How Do Service Quality and Exhibition Experience Impact Revisit Intention: Evidence from Metaverse Exhibitions

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ABSTRACT

This study investigates the impact of metaverse exhibitions on consumer behavior, focusing particularly on revisit intention. Using a quantitative research design, data were collected from 324 participants who attended exhibitions in Macau and Hengqin. The results obtained through Partial Least Squares Structural Equation Modeling (PLS-SEM) reveal that metaverse exhibitions significantly enhance revisit intention (β = 0.171, p = 0.007), perceived service quality (β = 0.237, p < 0.001), and exhibition experience (β = 0.284, p < 0.001). Both perceived service quality (β = 0.210, p < 0.001) and exhibition experience (β = 0.243, p < 0.001) positively influence revisit intention and act as significant mediators in these relationships. The total effect of the metaverse exhibition on revisit intention was β = 0.304 (p < 0.001), confirming strong direct and indirect effects. These findings underscore the critical role of service quality and experiential engagement in shaping visitor loyalty within virtual environments. Practically, the study suggests that exhibition organizers should leverage VR/AR technologies and interactive design strategies to enhance immersion and foster repeat visitation. Overall, this research highlights the transformative potential of the metaverse in redefining audience interaction and loyalty in virtual exhibition platforms.

Keywords Metaverse Exhibition, Perceived Service Quality, Exhibition Experience, Revisit Intention, Virtual Display

INTRODUCTION

Metaverse exhibitions are emerging as a new integration of the exhibition and tourism industries, receiving growing attention from both academia and industry. Metaverse exhibitions, which derive from the convergence of Virtual Reality (VR) and Augmented Reality (AR) technologies, are transforming the landscape of exhibition spaces by creating immersive interactive environments [1]. These exhibitions effectively integrate physical and digital elements, providing visitors with a wider range of options, innovative services, and product experiences [2]. By leveraging advanced technology, metaverse exhibitions provide exciting opportunities to redefine the way individuals interact with art, culture, and business.

This new form of exhibition not only enhances the audience's sense of participation but also creates more display and communication channels for exhibition organizers and artists. Through virtual technology, metaverse exhibitions can update content in real time, allowing artists and designers to adjust content based on audience feedback and preferences, thereby increasing the relevance and appeal of exhibitions [3]. In addition, visitors can freely explore in a virtual environment, transcending spatial and temporal

limitations of traditional exhibitions and greatly enriching their experience [4]. Moreover, this format can lower barriers to interpersonal communication by enabling novel human-machine dialogues, such as in the context of multilingual communication, which further improves exhibition quality and efficiency [5]. However, related studies remain relatively limited, and further theoretical analysis and empirical testing are required.

Metaverse technology has the potential to engage a wider audience, particularly young users and technology enthusiasts. It provides interactive and personalized experiences, and this in turn improves users' perceptions of service quality [6]. Such exhibitions are not only a visual feast, but also an emotional resonance. They can stimulate audience reflection and discussion, and this process also enhances audience understanding of and identification with exhibition themes [7]. In addition, immersive virtual exhibitions promote cultural exchange and knowledge dissemination, enabling audiences from diverse backgrounds to interact on a common platform and creating a more inclusive cultural experience [8]. This phenomenon is emerging in the tourism industry and is generally recognized as significant; however, existing research remains relatively limited.

Furthermore, metaverse exhibitions have been shown to foster positive memories and revisit intentions in visitors, providing a compelling argument for their application in the exhibition industry [9]. Research shows that when visitors experience exhibitions in an immersive environment, they are more likely to form lasting memories and respond positively to the exhibition content [10]. The formation of such memories not only improves visitor satisfaction but may also encourage future revisit intentions, thereby driving the growth of the exhibition industry.

Despite the substantial contribution of exhibitions to the tourism industry, there is still a significant gap in the literature in identifying the quality of metaverse exhibitions and the associated visitor experiences. Currently, research on metaverse exhibitions is relatively limited, particularly in establishing links between exhibition quality and visitors' behavioral intentions [9]. Existing studies primarily focus on technical implementation and user experience, while little attention has been given to visitors' evaluation of the perceived service quality in metaverse exhibitions [11]. Therefore, in-depth research exploring these aspects holds academic significance and practical relevance for the advancement of the exhibition industry.

To fill this gap, this study seeks to evaluate visitors' perceptions of service quality in metaverse exhibitions and examine how these perceptions influence their behavioral intentions. This includes, but is not limited to, the intention to revisit the exhibition brand. By quantifying these relationships, this study can offer practical recommendations to exhibition organizers and curators aimed at enhancing the quality of exhibitions and the visitor experience. This approach also enables organizers to differentiate themselves in an increasingly competitive market. Specifically, this study answers the following research questions:

RQ1: What are the key elements of a metaverse-based exhibition experience? How do these elements affect consumers' perceptions and their reactions to product quality?

