

# METaverse ESCAPES: WHERE TELEPRESENCE LOVES THE EXPERIENCE

**Kiran Desai, NMIMS Deemed-to-be-University**  
**Japmman Pahuja, Georgia State University**  
**Antra Shankar, NMIMS Deemed-to-be-University**  
**Saket Lakhotia, NMIMS Deemed-to-be-University**

## ABSTRACT

*Purpose:* This research extends the Technology Adoption Model with experience variables that influence the adoption of Metaverse applications in the travel and tourism sector

*Methodology:* Empirical study with data from 544 respondents. Data was analysed using PLS-SEM, PLSPredict, and Importance-Performance Mapping Analysis (IPMA).

*Findings:* The standard TAM model is insufficient to predict adoption of Metaverse Tourism. However, two-dimensional Hedonic Motivation and Telepresence significantly affect user satisfaction and technology adoption intentions. Attitude mediates the relationship between hedonic motivation, perceived usefulness, and behavioural intention. MICOM analysis reveals varying impacts of some constructs across demographic sub-groups such as income, gender and frequency of travel. IPMA Analysis facilitates construct level analysis for practitioners and item-level analysis for future empirical use by researchers.

*Practical Implications:* Researchers can use an extended TAM model to assess Metaverse tourism adoption and understand construct operationalisation. Marketers augment adoption by leveraging high hedonic motivation and telepresence.

*Limitations:* Cross-sectional designs and convenience sampling limit generalizability. Future research may consider longitudinal designs and randomized sampling.

**Keywords:** Metaverse, User Adoption, Travel and Tourism, Hedonic Motivation, Telepresence, Behavioural Intention, Technology Adoption Model, PLS-SEM, IPMA

## INTRODUCTION

Recently, Metaverse research in tourism and hospitality has been getting increased attention from researchers (Salvatore and Sacchi, 2003); (Buhalis et al., 2023; De Felice et al., 2022; Dwivedi et al., 2022), consultancies, and practitioners (Constantin et al., 2023). Past studies have called for more empirical and theory-based research (Tavakoli & Mura, 2015) and extension of TAM Model (Yung & Khoo-Lattimore, 2019). This paper explicates drivers of metaverse applications for India's travel industry. We ask, "What are the influencing drivers for adopting metaverse applications for travel and tourism in the Indian context?"

## LITERATURE REVIEW

### Metaverse

The Metaverse is a novel technological advancement, a transformative process demonstrating incorporation of technology into daily lives. Within virtual reality, individuals may become less cognizant of their physical presence, potentially altering their perceptions of time. The concept of the Metaverse, where individuals can establish a secondary existence in a digital realm, is becoming a new social reality.

### **Using and Adapting Metaverse in the Tourism Sector**

"Metaverse" refers to a digitally shared, community-driven space resulting from the merging of real and virtual reality. Metaverse tourism can be used in several ways - creating virtual replicas of real-life locations, facilitating immersive virtual experiences, and promoting social connections. The virtual world potentially provides an innovative platform for tourist management, and consumer engagement (Buhalis et al., 2023b).

### **Technology Adoption Model (TAM)**

TAM was introduced by with profuse contextual adaptations. Applied across various technologies and scenarios, TAM has been one of the most empirically validated models in research. In the technologically enabled immersive context of tourism, we posit that Hedonic Motivation and Telepresence may be relevant antecedents alongside PU, PEOU, Attitude, and Behavioural Intention (Ukpabi & Karjaluoto, 2017).

## **RESEARCH HYPOTHESIS**

### **Perceived Usefulness**

PU is defined as the degree to which a person believes using a technology improves their performance. Perceived usefulness is positively related to intrinsic motivation, attitude towards using technology, and intention to use technology. Chung et al. (2015) established a positive correlation between useful website design and user satisfaction, highlighting the precursors to intention. Specifically, user satisfaction with a well-designed website link to higher probability of continued usage intention. Their study can be extended to tourism applications using the metaverse. Lastly, S. Shen et al., (2022a) found that perceived usefulness enhances the adoption and usage of AR/VR applications.

### **Perceived Ease of Use**

PEOU is defined as the degree to which a person believes that using a particular technology is easy and effortless (Venkatesh & Davis, 2000a). It eases the cognitive effort, critically affects users' online service adoption (Shen & Chiou, 2010), and, positively impacts adoption and can be extended to the tourism context (Teng et al., 2022b). Khalifa & Liu (2007) found that PEOU is a significant predictor of customer satisfaction, Buhalis et al., (2023b) posit that, comprehension of the metaverse and creating practical and useable platforms, processes, and offerings can enhance value co-creation for all stakeholders in the tourism industry. Thus, PEOU expands adoption potential. S. Shen et al., (2022a) perceived that EOU plays a crucial role in enhancing the adoption and usage of AR and VR applications; hence, metaverse applications for travel need to be easy and effort-free.

## Hedonic Motivation

The preceding two factors, PEOU and PU represent rational and utilitarian dimensions. However, the fun, sensory experiences, sights, and sounds associated with tourism intentions require a measure of irrational dimension (Wang et al., 2021a). Hedonism measures arousal and pleasure and has relevance in the context of tourism (Rezaei et al., 2016; S. Shen et al., 2022b; Tavakoli & Mura, 2015); hedonic joy created by the flow experience will result in intention to adopt. Hedonic Motivation is defined as the measure of a person's attitude resulting from sensations derived from experience or the sensations one imagines would be experienced (Voss et al., 2003a).

Metaverse has potential to provide engaging joyful memorable experiences in virtual tourism (Dwivedi et al 2022, 2023; Al-Azawei & Alowayr (2020) found that hedonic motivation significantly impacted the intention to use mobile learning indicating pragmatic and enjoyment derived in using the technology. Lastly, in the study by (S. Shen et al., 2022a), hedonic motivation and the feeling of 'quasi escapist experiences' (Tavakoli & Mura, 2015, p. 405) which refers to the pleasure and enjoyment that users derive from the use of technology, was found to influence the adoption and usage of AR and VR applications. Our literature highlights users' importance of excitement, enjoyment, and fun.

