z's intention to use VR in tourism based on TPE perspectives

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Abstract

This quantitative study attempts to fill a significant gap in the existing body of research regarding Gen Z's perception of accepting virtual reality (VR) tourism based on the Technological Personal Environmental (TPE) framework. The research model comprises seven latent variables and two moderating factors. A questionnaire was administered online to collect 168 valid responses. The final data sample was then analyzed using Structural Equation Modeling (SEM). The results reveal that social influence, as an environmental factor, is the most prominent predictor of VR tourism acceptance among Gen Z, followed by perceived enjoyment, relative advantage, and perceived immersion, respectively. Conversely, network externalities and perceived ease of use showed no statistically significant impact. Moreover, neither gender nor age moderated the direct effects within the model. These findings highlight the critical role of peer recommendations in influencing Gen Z's engagement with VR tourism, suggesting that tour operators and VR developers should adopt targeted marketing strategies that harness social media platforms and encourage peer-to-peer sharing. Additionally, promoting the tangible benefits of VR tourism and enhancing immersive experiences can further increase acceptance and foster growth within the industry.

Keywords: Technological, Personal, Environmental, Tourism, Virtual reality.

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Introduction

Virtual Reality (VR) is a computer-generated three-dimensional simulation of a three-dimensional environment that imitates real-world experiences through specialized electronic equipment such as sensor-equipped helmets and screens (Lee et al., 2019). Through immersive and interactive elements, VR replicates real-life situations, engaging all sensory perceptions without the need for expensive resources or exposing individuals to potentially hazardous circumstances (Bayram and Caliskan, 2021; Karaman ÖZLÜ and Kaya, 2022). VR particularly stimulates users' senses of sight, hearing, touch, smell, and taste in an immersive manner (Li and Chen, 2019).

In recent years, VR has been widely utilized across various fields, including training and education (Pottle, 2019), e-commerce (Martínez-Navarro et al., 2019), and medicine (Javaid and Haleem, 2020). Further, VR has been adopted for tourism for various purposes, such as marketing, management, planning, education, historical preservation, entertainment, accessibility, and information exchange (Wiltshier and Clarke, 2017). A study by Leung et al. (2023) declared that VR was useful in enticing individuals to visit tourist attractions. Other findings showed that VR may increase visitors' interest in the tourist site and motivate them to travel to the tourist attractions they view through the VR application (An et al., 2021). Vishwakarma et al. (2019) argued that VR was an important marketing tool for the tourism industry. This comment aligns with the assertion of Alam et al. (2022) thatvisuall imagery has frequently been utilized to support the marketing and promotional aspects of the tourism industry.

Since the COVID-19 pandemic first appeared in 2020, there has been an increase in studies investigating the use of VR in tourism. For instance, Schiopu et al. (2022) underline that VR use in tourism is highly sought after as long as it offers the user comfort and advantages. Likewise, Wei et al. (2019) believe the pandemic will encourage people to turn to virtual tourism to relieve stress when unable to visit tourist destinations in person. These consumers gain from the availability of VR as a substitute for enjoying tourist objects without having to be physically present and being exposed to the virus (Schiopu et al., 2021). Tourism industry companies are also considering VR as a substitute to satisfy the demands of constrained tourism activities.

Agustina and Astari (2022) found that Gen Z is the generation that enjoys travel. As of 2020, Gen Z represented the largest demographic group in Indonesia, accounting for 27.94% of the population (Sinaga, 2021). IDN Research Institute (2024) stated that Gen Z in Indonesia considers travel a means to escape their daily routine and "heal" their mentality. Therefore, Indonesia's large number of Gen Z-ers should be significant in tourism. However, according to a study by Ramadhanty et al. (2021), VR technology is not widely used for tourism in Indonesian society. Meanwhile, Turner (2015) argued that Gen Z is known to be a technologically adept generation. Therefore, using VR technology should not be an issue for Gen Z-ers. Thus, this study will provide a fresh viewpoint on Gen Z's intention to experience VR technology. Tourism-related businesses can use the findings to create alternative marketing plans for their tourist attractions.

In order to explain the factors that affect Gen Z's acceptance of VR tourism, this research employs the Technological Personal Environmental (TPE) framework. The TPE framework is a theoretical model of individual acceptance of technology.

According to Jiang et al. (2010), the TPE framework is a development of the Technological-Organizational-Environmental (TOE) framework. Unlike the TOE framework, which is considered more suitable for assessing technology acceptance in an organizational context (Karsen et al., 2019), the TPE framework is considered more appropriate for evaluating individual technology acceptance (Hunafa et al., 2017).

The TPE framework offers a comprehensive perspective on technology adoption within a specific context. It comprises three fundamental dimensions: the technological, personal, and environmental. The technological dimension relates to the tools and methods commonly used to achieve specific objectives. The personal dimension focuses on individual traits and characteristics that influence behavior, while the environmental dimension encompasses external factors such as market competition, environmental conditions, and social influences. The TPE framework is considered especially reliable for evaluating individual-level models of technology acceptance.

This framework is better suited for application in an individual environment to investigate the factors that encourage people to accept new technologies (Jiang et al., 2010; Karsen et al., 2019). Hunafa et al. (2017) demonstrated that TPE was an effective framework for examining individuals' intentions. Therefore, by using the TPE framework, this study will address research questions to understand the adoption of VR tourism for Gen Z as follows: (1) What factors drive Gen Z to use VR tourism? (2) Does gender or age significantly moderate Gen Z's intention to accept VR tourism? The findings of this research will aid the tourism industry in gaining a better understanding of the significant factors that motivate Gen Z to adopt VR tourism, thus providing valuable insights for developing alternative marketing strategies and enhancing VR-based tourism experiences.