RQ2: How do consumers' perceptions and their reactions to product quality influence their behavioral intentions to participate in metaverse-based exhibitions?

This study examines how the metaverse exhibition experience affects consumer behavior and addresses gaps in the existing literature on metaverse exhibitions. The study has three primary objectives. First, it aims to determine whether metaverse exhibitions are accepted by exhibition participants and to explore participants' attitudes toward this new exhibition format. Second, it explores the relationships among metaverse exhibitions, exhibition quality, visitor experience, and behavioral intentions, and analyzes how these factors interact to shape consumer decision-making. Third, it seeks to provide practical insights into how exhibition organizations can integrate with metaverse technologies to enhance the visitor experience and increase consumer engagement in metaverse exhibitions. By achieving these objectives, the study provides new theoretical contributions to academia and presents strategic recommendations for exhibition organizers to remain competitive and innovative in the rapidly evolving metaverse environment.

Literature Review

Metaverse exhibition and revisit intention

A metaverse exhibition is defined as a virtual exhibition space grounded in the concept of the metaverse. It provides users worldwide with interactive and immersive experiences [12]. These exhibitions significantly enhance accessibility, enabling individuals to explore art and cultural heritage without the constraints of time and space [13]. By offering immersive experiences, metaverse exhibitions can stimulate interest in physical exhibitions and encourage repeat visits. Unlike traditional exhibitions, the integration of gamification and interactive elements fosters greater visitor engagement and a deeper understanding of exhibition themes. Furthermore, users can contribute personal narratives, which facilitates continuous content expansion and promotes social sustainability [14].

The creation of immersive metaverse experiences is heavily reliant on advanced technologies, including VR, AR, 5G networks, and the Internet of Things. Design modeling and human-computer interaction within these environments often utilize tools such as 3ds Max, SketchUp, and Unity [15]. The potential applications of metaverse technology extend beyond exhibitions to include areas such as tourism management and e-commerce, thereby offering innovative experiences for tourists [16].

Users' intentions to engage with metaverse exhibitions are shaped by their entertainment and educational experiences, with the sense of presence acting as a mediator in these interactions. Affective responses further moderate the influence of educational experience on usage intention [17]. The incorporation of integrated avatars and non-player characters (NPCs) has been found to enhance users' knowledge of and interest in city profiles [18]. Additionally, VR technology is increasingly employed to create interactive experiences that effectively engage tourists [19].

The enhancement of visitor engagement and the promotion of interest in offline exhibitions through gamification and interactive elements address the

limitations inherent in traditional exhibition formats [12]. Research on metaverse-mediated meetings, incentives, conferences, and exhibitions (MICE) activities indicates that various dimensions of media richness significantly enhance the perceived realism of the metaverse, influencing customer engagement and future visit intentions [20]. Investigations into the impact of digital technologies on visitor engagement in cultural heritage settings within the metaverse underline the complex processes that shape individuals' intentions to participate in these experiences [21].

Moreover, studies examining factors that influence participation in commercial exhibitions utilizing metaverse technology reveal that visual appeal and enjoyment significantly affect the use of AR technology and revisit intentions [22]. High levels of immersion and presence in metaverse exhibitions are positively correlated with user satisfaction and the intention to revisit. For example, storytelling within the metaverse has been shown to enhance both presence and immersion, thereby strengthening destination imagery and increasing the likelihood of subsequent real-world visits [23]–[25]. Based on these insights, the following hypothesis is proposed:

H1: The metaverse exhibition positively impacts revisit intention.

Metaverse exhibition, perceived service quality, and exhibition experience

The relationship between perceived service quality and the exhibition experience in the metaverse is influenced by a variety of factors. Service quality in exhibitions is multi-dimensional, encompassing elements such as booth management, service personnel, exhibition environment, and content quality. These dimensions play a crucial role in shaping exhibitor satisfaction and loyalty [26], [27]. The incorporation of avatars and NPCs in virtual exhibitions can significantly enhance user knowledge and interest, thereby creating a more engaging and informative experience [18]. In the context of metaverse exhibitions, extended dimensions of service quality, particularly those related to information and communication technology (ICT), are essential for shaping perceived value and satisfaction, both of which are critical for fostering trust and long-term engagement [28].

Recent advancements in metaverse technologies have transformed service experiences by creating virtual environments that seamlessly integrate real-life and digital interactions [29]. Metaverse exhibitions offer immersive and interactive experiences that substantially enhance user engagement. Factors such as information quality, system quality, and perceived ease of use positively influence perceived usefulness, curiosity, joy, and a sense of control, all of which contribute to immersion and behavioral intentions [9]. The presence of avatars and NPCs continues to play a significant role in enriching user knowledge and enhancing the overall experience [18].