Two dimensions of hedonism are relevant in the context of Metaverse tourism. We assume that hedonism in metaverse tourism is bi-dimensional, emerging from the joy of technology and the joy of travelling, hence a variable of importance. Tourism activity is a type of consumer identity project. The ability to travel and tour distant and iconic places is often a constraint for materially or socially limited identities. However, metaverse communities can, creatively travel far and wide, imaginatively and inventively reproduce the hedonistic aspects of physical tourism (Weijo et al., 2018, Dwivedi et al. 2022,). Metaverse tourism can fulfil transformative hedonistic experiences due to its capability to augment the spatial capital beyond material and socially anchored spaces through their engaging virtual avatars. Kim & Hall (2019) and Tamilmani et al., (2019) found that hedonic motivation positively influences users' behavioural intention to use technology, leading to actual use behaviour. Hedonic motivation is important in voluntary technology and travel choices. Meta travel applications must deliver the hedonistic good experience the users imagine and expect.

## Telepresence

Experience Economy Theory (EET) can explain metaverse adoption (Mehmetoglu and Engen (2011). Escapism (one of the 4E of EET) was found to be a significant variable, despite failure to study the ability of an individual to escape. Hence, we prefer Telepresence over escapism to measure metaverse experiences. Metaverse adoption is an immersive sensory experience, described by researchers as an embodied internet (Buhalis et al., 2023c). The motive for travel is finds support in the imaginative, happy experience anticipated in a foreign land. Users may teleport themselves for touristic discoveries and experiences. Vividness of imaginative telepresence of the user enhances the immersive multi-sensory experience providing useful and efficient outcomes. Higher presence leads to efficient performance in VR-based education (Shen et al., 2022c).

Telepresence is an understudied variable. The term telepresence has been used in human-machine interfaces (Johnsen and Corlis 1971, Minsky, 1980). It was first defined by Hendrix and

Barfield (1996) as "feeling present in a remote but real environment". Later, Draper et al. (1998, p) added the term "Projection into ..." and that telepresence improves performance. Two dimensions or vantage points of presence were included in definitions of Telepresence: the cybernetic vantage or machine-led human interaction and the experiential or the human vantage. Other contexts have also discussed the relevance of the construct of telepresence in a game environment where immersed viewers take on the avatar or persona of the player (Belk, 2013, p. 482). (Dwivedi et al., 2022) called telepresence an enabler to unlock Metaverse opportunities for tourism since it enables commutes between the virtual and real world. In their systematic review of 46 studies on tourism metaverse (Yung & Khoo-Lattimore, 2019) report that Presence has been an under-utilised variable (28% of studies) and presence theory has been an underutilized theory (23% of studies). The researchers reviewed 46 studies and found that more than 70% did not include this variable. They draw support from Social Presence Theory (Biocca et al., 2003), which posits that "Within human-computer interaction, social presence theory studies how the "sense of being with another" is shaped and affected by interfaces" (p.456). Biocca et al. suggest the "use of social presence measures to assess the performance of Social presence Technologies" (p.458).

The experiential telepresence alluding to "that imagined conscious experience" is relevant in this research context. Hartmann et al., (2016) developed a scale for spatial presence and called it like Telepresence. Telepresence measures a person's capacity to imagine an object that connects them to another time/place. It emphasises the importance of creating a synthetic customer experience perceived as authentic. When customers feel that the experience accurately reflects reality, they are more likely to engage with it and derive value from the online environment. A converse view (Kent and Martinec) was that the positive influence through technological telepresence may be perceived as iconically authentic, but indexical authenticity may need further support.

### **Attitude towards Technology**

Attitude (ATT) measures the valency or evaluation of desirability (Ajzen, 1991). It is "a relatively enduring evaluation of an object, person, or issue that predisposes an individual to respond in a particular way'. They contend that people's perspectives on technology can influence how they interact with services and how successfully they can use them. Adapting to new technologies is difficult, and it is not easy to identify the correct one and fit it into the right place. Many challenges and difficulties can be faced which cannot be predicted earlier before the start of the process. The act of solving technological challenges must be preceded by the correct attitude of the employees towards tech (Wagner & Włochowicz, 2021). Oleksy et al. (2023) found a positive relationship between the general attitudes towards technology and metaverse-related threats.

### **Behavioural Intention**

Behavioural intention (BI) to use is a measure of the likelihood a person will use the technology (Ajzen, 1991; M. A. FishbeinIcek, 1975). This directly translates to if there is an intention to change and use this technology behaviourally. A strong relationship exists between social influence and behavioural intention, as demonstrated by (Lau et al., 2020). Scholars demonstrated a strong relationship between attitude and behaviour intention (Ali et al., 2016a;

Singh & Lee, 2008). In the travel domain, behavioural intention is anything that leads to the intention to travel, willingness to make an effort to travel or investment in travel-related products and services. (Meng & Choi, 2016). For the study, the authors have proposed five hypotheses followed by the framework to be tested. Figure 1 depicts the proposed framework for the analysis.

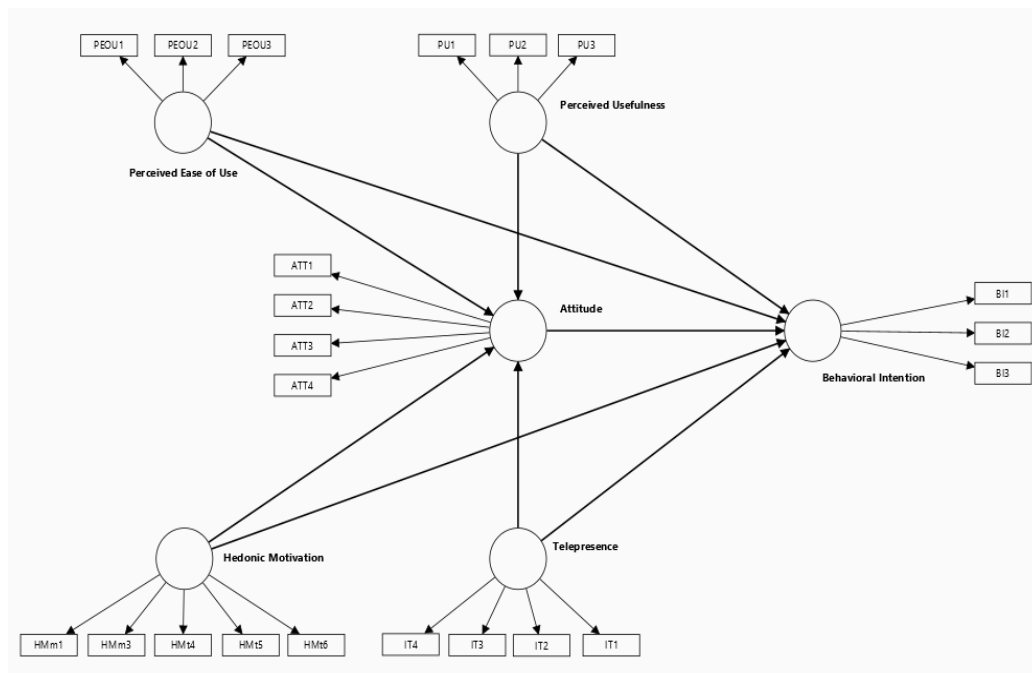
**H<sub>1</sub>:** Perceived usefulness positively influences the use of Metaverse applications for tourism.