Literature Review

Virtual Tour

Hassani and Bastenegar (2020) described virtual tours as digital representations that allow users to access audio, text, and video data from real-world locations, providing them with the sensation of visiting places such as museums, historical sites, or natural attractions, even if they are unable to travel there physically. Similarly, Dybsand (2022) defined virtual tours as computer-mediated experiences that create a sense of "being there," often referred to as telepresence. These definitions align with Kim et al. (2020), who explained that virtual tourism seeks to offer individuals immersive experiences through 3D visual simulations based on real environments. By allowing potential visitors to experience the site virtually, they can gain a better understanding of its offerings, potentially increasing their comfort and willingness to visit in person in the future.

Previously, there was a presumption that engaging in tourism necessitated physical travel to a location (Moura et al., 2023). However, the advent of information and communication technology (ICT) has significantly altered the business landscape in the tourism industry. Virtual Reality (VR) stands out as a widely used ICT tool for creating virtual tours, with its potential to revolutionize the travel and tourism sectors being recognized for some time (Ouerghemmi et al., 2023). VR immersively stimulates users'

senses of sight, hearing, touch, smell, and taste within a computer-simulated 3D environment (Li and Chen, 2019). The terms "VR travel" and "VR tourism" refer to applications of VR showcasing popular tourist destinations in the real world (Kim et al., 2020; Gibson and O'Rawe, 2018). In the tourism industry, VR finds applications across various domains, including marketing, management, planning, education, historical preservation, entertainment, accessibility, and information exchange (Wiltshier and Clarke, 2017).

As technology advanced, Fan et al. (2022) discovered that using VR tourism to acquaint customers with foreign destinations or hotels reduced their perception of danger or anxiety. With the widespread use of the internet, many individuals have access to travel and tourism resources, including written materials, images, and videos, which are not only readily available but also cost-effective to access. According to Kim et al. (2020), VR technology has the potential to enhance tourists' experiences in tourism-related activities.

Since the onset of the COVID-19 pandemic in 2020, there has been a surge in research exploring the use of VR in tourism. For example, Schiopu et al. (2022) emphasize that VR's popularity in tourism hinges on its ability to provide users with comfort and benefits. Similarly, Zhang et al. (2022) suggest that the pandemic will drive people to turn to virtual tourism to alleviate stress. When individuals cannot physically visit tourist destinations, they can benefit from VR technology as a substitute, allowing them to experience tourist attractions without being physically present and risking exposure to the virus (Cheng and Huang, 2022; Schiopu et al., 2021).

Meanwhile, stakeholders in the tourism industry are eager to leverage robust marketing tools to stimulate consumer interest in physically visiting tourist destinations once the COVID-19 pandemic subsides. In order to provide captivating visual content, Yung et al. (2021) discovered that VR has the potential to evoke positive emotions among customers and inspire them to consider visiting a location in person in the future. Thus, there is a widespread belief that VR can serve as a valuable instrument for businesses to attract prospective tourists to physical tourist destinations. This assertion is corroborated by various scholarly sources, including Tussyadiah et al. (2018), An et al. (2021), Panduputri et al. (2021), and Leung et al. (2023). This perspective is also consistent with previous research findings indicating that VR can be an effective marketing tool when users perceive value in their experience (Vishwakarma et al., 2019; Ramadhanty et al., 2021). However, Schiopu et al. (2021) have raised concerns about the sustainability of the desire to engage in physical activities following exposure to the benefits of VR technology. There is uncertainty about whether the inclination to physically visit tourist sites will persist once the COVID-19 pandemic has ended.

Mastroberardino et al. (2022) argue that VR can potentially enhance user interactions with tourist sites. According to Hu et al. (2020), the utilization of VR technology could enhance the museum experience by enabling visitors to visually interact with objects that are physically difficult to access, such as museum artifacts. These assertions align with the claims made by Kim et al. (2020), who suggest that VR allows consumers to experience tourist attractions in a manner comparable to real-life circumstances. However, it is crucial to carefully consider the quality of VR experiences to avoid ineffectiveness (Li and Chen, 2019), as users expect an entertainment element. Users may be less inclined to explore tourist destinations through VR solutions without this

entertainment aspect.

Technological Personal Environmental (TPE) Framework

The Technological-Personal-Environmental (TPE) framework provides a theoretical model for understanding individual acceptance of technology. Jiang et al. (2010) posit that the TPE framework builds upon the Technological-Organizational-Environmental (TOE) framework. While the TOE framework is commonly used for assessing technology acceptance in organizational contexts (Karsen et al., 2019), the TPE framework is deemed more appropriate for evaluating individual technology acceptance (Hunafa et al., 2017; Khan and Ali, 2018; Putri et al., 2020). The TPE framework comprises three primary components: technology, the individual, and the environment. The technology component involves various methods and tools utilized to achieve specific objectives. The personal component focuses on the qualities and characteristics that constitute an individual's personality. In contrast, the environmental component addresses external factors such as competition, regulations, environmental conditions, and social influences.

The TPE framework is widely recognized as a reliable tool for evaluating individual technological acceptance models. Various previous studies utilizing the TPE framework are presented in Table 1. To our knowledge, no research utilizing the TPE Framework has been conducted in the field of VR tourism. The TPE framework, used in earlier studies, shares similarities with technology adoption contexts like mobile payments, online food delivery, and marketing needs, as they all follow a similar process: determining how individuals or groups decide to adopt or use new technologies. Common factors such as perceived ease of use and perceived enjoyment are often highlighted in studies on VR technology acceptance in tourism (Prados-Castillo et al., 2024; Shao et al., 2020; Sancho-Esper et al., 2023). Additionally, both personal and environmental factors play a role in the adoption of VR for tourism (Prados-Castillo et al., 2024; Guo et al., 2024). The TPE framework aims to identify the key factors influencing individuals' adoption of VR technology in tourism, helping stakeholders to create more relevant user experiences and develop more effective marketing strategies.