The use of technologies such as VR, AR, and extended reality (XR) further elevates user experiences in exhibitions by creating interactive and immersive environments. These technologies effectively connect physical and virtual spaces, offering innovative ways to engage with exhibition content [30], [2]. For example, AR storytelling in cultural metaverse exhibitions makes the experience more interactive, allowing users to transition smoothly between real and virtual spaces, thus improving user engagement [31].

Several key factors shape the exhibition experience in the metaverse. High-quality information and robust system performance significantly enhance perceived usefulness and user engagement [9]. Research on service quality in the metaverse underscores the importance of a customer-oriented approach, identifying and prioritizing nine service features that markedly influence customer satisfaction in metaverse environments [29]. Another empirical finding indicates that service product and service environment are positively associated with all aspects of perceived value, which subsequently impacts overall satisfaction [32]. Studies on metaverse experiences in hospitality retailing also suggest that metaverse retail spaces should be designed to offer hospitality-driven experiences [25].

H2: The metaverse exhibition positively impacts perceived service quality.

H3: The metaverse exhibition positively impacts the exhibition experience.

H4: Perceived service quality positively impacts the exhibition experience.

Perceived service quality, exhibition experience, and revisit intention

Revisit intention is influenced by several key factors, with perceived service quality playing a significant role in shaping visitors' emotional responses and subsequently affecting their likelihood of returning. High levels of service quality are associated with enhanced positive emotions and diminished negative emotions, thereby fostering a stronger intention to revisit [33]. Across various contexts, perceived service quality consistently demonstrates a positive influence on revisit intention. For example, in the MICE industry, the quality of peripheral conference services has been shown to positively impact participants' satisfaction and their intention to revisit the host destination [34].

In the exhibition context, dimensions of service quality, such as functionality, electronic displays, and human service, positively influence both visitor traffic and revisit intention. Similarly, in the hotel industry, factors such as service climate and perceived service quality significantly predict guests' intentions to return [35]. Emerging evidence from virtual exhibitions in the metaverse, such as MetaCityProfile and other VR-based platforms, suggests that dynamic and engaging content experiences contribute to higher user satisfaction and participation.

In the metaverse, service quality is shaped by factors such as information quality, system quality, and perceived ease of use—all of which influence users' immersion behaviors and behavioral intentions [9]. In trade exhibitions, high service quality enhances corporate image, which subsequently boosts exhibitor satisfaction and loyalty intentions [36]. Additionally, service quality has a positive impact on destination image, which is significantly associated with revisit intention [37].

Exhibition organizers should prioritize improvements across multiple dimensions of service quality, including staff interactions, information availability, and the overall atmosphere. These factors contribute to positive emotional responses and increased revisit intention [38]. An examination of visitor expectations before and after attending a service experience, such as an art exhibition, revealed notable differences between forecasted and ideal expectations, which carry important implications for how service quality is

perceived [39].

Moreover, tourist satisfaction has been found to strengthen the relationship between service quality and revisit intention, as evidenced by various tourism studies [40], [41]. Factors such as physical, situational, and perceptual experiences positively influence exhibition satisfaction and revisit intention, with exhibition satisfaction mediating the relationship between embodied experience and revisit intention [42].

Research has also demonstrated that IT applications, including VR and electronic displays, positively affect visitor flow and revisit intention in exhibition contexts [43]. These technologies can enhance service innovation in mobile commerce, resulting in increased consumer satisfaction and revisit intention. Memorable on-site experiences, encompassing sensory, emotional, intellectual, and relational aspects, have been found to positively influence delight, recollection, and ultimately, revisit intention [44]. Furthermore, studies indicate that off-site exhibitions significantly enhance city image and travel intention, with such an exhibition experience mediating this relationship [45].

H5: Perceived service quality positively impacts revisit intention.

H6: Exhibition experience positively impacts revisit intention.

Metaverse exhibition, perceived service quality, exhibition experience, and revisit intention

Metaverse exhibitions play a crucial role in enhancing user engagement through both entertainment and educational experiences, which positively influence users' intentions to revisit the exhibition [17]. High levels of service quality are directly linked to greater satisfaction and favorable behavioral intentions. In metaverse-enabled hospitality retailing, factors such as realism, immersion, convenience, and social interaction significantly impact cognitive, affective, and product-quality responses. These responses, in turn, shape behavioral intentions [25]. The quality of exhibition content and services is fundamental in determining overall satisfaction and future participation intentions [46].

Several factors influence revisit intention within the context of metaverse exhibitions, including embodied, physical, situational, and perceptual experiences, all of which have been found to positively affect exhibition satisfaction and revisit intention [42]. Immersive experiences characterized by high levels of realism and interactivity enhance users' cognitive and affective responses, leading to improved perceptions of product quality and increased behavioral intentions [25], [47]. The introduction of human services and IT applications, such as VR experience zones, significantly influences visitor flow and their intention to revisit [48]. The perceived value derived from metaverse experiences, including entertainment, education, escapism, and aesthetics, has a substantial impact on users' intentions to continue engaging with the platform [49].

