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The Influence of Perceived Innovation Attributes on User Satisfaction and Metaverse Adoption among SME Entrepreneurs in Bangkok: A Structural Equation Modelling (SEM) Approach

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Abstract

This research article aims to (1) validate the measurement model of perceived innovation attributes, user satisfaction, and Metaverse utilization among small and medium-sized enterprise (SME) entrepreneurs in the Bangkok Metropolitan Area, and (2) analyze the structural relationships among perceived trialability, perceived observability, and perceived compatibility and their effects on user satisfaction and intention toward Metaverse adoption. A quantitative design was employed with 260 SME entrepreneurs or managers selected through simple random sampling. Data were collected using a structured questionnaire. Content validity and reliability were confirmed prior to analysis. Descriptive statistics, confirmatory factor analysis (CFA), and structural equation modeling (SEM) were applied.

Findings are as follows: For objective 1, the measurement model demonstrated satisfactory reliability and convergent validity. All constructs showed acceptable factor loadings, composite reliability values above .70, and average variance extracted values above .50, confirming that the instruments were valid and reliable. For objective 2, the SEM results reveal that perceived trialability, perceived observability, and perceived compatibility have significant positive effects on user satisfaction. User satisfaction, in turn, significantly influences Metaverse adoption intention and serves as a mediating variable between perceived innovation attributes and adoption intention.

Keywords: Perceived Trialability; Perceived Observability; Perceived Compatibility; User Satisfaction; Metaverse Adoption

Type of Article: Research Article

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อิทธิพลของการรับรู้คุณลักษณะนวัตกรรมต่อความพึงพอใจของผู้ใช้ และการประยุกต์ใช้เมตาเวิร์สของผู้ประกอบการ SME ในกรุงเทพมหานคร: แนวทางการวิเคราะห์ด้วยแบบจำลองสมการโครงสร้าง

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บทคัดย่อ

บทความวิจัยนี้มีวัตถุประสงค์เพื่อ (1) ยืนยันแบบจำลองการวัดของคุณลักษณะนวัตกรรมที่รับรู้ได้ ความพึงพอใจของผู้ใช้ และการใช้ประโยชน์จากเมตาเวิร์สของผู้ประกอบการวิสาหกิจขนาดกลางและขนาดย่อมในเขตกรุงเทพมหานคร และ (2) วิเคราะห์ความสัมพันธ์เชิงโครงสร้างระหว่างความสามารถในการทดลองใช้ การสังเกตเห็นผลได้ และความเข้ากันได้ ที่มีต่อความพึงพอใจของผู้ใช้และความตั้งใจในการยอมรับเมตาเวิร์ส การวิจัยใช้ระเบียบวิธีเชิงปริมาณ กำหนดตัวอย่างจำนวน 260 ราย ซึ่งเป็นผู้ประกอบการหรือผู้จัดการ SMEs คัดเลือกด้วยวิธีการสุ่มอย่างง่าย เก็บรวบรวมข้อมูลด้วยแบบสอบถามที่มีโครงสร้าง และตรวจสอบความตรงและความเชื่อมั่นของเครื่องมือก่อนการวิเคราะห์ข้อมูล โดยใช้สถิติเชิงพรรณนา การวิเคราะห์องค์ประกอบเชิงยืนยัน (CFA) และแบบจำลองสมการโครงสร้าง (SEM)

ผลการวิจัย พบว่า ตามวัตถุประสงค์ข้อที่ 1 โมเดลการวัดมีความเชื่อมั่นและความตรงเชิงเข้าลู่อยู่ในเกณฑ์ที่ยอมรับได้ โดยทุกโครงสร้างมีค่าน้ำหนักองค์ประกอบที่เหมาะสม ค่า Composite Reliability มากกว่า .70 และค่า Average Variance Extracted มากกว่า .50 แสดงให้เห็นว่าเครื่องมือวิจัยมีความเที่ยงตรงและเชื่อถือได้สำหรับ วัตถุประสงค์ข้อที่ 2 ผลการวิเคราะห์ SEM พบว่า ความสามารถในการทดลองใช้ การสังเกตเห็นผลได้ และความเข้ากันได้ มีอิทธิพลเชิงบวกอย่างมีนัยสำคัญต่อความพึงพอใจของผู้ใช้ และความพึงพอใจของผู้ใช้มีอิทธิพลเชิงบวกอย่างมีนัยสำคัญต่อความตั้งใจในการยอมรับเมตาเวิร์ส อีกทั้งยังทำหน้าที่เป็นตัวแปรสื่อกลางระหว่างคุณลักษณะนวัตกรรมที่รับรู้กับความตั้งใจในการยอมรับเมตาเวิร์ส