Table 1: TPE framework studies

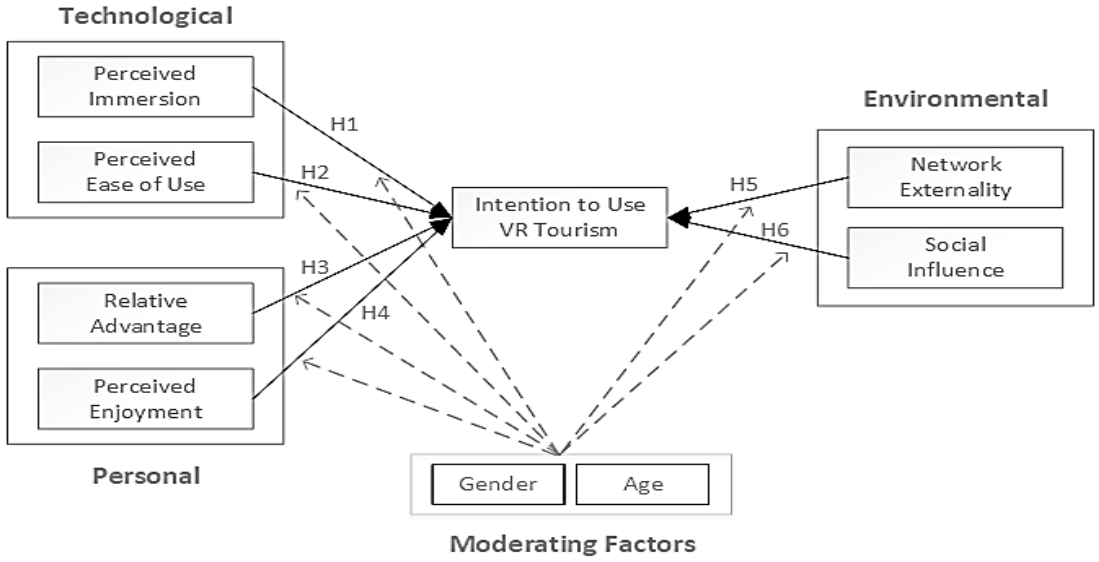
Topic	Variables	Authors
WIoT Adoption in Healthcare Crises	WIoT devices' technical, perceived social usefulness, epidemic ecosystem, regulatory environment.	Guerra et al. (2023)
Adoption of Online Food Delivery	Price Value, Information Quality, Convenience, Personal Innovativeness, Prior Online Purchase Experience, Compatibility, Subjective Norm, eWOM	Tran and Tran (2020)
Mobile Payment Adoption	User Innovativeness, Brand Image, Perceived Usefulness, Perceived Risk, Perceived Ease of Use.	Tran et al. (2018)
Mobile Payment Adoption	Social Influence, Credibility Additional Value, Normative	Putri et al. (2020)

Topic	Variables	Authors
Acceptance of Digital Marketing Devices	Social Image, Facilitating Conditions, Payment Culture, Lifestyle Compatibility. Subjective Norms, Self-efficacy, Perceived Usefulness, Perceived Ease of Use, Perceived Behavioral Control, Attitude, Vendor Support, Competition, Government Influence.	Otika et al. (2021)

Research Model and Hypotheses Development

The research model development was based on existing relevant research and adopted the TPE framework perspective. As shown in Figure 1, the model comprises six different constructs that can be grouped into three aspects: technological, personal, and environmental. According to the TPE framework, these three impacts are essential in driving Gen Z's intention to use VR tourism. One of the technological constructs is perceived ease of use. This construct is one of the variables in a well-known adoption model, the Technology Acceptance Model (TAM), proposed by Davis (1989). Additionally, in the environmental aspect, there is also the construct of social influence, which is one of the variables in another well-known adoption framework, the Unified Theory of Acceptance and Use of Technology (UTAUT) by Venkatesh et al. (2003). The research model utilizes two moderating factors, namely gender and age, to make the findings more comprehensive.

Figure 1: Research model



Several studies have examined the role of technology as an essential aspect for users to accept new technology in various contexts (Guerra et al., 2023; Karsen et al., 2019; Wang et al., 2016). This study includes perceived immersion and perceived ease of use as two technological factors to explain user perceptions toward VR tourism usage. A study by Vishwakarma et al. (2019) defined perceived immersion as the experience of

having the sensation of being physically present in a nonphysical reality. Several authors revealed that perceived immersion in VR technology was a strong predictor for travelers' decisions to use VR tourism (Gibson and O'Rawe, 2018; Vishwakarma et al., 2019). On the contrary, Wei et al. (2019) reported that the influence of perceived immersion on user intention toward VR usage was insignificant. Thus, this study postulates the following hypothesis:

H1 Perceived immersion positively affects Gen Z's intention to use VR tourism.

This study refers to perceived ease of use as the level of difficulty that users experience when interacting with VR applications (Lisana, 2020). As mentioned by several scholars (Alam et al., 2022; Vishwakarma et al., 2019; Wei et al., 2019), innovative technology that is hard to understand and complex to use will negatively affect user intention, leading to a decreased system adoption rate. Gen Z, as digital natives, has high expectations for smooth and effortless digital experiences, which influence their adoption decisions. If Gen Z believes that using virtual reality to experience a location is easy, then they are more likely to intend to use the technology. Most of the prior studies have confirmed the significance of perceived ease of use as the most significant determining factor for travelers in deciding whether or not to use VR technology (Adegoke et al., 2022; Gibson and O'Rawe, 2018; Vishwakarma et al., 2019). However, Sánchez et al. (2021) and Kim and Hall (2019) concluded a different result, showing no significant impact of perceived ease of use on the acceptance of VR technology. Studies related to VR tourism reveal that ease of use is a critical factor in adopting VR technology in tourism (Shao et al., 2020; Teng et al., 2024). Research by Prados-Castillo et al. (2024) indicates that individuals with prior experience using similar technologies tend to find VR tourism applications easier to use, which, in turn, positively influences their intention to adopt the technology. Therefore, this study develops the following hypothesis:

H2 Perceived ease of use positively affects Gen Z's intention to use VR tourism.