The overall exhibition experience, incorporating various dimensions of service quality, plays an essential role in shaping revisit intention. For example, in the context of wetland parks, the tourist experience has been found to mediate the relationship between service quality and revisit intention, emphasizing the importance of aesthetic and experiential elements [50]. In metaverse-enabled environments, cognitive and affective responses to the exhibition experience

significantly influence behavioral intentions. Key factors such as realism, immersion, convenience, and social interaction are critical in shaping these responses [25].

H7: Perceived service quality mediates the relationship between metaverse exhibition and revisit intention.

H8: Exhibition experience mediates the relationship between metaverse exhibition and revisit intention.

H9: Perceived service quality and exhibition experience sequentially mediate the relationship between metaverse exhibition and revisit intention.

Figure 1 illustrates the proposed research model depicting the relationships among metaverse exhibition, perceived service quality, exhibition experience, and revisit intention, including both direct and mediated effects.
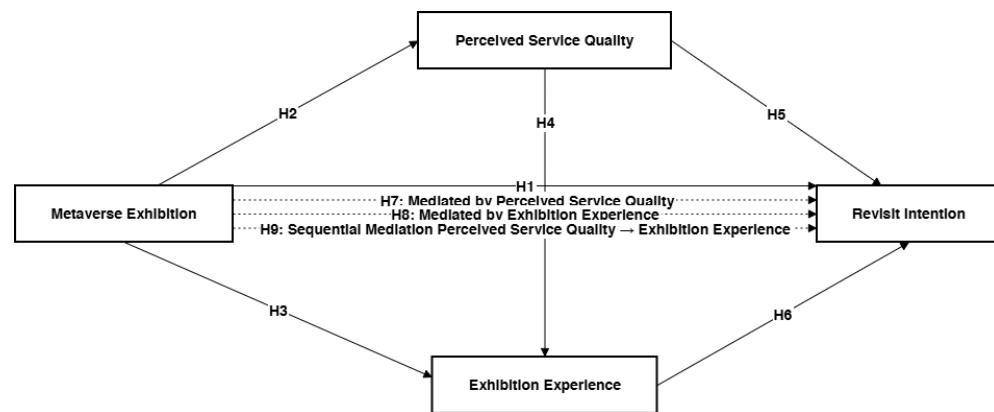
Figure 1 Proposed Hypothetical Model

Methodology

Scale

The study examined the relationships among the independent variables of metaverse exhibition, perceived service quality, and exhibition experience, and the dependent variable of revisit intention. The measurement instrument for the metaverse exhibition was primarily derived from a previous questionnaire [51], resulting in eight measurement items. Perceived service quality was measured using items adapted from earlier studies [52]–[54], comprising five items. Exhibition experience was evaluated using five items drawn from prior work [51], [55]. Revisit intention was measured using three items based on existing scales [45], [56].

A back-translation procedure was employed to ensure content validity [57], [58]. The measurement items were originally developed in English and subsequently translated into Chinese by two independent professionals proficient in both languages. This translation process ensured the accuracy and integrity of the instrument's content. A 5-point Likert-type scale was adopted, ranging from strongly disagree (1) to strongly agree (5).

Partial Least Squares Structural Equation Modeling (PLS-SEM) was chosen due to its suitability for explaining complex relationships and effectively addressing issues such as improper solutions and factor indeterminacy [59].

The analysis followed the recommended two-step procedure [60], beginning with an assessment of the measurement model followed by evaluation of the structural model. The PLS-SEM analysis was conducted using SmartPLS version 3.2.9, and SPSS version 26.0 was used for preliminary data processing and descriptive statistics.

Data

The sample for this study comprised visitors who attended exhibitions held in Macau and Hengqin. Hengqin, an island in Zhuhai, Guangdong Province, China, is located adjacent to Macao and has been designated as a key zone for regional integration and cross-border cooperation between Guangdong and Macao under the Guangdong–Macao In-Depth Cooperation Zone framework.

Macau has successfully hosted numerous large-scale exhibitions under the "one exhibition, two locations" model, which allows events to be co-organized across both Macau and Hengqin. Notable examples include the Macau International Tourism (Industry) Expo, the China International High-Quality Consumption Expo, the World Bay Area Forum, and the BEYOND International Science and Technology Innovation Expo, among others.

All exhibition activities in Macau and Hengqin for the year 2024 concluded on December 3, 2024. A snowball sampling method was employed to distribute an electronic survey to visitors who participated in these exhibitions. Data collection was completed by the end of January 2025, resulting in a total of 324 valid questionnaires.