**H<sub>2</sub>:** Perceived ease of use positively influences the use of Metaverse applications for tourism.

**H<sub>3</sub>:** Hedonic Motivation positively influences the use of Metaverse applications for tourism.

**H<sub>4</sub>:** Telepresence positively influences the use of Metaverse applications in tourism.

**H<sub>5</sub>:** Attitude towards metaverse technology positively affects behavioural intention to use Metaverse applications for tourism.



**FIGURE 1**  
**CONCEPTUAL FRAMEWORK**  
**RESEARCH METHODOLOGY**

The study used a descriptive cross-sectional design. Data was collected through a structured online questionnaire. The Kuppaswamy Socio-Economic scale (Mohd Saleem, 2019) was applied to determine participants' occupational and income status, offering a comprehensive view of socio-economic diversity within the sample. Table 1 summarises the source of measurement and items (Table 1). The sample consisted of 544 respondents, aged 17 to 57 years, with a male-female ratio of approximately 2:1 and a majority falling within the high-income bracket. Table 2 depicts the profile of the respondents.

<b>Category</b>	<b>Characteristic</b>	<b>Frequency (n)</b>	<b>Percentage</b>
Gender	Male	374	69
	Female	170	31
Level of Education	Businessman/Professional (white collar)	425	78
	Semi-professional	56	10
	Clerical/Shop or farm owner	15	3
	Skilled Worker	32	6
	Semi-Skilled worker	4	1
	Unskilled worker	1	0
	Unemployed	11	2
Family Income	>2,00,000	290	53
	1,00,000 - 2,00,000	111	20
	80,000 - 1,00,000	57	10
	60,000 - 80,000	37	7
	40,000 - 60,000	26	5
	<40,000	23	4
Travel Frequency	Never	21	4
	1-3 times/year	348	64
	4-6 times/year	106	19
	> 6 times/year	69	11
24/7 Internet	Yes	515	95
	No	29	5
Prior experience of using Metaverse	Yes	283	52
	No	261	48

SmartPLS was employed to conduct Partial Least Squares Structural Equation Modelling (PLS-SEM) to evaluate the measurement and structural models. The assessment of the measurement model focused on its reliability and validity, while the structural model evaluated the proposed relationships among the constructs. Additionally, the Importance-Performance Matrix Analysis (IPMA) was used to assess the significance and performance mapping of the constructs within the model. This analysis was conducted to test six hypotheses concerning the factors influencing the adoption of metaverse applications.

## **DATA ANALYSIS AND RESULTS**

### **Measurement Model Assessment**

#### **Indicator Loadings**

The measurement model was assessed by examining the indicator reliability of the items of each construct. Outer Loadings above 0.708 are recommended (Hair et al., 2011), indicating that the construct explains over 50% of the indicator variance.

For attitude, the outer loadings of its items ranged between 0.821 to 0.88, indicating a strong reliable association in the context of metaverse tourism applications. Similarly, the outer loading of the items of Behavioural Intention exhibited very high outer loadings, (0.866 to 0.901). This confirms the items' effectiveness in encapsulating the users' intention to engage with metaverse applications. There was similar consistency displayed by the items of Perceived Usefulness, ranging from 0.851 to 0.891, confirming their association with the construct. Finally, for Telepresence, the items exhibited strong loadings between 0.764 and 0.786, underscoring the reliability of these items in measuring the users' immersive experience within the metaverse environment.

In examining Hedonic Motivation, a divergence was noted. While HMt4 to HMt6 aligned well with the construct, as reflected by loadings above 0.839, HMm1 and HMm3 exhibited lower loadings of 0.466 and 0.464, respectively. Despite falling below, the preferred threshold of 0.7, these figures are acceptable limits for exploratory research since the construct's AVE (discussed in the next section) is 0.541(Henseler et al., 2015a)

Lastly, the outer loading for all the items of Perceived Ease of Use fell below the acceptable threshold of 0.708, and the AVE for the construct failed to meet the minimum criterion of 0.541(Henseler et al., 2015a), reinforcing the construct's limited contribution to the explanatory power of the model. Thus, the strong loadings observed for most of the indicators across the constructs underpin the robustness of the measurement model, while few loadings invite further introspection to enhance the model's precision.

*Indicator Reliability via Bootstrapping:* The bootstrapping procedure, a non-parametric resampling method with 10,000 samples, was employed to test the statistical significance of the outer loadings. The reliability of the loadings is reaffirmed by the bias-corrected confidence intervals. All intervals exclude zero, which provides confidence in the stability of the loadings across the samples Table 2.

	Original Sample	STDEV	P
ATT1 <- ATT	0.859	57.149	0.000
ATT2 <- ATT	0.881	76.704	0.000
ATT3 <- ATT	0.838	43.736	0.000
ATT4 <- ATT	0.821	40.314	0.000
BI1 <- BI	0.885	74.524	0.000
BI2 <- BI	0.901	80.220	0.000
BI3 <- BI	0.866	55.464	0.000
HMm1 <- HM	0.466	6.976	0.000
HMm3 <- HM	0.464	6.976	0.000
HMt4 <- HM	0.839	45.462	0.000
HMt5 <- HM	0.839	51.339	0.000
HMt6 <- HM	0.855	48.796	0.000
IT1 <- IT	0.774	30.352	0.000
IT2 <- IT	0.782	34.438	0.000
IT3 <- IT	0.764	31.665	0.000

IT4 <-IT	0.786	34.105	0.000
PU1 <- PU	0.880	70.784	0.000
PU2 <- PU	0.851	49.601	0.000
PU3 <-PU	0.891	89.522	0.000

Overall, the bootstrapping results corroborated the reliability of the indicators. All loadings are significant, which strengthens the measurement model's robustness. For the items related to Hedonic Motivation that previously showed lower loadings (HMm1 and HMm3), the bootstrapping analysis, with t-statistics of 6.976 and a confidence interval that does not include zero, also supports their retention (Zhang et al., 2010). These items are statistically significant despite their lower loadings, suggesting their meaningful contributions to the construct.

