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Does Impulsive Buying Lead to Compulsive Buying in Metaverse? A Dual-Stage Predictive-Analytics SEM-ANN Analysis. The Empirical Study from Vietnam

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Abstract

The expansion of the metaverse, an all-encompassing digital environment that integrates virtual reality, augmented reality, and the internet, has fundamentally altered human interaction and behavior, including online purchasing. Due to its interactivity and immersion, the metaverse provides a unique experience that blurs the line between the physical and digital realms. A multitude of prominent corporations have established virtual retail locations within the metaverse, enabling customers to virtually examine merchandise by utilizing photorealistic avatars; this has led to a surge in revenue. Considerable scholarly investigation has been devoted to the subject of impulsive online shopping behavior. Furthermore, the evolution of the metaverse may intensify predispositions towards impulsive and compulsive buying. Nevertheless, there is a dearth of empirical research examining the impact of the metaverse on consumer decision-making. The primary objective of this research endeavor is to examine the impact of the metaverse on compulsive and impulsive buying behavior. Specifically, this study will investigate the influence of perceived value, social influence conformity, metaverse engagement presence, and virtual identity alignment. The utilization of the S-O-R framework in this study provides valuable insights into consumer behavior in virtual environments, which have substantial ramifications for developers and businesses operating in the metaverse. In order to enhance comprehension of consumer behavior in the metaverse, this research utilized a non-probability judgmental sampling technique to select 186 respondents who are active participants in online purchasing within the metaverse in Vietnam. Next, the PLS-SEM and ANN analyses were applied to test the relationship among variables. The research substantiates the importance of impulsive

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buying and its impact on compulsive buying within the metaverse setting by identifying two influential factors (PCV and MEP) that determine impulsive buying. This study offers significant contributions to the understanding and administration of consumer behavior in the metaverse.

Keywords: Metaverse, impulsive, compulsive, PLS-SEM, ANN, SOR
JEL Classifications: M16, M31, O32

1. Introduction

The metaverse, an immersive virtual world that combines augmented reality, virtual reality, and the internet, has experienced significant growth in recent years. This development has brought about a revolution in how people interact, communicate, and engage in various activities, such as online shopping. The metaverse provides users with a distinct and captivating experience that blurs the boundaries between the physical and digital worlds (Payal et al., 2024). With the rising popularity of the metaverse, researchers have developed a growing interest in studying consumer behavior within this unique virtual environment. Online shopping platforms have revolutionized the retail industry by providing consumers with the convenience of browsing and purchasing products and services from the comfort of their own homes. With the incorporation of additional layers of interactivity and immersion in the metaverse, it is likely that consumer behavior will experience further transformations (Kim, 2021). Shoppers in the metaverse can virtually try on things using lifelike avatars, thanks to the proliferation of 3D virtual stores. It is possible to create a realistic avatar of oneself using the Unreal Engine's Meta-Human Creator for the express goal of visiting a virtual store and acquiring an accurate understanding of the products sold there. Therefore, it is possible to increase revenue for companies, which has been proven by a series of large companies that have opened their own virtual stores in the metaverse, such as Nike, Puma, Gap, Clarks, and so on (Giang & Shah, 2023). On the other hand, numerous studies in the field of marketing research demonstrate the significance of impulsive online purchases (Karim et al., 2021;Cahyani & Artanti, 2023; Zhang et al., 2021). For instance, consumers spend an average of $5,400 annually on food, clothing, domestic items, and shoes by impulsive buying (Chakraborty et al., 2024). In addition, impulsive shopping has been proven to lead to an online shopping frenzy (Zafar et al., 2021), and the development of the metaverse could open the door to increasingly strong impulse and compulsive buying. However, there is a lack of empirical research exploring the impact of the metaverse on consumer decision-making. Therefore, the main objective of this study is to investigate the role of the metaverse in impulsive buying behavioral, and compulsive buying.

Furthermore, there is a significant gap in the current literature regarding the understanding of how the distinct characteristics of the metaverse, such as Metaverse Engagement Presence, Alignment of Virtual Identity, Social Influence Conformity, and Perceived Value, influence impulsive and compulsive buying behaviors. Examining these factors can offer valuable insights into how the metaverse influences consumer decision-making and provide a better understanding of the potential effects for marketers, policymakers, and virtual environment designers. This study will concentrate on individuals who engage in online purchasing activities within the metaverse. This study will investigate the various virtual environments and platforms that comprise the metaverse. The research will entail the collection of quantitative data through surveys to examine the experiences, attitudes, and behaviors of consumers in relation to impulsive and compulsive metaverse purchasing. This study's findings will provide important insights into the emerging field of consumer behavior in virtual environments. Moreover, they will contribute to a greater comprehension of the implications of the metaverse for online purchasing.

The study is organized as shown below. Sections 2 discuss the literature review and hypotheses of the research, whereas Section 3 discusses the methods employed. The fourth section provides context for the statistical results. Section 5 discusses the results and Section 6 their implications. Section 7 concludes the paper.