Sample

Table 1 presents the demographic characteristics of the 324 respondents. In terms of gender distribution, females constituted 57.4% (186) of the sample, while males accounted for 42.6% (138), indicating a potential gender imbalance in the data collection or the population under study. Regarding age, the most represented group was 26–35 years, comprising 32.7% (106), followed by the 19–25 age group at 25.3% (82). Older age groups (46 and above) were notably underrepresented, suggesting a predominantly younger demographic. As for educational attainment, the majority of respondents had completed at least high school, with 36.7% (119) holding a high school diploma and 15.7% (51) having a master's degree or higher. Income distribution indicated that 46.3% (150) of respondents earned MOP5,000 or less per month, reflecting a relatively low-income level within the sample and a marked decrease in frequency at higher income levels. Regarding visiting frequency, the majority of respondents reported visiting three times a year or more, reflecting a relatively high engagement with the exhibitions under investigation.

Table 1 Sample Description (n=324)			
Variable	**Items**	**Frequency**	**Percentage (%)**
Gender	Female	186	57.4
	Male	138	42.6
Age (years)	18 or below	29	9
	19–25	82	25.3
	26–35	106	32.7

	36–45	67	20.7
	46–55	31	9.6
	56 or above	9	2.8
Education	Junior high school or below	56	17.3
	High school	119	36.7
	Bachelor's degree	98	30.2
	Master's degree or above	51	15.7
Monthly income (MOP)	5,000 or below	150	46.3
	5,001–10,000	74	22.8
	10,001–15,000	52	16
	15,001–20,000	18	5.6
	20,001 or above	30	9.3
Visiting frequency	Once per year	45	13.9
	Twice per year	84	25.9
	Three times per year	103	31.8
	Four or more times per year	92	28.4

Measures

The Confirmatory Factor Analysis (CFA) results in table 2 indicated strong construct validity and reliability across four key dimensions: metaverse exhibition (MATE), perceived Service Quality (SQ), Exhibition Experience (EE), and Revisit Intention (RVI). All items exhibited factor loadings exceeding the recommended threshold of 0.70, with the highest loading of 0.872 for the item related to actively promoting Macau's exhibitions. Cronbach's alpha values for all constructs exceeded 0.70, suggesting good internal consistency. Both Composite Reliability (CR) and Average Variance Extracted (AVE) values also confirmed the robustness of the measurement model. Additionally, all Variance Inflation Factor (VIF) values remained below the accepted threshold, indicating that multicollinearity was not a concern.

Table 2 Results of CFA

	Item	Loading	Cron' α	CR	AVE	VIF
Metaverse exhibition (MATE)	The metaverse presents a combination of virtual and augmented reality	0.794	0.906	0.924	0.602	2.107
	The virtual exhibition hall presents an innovative brand image.	0.740				1.887
	The virtual exhibits enhance my view of Macau's digital image.	0.817				2.258
	The metaverse exhibition's immersive experience increases my focus on the content.	0.801				2.224
	Combining virtual and real exhibitions offers richer, more diverse experiences.	0.737				1.705
	This combination enhances the exhibition brand's attractiveness and influence.	0.784				2.012
	The metaverse's technical support demonstrates high-quality, innovative exhibition services.	0.729				1.880
	The immersive experience strengthens the professional image of the	0.801				2.163

	metaverse format.					
Perceived service quality (SQ)	The exhibition venue is tidy with a reasonable layout	0.764	0.848	0.891	0.621	1.728
	The staff provide enthusiastic and professional service during the exhibition	0.768				1.579
	Exhibition information is clear and easy to obtain.	0.791				1.749
	Technical support makes the exhibition convenient and efficient.	0.817				1.960
	I feel satisfied with the service of the exhibition.	0.797				1.817
Exhibition experience (EE)	Participating in the exhibition is a pleasant experience	0.778	0.842	0.888	0.613	1.684
	The exhibition presents new knowledge	0.733				1.774
	The exhibition is an interesting event within its context	0.786				1.876
	The exhibition is convenient for me to visit	0.816				1.916
	The exhibition provides a communication platform	0.799				1.767
Revisit intention (RVI)	I am very interested in participating in similar exhibitions again	0.812	0.795	0.880	0.709	1.559
	I will recommend Macau as an ideal destination for tourism and exhibitions	0.842				1.783
	I will actively promote Macau's exhibitions to others	0.872				1.788

Table 3 presents the results of the discriminant validity using both the Fornell-Larcker criterion and the Heterotrait-Monotrait Ratio (HTMT). The square root of the AVE is highlighted in bold, indicating that each construct's value was greater than its correlations with other constructs, which supports discriminant validity according to the Fornell-Larcker criterion. Specifically, the MATE had a value of 0.776, while RVI, SQ, and EE indicated lower inter-construct correlations, confirming that these constructs are empirically distinct. Additionally, all HTMT values were below the recommended threshold of 0.85, providing further evidence of discriminant validity. Overall, these results indicate the distinctiveness of the constructs measured in the study and support the validity of the measurement model.