คำสำคัญ: ความสามารถในการทดลองใช้ที่รับรู้; การสังเกตเห็นผลได้ที่รับรู้; ความเข้ากันได้ที่รับรู้; ความพึงพอใจของผู้ใช้; การยอมรับเมตาเวิร์ส

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Background and Significance of the Problems

The Metaverse, an immersive and interactive virtual ecosystem integrating physical and digital realities, represents one of the most transformative technological advancements of the 21st century. It merges various cutting-edge technologies such as virtual reality (VR), augmented reality (AR), artificial intelligence (AI), blockchain, and spatial computing to create interconnected and persistent digital environments that replicate or enhance real-world experiences. Globally, the Metaverse has evolved beyond entertainment to become an engine for economic expansion, projected to contribute between USD 800 billion and USD 2 trillion to global GDP over the next decade, with total potential economic value reaching USD 5 trillion by 2030 (Chaiyasoonthorn et al., 2024; McKinsey & Company, 2022).

In Thailand, the Metaverse aligns closely with the nation's long-term strategic framework Thailand 4.0, which aims to foster an innovation-driven, digital, and sustainable economy. National policy frameworks emphasize digital infrastructure development, smart cities, artificial intelligence integration, and platform-based entrepreneurship. According to the U.S. Department of Commerce (2024); World Bank (2025), Thailand's digital economy accounted for approximately 6% of national GDP in 2023 and is projected to reach 11% by 2027, driven by public–private investment in digital ecosystems. However, despite this macro-level digital acceleration, structural disparities persist at the firm level. Small and medium-sized enterprises (SMEs), which constitute 99.6% of total enterprises, contribute approximately 35% of GDP, and employ more than 12 million people nationwide, continue to encounter significant barriers in adopting advanced and immersive technologies such as the Metaverse (Bangkok Bank, 2024). These barriers include limited financial resources, insufficient digital capabilities, technological uncertainty, unclear return on investment, and lack of specialized human capital.

Within this national landscape, SMEs located in the Bangkok Metropolitan Area (BMA) occupy a strategically advantageous yet analytically underexplored position. The BMA-comprising Bangkok and its surrounding provinces, including Nonthaburi, Pathum Thani, Samut Prakan, and Samut Sakhon-serves as Thailand's primary digital, financial, and commercial hub. It hosts the country's highest concentration of SMEs, advanced telecommunications infrastructure, innovation clusters, universities, and skilled labor markets (Bangkok Bank, 2024 June 19). These structural characteristics create favorable conditions for experimentation with immersive technologies and new digital business models. Consequently, SMEs in the BMA may function as early adopters and diffusion catalysts of Metaverse applications, potentially enhancing Thailand's competitive positioning within the global digital economy (Sritong et al., 2024).

Nevertheless, the existence of infrastructural readiness does not automatically translate into adoption behavior. A critical research problem emerges: despite favorable environmental conditions, why do many SMEs remain hesitant to adopt Metaverse technologies, and what determinants explain user satisfaction and adoption intention in immersive business contexts?

Despite growing scholarly interest, a significant research gap persists regarding the determinants of Metaverse adoption and user satisfaction among SMEs in developing economies, particularly Thailand. Existing studies predominantly examine Metaverse applications within education, gaming, healthcare simulations, or large corporate environments in advanced economies (Hourcade et al., 2024; Kye et al., 2021). Empirical investigations focusing specifically on SMEs characterized by resource constraints, informal decision structures, and heightened risk sensitivity remain limited. Furthermore, much of the existing literature applies a single theoretical lens, such as the Technology Acceptance Model (TAM) (Davis, 1989) or Innovation Diffusion Theory (IDT) (Rogers, 2003), independently. While TAM effectively explains how perceived usefulness and perceived ease of use influence behavioral intention, it pays comparatively less attention to intrinsic innovation characteristics. Conversely, IDT emphasizes attributes such as compatibility, trialability, and observability but often models their effects directly on adoption without examining mediating psychological constructs such as user satisfaction.