### Construct Reliability and Discriminant Validity

Construct Reliability was established through Cronbach's Alpha and Composite Reliability (Jöreskog, 1971), where higher values indicate higher levels of reliability. Values from 0.60 to 0.70 are considered 'acceptable in explanatory research', 0.70 to 0.90 is considered 'satisfactory to good', and values above 0.90 are problematic since they indicate that the indicators are reducing construct reliability (Diamantopoulos et al., 2012). The Composite Reliability score ranged from 0.781 to 0.875, indicating that the constructs have internal consistency and the items that represent them are reliable. Similarly, Cronbach's Alpha is an acceptable lower-bound approximation of the true internal consistency reliability. Its values from 0.772 for Hedonic Motivation to 0.872 for Attitude indicate acceptable to excellent internal consistency between the items of each construct (Trizano-Hermosilla & Alvarado, 2016)

Further, the Convergent Validity was evaluated by the Average Variance Extracted (AVE). All constructs demonstrated AVE values above the minimum acceptable level of 0.50 (Hair et al., 2011). Although the AVE for Hedonic Motivation was lower, it still met the minimal criteria, suggesting that the construct has an acceptable level of convergent validity.

Table 3 exhibits the Composite Reliability, Cronbach's Alpha and Average Variance Extracted for all constructs.

Constructs	Alpha	CR	AVE
Attitude	0.872	0.912	0.722
Behavioural Intention	0.861	0.915	0.782
Hedonic Motivation	0.772	0.832	0.514
Perceived Usefulness	0.845	0.907	0.764
Telepresence	0.78	0.859	0.603

Note: CR: Composite Reliability, AVE: Average Variance Extracted.

Higher values of Composite Reliability and Cronbach Alpha across the constructs suggest the consistency of survey items measuring the same underlying construct. The cross-loading of each item along was assessed for discriminant validity. Table 4 exhibits the values of the Fornell-Lacker Criterion that indicate that each construct shares more variance with its indicators than with other constructs.

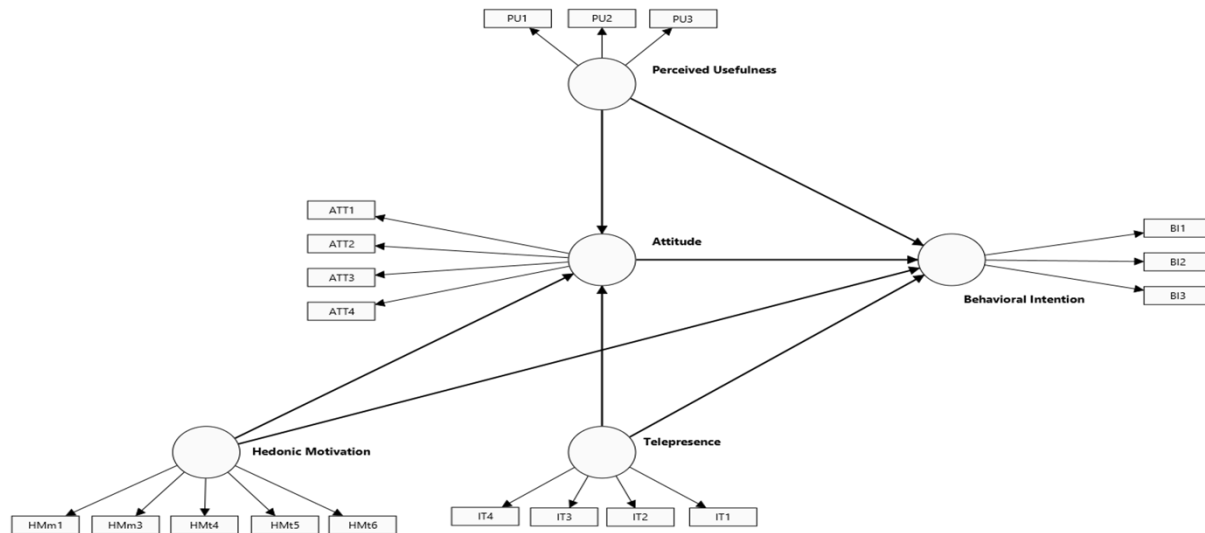


	ATT	BI	HM	PU	IT
Attitude	<b>0.85</b>				
Behavioural Intention	0.845	<b>0.884</b>			
Hedonic Motivation	0.829	0.73	<b>0.717</b>		
Perceived Usefulness	0.837	0.794	0.748	<b>0.874</b>	
Telepresence	0.737	0.682	0.714	0.688	<b>0.776</b>

Further, the authors used the Heterotrait-Monotrait Ratio (HTMT) of correlations, as exhibited in Tables 4-6, to assess the discriminant validity. The bootstrap confidence intervals were used to test whether the HTMT significantly differed from 1 (Henseler et al., 2015b) or a lower threshold value, such as 0.9 or 0.85 (Franke & Sarstedt, 2019) To obtain the confidence intervals in line with (Aguirre-Urreta & Rönkkö, 2018) the authors used 10,000 bootstrapped samples (Streukens & Leroi-Werelds, 2016). All the HTMT values lie between the lower and upper bound, indicating discriminant validity between the constructs.

	Original Sample	Mean Sample	2.5%	97.5%
BI <-> ATT	0.972	0.972	0.939	1.002
HM <-> ATT	0.920	0.921	0.866	0.968
HM <-> BI	0.777	0.778	0.706	0.844
PU <-> ATT	0.972	0.972	0.937	1.003
PU <-> BI	0.928	0.929	0.874	0.975
PU <-> HM	0.844	0.844	0.780	0.901
IT <-> ATT	0.893	0.893	0.840	0.939
IT <-> BI	0.831	0.830	0.773	0.882
IT <-> HM	0.873	0.874	0.814	0.930
IT <-> PU	0.847	0.847	0.789	0.901

The discriminant validity and cross-loading examination assessment suggest that the constructs within the measurement model are distinct and well-represented by their respective indicators. The values confirm the model's theoretical foundation, ensuring that the constructs are reliable and distinct, and the measurement model is deemed suitable for the structural model analysis to test the proposed hypotheses regarding adopting metaverse applications for travel and tourism in the Indian context. Figure 2 represents the final model for further analysis.



