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Analyzing Consumer Behavior in Metaverse Environment

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Abstract

The metaverse is quickly transforming digital consumer behavior, especially among Generation Z, who are digital natives by nature. This research investigates Gen Z's interaction with the metaverse, with an emphasis on awareness, information search, interaction, and post-engagement assessment. With a survey research design involving 197 respondents and Factor Analysis via SPSS, the study presents three major factors that drive consumer behavior: Metaverse Usage Behavior and Engagement, Perceived Usefulness and Trust, and Financial and Technical Barriers. Results reveal that Gen Z engages in active use of the metaverse with virtual asset buys and immersive engagements but is deterred from adopting it by security issues and excessive technological expenses. Companies can use these findings to build consumer-oriented strategies, foster trust, and build interactive virtual experiences. The research contributes to metaverse marketing and digital consumer behavior scholarship and also points out areas for future research in developing virtual environments.

1 Introduction

The metaverse gains widespread interest because it demonstrates substantial power to change modern marketing ideas while transforming how consumers behave. The metaverse defines itself as a virtual reality which extends beyond current reality according to Kolesnichenko et al. (2019), Kye et al. (2021) and Bale et al. (2022) yet it also serves to connect imagination to reality and unite social networks with immersive virtual systems Ayiter (2019).

The industry growth has been significant because of this innovative concept which is predicted to reach USD 996.42 billion in 2030 while demonstrating an annual growth rate of 39.8% (Precedence Research, 2023). Companies have chosen the metaverse as their new strategic front by recognizing its position beyond brick-and-mortar and e-commerce operations which leads them to establish various brands including Walmart and Adidas and McDonald's within this virtual domain (Lee et al., 2021; Mogaji, Dwivedi, & Raman, 2023; Mogaji, Wirtz, et al., 2023).

Although the metaverse grows fast it has not led to complete clarity in how consumers actually behave in this virtual domain. The research field presents a lack of empirical examination of consumer behavior inside the Metaverse because existing studies mainly consist of literature reviews and expert insights. The paper delivers a multidisciplinary view about Metaverse emerging challenges and research opportunities along with practice and policy recommendations. The research conducted by Dwivedi, Hughes, Baabdullah, et al. (2022) fundamentally examined the direction Metaverse would lead consumer research and practice into the future. The work by Koohang et al. (2023) forecasted business sector operational changes that result from Metaverse adoption and use along with Mogaji et al. (Mogaji, Dwivedi, & Raman, 2023; Mogaji, Wirtz, et al., 2023) developed the concept of Immersive time (ImT) within the Metaverse context. These theoretical pieces assist new perspective development but their lack of empirical support means that laboratory research represents the following logical step. This research seeks to fill the existing gap by obtaining theoretical foundations from immersive time (Mogaji, Dwivedi, & Raman, 2023; Mogaji, Wirtz, et al., 2023) as a modern and unique user behavior concept.

Quantitative methodology combined with a survey questionnaire with 197 participants allows the researchers to study Generation Z consumer interactions in the Metaverse. These individuals born between the mid-1990s through early 2010s maintain a special connection with digital technology while actively exploring virtual and augmented reality environments (Lim, 2022; Sung et al., 2023). The analysis of Gen Z consumer activity within Metaverse demands focus because they inherently feel comfortable with digital technologies (Chakraborty, Patre, & Tiwari, 2023; Chakraborty, Polisetty, et al., 2023; Nalbant & Aydin, 2023). Virtual interaction comfort among users establishes valuable guidelines for developing the future Metaverse experience according to research by Park & Kim (2023) and Periyasami & Periyasamy (2022). This research examines consumer interactions to establish how people become aware of the Metaverse platform alongside the persuasive power of company approaches and the relationship between exploratory buying behavior against user participation within virtual environments.