The model was further examined using multiple fit indices: the d_ULS value (0.674), the d_G value (0.205), the NFI value (0.875), the Chi-square value (395.527), and the SRMR value (0.054), all of which were within acceptable ranges. Therefore, all indicators met the model fit criteria, suggesting that the overall model fit was satisfactory.

Table 3 Discriminant Validity

	Fornell-Larcker Criterion				Heterotrait-Monotrait Ratio (HTMT)			
	MATE	RVI	SQ	TE	MATE	RVI	SQ	TE
MATE	0.776							
RVI	0.304	0.842			0.351			
SQ	0.237	0.328	0.788		0.261	0.395		
EE	0.344	0.368	0.320	0.783	0.387	0.443	0.372	

The square root of AVE (bold values) is shown in parentheses, demonstrating discriminant validity.

Result

Table 4 presents the results of the path analysis, which examined the relationships among the constructs: MATE, perceived SQ, EE, and RVI. All

hypotheses were supported, indicating significant positive relationships. Specifically, MATE had a positive influence on RVI (B = 0.171, p = 0.007), suggesting that experiences in the metaverse led to an increased interest in revisiting. MATE also significantly impacted SQ (B = 0.237, p < 0.001) and TE (B = 0.284, p < 0.001), highlighting the importance of the metaverse in enhancing perceived service quality and the overall exhibition experience. Furthermore, SQ significantly affected EE (B = 0.252, p < 0.001) and RVI (B = 0.210, p < 0.001), while EE also had a strong positive influence on RVI (B = 0.243, p < 0.001). These findings collectively underscore the critical role of the metaverse in shaping attendees' perceptions and intentions regarding future exhibitions. Accordingly, hypotheses H1 through H6 received empirical support. The path coefficients of the model are shown in figure 2.

Table 4 Path Analysis

	Path	B	SE	T-Value	P Values	Decision
H1	MATE → RVI	0.171	0.063	2.716	0.007	Supported
H2	MATE → SQ	0.237	0.062	3.851	0.000	Supported
H3	MATE → TE	0.284	0.061	4.685	0.000	Supported
H4	SQ → TE	0.252	0.059	4.290	0.000	Supported
H5	SQ → RVI	0.210	0.060	3.524	0.000	Supported
H6	TE → RVI	0.243	0.059	4.110	0.000	Supported

* P<0.01, ** p<0.001; MATE=Metaverse exhibition, SQ =Perceived service quality, TE= Exhibition experience, RVI= Revisit intention.
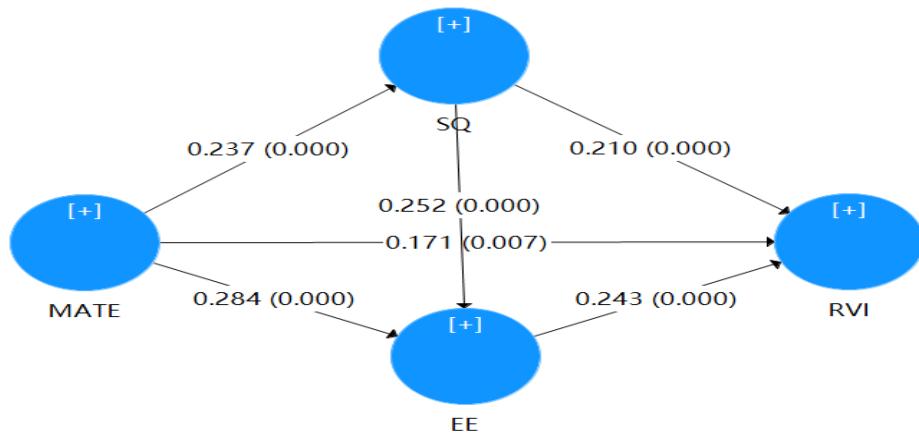

Figure 2 Path coefficient of the model

Furthermore, SmartPLS version 3.2.9 was employed to examine hypotheses H7 through H9, which address the mediating effects within the proposed model. The analysis in table 5 reveals significant indirect relationships among the constructs and their impact on RVI. The total effect of the MATE on RVI was found to be substantial (B = 0.304, p < 0.001) with a direct effect also observed (B = 0.133, p < 0.001). Hypothesis H7, which posits that perceived SQ mediates the relationship between MATE and RVI, was supported with an indirect effect of 0.050 (p = 0.015) and a variance accounted for (VAF) of 0.441, indicating a moderate level of mediation. Hypothesis H8, which posits that EE also mediates this relationship, was validated with an indirect effect of 0.069 (p = 0.004).

Hypothesis H9, which posits that SQ and EE jointly mediate the relationship between MATE and RVI, was likewise supported with an indirect effect of 0.015 (p = 0.033). These findings highlight the mediating roles of SQ and EE and emphasize their contributions to enhancing the overall impact of the metaverse exhibition on attendees' revisit intention. Accordingly, hypotheses H7 through H9 were substantiated.