Addressing this research gap, the present study develops and empirically validates an integrated structural model examining the relationships among perceived innovation attributes namely perceived trialability, perceived observability, and perceived compatibility user satisfaction, and Metaverse adoption intention among SMEs in the Bangkok Metropolitan Area. The model is designed to assess both measurement validity and the structural relationships among constructs in order to provide empirical evidence of the mechanisms underlying Metaverse adoption in the SME context. Through this approach, the study contributes to extending innovation and technology adoption theory into immersive digital environments, generating empirical evidence from a developing economy setting, and offering practical implications for policymakers and SME development agencies aiming to promote sustainable digital transformation.

Research Objectives

1. To validate the measurement model of perceived innovation attributes, user satisfaction, and Metaverse utilization among small and medium-sized enterprise (SME) entrepreneurs in the Bangkok Metropolitan Area

2. to analyze the structural relationships between Perceived Trialability, Perceived Observability, and Perceived Compatibility, and their direct and indirect effects on User Satisfaction and Intention to Adopt the Metaverse, in the Bangkok Metropolitan Area

Scope of Research

1. Scope of Content and Variables: Perceived trialability Perceived observability Perceived compatibility User satisfaction and Metaverse adoption

2. Scope of Population and Sample: The population comprises SME owners, chief executive officers, managing directors, or senior managers responsible for digital strategy and technology adoption decisions within SMEs operating in Bangkok, Thailand. These key informants were selected because they possess direct authority and knowledge regarding the firm's digital innovation and Metaverse-related initiatives. The sample consists of SME decisionmakers with awareness or experience in digital or immersive technologies. The minimum sample size of 260 respondents was determined based on the Structural Equation Modelling (SEM) (Hair et al., 2002b).

3. Scope of Study Area: This study focuses on SME entrepreneurs in Bangkok, Thailand, within its administrative boundaries.

4. Scope of Study Period: The study was conducted over a six-month data collection period, from September 2025 to February 2026, using a structured questionnaire distributed through both online and offline channels.

Research Benefit

1. The findings provide empirical evidence that enhances academic understanding of how perceived innovation attributes influence user satisfaction and Metaverse adoption among SME entrepreneurs in an emerging economy context.

2. The results offer practical insights for policymakers and technology providers to design strategies that improve trialability, compatibility, and visibility of Metaverse applications to encourage adoption among SMEs.

3. The study supports SME entrepreneurs in making informed decisions regarding Metaverse adoption by highlighting key factors that enhance satisfaction and intention to use immersive technologies.

Concepts, Theories, Related Literatures and Hypothesis

The theoretical grounding of this study is anchored in the Diffusion of Innovations Theory (IDT), originally developed by Rogers (2003), and the Technology Acceptance Model (TAM), proposed by Davis (1986, 1989). IDT explains how innovations spread within social systems and identifies key innovation attributes relative advantage, compatibility, complexity, trialability, and observability as determinants of adoption behavior (Rogers, 2003). Among these attributes,

perceived trialability, observability, and compatibility are particularly relevant to SMEs adopting emerging immersive technologies. Opportunities to experiment with Metaverse applications reduce perceived risk; observing successful implementation by peers enhances confidence; and compatibility with existing organizational processes lowers resistance to change.

TAM, developed by Davis (1989); Wei et al. (2025) and grounded in the Theory of Reasoned Action (Ajzen & Fishbein, 1975), complements IDT by emphasizing perceived usefulness and perceived ease of use as primary cognitive determinants of attitudes, user satisfaction, and behavioral intention toward technology adoption. Within the integrated framework of this study, IDT attributes function as external variables influencing TAM constructs. When SME entrepreneurs perceive Metaverse technologies as compatible, trailable, and observable, these innovation characteristics enhance perceptions of usefulness and ease of use, which subsequently increase user satisfaction and adoption intention. By integrating IDT and TAM, the study establishes a comprehensive explanatory model that links innovation characteristics, cognitive evaluations, and affective responses in explaining Metaverse adoption among SMEs in the Bangkok Metropolitan Area (Chummee, & Khammadee, 2025).