**FIGURE 2**  
**EMPIRICAL CONCEPTUAL FRAMEWORK**

## Structural Model Assessment

### Path Coefficients and Hypotheses Results

The path coefficients of the structural model, exhibited in Table 6 were evaluated on bootstrapping standard errors as a basis for calculating t-values of path coefficients (Streukens & Leroi-Werelds, 2016) to determine the significance and strength of the hypothesized relationships between constructs.

The path from Attitude to Behavioural Intention is positive and significant with a coefficient of 0.546 ( $t=7.92$ ,  $p<0.001$ ), suggesting that a positive attitude towards the metaverse significantly predicts the intention to use it for travel experiences. Hedonic Motivation's impact on attitude is also positive and significant ( $\beta=0.39$ ,  $t=7.745$ ,  $p<0.001$ ), indicating that the enjoyment and pleasure derived from the metaverse positively influence users' attitude towards it. However, the direct effect of Hedonic Motivation on Behavioural Intention is not significant ( $\beta=0.02$ ,  $t=0.304$ ,  $p<0.761$ ), implying that hedonic motivation does not directly influence the intention to use the metaverse for travel experiences without it first affecting attitude. Further, the path from Perceived Usefulness to Attitude is significant ( $\beta=0.436$ ,  $t=10.24$ ,  $p<0.001$ ), demonstrating that the perception of the metaverse as useful strongly influences users' attitudes. Similarly, Perceived Usefulness also significantly affects Behavioural Intention ( $\beta = 0.264$ ,  $t = 4.515$ ,  $p < 0.001$ ), indicating that usefulness perceptions can lead directly to higher intentions to use the metaverse. However, a higher t-statistic and smaller standard deviation (STDDEV = 0.043) suggest a better, more robust, and stronger relationship between Perceived Usefulness to Attitude than Perceived Usefulness directly on Behavioural Intention. Lastly, the influence of Telepresence on Attitude is significant, although modest ( $\beta = 0.16$ ,  $t = 3.641$ ,  $p < 0.001$ ), suggesting that the sense of presence in the metaverse contributes positively to user's attitudes. Thus, telepresence exhibits a small but significant path to Behavioural Intention ( $\beta = 0.083$ ,  $t = 2.071$ ,  $p = 0.038$ ). We can conclude that telepresence has a stronger impact on attitude than behavioural intention.

The structural model analysis provides that Attitude and Perceived usefulness are strong predictors of Behavioural Intention toward adopting metaverse applications for travel experiences. Hedonic Motivation significantly influences attitude but does not directly impact Behavioural Intention. Telepresence has a notable effect on attitude and a minor yet significant effect on Behavioural Intention. The findings support most of the hypothesised relationships confirming the model's validity in explaining user adoption intentions in the context of the metaverse for travel and tourism in India.

Hypotheses	B	T	P*	Results
ATT -> BI	0.546	7.920	0.000	Supported
HM -> ATT	0.390	7.475	0.000	Supported
HM -> BI	0.020	0.304	0.761	Not Supported
PU -> ATT	0.436	10.240	0.000	Supported
PU -> BI	0.264	4.515	0.000	Supported
IT-> ATT	0.160	3.641	0.000	Supported
IT -> BI	0.083	2.071	0.038	Not Supported

Note: Relationships are significant at \* $p < 0.01$ , B=Beta Coefficient, T=t-statistics, P= Probability (P) value.

### Role of Attitude as a Mediator

Mediation Analysis assessed the indirect effects of Hedonic Motivation, Perceived Usefulness, and Telepresence on Behavioural Intention through Attitude. The indirect effects are statistically significant, confirming that Attitude mediates the relationship between these constructs and Behavioural Intention. (Preacher & Hayes, 2004)

For Hedonic Motivation to Behavioural Intention through Attitude, the indirect path coefficient is 0.213 with a standard deviation of 0.035. The t-statistic of 6.030 ( $p < 0.001$ ) indicates a strong, significant mediating effect of Attitude in the relationship between Hedonic Motivation and Behavioural Intention. Hence, we propose that the pleasure and enjoyment users find in using metaverse contribute to forming a positive Attitude, significantly influencing their intention to use metaverse.

For Perceived Usefulness to Behavioural Intention through Attitude, the indirect path coefficient is 0.238, with a standard deviation of 0.029 and a t-statistic of 2.995 ( $p = 0.003$ ). The significant mediation effect implies that the perception of utility in metaverse applications positively affects their Attitude, leading to higher intention to use these applications for travel experiences.

For Telepresence to Behavioural Intention through Attitude, the indirect path coefficient for Telepresence is 0.087, with a standard deviation of 0.029 and a t-statistic of 2.995 ( $p = 0.003$ ). While this effect is smaller than the other constructs, it remains statistically significant, indicating that the immersive experiences of telepresence in the metaverse positively influence Attitude, which modestly increases the Behavioural Intention to engage with metaverse applications.

The mediation analysis (as exhibited in Table 7) validates that Attitude plays a critical mediating role in adopting metaverse applications for travel and tourism. Hedonic Motivation and Perceived Usefulness exert a stronger mediated effect on Behavioural Intention than Telepresence. These findings suggest that the interventions aiming to enhance the attitude

towards the metaverse may be effective in increasing adoption intentions, particularly by leveraging the aspects related to the enjoyment and usefulness of the technology. While still impactful, telepresence may require additional support from other constructs to affect adoption intentions significantly.

Hypotheses	B	P	Results
Hedonic Motivation -> Attitude -> Behavioral Intention	6.030	0.000	Supported
Perceived Usefulness -> Attitude -> Behavioral Intention	6.502	0.000	Supported
Telepresence -> Attitude -> Behavioral Intention	2.995	0.003	Supported

Note: Relationships are significant at  $p < 0.05$ .

### Moderation Analysis

MICOM uses a three-step process for measurement invariance in the data configural invariance, compositional invariance and the equality of composite mean values and variances (Henseler et al., 2015b).

We have assessed the moderating influences within our model. Measurement Invariance Composite Analysis (MICOM) was performed to establish the equivalence of constructs across different groups (Henseler et al., 2009). Based on MICOMs outcomes, Multi-Group Analysis (MGA) was subsequently conducted to discern the potential variations in construct relationships for Frequency of Travel and Income. For other binary variables, such as gender and internet access, MGA offered insights into the differential effects these moderators may exert on the model.