This study employs two constructs, namely relative advantage and perceived enjoyment, to explain how personal factors affect Gen Z's intention to use VR tourism. In the VR tourism context, relative advantage refers to the degree to which an individual believes that using a particular VR application will provide some benefits (Alam et al., 2022). Research by Vishwakarma et al. (2019) declared that when travelers think that using VR applications makes it easier for them to decide where they want to go, they think VR is more useful, leading to increased intention to use VR systems. Previous studies have also proven that relative advantage is a key driver in developing travelers' intention to use VR tourism (Adegoke et al., 2022; Alam et al., 2022; Kim and Hall, 2019; Sánchez et al., 2021). Hence, based on the evidence, the following hypothesis is framed:

H3 Relative advantage positively affects Gen Z's intention to use VR tourism.

The second personal factor is perceived enjoyment, which is defined as the extent to which a certain VR system is experienced as fun (Lee et al., 2019). A study conducted by Alex and O'Rawe (2018) discovered that perceived enjoyment influenced tourists to adopt VR tourism. Several authors also supported the finding (Kim and Hall, 2019; Vishwakarma et al., 2019; Wei et al., 2019), showing the level of enjoyment

experienced while using VR to explore a site substantially impacts the intention to utilize VR tourism. Considering that enjoyment has been consistently included in recent technology adoption research, there is no doubt that this variable deserves further investigation in the context of VR tourism. Thus, this study proposes the following hypothesis:

H4 Perceived enjoyment positively affects Gen Z's intention to use VR tourism.

This study proposes two environmental determinants, network externalities and social influence, that have been investigated by some authors to significantly influence user acceptance of immersive technologies (Chandra and Kumar, 2018; Saleem et al., 2023). Gen Z has grown up in a highly connected digital world where the value of a product or service depends on its user base. Gen Z relies heavily on peer influence and social validation when making adoption decisions. They are more likely to engage with a service if many of their peers are using it. Lisana (2020) argued that the number of people using a product or service influences its value. The number of other users already connected to a network is an important factor in determining the value of joining that network (Xu et al., 2017). Prior studies have actively investigated the role of network externalities in developing users' intentions to adopt technology in various contexts, including mobile payment (Lisana, 2020), online games (Xu et al., 2017), and online banks (Miranda and Balqiah, 2021). Other studies found that network externalities can enhance the VR tourism experience (Zhu et al., 2024; Ghali et al., 2024). However, this factor remains underexplored in the context of the adoption of VR technology. Hence, the following hypothesis is posited:

H5 Network externalities positively affects Gen Z's intention to use VR tourism.

Social influence, as the second environmental factor, is defined as an individual's perception of the degree to which influential people around them believe he or she ought to adopt a new system (Jung et al., 2018). The significant effect of social influence on developing user intentions has been confirmed and well-established by the majority of VR tourism acceptance scholars (Adegoke et al., 2022; Alam et al., 2022; Wei et al., 2019). However, an empirical study by Sánchez et al. (2021) revealed that the impact of social influence did not play a significant role in determining users' decisions to utilize VR applications in National Parks. Therefore, this study posits the following hypothesis:

H6 Social influence positively affects Gen Z's intention to use VR tourism.

Methodology

This quantitative cross-sectional study adopts the guidelines from Neuman (2000) to examine the factors affecting the intention among Gen Z-ers toward VR tourism usage. Data were collected using a questionnaire that consisted of 23 questions that represent seven constructs used in the research model. In detail, Table 2 lists all measurement items of each construct previously validated by many studies. Participants rated their responses on a 5-point Likert scale, with 1 and 5 representing strong disagreement and strong agreement, respectively. In order to guarantee the reliability of the survey, two professionals with extensive knowledge of VR platforms reviewed the questionnaire

and offered informative feedback as well as suggestions. Subsequently, five participants were invited to participate in a pilot study to gather feedback before finalizing the questionnaire.

Table 2: Measurement instruments

Construct	Indicator	Item	Source
Perceived Immersion	PIM1	During the VR tourism experience, I feel like I am in another world.	Vishwakarma et al. (2019)
	PIM2	Once in VR tourism, I was clueless of what was going on around me.	
	PIM3	Once into VR tourism, I felt disconnected from the outside world.	
	PIM4	During my VR tourism experience, I felt as if I was actually traveling.	
Perceived Ease of Use	PEU1	I find VR tourism easy to use.	Kim and Hall (2019)
	PEU2	When I use tourism-related VR activity, I can easily get what I want.	
	PEU3	It is not difficult to engage in tourism-related VR activities.	
	PEU4	I can easily manipulate tourism-related VR activity.	
Relative Advantage	RA1	Experiencing tourism-related VR activity is beneficial.	Alam et al. (2022)
	RA2	The tourism-related VR activity enhanced my knowledge.	
	RA3	It is beneficial to gather information by participating in tourism-related VR activities.	
Perceived Enjoyment	PEJ1	I have a lot of fun getting information by playing with VR tourism.	Jung et al. (2018)
	PEJ2	I enjoy using VR tourism.	
	PEJ3	Using VR tourism does not bore me.	
Network Externality	NE1	I saw a good number of people use VR tourism.	Xiao et al. (2018)
	NE2	I think most of my friends are using VR tourism.	
	NE3	A wider variety of VR tourism apps will be offered.	
Social Influence	SI1	My family and/or friends think I should use VR tourism.	Sánchez et al. (2021)
	SI2	People whose opinions I value would prefer I use VR tourism.	
	SI3	My friends and/or family support me in using VR tourism.	
Intention to Use	BI1	I plan to use VR tourism for my travel plan in the near future.	Vishwakarma et al. (2019)
	BI2	I intend to use VR tourism in my travel plan in the future.	
	BI3	I can see myself using VR tourism in my travel plan in the future.	