2 LITERATURE REVIEW

2.1 Consumer Engagement and Brand Interactions

The world of the metaverse provides an entirely new extent of consumer engagement through real-life, immersive digital experiences via an avatar and one’s virtual self (Coble et al., 2024). Brands have started interacting with consumers at different digital platforms than usual as they provide consumers multisensory engagements and personalized experiences which affects consumer loyalty and purchasing intent (Arora et al., 2024). Especially for Generation Z, experiential marketing and brand interactions in the metaverse are very responsive to authenticity, entertainment, and other aspects (Kim et al., 2025). These opportunities have also been taken by companies such as McDonald’s and Adidas through strong virtual presence (Hadi et al, 2024). Also, the engagement is of another

nature, since symbolic gratification and virtual self-expression (Kathuria, 2024) are becoming more and more important.

2.2 Consumer Decision-Making in Virtual Marketplaces

The behavior of consumers in metaverse enabled marketplaces shows change in the way users perceive value and take purchase decisions. Tokenization and digital ownership of NFTs change the traditional buyer's journey by blending the digital scarcity and identity-based consumption (Wijoyo, 2024). Kaur et al. (2024) indicate that Gen Z users tend to possess evolving preferences influenced by symbolic gratification and the enhancements of reality, which influence the evaluation and the post engagement phases of the Engel-Kollat-Blackwell decision making model. In addition, digital environments support decision making (of which not every experiential stimulus [such as smell or feel] is beneficial to purchase willingness; Arora et al., 2024).

2.3 Psychological and Behavioral Influences

Consumer behavior in the metaverse is based on their psychological foundation, identity construction, authenticity, mediated presence. Generation Z are products of internet culture and social media norms and are value seekers who prefer brands who align with the personal identity (Gupta, 2024). Most research on avatars has demonstrated that avatars influence consumer emotions and behaviors and how they make purchasing decisions in the in-game based on visual representation and social signaling (Coble et al., 2024). Additionally, platforms like BeReal show that Gen Z values authentic sense of self on the digital plane and the psychological importance of identity and visibility within its digital engagement (Neufeld-Wall, 2023).

2.4 Metaverse Marketing Strategies and Consumer Behavior

In the process of shifting from informational to experiential strategies, businesses adapt to the metaverse. That is interactive events, gamified brand experiences and influencer driven marketing for all immersive platforms (Koohang et al., 2023). With the rise of digital information and the convenience it provides, companies have started to develop different approaches to adapt their methods of reaching consumers by dividing them into groups based on technological fluency and openness to virtual realities, with a focus on targeting Gen Z due to their technological savviness and their dependence on social media (Puchkova et al., 2017). Decentralized data ownership in Web3 infrastructure is enhanced through transparency and a consumer's control over own digital assets (Deloitte, 2022).

2.5 Bibliometric Analysis of Consumer Behavior in the Metaverse

Now, there has been a significant interest in the metaverse on the part of academics, but bibliometric studies show that there is a lack of empirical research on the behavior of real users, especially Gen Z (Kaur et al., 2024). Little work is currently done that is concrete or empirical. Nevertheless, some of the emerging interdisciplinary research suggests the possibilities in marketing, education, healthcare, and retail (Koohang et al., 2023). Pew Research Center (2022) also highlights that the impact of the metaverse is a question for which experts are divided; the conclusion is from a utopian integration to a dystopian isolation, thus, it demands more empirical exploration and longitudinal studies in this evolving domain.

3 Research Methodology

3.1 Introduction to Factor Analysis

Factor Analysis is a
statistical method employed to reveal hidden structures within datasets through the identification of interrelated variables and their bundling into factors. In this research, Principal Component Analysis (PCA) with Varimax rotation is utilized to examine the underlying dimensions of Generation Z's engagement with the metaverse. The reduction of the complexity of the dataset while preserving its informational integrity is the aim of the analysis.

3.2 Data Collection and Preparation

A structured survey involving 197 participants measured their understanding of the metaverse together with their user participation and perception of it. The questionnaire used 19 Likert-scale items that operated between 1 (Strongly Disagree) and 5 (Strongly Agree).

Preprocessing steps included:

- Missing responses within the data received replacement through the computing method of column mean values.