*Measurement Invariance and Multi-Group Analysis Based on Income:* The MICOM procedure assessed whether constructs were perceived similarly across high-income and low-income groups. Based on the permutation results (as exhibited in Table 8) for correlation invariance, there was no significant difference in the correlations between constructs across the two income groups. The findings suggest that, regardless of income, the respondents understand and relate to the constructs similarly.

For Mean invariance, the analysis indicated no significant differences in the means of the constructs between the high and low-income groups ( $p$ -values range from 0.297 to 0.836). Thus, we can infer that the central tendency of how the constructs are rated does not vary meaningfully with income.

	Measurement Variance	Partial	Full	Partial	Partial	Partial
Step 3(b)	Equal Variance	Yes	Yes	Yes	Yes	Yes
	Confidence Interval (Variance)	-0.275, 0.306	-0.226, 0.262	-0.300, 0.324	-0.255, 0.313	-0.308, 0.316
	Variance Difference	-0.045	0.163	-0.108	0.072	0.194

Step 3(a)	Equal Mean	No	Yes	No	No	No
	Confidence Intervals (Mean)	-0.191, 0.190	-0.195, 0.192	-0.196, 0.188	-0.199, 0.198	-0.179, 0.193
	Mean Differences	0.102	0.024	0.04	0.053	-0.021
Step 2	Compositional variance	Yes	Yes	Yes	Yes	Yes
	5% quantile	1.000	1.000	0.989	0.999	0.997
	Original Correlation	1.000	1.000	0.999	1.000	0.999
Step 1	Configural Variance	Yes	Yes	Yes	Yes	Yes
	Construct	AT	BI	HM	PU	IT

To measure the moderating role of income, bias-corrected and bootstrapped 10,000 subsamples were used to apply the MGA technique. This technique directly evaluates the path coefficients between two groups through bootstrapping, and the p-value of variances between path coefficients should be less than 0.05 to show significant variations in the path coefficient (Hair et al., 2011)

In the path from Attitude, Hedonic Motivation, and Perceived Usefulness, there are no significant differences between income groups concerning these paths' impact on Behavioural Intention. The findings imply that these constructs influence Behavioural Intention similarly, regardless of the respondents' income (Refer to Table 9). The authors defined high-income groups with income greater than 1,00,000 Indian rupees per annum, while annual income up to 40,000 Indian rupees as low-income.

The path from Telepresence to Behavioural Intention shows a marginally significant difference ( $p=0.058$ , two-tailed), suggesting a trend where Telepresence may have a different effect on Behavioural Intention across income groups, potentially having a more substantial influence on high-income respondents.

	Difference	1-tailed p-value	2-tailed p-value
ATT -> BI	-0.003	0.512	0.976
HM -> ATT	0.112	0.192	0.384
HM -> BI	-0.058	0.65	0.7
PU -> ATT	-0.166	0.95	0.099
PU -> BI	-0.013	0.512	0.976
IT -> ATT	0.034	0.36	0.72
IT -> BI	0.161	0.029	0.058

The MICOM and MGA analysis indicate that metaverse applications may cross traditional income barriers regarding users' attitudes and intentions. While income variations do not significantly dictate the perceived usefulness or enjoyment of the metaverse, Telepresence's marginally significant influence on Behavioural Intention among high-income users may merit further exploration to understand the subtleties of economic factors on capability to imaginary presence in locations.

*Measurement Invariance and Multi-Group Analysis Based on Frequency of Travel:* The MICOM procedure assessed whether constructs were perceived similarly across frequent and infrequent travellers.

The permutation p-values (Refer to Tables 10 & 11) for Attitude and Behavioural Intention ( $p=0.343$  and  $p=0.983$ , respectively) indicate no significant difference in how these constructs correlate with travel frequency. In contrast, Hedonic Motivation shows a significant difference ( $p=0.015$ ), suggesting that individuals who travel frequently perceive the enjoyment derived from metaverse applications differently than those who travel less often. The lack of significant p-values across all constructs while assessing the means between groups indicates that the average ratings of these constructs are similar between frequent and infrequent travellers. Our empirical findings suggest that both groups have similar central tendencies in evaluating the constructs.

The significant difference found in Hedonic Motivation aligns with interaction moderating, indicating that frequent travellers may have distinct motivations compared to infrequent travellers, potentially due to varying levels of familiarity and comfort with metaverse technology related to travel.

	Measurement Variance	Partial	Partial	Partial	Partial	Partial
	Equal Variance	Yes	Yes	Yes	Yes	Yes
	Confidence Interval (Variance)	-0.260,0.249	-0.238,0.197	-0.293,0.197	-0.271,0.240	-0.316,0.294
Step 3(b)	Variance Difference	0.164	0.174	-0.065	0.079	0.245
	Equal Mean	No	No	No	No	No
	Confidence Intervals (Mean)	-0.189,0.170	-0.180,0.172	-0.182,0.178	-0.177,0.171	-0.175,0.186
Step 3(a)	Mean Differences	0.043	-0.032	0.066	0.022	0.063
	Compositional variance	Yes	Yes	Yes	Yes	Yes
	5% quantile	1.000	1.000	0.99	1.000	0.997
Step 2	Original Correlation	1.000	1.000	0.985	1.000	0.999
Step 1	Configural Variance	Yes	Yes	Yes	Yes	Yes
	Construct	AT	BI	HM	PU	IT

*Multi-Group Analysis Based on Gender:* As exhibited in Table 11, the difference between the coefficient estimation for the relationship between ATT->BI, HM->BI, PU->BI, PU->ATT and IT->BI are statistically insignificant. Hence, we can conclude that there is no significant difference in the effect of these constructs on attitude or behavioural intention between females and males (Venkatesh et al., 2003).

	Difference (Female - Male)	1-tailed (Female vs Male) p-value	2-tailed (Female vs Male) p-value
ATT -> BI	0.028	0.413	0.827
HM -> ATT	0.221	0.006	0.011
HM -> BI	0.165	0.092	0.184
PU ->AT	0.033	0.344	0.689
PU -> BI	-0.037	0.638	0.724
IT -> AT	-0.238	0.999	0.002
IT -> BI	-0.129	0.953	0.095

The difference is statistically significant for the relationship between HM -> ATT, with p-values of 0.006 for 1-tailed and 0.011 for 2-tailed. The effect of hedonic motivation on attitude (Venkatesh et al., 2012) is significantly higher for females than males. Similarly, p-values equal to 0.953 for 1-tailed and 0.095 for 2-tailed suggest a statistical difference in the effect of telepresence on attitude. Specifically, the effect of telepresence on attitude is higher for attitude for males compared to females.