Regarding participant selection, this study applied a purposive sampling method. The targeted respondents were Gen Z-ers who have used VR technology while living in an urban area in Indonesia. The minimum number of respondents in this study was determined based on several established SEM guidelines. According to Hair et al. (2010), the sample size should be at least five times the total number of indicators. With 23 indicators used in this study, a minimum of 115 respondents was required. Additionally, Kline (2016) recommends a minimum of 20 respondents per factor; given that this study includes seven latent factors, the minimum required sample would be 140 respondents. Furthermore, Mahlke et al. (2019) suggest that a sample size ranging from 100 to 400 is suitable to ensure more precise results in SEM analysis. After data were collected, the study tested the validity and reliability of each construct using Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA), respectively. The valid data were then analyzed using the structural equation modeling (SEM) method to confirm the proposed hypotheses.

Results

Preliminary Analysis

A total of 181 responses were initially collected for this study, all of which were from individuals belonging to Generation Z. After conducting data cleaning procedures to identify and remove outliers, 13 responses were excluded, resulting in a final sample of 168 valid respondents. This sample size meets the recommended minimum thresholds for SEM, following the recommendations of Hair et al. (2010), Kline (2016), and Mahlke et al. (2019). Table 3 displays the characteristics of the participants, revealing that male respondents were more frequent than female respondents. The age range of the respondents was 17 to 27 years old, with the majority falling between 17 and 20 years of age.

Table 3: Profile of participants

Characteristics	Frequency	Percentage (%)
Gender		
Male	106	63.1
Female	62	36.9
Age		
17 to 20	89	53.0
21 to 26	79	47.0

Following the validity test conducted in this study, the initial iteration revealed that most factor loading values are deemed acceptable, with values exceeding 0.708, as recommended by Hair et al. (2010). However, one indicator, PI1, exhibited a factor loading value below 0.708. Consequently, PI1 was eliminated as an indicator from the perceived immersion latent variable.

Subsequently, a reliability test was conducted utilizing Composite Reliability (CR), Average Variance Extracted (AVE), and Cronbach's Alpha. The CR test evaluates the reliability of each latent variable, which is expected to exceed 0.7. The AVE test should

yield a value surpassing 0.5, while the Cronbach's Alpha test should yield a value greater than 0.7, as suggested by Hair et al. (2019).

Table 4 presents the final results of factor loading, CR (Composite Reliability), AVE (Average Variance Extracted), and Cronbach's alpha values. All CR values for latent variables are satisfactory. Although perceived immersion shows the lowest Cronbach's alpha value, it is still within an acceptable range. Conversely, perceived ease of use and relative advantage demonstrate strong Cronbach's alpha values. Additionally, perceived enjoyment, network externalities, social influence, and intention to use display excellent Cronbach's alpha values.