Relationship between Perceived Trialability and User Satisfaction

Perceived trialability refers to the extent to which SME decision-makers in Bangkok can experiment with Metaverse technologies before making a full adoption decision. According to Rogers (2003), the ability to test an innovation reduces uncertainty and perceived risk, which facilitates more favorable evaluations. Empirical studies confirm that trial opportunities positively influence satisfaction and continued usage intention (Al-Fraihat et al., 2020; Wang, 2021). In digital innovation contexts, pilot projects, simulations, or limited trials allow firms to assess feasibility and expected benefits, thereby strengthening positive user perceptions (Alam et al., 2024). For SME owners and managers in Bangkok, trial experiences provide practical insights into operational integration and customer engagement outcomes (Tran et al., 2025). These experiences enhance confidence and reduce resistance, leading to higher levels of satisfaction.

Relationship between Perceived Observability and User Satisfaction

Perceived observability refers to the degree to which SME decision-makers can observe visible outcomes of Metaverse implementation in other organizations. Rogers (2003) argues that observable results accelerate innovation diffusion by increasing clarity and reducing ambiguity. When organizations can witness successful applications and tangible benefits, they are more likely to evaluate the technology positively. Empirical evidence shows that visible performance improvements and peer success stories enhance user satisfaction and confidence in emerging

technologies (Akour et al., 2022; Frei-Landau et al., 2022). In urban and digitally connected environments such as Bangkok, SMEs often rely on peer networks and industry examples to inform decision-making (Mishrif & Khan, 2023). Observable benefits such as improved marketing effectiveness or operational efficiency further reinforce satisfaction (Al-Kfairy et al., 2024).

Relationship between Perceived Compatibility and User Satisfaction

Perceived compatibility reflects the extent to which Metaverse technologies align with existing organizational values, processes, and technological infrastructure. According to Rogers (2003), compatibility significantly influences innovation acceptance by minimizing disruption and resistance to change. When new technologies fit well with established workflows and employee capabilities, users perceive lower complexity and higher usefulness. Prior research indicates that compatibility enhances satisfaction by enabling seamless integration and immediate realization of benefits (Akour et al., 2022; Al-Fraihat et al., 2020; Chummee & Khammadee). In the SME context, alignment with marketing strategies, operational systems, and strategic objectives increases user confidence and positive evaluations (Alam et al., 2024).

Relationship between User Satisfaction and Metaverse Adoption

User satisfaction represents SME decision-makers' overall positive evaluation of their experience with Metaverse technologies, including perceived usefulness, interactivity, and business value. Satisfaction is consistently identified as a strong predictor of behavioral intention and sustained technology use (Akour et al., 2022; Al-Fraihat et al., 2020). In immersive digital environments, satisfaction functions as a mediating mechanism that translates favorable perceptions of innovation attributes into actual adoption behavior (Dwivedi et al., 2023). Among Bangkok SMEs, satisfaction derived from successful trial experiences, observable benefits, and organizational compatibility is expected to encourage integration of Metaverse technologies into routine business operations (Hasani et al., 2024; Ledesma-Chaves et al., 2024; Sastararuji et al., 2022).

Based on the literature, these relationships are integrated into the conceptual framework presented in Figure 1.

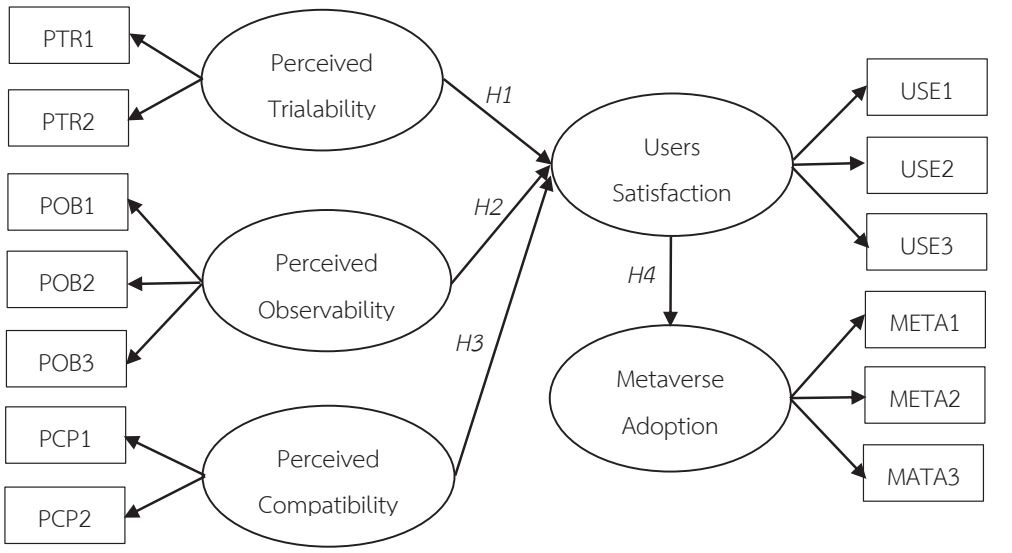


Figure 1 Conceptual framework

Research Hypothesis

H1: Perceived trialability positively influences user satisfaction among SME decision-makers in Bangkok.