2. Literature review

2.1 The Stimulus-Organism-Response (SOR)

The Stimulus-Organism-Response (SOR) model is a psychological framework for investigating and explaining how people react to various stimuli (Nguyen et al., 2022; Yuan et al., 2020). Any external event, object, or situation that affects a person's senses is referred to as a stimulus in this theoretical framework (Jafar et al., 2023). Beliefs, emotions, thoughts, and past experiences are all part of the organism and contribute to the way in which the stimulus is interpreted and processed (Shiau & Huang, 2022). Finally, the response is the outward manifestation of the individual's behavioral or psychological reaction to the stimulus and their internal processing of it (Ali et al., 2022). According to the SOR framework, people have different reactions to the same environmental cues because of how they individually interpret and respond to those cues (Nguyen et al., 2022). This model is useful in several settings for both understanding and predicting human behavior, and as such has found use in fields as diverse as psychology, marketing, and user experience research (Ali et al., 2022).

With the application of the Stimulus-Organism-Response (SOR) framework, the present research extensively explores the complex interplay between metaverse participation, physical presence, virtual identity alignment, social influence, conformity, perceived value, and subsequent impulsive and compulsive purchasing in the online space. It is becoming increasingly important for businesses, marketers, and researchers to comprehend consumer behavior in the metaverse as it develops as a novel and compelling virtual environment. Metaverse engagement, which stands for the depth of users' participation and interactions in the virtual space; presence, which refers to users' subjective experience of "being there" in the virtual environment; and alignment with virtual identity, which shows how closely users' online and offline identities match up (Buhalis et al., 2023). The organism represents the metaverse consumer's mind and the way it works to interpret and react to stimuli. The term "social influence" refers to the way in which the actions and perspectives of other avatars and entities in a virtual environment can affect the decisions, attitudes, and behaviors of the users who inhabit those worlds (Alvarez-Risco et al., 2022). Conformity refers to the degree to which users in the metaverse modify their actions and decisions to fit in with accepted social norms and expectations (Lee et al., 2008). Perceived value is a broader concept that includes users' subjective evaluations of products, experiences, and virtual possessions and how those evaluations affect their propensity to make a purchase (Nguyen et al., 2022). Impulsive purchases, defined as those made on the spur of the moment in response to sensory input or an emotional state, and compulsive purchases, defined as those made repeatedly and in excess because of an insatiable need to satisfy an obsession, are of particular interest. To better understand consumer behavior in virtual environments and to provide useful insights for practitioners navigating the rapidly expanding metaverse, this study seeks to shed light on the interplay between the metaverse's unique stimuli, the complex psychological factors that influence user behavior, and the resulting purchasing tendencies.

2.2 Commerce in Metaverse

User experiences and interactions in the immersive digital realm are heavily influenced by purchasing behavior, which plays an important role in the metaverse's ever-changing landscape. Impulsive and compulsive shopping are two common types of consumer behavior in the online world (Bighiu et al., 2015; Tarka et al., 2022). In the virtual world, "impulsive buying" refers to purchases made on the spur of the moment rather than carefully considering them. Users experience fear of missing out (FOMO) due to the abundance of new and exciting opportunities presented by the metaverse, many of which have an air of exclusivity about them (Brunelle & Grossman, 2022). Customers feel pressured to act quickly to take advantage of special offers and acquire rare virtual items, so they don't feel left out of the ever-changing metaverse.

Impulsive shopping occurs when a person purchases products that they do not want to buy. It frequently occurs abruptly and in the heat of the moment, spurred by a "can't miss" deal or the discovery of covetable objects that are simply too tempting to pass up (Dang Quan et al., 2024). For example, you buy a dink while shopping or buy candy while waiting for the checkout line. In-app purchases and microtransactions also play a significant role in encouraging impulsive spending because they make it simple and fast for users to acquire virtual assets (Akram et al., 2018). With no barriers to entry, users are more likely to make spontaneous purchases thanks to the convenience of these methods. The social aspect of the metaverse also significantly contributes to impulsive purchasing behavior. When users interact with other users and their avatars, they develop a desire for social approval and recognition, which in turn motivates them to make hasty purchases meant to improve their avatar's appearance, identity, or standing in the virtual community (Alvarez-Risco et al., 2022).

Conversely, unlike impulsive buying, compulsive buying involves more than just spending more than you expected. It entails a compulsive desire to purchase stuff, many of which are unnecessary. People who participate in compulsive buying do so to boost their mood, self-esteem, and stress management (Black, 2022). Compulsive buying is characterized by compulsive and excessive purchasing behaviors motivated by an incessant need or addiction to accumulating fictitious goods or services (Black, 2022). As users seek to forge an idealized virtual identity or escape from real-world stresses, the metaverse's immersive and escapist nature can exacerbate compulsive buying tendencies (Moon et al., 2022). Users may engage in compulsive purchasing as they attempt to sustain the perceived emotional benefits from their virtual possessions, leading to a vicious cycle of virtual hoarding and the accompanying addiction.