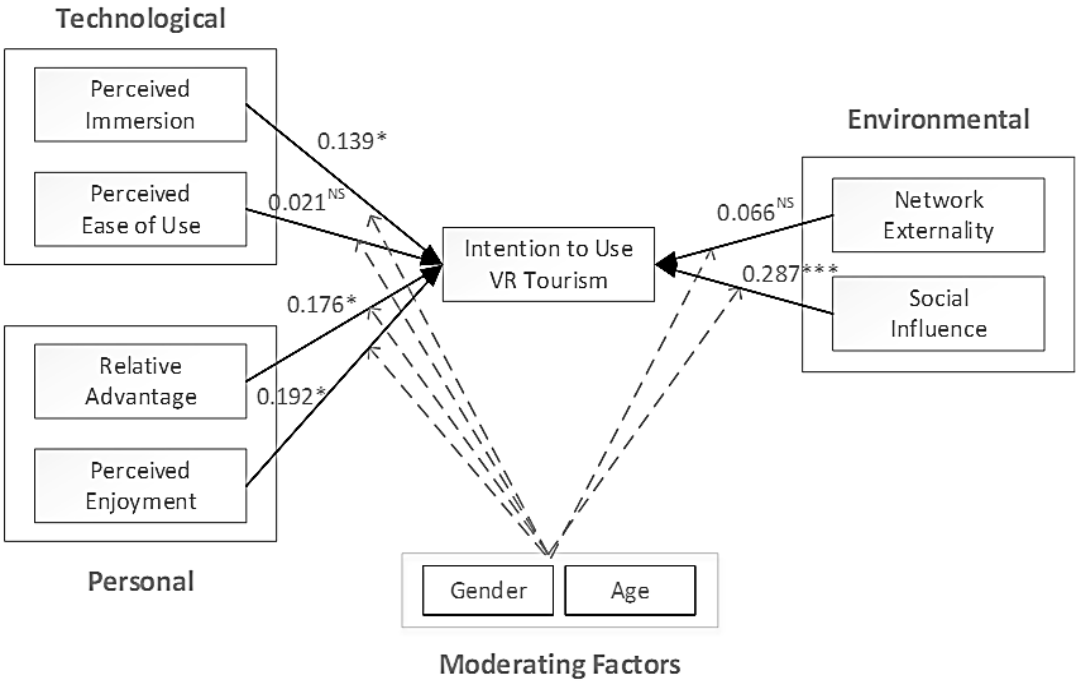
Table 4: Validity and Reliability

Latent Variable	Indicator	Factor Loading	CR	AVE	Cronbach's Alpha	Interpretation
Perceived Immersion	PI2	0.752	0.856	0.665	0.756	Acceptable
	PI3	0.820				
	PI4	0.870				
Perceived Ease of Use	PEU1	0.871	0.917	0.735	0.881	Good
	PEU2	53.0				
	PEU3	47.0				
	PEU4	0.872				
Relative Advantage	RA1	0.919	0.912	0.777	0.861	Good
	RA2	0.884				
	RA3	0.839				
Perceived Enjoyment	PENJ1	0.937	0.956	0.878	0.931	Excellent
	PENJ2	0.947				
	PENJ3	0.927				
Network Externalities	NE1	0.954	0.953	0.871	0.927	Excellent
	NE2	0.950				
	NE3	0.895				
Social Influence	SI1	0.950	0.971	0.917	0.954	Excellent
	SI2	0.967				
	SI3	0.955				
Intention to Use	BI1	0.924	0.943	0.847	0.910	Excellent
	BI2	0.933				
	BI3	0.904				

Model Analysis

The research model was analyzed using the AMOS software. Figure 2 presents the detailed results of the hypotheses testing proposed in the research model. The notation "NS" indicates that the relationship between variables is insignificant, while the notation ***, **, * indicates significant levels at 0.001, 0.01, and 0.05, respectively. The findings revealed that all hypotheses were supported except for hypotheses H2 and H5.

Figure 2: Hypotheses testing results



Discussion

The study revealed that perceived immersion, as a technological factor, significantly predicts Generation Z's intention to use VR tourism. This indicates that the immersive experiences provided by VR environments play a crucial role in shaping Gen Z's willingness to engage with VR-based tourism activities, aligning with previous research highlighting immersion as a key driver of VR adoption (Gibson and O'Rawe, 2018; Vishwakarma et al., 2019). The importance of immersive experiences for Gen Z can be attributed to their preference for high-engagement, sensory-rich environments that closely simulate real-world settings. For VR developers and tourism operators, this underscores the need to invest in improving the realism and interactivity of VR content. The greater the sense of presence and immersion, the more likely Gen Z is to be drawn to VR tourism, suggesting that advancements in visual, auditory, and even haptic technologies will be key to maintaining their interest. By focusing on enhancing these immersive elements, the tourism industry can create more compelling virtual experiences that cater specifically to Gen Z's expectations for digital engagement.

Interestingly, perceived ease of use did not significantly affect Gen Z's intention to use VR tourism. While ease of use is often a crucial determinant in technology adoption, this finding aligns with the understanding that Gen Z, as digital natives, possess a high level of digital literacy and adaptability (Turner, 2015; Siahaan, 2024). Unlike older generations, who may view complex interfaces as barriers, Gen Z is more likely to experiment and navigate through digital platforms without requiring them to be intuitively simple. This reduced sensitivity to usability challenges reflects a shift in what factors drive technology acceptance among younger cohorts. This trend has also been highlighted in extended models of TAM, such as TAM2 and UTAUT2, where user experience and intrinsic motivation (e.g., enjoyment, habit) are considered more influential than ease of use in certain contexts (Venkatesh et al., 2012). Therefore, in

the case of VR tourism, the emphasis for Gen Z lies more in experiential quality and social validation rather than system simplicity. As such, tourism providers should focus on immersive and enjoyable features rather than minimizing interface complexity, which may no longer be a strong predictor of adoption for this digitally native generation.

The findings indicated that both variables in the personal aspect, relative advantage and perceived enjoyment, demonstrated significant direct effects on Gen Z's intention to use VR tourism. This suggests that Gen Z individuals are more inclined to engage with VR in tourism if they perceive it as offering clear advantages over traditional tourism experiences and if they find the interaction with VR technology enjoyable. These findings underscore the importance of highlighting the unique benefits of VR tourism, such as convenience, accessibility, and enhanced engagement, which are not typically available through conventional tourism. Additionally, the entertainment factor plays a crucial role, as Gen Z is known for prioritizing experiences that are both fun and engaging. For tourism marketers, these insights suggest that focusing on the distinct advantages and enjoyment provided by VR could significantly boost its appeal to this demographic. By emphasizing how VR tourism offers novel, exciting, and enjoyable experiences that differ from traditional travel, businesses can tap into Gen Z's preference for innovation and entertainment. This aligns with existing research on consumer behavior, which emphasizes the role of relative advantage and enjoyment in technology adoption (Vishwakarma et al., 2019; Alam et al., 2022), further solidifying the relevance of these factors in influencing Gen Z's technological preferences.

The environmental factor, social influence, emerged as the most significant predictor of Gen Z's intention to engage in VR tourism. This finding is supported by previous studies (Adegoke et al., 2022; Alam et al., 2022; Wei et al., 2019), highlighting the powerful role that peers, social networks, and societal norms play in shaping Gen Z's attitudes towards technology adoption. The significant impact of social influence suggests that Gen Z's decisions to adopt VR tourism are not made in isolation but are heavily influenced by their social circles. Word-of-mouth recommendations, social media endorsements, and peer interactions all contribute to creating a sense of trust and legitimacy around new technologies. For tourism marketers and VR developers, this insight emphasizes the importance of leveraging social influence mechanisms to promote VR tourism. By incorporating peer reviews, testimonials, and influencer marketing, businesses can effectively tap into Gen Z's social connectivity to drive adoption. Creating a community-driven marketing strategy where users can share their VR tourism experiences may increase engagement and foster greater interest in VR tourism offerings.