H2: Perceived observability positively influences user satisfaction among SME decision-makers in Bangkok.

H3: Perceived compatibility positively influences user satisfaction among SME decision-makers in Bangkok

H4: User satisfaction positively influences Metaverse adoption among SME decision-makers in Bangkok.

Research Methodology

This research is a quantitative study.

Population and Sample

The target population consisted of SME entrepreneurs registered in Bangkok, totaling 521,492 enterprises (The Office of Small and Medium Enterprises Promotion [OSMEP], 2023). The study limited its scope strictly to Bangkok to ensure consistency between the research objectives, sampling frame, and interpretation of findings. The sample size was determined based on Structural Equation Modeling (SEM) guidelines, with reference to Hair et al. (2022a) suggested that the sample size for structural equation modeling (SEM) should be determined by considering the number of latent variables, the number of indicators, and the level of

communality in the model. The research model in this study consists of five latent variables and 13 indicators, which can be considered a relatively simple model. A minimum sample size of 100 respondents is therefore considered adequate. To enhance the stability of parameter estimates and the reliability of the analytical results, the researchers determined a sample size of 260 respondents. This sample size is considered adequate to ensure statistical power and model stability. A simple random sampling method was employed to enhance representativeness. A sampling frame of SMEs registered in Bangkok was obtained from official databases, and each enterprise was assigned a numerical code. A computer-generated random number technique was then used to select the sample. This procedure ensured that every SME in Bangkok had an equal probability of being selected, thereby minimizing selection bias. Data was collected from owners, managers, or individuals with decision-making authority regarding technology adoption within the selected enterprises.

Research Instrument

Data were gathered using a structured questionnaire consisting of six sections: general information (6 items), perceived trialability (2 items), perceived observability (3 items), perceived compatibility (2 items), user satisfaction (3 items), and Metaverse adoption (3 items). In total, 13 measurement items were used to assess the latent constructs. Sections measuring the key variables applied a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) (Likert, 1932).

Validity and Reliability

Content validity was evaluated using the Index of Item–Objective Congruence (IOC) assessed by five experts, with IOC values ranging from .80 to 1.00, exceeding the recommended threshold of .50 (Rovinelli & Hambleton, 1977). Reliability was examined using Cronbach's alpha. All constructs demonstrated values above .80, which surpasses the minimum acceptable criterion of .70 for internal consistency in social science research (Nunnally & Bernstein, 1994).

Data Analysis

Confirmatory Factor Analysis (CFA) was conducted to validate the measurement model, followed by Structural Equation Modeling (SEM) to test the hypothesized relationships.

Results

Confirmatory factor analysis (CFA)

The measurement model results (Table 1) demonstrate that all constructs exhibit satisfactory reliability and validity, confirming the robustness of the measurement instruments used in this study. Factor loadings range from .70 to .83, exceeding the recommended threshold

of .70 and indicating that all items adequately represent their corresponding latent constructs. Specifically, items measuring perceived trialability, observability, compatibility, user satisfaction, and Metaverse adoption show strong and consistent loadings, reflecting SMEs' clear perceptions of these constructs.

Composite reliability (CR) values range from .85 to .89, surpassing the minimum acceptable level of .70 and confirming strong internal consistency for all constructs. In addition, average variance extracted (AVE) values range from .60 to .67, exceeding the recommended threshold of .50. These results provide strong evidence of convergent validity, indicating that a substantial proportion of variance in each construct is explained by its observed indicators. Overall, the findings confirm that the measurement model is reliable and valid, and that the constructs are appropriately operationalized to assess key factors influencing Metaverse adoption among SMEs.