Table 5 Mediation effect analysis							
Hypotheses	**Path**	**B**	**SE**	**T-Value**	**P Values**	**VAF**	**Decision**
	MATE → RVI (total)	0.304	0.064	4.773	0.000		
	MATE → RVI (direct)	0.133	0.076	0.206	0.000		
H7	MATE → SQ → RVI（indirect）	0.050	0.020	2.435	0.015	0.441	Supported
H8	MATE → EE → RVI（indirect）	0.069	0.024	2.846	0.004		Supported
H9	MATE → SQ → TE → RVI（indirect）	0.015	0.007	2.136	0.033		Supported

* P<0.01, ** p<0.001; MATE=Metaverse exhibition, SQ =Perceived service quality, EE= Exhibition experience, RVI= Revisit intention.

Discussions and Conclusion

This study demonstrates the effectiveness of the Random Forest algorithm in predicting the popularity of Roblox games based on key player engagement metrics such as Active players, Likes, Dislikes, Favourites, and Rating. The model achieved a strong R-squared value of 0.7814, indicating its ability to explain a significant portion of the variance in game Visits, and provides valuable insights into how various features influence game success. Our analysis highlighted the crucial role of both positive and negative player feedback, particularly Dislikes, which was found to be the most important feature in predicting game popularity. These findings contribute to the growing body of research on metaverse game dynamics, offering a data-driven tool that can help developers optimize their games for greater engagement and success on platforms like Roblox.

Discussions

First, the findings of this study reveal that the metaverse exhibition has a positive impact on revisit intention. This result aligns with prior literature [23]–[25], which indicates that the immersive and interactive features of metaverse exhibitions significantly enhance user engagement and satisfaction—key factors in fostering repeat visits. The mechanisms underlying this positive relationship can be attributed to several aspects of the metaverse experience. Specifically, the incorporation of advanced technologies creates a more engaging environment that captures users' attention. This heightened engagement leads to increased emotional responses, which are essential for forming lasting impressions.

Secondly, the metaverse exhibition was identified as having a direct and positive impact on perceived service quality. This finding is consistent with previous studies [28], [18], demonstrating that immersive virtual environments

enhance users' perceptions of service quality. Virtual exhibition halls improve access to information and facilitate interactions, resulting in more engaging and informative experiences. The integration of metaverse technologies enriches user interaction by providing personalized assistance and interactive elements, enhancing both understanding and perceived support throughout the exhibition experience.

Additionally, this study reveals that the metaverse exhibition positively impacts the exhibition experience. This finding aligns with prior research [18], [30], [31], which demonstrates that immersive technologies significantly enhance user engagement and satisfaction in virtual environments. The interactive and dynamic nature of metaverse exhibitions contributes to a more compelling experience, allowing deeper cognitive and emotional engagement that traditional exhibitions cannot achieve.

Furthermore, the results indicate that perceived service quality positively impacts the exhibition experience. This observation supports previous findings [9], [29], [25], emphasizing that high levels of perceived service quality enhance user engagement and satisfaction in virtual settings. Effective service delivery plays a critical role in maximizing user satisfaction and fostering repeated engagement within metaverse exhibitions.

Thirdly, the findings show that perceived service quality positively impacts revisit intention. This aligns with prior research [33], [37], which demonstrates that higher perceived service quality leads to stronger loyalty and a greater likelihood of returning. When visitors feel valued and well-served in metaverse environments, they are more inclined to revisit future exhibitions.

Moreover, the exhibition experience was found to have a direct positive impact on revisit intention, supporting earlier studies [42], [44], which indicate that rich and engaging experiences enhance visitors' likelihood of returning. Creating interactive, emotionally resonant exhibition environments is essential for motivating revisits and long-term engagement.

Another key finding of this study is that perceived service quality mediates the relationship between metaverse exhibition and revisit intention, consistent with previous evidence [47], [49], [25]. High service quality enhances user satisfaction and engagement, emphasizing the need for its integration into metaverse exhibition design. Similarly, the exhibition experience mediates the same relationship, suggesting that personalized interactions and effective communication drive satisfaction and revisitation.

In addition, perceived service quality and exhibition experience act as sequential mediators in the relationship between metaverse exhibition and revisit intention. This highlights the interconnected nature of these factors in shaping visitor loyalty. An engaging metaverse exhibition first elevates perceived service quality, which then enhances the exhibition experience, ultimately fostering revisit intention. This sequential process underscores the necessity of delivering both high-quality service and immersive experiences to maintain user engagement and loyalty.

Theoretical Implications

The findings of this study offer several theoretical implications for understanding the metaverse exhibition and its impact on visitor behavior. First, the identified

positive relationship between metaverse exhibition and revisit intention contributes to existing literature on immersive experiences [23]–[25]. This confirms that immersive and interactive elements enhance engagement and satisfaction, demonstrating the importance of advanced technologies in fostering emotional connections that encourage repeat visits.