Interestingly, network externalities, also categorized as an environmental factor, did not exhibit a significant direct impact on Gen Z's intention to utilize VR tourism. This unexpected result challenges the traditional view that network size and social interactions, which create network effects, are pivotal in technology adoption. In contrast to other domains like mobile payments (Lisana, 2020), online banking (Miranda and Balqiah, 2021), and online gaming (Xu et al., 2017), where network effects play a central role in adoption, VR tourism appears to be more influenced by personal enjoyment and social influence than by the size or connectivity of one's network. This could be due to the relatively niche nature of VR tourism compared to the more widespread applications of mobile banking or gaming (Ramadhanty et al.,

2021). As VR tourism has not yet achieved mass adoption, the expected network externalities may not be as pronounced. Specifically for Gen Z, VR has not integrated into individuals' lifestyles in the same manner as smartphones. The lack of virtual reality in Gen Z's lifestyle is not an issue. The research by Fitri et al. (2024) on the FOMO phenomenon among Gen Z in Indonesia revealed that higher self-esteem correlates with reduced levels of FOMO. Thus, it is unsurprising that the findings of this study on VR tourism indicated that network externalities exerted minimal influence, as Gen Z did not perceive a necessity to engage in VR tourism as others did. Gen Z remains content without the need to emulate individuals engaged in VR tourism. Thus, Gen Z's inclination to use VR tourism seems to be driven more by the individual benefits and social influences rather than the broader network effects typically seen in more established technologies. This finding suggests that for VR tourism to see broader adoption, its developers and marketers should focus on strengthening the immediate social and personal benefits rather than relying on the network externalities that may develop with larger user bases.

The analysis of two moderating factors, gender and age, revealed that neither had a significant effect on the relationship between the dependent and independent variables, including the intention to use VR tourism. This suggests that neither gender nor age plays a discernible role in influencing Gen Z's intention to engage with VR tourism. These results are in line with the findings of Geng et al. (2022), who noted that both male and female users exhibit similar intentions when it comes to using VR technology in tourism. Since both genders belong to Gen Z, a demographic highly receptive to technological advancements, the absence of gender-based differences in their attitudes toward VR tourism is not surprising. Additionally, the lack of age-based moderation effects further reinforces the idea that Gen Z as a whole, irrespective of age or gender differences, is broadly open to adopting and using new technologies like VR.

From an early age, Gen Z has been acquainted with diverse technologies. Gen Z's male and female members possess equal opportunities to pursue education and gain experience in technology. This indicates that both early and late Gen Z cohorts, regardless of gender, exhibit minimal differences in experience. None of these distinct groups exhibits more enthusiasm for utilizing VR. This finding suggests that VR tourism providers can target Gen Z as a unified market segment, without the need for gender- or age-based segmentation strategies related to adoption intentions. Given Gen Z's strong familiarity with and openness to technology, the focus should instead be on the personal and social factors influencing their decisions, rather than on demographic distinctions.

In conclusion, this study intends to fill a substantial gap in the literature concerning the adoption of virtual reality tourism by analyzing the direct and moderating effects across variables in a theoretical model established from previous studies. The study's findings revealed that social influence, perceived enjoyment, relative advantage, and perceived immersion were significant factors influencing Gen Z's intention to use VR tourism. However, none of the moderating factors (gender and age) significantly impacted the direct relationships between these constructs. These results have important practical implications for the tourism industry, highlighting the need to incorporate VR technology in their marketing strategies to attract the younger generation of travelers. By leveraging the determinants that significantly affect Gen Z's intention toward VR tourism usage, tourism businesses can create immersive and enjoyable experiences that

cater to the preferences of Gen Z-ers.

This study offers valuable insights into Indonesian Gen Z's adoption of VR tourism; however, several limitations must be acknowledged. The exclusive focus on Indonesian participants limits the generalizability of the findings to other cultural and socio-economic contexts. Cultural factors play a crucial role in shaping technology acceptance. In countries with higher VR adoption rates, such as South Korea, Japan, or the United States, VR's novelty and perceived complexity may be lower, and network externalities may exert a stronger influence on behavioral intentions. In such contexts, VR may already be normalized within peer groups, strengthening peer-based social influence. Moreover, social media usage patterns differ widely across cultures. For instance, platforms like Reddit and Snapchat are dominant in Western countries, while TikTok and Instagram are more popular in Indonesia. These variations can affect how social influence and user-generated content impact Gen Z's engagement with VR tourism. Therefore, future research should consider cross-cultural comparative studies to explore how the TPE framework functions in diverse settings and whether the significance of its constructs varies across cultural contexts.

In addition to cultural limitations, the use of purposive sampling in this study may have introduced self-selection bias, potentially affecting the representativeness of the sample. Future research is encouraged to adopt stratified random sampling techniques to ensure broader demographic representation and improve generalizability. Increasing the number of respondents in future studies may further enhance the robustness of the findings and improve the generalizability of the results. Expanding the sample to include respondents from different regions, countries, and socio-economic backgrounds could also provide a more holistic understanding of Gen Z's adoption behavior. Furthermore, incorporating additional variables or moderators, such as education level, income, or cultural orientation, could enrich the analysis and offer deeper insights into the personal and environmental influences on VR tourism acceptance.

Due to the limited research on the acceptance of VR tourism, this research is intended to theoretically contribute by examining the elements influencing Gen Z's decisions to use virtual reality technology in tourism based on the TPE framework (Technological, Personal, and Environmental). The research model employed network externalities as one of the environmental factors, which many authors still underexplored.

Practical Implications for Asian Business

Based on the results, the participation of Gen Z in VR tourism is most strongly influenced by their peers. This finding can help tour companies and VR developers produce more effective marketing strategies and enhance the overall VR tourism experience. Peer recommendations and word-of-mouth marketing are crucial in promoting VR tourism to Gen Z, as this generation tends to rely heavily on the opinions and experiences of their peers when making decisions. Tour companies and VR developers targeting Gen Z should focus on building a strong presence on social media platforms and encouraging the sharing of experiences among peers to maximize the effectiveness of their marketing efforts.