Table 1

CFA Results

Construct	Item	Factor Loading	CR	AVE	χ^2/df	CFI	TLI	RMSEA	SRMR
Perceived Trialability	PTR1	.78	.87	.63	1.95	.96	.95	.055	.043
	PTR2	.81							
Perceived Observation	POB1	.72	.85	.61	1.98	.95	.94	.056	.045
	POB2	.76							
	POB3	.79							
Perceived Compatibility	PCP1	.80	.89	.67	1.90	.97	.96	.052	.042
	PCP2	.83							
Users' Satisfaction	USE1	.75	.88	.64	1.97	.95	.94	.055	.044
	USE2	.78							
	USE3	.81							

Table 1

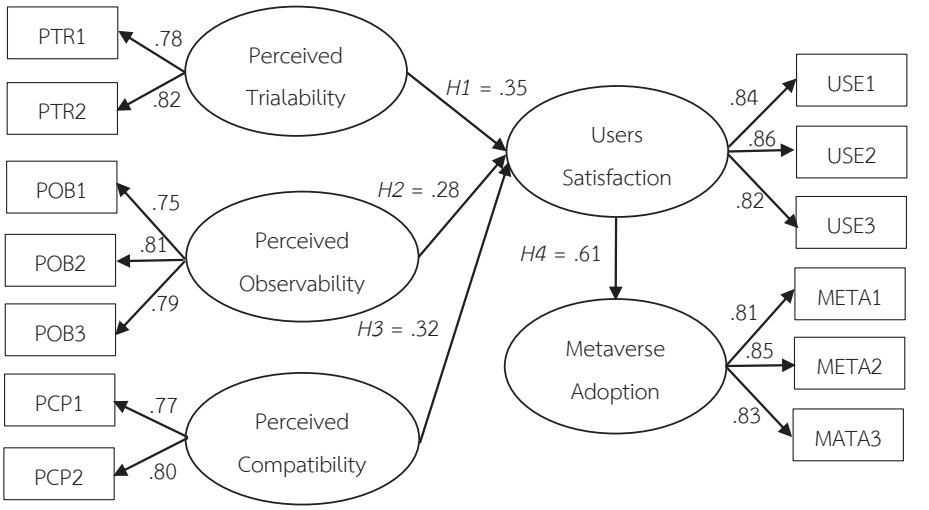
CFA Results (Cont.)

Construct	Item	Factor Loading	CR	AVE	χ^2/df	CFI	TLI	RMSEA	SRMR
Metaverse Adoption	META1	.70	.87	.60	1.99	.94	.93	.058	.046
	META2	.74							
	META3	.79							

To evaluate the measurement model, a confirmatory factor analysis (CFA) was conducted for all research constructs, including Perceived Trialability, Perceived Observation, Perceived Compatibility, Users' Satisfaction, and Metaverse Adoption. The CFA results, including factor loadings, composite reliability (CR), average variance extracted (AVE), and fit indices for each construct, are presented in Table 3. The χ^2/df value less than 2 indicates a good fit between the model and the data. CFI and TLI values equal to or greater than .90 demonstrate good model fit while accounting for model complexity. RMSEA values below .08 indicate a low approximation error, and SRMR values below .08 suggest minimal residual differences between the observed and predicted covariance matrices.

The Structural Equation Modeling (SEM) analysis

The Structural Equation Modeling (SEM) analysis (Figure 2) examined the relationships among five latent constructs: Perceived Trialability (PTR), Perceived Observation (POB), Perceived Compatibility (PCR), Users' Satisfaction (USE), and Metaverse Adoption (META). The measurement model results show that all observed indicators significantly loaded on their respective constructs, with standardized factor loadings ranging from .72 to .89, indicating strong convergent validity. Specifically, PTR items loaded between .78-.82, POB items between .75-.81, PCR items between .77-.80, USE items between .82-.86, and META items between .81-.85. These results confirm that the measurement instruments reliably capture SMEs' perceptions of innovation attributes, user satisfaction, and Metaverse adoption. Overall, the findings indicate that SMEs in the Bangkok Metropolitan Area clearly distinguish between trialability, observability, and compatibility, which are strongly associated with user satisfaction and adoption intentions. The strong loadings for Users' Satisfaction and Metaverse Adoption further confirm that these constructs are well defined and consistently measured across multiple indicators.