- Factor Analysis required KMO testing and Bartlett's test of sphericity which determined the suitability for the analysis.

3.3 Suitability Assessment

Two statistical tests were executed to confirm data suitability for factor analysis.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.916
Bartlett's Test of Sphericity	Approx. Chi-Square	1836.224
	df	171
	Sig.	.000

For decision-making regarding factor analysis appropriateness, the given table displays Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity values.

1. Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy
Value: 0.916

Interpretation:
KMO values range from 0 to 1.

The data exhibits outstanding suitability for factor analysis when the KMO value reaches above 0.9. The data shows excellent factor analysis suitability because the value of 0.916 exceeds 0.8.

2. Bartlett's Test of Sphericity Chi-Square
Value: 1836.224
Degrees of Freedom (df): 171
Significance (Sig.): 0.000

Interpretation:
Bartlett's test enables analysts to verify if the correlation matrix retains the default identity format indicating uncorrelated data.
A p-value of 0.000 indicates that we should discard the null hypothesis which demonstrates the presence of correlations between variables.
Factor analysis proves suitable as an analytical method by the substantial evidence collected from the study.

3.4 Principal Component Analysis (PCA) – Total Variance Explained

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.135	42.816	42.816	8.135	42.816	42.816
2	1.854	9.759	52.576	1.854	9.759	52.576
3	1.014	5.339	57.914	1.014	5.339	57.914
4	.845	4.450	62.364			
5	.805	4.237	66.601			
6	.717	3.776	70.377			
7	.712	3.749	74.126			
8	.697	3.670	77.796			
9	.598	3.147	80.942			
10	.540	2.842	83.784			
11	.470	2.472	86.257			
12	.428	2.253	88.510			
13	.410	2.160	90.671			
14	.381	2.003	92.674			
15	.350	1.845	94.519			
16	.292	1.539	96.058			
17	.262	1.381	97.439			
18	.254	1.336	98.775			
19	.233	1.225	100.000			

Principal Component Analysis (PCA) identified the data structure through Total Variance Explained methods. The total number of factors was selected per the Kaiser's criterion method by examining Eigenvalues greater than 1.

Initial Eigenvalues and Extraction Sums of Squared Loadings

The research output shows that three components possess eigenvalues exceeding 1.

These factors collectively demonstrate 57.914% variance explanation in the final data framework. This indicates the components include major factors from the original dataset.

Specifically:

Component 1 demonstrates an explanatory power of 42.816% toward the entire variance in the data.

Component 2 explains 9.759%,

Component 3 explains 5.339%.

The reduction of necessary data to three principal components proves effective given that substantial information remains intact.

Total Variance Explained

Component	Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	5.545	29.186	29.186
2	2.989	15.734	44.920
3	2.469	12.994	57.914
4			
5			
6			
7			
8			
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16			
17			
18			
19			

Extraction Method: Principal Component Analysis.

Rotation Sums of Squared Loadings

The application of Varimax rotation methods achieved better interpretability by spreading the variance across the components yet preserving 57.914% total variance explanation.

After rotation:

Component 1 accounts for 29.186%,

Component 2 for 15.734%,

Component 3 for 12.994%.

The extracted factors become more distinguishable after this discovery.

The data analysis using PCA demonstrates three major components sufficiently describe the information while keeping the analysis simple to understand. The Rotated Component Matrix will analyze the components in order to identify variables which strongly correlate to each.

3.5 Exploratory Factor Analysis (EFA)

Rotated Component Matrix[a]

	Component		
	1	2	3
I have purchased virtual assets (NFTs, digital fashion, in-game items, virtual land, etc.).	.806	-.036	-.009
I am willing to spend real money on digital items in the metaverse.	.765	.100	.263
I have attended virtual events (e.g., concerts, conferences, meetings) in the metaverse.	.743	.263	.036
I feel comfortable socializing with people in the metaverse.	.695	.173	.323
I regularly spend time in virtual environments.	.670	.260	.269
I prefer using the metaverse over traditional social media platforms.	.656	.303	.117
I see virtual purchases as valuable investments.	.619	-.016	.379
I use the metaverse to learn new skills or attend virtual courses.	.606	.443	.021
I use the metaverse for entertainment and gaming.	.597	.355	.289
I engage with the metaverse for business and investment opportunities.	.596	.290	.134
The metaverse provides an immersive and engaging experience.	.520	.398	.177
The metaverse helps me connect with like-minded people.	.482	.458	.246