For Asian businesses, leveraging platforms that dominate the regional social media

landscape, such as WeChat, Instagram, and TikTok, is critical. These platforms play a central role in communication and influence among Asian Gen Z consumers, making them ideal avenues for peer-driven marketing campaigns. Siahaan (2024) reported that Gen Z in Indonesia spends an average of 6 hours a day using social media. Therefore, developers must be able to take advantage of this situation to introduce their products, for example, through advertising campaigns on social media. Tour companies can also collaborate with influencers and local celebrities to promote VR tourism experiences. In particular, integrating user-generated content like reviews and virtual tour experiences can enhance credibility and boost peer recommendations. Furthermore, VR tourism developers could integrate collaborative experiences that allow users to participate in virtual tours together, replicating real-world travel where people commonly explore and share experiences. This could involve features such as synchronized tours, enabling users to visit the same destinations and engage in activities simultaneously while interacting with each other through avatars, voice chat, or text messages.

The other influential factors determining VR tourism acceptance among Gen Z are perceived enjoyment, relative advantage, and perceived immersion. VR developers should focus on creating enjoyable and engaging experiences that appeal to this demographic while emphasizing the potential for fun, excitement, and exploration in their marketing efforts. For businesses in Asia, where tech-savvy youth have a strong inclination toward entertainment and interactive experiences, developing VR tourism products that align with local cultural preferences is essential. Asian businesses should not only focus on the enjoyment aspect but also ensure that their offerings provide culturally meaningful content. For instance, in countries where digital gaming and interactive media are well-established, creating VR experiences that blend tourism with gamified elements could capture the attention of Gen Z tourists. Additionally, integrating local storytelling or historical themes into VR tourism can further increase engagement.

Furthermore, Gen Z is more likely to adopt VR tourism if they perceive it as offering relative advantages over traditional tourism. This means that tour companies should focus on the unique benefits VR tourism can provide, such as cost savings, convenience, and enhanced safety factors that resonate with a generation known for their digital-first mindset. In many Asian markets, particularly in rapidly urbanizing regions, travel can often be time-consuming or costly, making VR tourism an appealing alternative. Asian tour companies can emphasize the convenience of exploring destinations virtually from the comfort of one's home, the lower costs compared to physical travel, and the safety and security of virtual experiences during uncertain times such as geopolitical instability. By positioning VR tourism as a budget-friendly and practical solution to these challenges, Asian businesses can capture a larger share of the youth travel market.

Regarding perceived immersion, VR tourism acceptance can be further increased by taking actions such as investing in advanced technology, designing highly immersive experiences, and promoting education and awareness about VR tourism's potential. In Asia, where tourism plays a vital economic role in many countries, strategic investments in immersive VR technologies can give businesses a competitive advantage. Asian companies should aim to create deeply immersive VR tourism experiences that can replicate the feeling of actually being in the destination. In markets where traditional tourism faces challenges, such as limited infrastructure or

environmental concerns, VR tourism offers a sustainable alternative. Promoting VR as an environmentally friendly, low-carbon option for exploring distant or ecologically sensitive destinations can also appeal to eco-conscious Gen Z consumers in Asia. Furthermore, Asian businesses should also focus on educating their target audience about the value of VR tourism through engaging marketing campaigns, including virtual previews, free trials, or demo experiences to help customers understand the depth of immersion that VR can offer.

Beyond marketing and entertainment value, VR tourism presents a promising avenue for addressing broader issues within the tourism industry, particularly environmental conservation and accessibility. By offering immersive experiences that do not require physical travel, VR tourism reduces the carbon emissions associated with air travel and over-tourism in ecologically sensitive destinations (Mavrin et al., 2024). This aligns with global goals for sustainable tourism development. Additionally, VR can help preserve fragile natural and cultural heritage sites by minimizing human impact while still allowing visitors to engage with them virtually. From an accessibility standpoint, VR tourism opens up experiences for individuals who face physical, financial, or geographic barriers to travel. Those with mobility challenges or chronic health conditions can now explore destinations that might otherwise be inaccessible. Similarly, individuals with limited financial means can engage in cultural and educational tourism experiences through VR without incurring the cost of travel. This democratization of travel experiences underscores VR's potential as a socially inclusive innovation in the tourism sector (Folgado-Fernández et al., 2023; Oncioiu and Priescu, 2022).

VR tourism presents a valuable opportunity to lessen carbon footprints and encourage environmental sustainability. By offering immersive experiences without the need for physical travel, VR tourism acts as an environmentally friendly substitute, significantly reducing carbon emissions from travel and accommodation (Mavrin et al., 2024). Furthermore, VR can support preserving natural and cultural heritage sites by recreating endangered or inaccessible locations, thereby minimizing tourism's physical impact while promoting education and awareness (Folgado-Fernández et al., 2023). The technology also showcases vibrant eco-tourism destinations, enabling users to enjoy nature from home, which reduces environmental harm and supports eco-tourism. Additionally, VR can raise awareness of environmental issues, potentially inspiring travelers to adopt more sustainable behaviors. Educational programs via VR could also lead to lasting changes in tourists' travel habits and their approach to conservation. The tourism sector can strategically integrate VR into sustainable development plans, promoting responsible tourism practices while ensuring growth does not contribute to environmental damage (Oncioiu and Priescu, 2022). VR also enhances accessibility to travel for those with financial or physical challenges, expanding tourism opportunities while reducing environmental effects (Folgado-Fernández et al., 2023). In summary, VR technology has the potential to significantly advance environmental sustainability in tourism by decreasing carbon emissions, aiding conservation efforts, and driving long-term changes in tourists' behaviors.

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