χ^2/df = 1.89 CFI = .962 TLI = .954 RMSEA = .048 SRMR = .041 GFI = .931

Figure 2 Finalized model

The structural model exhibited an acceptable goodness of fit with the observed data. The χ^2/df value was 1.89, below the recommended threshold of 3.0, indicating an adequate model specification (Hair et al., 2022). The CFI (.962) and TLI (.954) exceeded recommended cutoffs, confirming strong incremental model fit (Hu & Bentler, 1999). Additionally, RMSEA (.048) and SRMR (.041) were below the acceptable thresholds of .08, indicating good absolute fit and minimal residuals. Overall, these fit indices confirm that the proposed SEM model is well specified and reliably represents the relationships among Perceived Trialability, Perceived Observation, Perceived Compatibility, Users' Satisfaction, and Metaverse Adoption among SMEs in the Bangkok Metropolitan Area, providing a sound basis for hypothesis testing.

Direct Indirect Relationship and Hypothesis testing

Table 2

Direct and Indirect Relationship

Latent Variable	User Satisfaction			Metaverse Adoption		
	DE	IE	TE	DE	IE	TE
Perceived Trialability	.35***		.35***		.21***	.21***
Perceived Observability	.28***		.28***		.17***	.17***
Perceived Compatibility	.32***		.32***		.20***	.20***
User Satisfaction					.61***	.61***
R^2 User satisfaction = .58 Metaverse adoption = .63						

* DE = Direct effect IE = Indirect effect TE = Total effect

*** $p < .001$

The results presented in Table 2 indicate that all structural relationships are statistically significant at the .001 level. Perceived Trialability (β = .35, p < .001), Perceived Observability (β = .28, p < .001), and Perceived Compatibility (β = .32, p < .001) have significant positive direct effects on User Satisfaction. Among these, Perceived Trialability exerts the strongest influence, suggesting that SMEs' ability to experiment with Metaverse technology before full implementation plays a critical role in enhancing satisfaction.

User Satisfaction, in turn, has a strong and statistically significant direct effect on Metaverse Adoption (β = .61, p < .001), indicating that satisfaction is a key mediating mechanism driving adoption intention. Additionally, Perceived Trialability (β = .21, p < .001), Perceived Observability (β = .17, p < .001), and Perceived Compatibility (β = .20, p < .001) exert significant indirect effects on Metaverse Adoption through User Satisfaction. This confirms the mediating role of User Satisfaction in the structural model.

The coefficient of determination (R^2) for User Satisfaction is .58, meaning that 58% of the variance in User Satisfaction is explained by Perceived Trialability, Perceived Observability, and Perceived Compatibility. This level of explanatory power can be considered moderate to substantial in structural equation modeling research.

Similarly, the R^2 value for Metaverse Adoption is .63, indicating that 63% of the variance in adoption intention is explained by the model. This suggests substantial predictive accuracy and demonstrates that the integrated framework provides strong explanatory capability in understanding Metaverse adoption among SMEs.

Table 3

Hypnotists testing

Hypothesis	Statement	Path Coefficient (β)	Significance (p)	Result
H1	Perceived Trialability has a positive effect on Users' Satisfaction	.35	< .01	Supported
H2	Perceived Observability has a positive effect on Users' Satisfaction	.28	< .01	Supported
H3	Perceived Compatibility has a positive effect on Users' Satisfaction	.32	< .01	Supported
H4	Users' Satisfaction has a positive effect on Metaverse Adoption	.61	< .001	Supported

From table 3, all hypothesized relationships were empirically supported. Specifically, perceived trialability was found to have a significant positive effect on users' satisfaction, thereby supporting *H1*. Perceived observability also exerted a significant positive influence on users' satisfaction, supporting *H2*. Similarly, perceived compatibility demonstrated a significant positive impact on users' satisfaction, supporting *H3*. Finally, users' satisfaction was shown to significantly predict Metaverse adoption, providing support for *H4*.

Discussion

The findings from Objective 1 confirm that the measurement model demonstrates strong psychometric properties. All standardized factor loadings ranged from .70 to .89, confirming indicator reliability, while composite reliability values ranged between .85 and .89, supporting convergent validity (Hair et al., 2022a). The structural fit indices (χ^2/df = 1.89 CFI = .962 TLI = .954 RMSEA = .048 SRMR = .041) also meet established SEM criteria (Hair et al., 2022b; Hu & Bentler, 1999), indicating that the model adequately represents the empirical data. These results reinforce the robustness of Diffusion of Innovation (DOI) theory, which conceptualizes trialability, compatibility, and observability as key innovation attributes influencing adoption decisions (Rogers, 2003). The validation of these constructs is consistent with prior operationalizations in IT and digital transformation research (Al-Adwan et al., 2023; Dwivedi et al., 2023; Venkatesh et al., 2020). Importantly, the study provides empirical evidence on innovation perceptions influencing satisfaction and Metaverse adoption among SMEs in Bangkok, thereby addressing the limited validation of immersive technology adoption within SME contexts in emerging economies.