*Multi-Group Analysis Based on Prior Experience with Metaverse:* Examination of Table 12 shows that the differences in the coefficients for the relationships between ATT and BI, HM and BI, PU and BI, and IT and BI are not statistically significant. Thus, the impact of these variables on attitude and behavioural intention is similar for both females and males (Wang et al., 2021b).

Consequently, with p-values 0.988 (1-tailed) and 0.025 (2-tailed) (Zhou et al., 2014), the effect of hedonic motivation on attitude appears to be significantly lower for individuals with experience with the metaverse before compared to those without experience. Similarly, with p-values 0.019 1-tailed and 0.038 2-tailed, the effect of telepresence on attitude is significantly higher for individuals who have experienced the metaverse before compared to those who have not. (Faiola et al., 2013)

	Difference	1-tailed p-value	2-tailed p-value
ATT ->BI	0.041	0.379	0.758
HM -> ATT	-0.211	0.988	0.025
HM -> BI	-0.14	0.878	0.244
PU ->AT	0.054	0.251	0.501
PU -> BI	0.03	0.391	0.782
IT -> AT	0.159	0.019	0.038

IT -> BI	0.052	0.252	0.504
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Note: Difference = (Yes Experience with Metaverse – No Experience with Metaverse).

### Goodness of Fit and Explanatory Power of the Model

The R<sup>2</sup> value indicates the model's explanatory capacity. The original sample revealed an R-Square of 0.805 for attitude and 0.743 for Behavioural Intention, exceeding 0.7, manifesting a strong proportion of variance in both Attitude and Behavioural Intention, reinforcing the constructs' substantial role within the theoretical framework, (Hair et al., 2011).

F-square value of 0.02 or higher is considered small, 0.15 or higher is considered medium, and 0.35 or higher is considered large. The effect of Hedonic Motivation, Perceived Usefulness, and Telepresence on Attitude is 0.285, 0.382 and 0.057, respectively. The analyses suggest a strong influence of enjoyment and pleasure of metaverse applications along with the perception of usefulness in shaping the users' attitudes, while telepresence denotes a modest but notable influence on how users perceive the metaverse applications. On the other hand, our assessment of the effect of Hedonic Motivation and Telepresence on Behavioural Intention resulted in f-square values less than 0.02, indicating negligible direct effects on the dependent variables. These findings support the mediation analysis results, where attitude is the mediating pathway through which these factors influence behavioural intention.

This research records the Q<sup>2</sup> predict value for attitude at a robust 0.800, signifying the PLS model's strong predictive capability for this construct. Consequently, the RMSE and MAE are notably low, corroborating the high precision of the PLS model in forecasting attitude within the metaverse context. Concurrently, Behavioural intention demonstrated a substantial Q<sup>2</sup> prediction of 0.677, reflecting the model's substantive predictive relevance for this latent variable. While the RMSE and MAE values for Behavioural Intention are marginally higher relative to attitude, they are nonetheless considered within an acceptable range, implying that the PLS model's predictions for Behavioural Intention retain a commendable degree of accuracy.

The model's fit was evaluated using the Standardized Root Mean Square Residual (SRMR), a fit index that quantifies the average discrepancy between the observed correlations and the model's predicted correlations. Both the saturated and estimated models reported SRMR values of 0.074 for the original sample, mirroring closely with a sample mean of 0.045. The consistency of these values within the 95% and 99% confidence intervals substantiates the model's adequacy in fitting the observed data. Generally accepted thresholds posit an SRMR below 0.08 as indicative of a good fit; thus, our findings corroborate a satisfactory fit of the model to the empirical data (Refer to Tables 13,14).

Construct	R-Square	SRMR	Q <sup>2</sup> predict
Attitude	0.805	0.074	0.800
Behavioural Intention	0.743	0.074	0.677

	Attitude	Behavioural Intention
Attitude		0.225



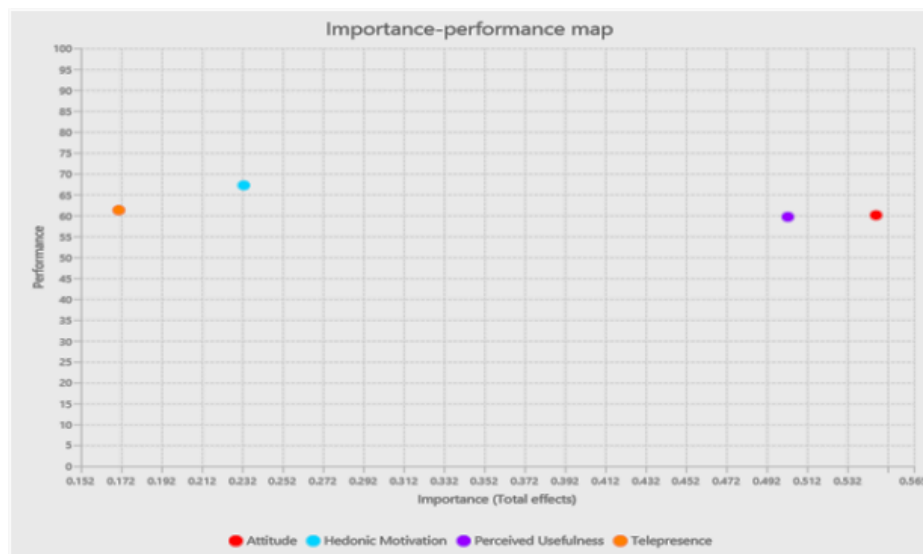
Hedonic Motivation	0.285	0.000
Perceived Usefulness	0.382	0.077
Telepresence	0.057	0.011

These metrics collectively emphasise the PLS model's efficacy in predicting key constructs, thus providing a reliable foundation for practical implications in the metaverse research and development field.

### Importance-Performance Map Analysis (IPMA)

The Importance-Performance Map Analysis helps discern the significance and performance of latent and manifest variables. The dual-axis mapping provides a visual and statistical assessment of the constructs' importance vs performance, offering an intuitive understanding of areas requiring managerial focus.