Rotated Component Matrix[a]

	Component		
	1	2	3
The metaverse is an exciting and innovative technology.	.149	.764	.306
I believe the metaverse will play a significant role in the future of digital interactions.	.172	.684	.298
Privacy and security are major concerns for me when using the metaverse.	.159	.570	.437
I think the metaverse is just a temporary trend that will decline in the future.	.528	.543	-.200
Technical issues such as lag and glitches affect my experience in the metaverse.	.127	.212	.774
I am familiar with the concept of the metaverse.	.200	.151	.702
The high cost of VR/AR equipment limits my ability to fully experience the metaverse.	.153	.456	.605

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]
a. Rotation converged in 10 iterations.

Generation Z's metaverse interaction was analyzed through Exploratory Factor Analysis (EFA) using Principal Component Analysis (PCA) extraction.

The application of Varimax rotation alongside Kaiser Normalization enhancement method worked to interpret the results by maximizing each factor's squared loadings.

Factor Extraction and Interpretation The Rotated Component Matrix showed three separate components through its factor loading analysis.

Component 1: Metaverse Engagement and Usage Behavior

The set of statements such as *"I have purchased virtual assets (NFTs, digital fashion, in-game items, virtual land, etc.)"* and *"I regularly spend time in virtual environments"* under this component describes both asset purchases and attending virtual events meeting alongside metaverse socializing together with entertainment and business and educational purposes of the platform.

The "Metaverse Engagement and Usage Behavior" factor incorporates two specific questionnaire items that show strong associations with this construct.

Component 2: Perceived Benefits and Trust in the Metaverse

Participants define the metaverse through this component as a new digital environment which is both evolving and changing old practices.

Statements such as *"The metaverse is an exciting and innovative technology"* and *"I believe the metaverse will play a significant role in the future of digital interactions"*. about metaverse technology being exciting and innovative and about its significant influence on digital contacts in the future demonstrated strong meaningful connections.

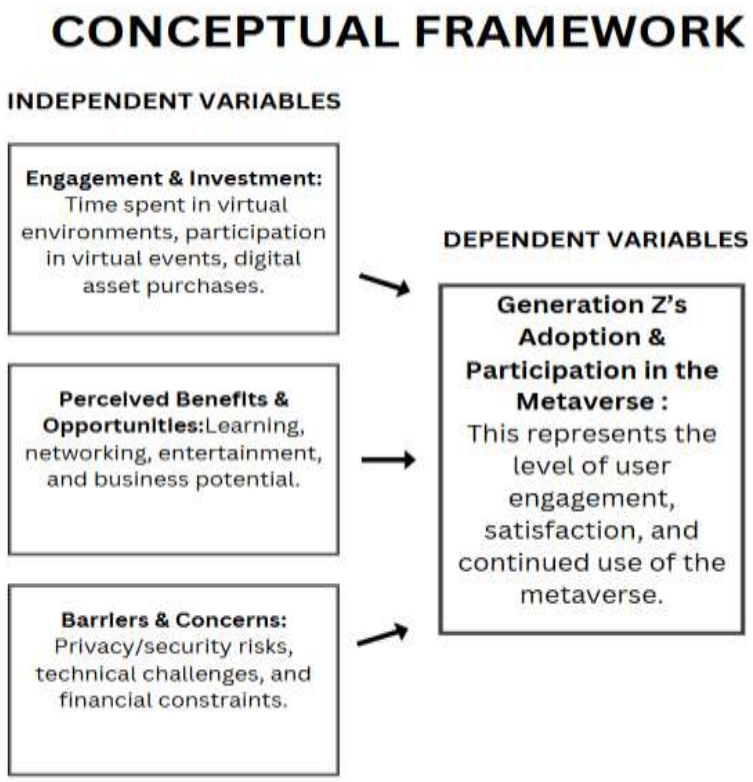
This factor revealed that participants linked privacy issues combined with security concerns to their perception of the metaverse because trust mattered to them.