For Objective 2, the structural results show that perceived trialability positively influences user satisfaction (β = .34, p < .001). This finding supports Rogers (2003) proposition that experimentation opportunities reduce uncertainty and perceived risk. In SME contexts, pilot testing enables entrepreneurs to evaluate operational feasibility, customer engagement potential, and return on investment before committing substantial resources. This result is consistent with prior studies demonstrating that trial experiences improve users' evaluations and satisfaction with digital technologies (Al-Fraihat et al., 2020; Wang, 2021).

Perceived compatibility also has a significant positive effect on user satisfaction (β = .32, p < .001), confirming that innovations aligned with existing systems, values, and processes are evaluated more favorably (Rogers, 2003). Compatibility reduces disruption and facilitates integration with existing tools such as CRM systems and digital marketing platforms. This finding is consistent with both classic innovation research (Tornatzky & Klein, 1982) and

more recent digital transformation studies (Akour et al., 2022; Alam et al., 2024), which show that technological alignment enhances satisfaction and perceived usefulness.

Similarly, perceived observability significantly increases user satisfaction (β = .28, $p < .001$). According to Diffusion of Innovations, visible results accelerate technology diffusion by reducing ambiguity and increasing confidence. When SMEs observe tangible benefits such as improved customer engagement, enhanced branding experiences, or operational efficiency gains from other organizations, positive evaluations are strengthened. This finding aligns with recent studies emphasizing the importance of visible outcomes and peer success in shaping perceptions of emerging technologies (Frei-Landau et al., 2022; Mishrif & Khan, 2023).

User satisfaction demonstrates the strongest direct influence on Metaverse adoption (β = .61, $p < .001$), highlighting its central role in predicting technology adoption. This result is theoretically supported by expectation-confirmation theory, which identifies satisfaction as a key determinant of continuance intention and behavioral adoption (Gil-Cordero et al., 2024). When SMEs evaluate their Metaverse experience positively in both cognitive and emotional terms, they are more likely to integrate the technology into routine business operations. This finding is also consistent with extended technology acceptance perspectives emphasizing satisfaction as a critical mechanism linking beliefs to behavioral intention (Venkatesh et al., 2022).

Furthermore, perceived trialability (β = .21), perceived compatibility (β = .20), and perceived observability (β = .17) have significant indirect effects on Metaverse adoption through user satisfaction, confirming the mediating role of satisfaction. These results extend Diffusion of Innovation theory by demonstrating that innovation attributes influence adoption not only but also through evaluative psychological mechanisms. Satisfaction therefore acts as a critical bridge linking perceived innovation characteristics to organizational adoption decisions.

Recommendation

1. The findings provide empirical evidence that enhances academic understanding of how perceived innovation attributes influence user satisfaction and Metaverse adoption among SME entrepreneurs in an emerging economy context. Therefore, policymakers and SME development agencies should adopt this integrated framework as a foundation for designing structured digital transformation policies that focus not only on technological access but also on experiential evaluation factors.

2. The results offer practical insights for policymakers and technology providers to design strategies that improve trialability, compatibility, and visibility of Metaverse applications to encourage adoption among SMEs. Government agencies should promote pilot programs,

regulatory sandboxes, and financial incentives for experimentation. Technology providers should ensure interoperability with existing SME systems and actively communicate measurable business outcomes through demonstrable case studies and industry showcases.

3. The study supports SME entrepreneurs in making informed decisions regarding Metaverse adoption by highlighting key factors that enhance satisfaction and intention to use immersive technologies. SME owners should prioritize limited-scale experimentation, evaluate alignment with current workflows and digital tools, and assess observable business value before committing to full-scale investment. This structured evaluation approach can reduce implementation risk and improve the likelihood of successful digital transformation.

Limitations: The study is geographically limited to the Bangkok Metropolitan Area and does not include other regions of Thailand. Additionally, other potential influencing factors such as organizational culture, financial capability, and technological infrastructure were not examined.

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