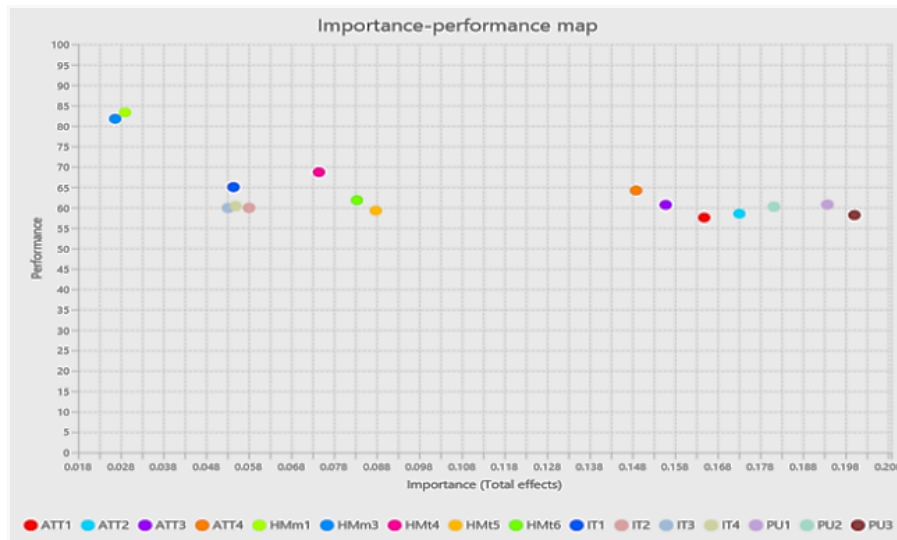
The Analysis for Manifest Variables (Figure 3) indicates that Attitude and Perceived Usefulness are crucial factors with moderate performance (importance approximately 0.55 and 0.50, and performance around 65 and 70, respectively). These constructs are vital for the metaverse system's success, suggesting that efforts should be concentrated on improving these areas to maximize overall impact. Conversely, Hedonic Motivation, despite its high performance (approximately 70), holds low importance (around 0.22), indicating it is less critical for success and can be deprioritized. Telepresence, with both low importance (approximately 0.17) and performance (around 60), should be the lowest priority for improvement. Therefore, the primary focus should be on enhancing Attitude and Perceived Usefulness to ensure a significant positive effect on system performance.



**FIGURE 3**  
**ANALYSIS OF MANIFEST VARIABLE**

The Analysis for Latent Variables (Figure 4) reveals that various constructs exhibit differing levels of importance and performance, which aids in identifying key areas for improvement. Specifically, the constructs ATT2 and PU3 emerge as critical due to their high importance (0.158 and 0.208, respectively) and relatively lower performance (approximately 60

and 55). These constructs should be prioritized for enhancement to maximize their impact on the system. Conversely, factors like ATT1 and Hedonic Motivation (HMm) have lower importance but varying performance levels, suggesting they are less critical for immediate improvement efforts. With moderate importance and performance, constructs such as ATT3, ATT4, and IT2 also warrant attention to maintain or slightly enhance their contributions. This targeted approach ensures that resources are allocated efficiently, first addressing the most impactful areas.



**FIGURE 4**  
**ANALYSIS OF LATENT VARIABLES**

The Importance-Performance Map (IPMA) highlights that Attitude and Perceived Usefulness are critical factors with high importance but moderate performance, necessitating targeted improvements to enhance overall system success. Conversely, Hedonic Motivation, while performing well, is less critical. Constructs such as ATT3, ATT4, should be considered for optimization. This strategic approach ensures efficient resource allocation, first addressing the most impactful areas to maximize system effectiveness.

## Discussion

The constructs of Attitude, Behavioural Intention, Hedonic Motivation, Telepresence and Perceived Usefulness emerged as pivotal within the metaverse adoption for travel and tourism. The robust outer loadings and high R square values substantiate their significance. It appears that operationalisation of items with lower loadings, such as HMm1 and HmM3, need a construct re-evaluation or realignment. The mediator role of attitude reinforces its centrality in technology acceptance models, suggesting it can significantly amplify behavioural intentions (Ajzen, 2014).

The elimination of PEOU from the Technology Adoption Model (TAM) due to its low factor loadings and AVE indicates it may not be as crucial in the context of the metaverse. Our findings disagree with Yung and Khoo's 2017 framework among our largely tech-savvy professional audiences. It can be argued that most respondents believed themselves task proficient, should the need arise. Perceived Usefulness significantly reflects the respondent's valued outcomes of Metaverse in Tourism. Thus, technological proficiency of the survey

respondents may decrease the use of a less critical measure. We end our argument for a weak PEOU relationship with a reference to the subsequent work of Davis in, where PU is a major predictor, whereas PEOU is a secondary determinant of attitude and intention; over time, EOU became insignificant.

Further, HMm1 (Use of Metaverse Applications will be Fun) and HMm3 (Travelling using Metaverse Applications is exciting), scoring highly in analysing manifest variables, offer marketers and researchers valuable insights into designing metaverse experiences that amplify hedonic value. Marketers can incorporate immersive elements to enhance customer engagement. The gender-differentiated impact of Hedonic Motivation and Telepresence on Attitude pinpoints the necessity to customize along gender lines to amplify the appeal of metaverse applications (Venkatesh et al., 2003). For experienced metaverse individuals, the diminished influence of hedonic motivation and the amplified effect of telepresence on attitude may suggest that post initial novelty, users seek deeper, more meaningful experiences. Marketers might pivot towards sophisticated content-rich experiences that sustain engagement beyond mere hedonic pleasure, guiding investments in advanced VR techniques and richer sensory environments. Marketers should focus on ease of use and introductory offers that emphasise fun and excitement to attract these first-time users.

### Limitations and Scope for Further Research

The limitations highlighted by the lower loadings of PEOU underscore an area ripe for further research including other relevant constructs, such as consumer trust, that enrich user understanding (Kim & Park, 2013).

On metaverse and securing spatial resources, we argue that the joy of tourism is manifold due to the immersive spatial affordance of consumer identity projects related to tourism. We find that the adoption is agnostic of respondents' income group, corroborating our argument. This multi-faceted approach, integrating theoretical insights with practical outcomes and highlighting areas for further research, ensures a comprehensive appreciation of intricate dynamics in adopting and enjoying metaverse applications.

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