Component 3: Technical and Financial Barriers

Technology related obstacles along with system delays become an important factor because they impact connection to the metaverse through hardware limitations.

Items such as "*Technical issues such as lag and glitches affect my experience in the metaverse*" and "*The high cost of VR/AR equipment limits my ability to fully experience the metaverse*"

According to the data these two statements about metaverse problems related to technical issues and high equipment costs were key components in lowering metaverse adoption.



4 Conclusion

4.1 Key Insights from the Study

This research delivers extensive knowledge about Generation Z's metaverse interaction styles as well as their theory of how they process awareness and participate and evaluate what occurs afterward. The study's factor analysis confirmed three essential variables which affect consumer behavior.

Members of Gen Z actively participate in the metaverse by buying digital assets including NFTs as well as virtual fashion items and taking part in virtual events. The metaverse continues to acquire commercial validity because users choose to use real money inside virtual spaces.

People view the metaverse as a vibrant space which delivers advantages and possibilities through learning connection and entertainment use. People utilize the metaverse because they find it helpful for developing professionally as well as maintaining social connections and interacting with innovative elements.

Stifled adoption of VR/AR technology remains a problem due to worries about personal data security as well as technical safety risks and the expensive nature of these technologies. Security infrastructure needs improvement together with cost reduction to overcome present challenges.

4.2 Implications for Businesses and Digital Marketing

Research data provides strategic directions for businesses which want to use the metaverse for brand engagement purposes.

Marketers should develop interactive consumer engagement solutions which use virtual influencer campaigns as well as user-specific content and videogame elements to establish stronger audience relationships.

Enhancing trust and security demands transparent protection measures and data privacy policies to build consumer confidence.

The expansion of VR/AR technologies depends on developing cheaper systems that serve a wide range of users.

4.3 Contribution to Academic Research

The research performs empirical analysis of metaverse consumer behavior through factor analysis to close theoretical discussions in the field. This research expands digital consumerism knowledge by introducing an organized system which evaluates engagement drivers operating in virtual environments.

4.4 Limitations and Areas for Future Exploration

The research delivers important findings but researchers must recognize several intervening factors because of which generalization becomes restricted.

The results of this study lose some applicability beyond their demographic limitations because the research sample counts 197 participants.

This research excludes analysis of digital behavior among older population segments whose Meta-averse experience might differ from Generation Z.

Research to track emerging metaverse trends requires ongoing analysis of real-time data because the metaverse evolves as a concept.

Future research needs to increase demographic diversity among their participants together with multi-point survey assessments and psychological studies of metaverse engagement drivers.

4.5 Concluding Thoughts

Digital transformations across the metaverse are fast-paced because Generation Z members are actively adopting its growing impact. Due to ongoing obstacles businesses together with researchers need to create trust-based virtual spaces which also offer enhanced accessibility and foster innovation to succeed with modern consumer demands. This research work will support future businesses in developing successful metaverse consumerism approaches thus guiding their strategy for this quickly changing environment.

The metaverse demonstrates steady progress toward its essential incorporation into regular life as technology develops further. Business entities need to develop both exceptional user interface strategies and procedures to

protect privacy rights while ensuring inclusive access along with the promotion of digital mental health. The metaverse future relies on its ability to achieve sustainable commercial development together with innovative practices that promote responsibility.

Customer expectations in virtual spaces are expected to transform through time so businesses need adaptable marketing approaches and complete technology integration systems. A secure and inclusive metaverse will be developed through the partnership between researchers and industry leaders.

This research demonstrates the potential of metaverse as a dynamic virtual space yet recognizes the critical issues which require resolution. Consumer engagement research and strategy development by businesses and scholars will help form an immersive sustainable digital future.

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