The identification of perceived service quality as a key factor influencing both the exhibition experience and revisit intention adds a new theoretical dimension. Previous work [28], [18] emphasized the role of service quality in virtual environments, and this study extends those findings by showing how metaverse technologies can further enhance service perception. This reinforces the importance of high-quality service delivery for visitor satisfaction and long-term engagement.

Consistent with prior evidence [42], [44], this study supports the mediating role of exhibition experience between metaverse exhibition and revisit intention. The mediation effect demonstrates that immersive and interactive elements are vital in encouraging revisits by fostering positive emotions and meaningful engagement. By highlighting how digital experiences influence emotional and behavioral responses, this study contributes to a deeper theoretical understanding of visitor behavior in virtual exhibition contexts.

The sequential mediation of perceived service quality and exhibition experience in the relationship between the metaverse exhibition and revisit intention presents a complex interplay of factors that shape visitor loyalty. This finding extends the existing literature by demonstrating that high service quality not only has a direct effect on visitor satisfaction but also enhances the overall experience, which subsequently increases revisit intention. This nuanced understanding encourages further investigation into the interrelationship between service quality and experiential factors within the context of metaverse exhibitions.

Overall, the theoretical implications of this study suggest that adopting a holistic approach is necessary for understanding and optimizing metaverse exhibitions. Future research should continue to examine the intricate relationships among metaverse technologies, service quality, exhibition experiences, and behavioral intentions in order to develop a comprehensive framework that enhances visitor engagement and satisfaction within metaverse environments.

Managerial Implications

The findings of this study offer valuable insights for managers and organizers of metaverse exhibitions, highlighting several key areas for improvement and strategic focus. As immersive and interactive experiences in the metaverse significantly influence revisit intention, managerial efforts should prioritize the integration of advanced technologies. This includes investing in virtual and augmented reality tools that enhance user engagement and create captivating environments. Such technologies not only attract visitors but also foster emotional connections that encourage repeat visits.

The positive relationship between perceived service quality and both the exhibition experience and revisit intention underscores the necessity for delivering high-quality service. Managers should ensure that virtual exhibition halls are equipped with metaverse technologies capable of providing

personalized assistance. This enhancement can improve user interactions, making visitors feel supported and valued, which in turn leads to greater satisfaction and loyalty.

To maximize visitor engagement in metaverse exhibitions, it is crucial to create dynamic and interactive experiences. This can be achieved by incorporating elements such as gamification and storytelling, which have been shown to deepen cognitive engagement. Managers should focus on providing rich and meaningful content that elicits positive emotions, as such affective experiences are positively associated with revisit intention. In addition, marketing strategies should emphasize the unique advantages of metaverse exhibitions. Highlighting the immersive nature and enhanced accessibility of these exhibitions has the potential to attract broader audience segments. By effectively communicating these advantages, organizers can increase attendance and foster a loyal visitor base.

Finally, exhibition organizers should develop long-term engagement strategies aimed at encouraging repeat visitation. This may include offering exclusive content, loyalty programs, or special events within the metaverse. By fostering sustained relationships with attendees, organizers can enhance revisit intention and build a loyal community around their exhibitions.

Limitations

This study has several limitations that should be acknowledged. First, the research primarily focuses on specific metaverse exhibitions, which may limit the generalizability of the findings to other contexts or types of exhibitions. The unique characteristics of the selected exhibitions may not reflect the broader spectrum of metaverse experiences available, potentially skewing the results. Second, the study relies on self-reported data, which can introduce biases such as social desirability or recall bias. Participants may have responded in ways they believed to be more favorable or acceptable, thus affecting the accuracy of the reported perceptions of service quality, exhibition experience, and revisit intention. Additionally, while this research identifies key relationships among metaverse exhibition, perceived service quality, exhibition experience, and revisit intention, it does not delve into the demographic or contextual factors that may influence these relationships. Future studies could benefit from exploring how variables such as age, technological proficiency, or cultural background affect user experiences in metaverse exhibitions. Future research should address these limitations by broadening the scope of investigation to include a wider variety of metaverse exhibitions across different contexts and settings. This approach would enhance the generalizability of the findings and provide a more comprehensive understanding of visitor experiences in the metaverse.

Declarations

Author Contributions

Conceptualization: J.Z., Z.W.; Methodology: J.Z., H.-W.H.; Software: Z.W.; Validation: J.Z., H.-W.H.; Formal Analysis: J.Z.; Investigation: Z.W.; Resources: H.-W.H.; Data Curation: Z.W.; Writing – Original Draft Preparation: J.Z.; Writing – Review and Editing: H.-W.H., Z.W.; Visualization: Z.W.; All authors have read and agreed to the published version of the manuscript.

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