Many metaverse experiences feature gamification elements that encourage compulsive purchasing, such as rewards, achievements, and loot systems (Brunelle & Grossman, 2022). Users may feel compelled to make repeated purchases in the endless pursuit of virtual advantages and in-game advancement because of the cycle of rewards and positive reinforcement. In addition, users may rely on purchasing as a coping mechanism or a means of satisfying psychological needs, and emotions like excitement, thrill, or a need for control can stimulate compulsive purchasing behaviors in the metaverse.

Understanding the underlying drivers of impulsive and compulsive buying behaviors is crucial as commerce in the metaverse continues to expand and integrate with various virtual platforms (Black, 2022). Businesses, platform creators, and other stakeholders all have a responsibility to think about how they can best protect users' physical and mental health while facilitating virtual commerce (Moon et al., 2022). A positive and sustainable virtual economy in the ever-evolving metaverse can be fostered through responsible design and open communication with users about virtual purchases.

2.3 Hypotheses development

2.3.1) Metaverse Engagement Presence

The term "Metaverse" refers to an expansive and interconnected virtual reality space that combines elements of physical reality, augmented reality, and virtual environments created using digital technology (Tan et al., 2023). It is a digital universe that is both immersive and interactive, and it allows users to interact with one another, socialize with other users, create content, and participate in a variety of activities by using avatars, which are virtual representations of themselves. The term "metaverse engagement presence" would refer to the extent to which users are actively involved in and immersed in the various online commercial activities that take place within the metaverse (Jafar et al., 2023). Users are actively participating in the virtual marketplace, interacting with products and services, and forming meaningful connections with other users or brands if there is a high metaverse engagement presence. The number of people who participate in the metaverse will increase as time goes on (Dang Quan et al., 2024). The study anticipates that users who are more engaged and immersed in the metaverse and who experience a higher sense of presence will be more likely to conform to social norms and opinions within the virtual environment. This is because these users will experience a higher sense of presence. Their level of engagement and presence determines the strength of the influence of the actions and perspectives of others on their own decision-making, which ultimately leads to an increase in the amount of social influence conformity (Jafar et al., 2023). As a result, the study hypothesizes:

H1a: Metaverse engagement presence (MEP) positively affects social influence conformity (SIC).

In the context of the metaverse, the term "perceived value" refers to the subjective evaluation and worth that users ascribe to virtual goods, services, experiences, or interactions that take place within the digital world (Mehta et al., 2023). It refers to the benefits and levels of happiness that users believe they will achieve because of their participation in the metaverse or the acquisition of something from it. Users who are highly engaged and present in the metaverse are likely to have a more positive perception of the value of the virtual experiences, goods, and services provided by the digital realm (Suh, 2023), which is consistent with our expectations. If they are more engaged in the experience and have a stronger sense of presence, they will feel more immersed in the metaverse. This will lead to a heightened perception of the significance and desirability of virtual offerings, which will ultimately lead to an increase in perceived value. Following, the study proposes the hypothesis:

H1b: Metaverse engagement presence (MEP) positively affects perceived value (PCV).

2.3.2) Alignment Virtual Identity (AVI)

Virtual identity refers to a user's digital representation in the metaverse (Zhao et al., 2022a). It is the persona or avatar created by the user to interact with others and navigate the virtual environment (Dwivedi et al., 2023). This virtual identity may be distinct from a user's real-world identity, allowing them to explore different facets of themselves or express themselves creatively in the digital realm. The conformity of social influence in the metaverse may be positively affected with a person's alignment with their virtual identity (Alvarez-Risco et al., 2022). Users who have a sense that their real-world selves and their virtual personas are more aligned with one another are more likely to conform to the social norms and behaviors that are prevalent within the virtual community (Jafar et al., 2023). The stronger the alignment with a user's virtual identity, the more likely it is that users will be swayed by the behaviors and perspectives of others within the metaverse, which will ultimately result in increased social influence conformity. As a result, the study hypothesizes:

H2a: Alignment virtual identity (AVI) positively affects social influence conformity (SIC).

There will be a strong positive correlation between alignment with virtual identity and perceived value in the metaverse (Suh, 2023). We have a hypothesis that users who feel greater alignment with their virtual personas will place a higher value on the virtual experiences, goods, and services that are provided by the metaverse. The more that users identify with their virtual identity, the more immersed and emotionally connected they feel in the virtual environment (Shi et al., 2023). This, in turn, leads to a heightened perception of the significance and desirability of virtual offerings, which ultimately leads to an increase in perceived value. Following the study proposes the hypothesis:

H2b: Alignment virtual identity (AVI) positively affects perceived value (PCV)

Through stimuli such as novelty, social influence, and limited time offers, metaverse engagement presence, which represents the degree of involvement and immersion, contributes to impulsive purchasing behaviors. As users actively participate and feel present in the virtual environment, they may succumb to the temptation to make impulsive purchases to enhance their experiences or keep up with the latest trends (Black, 2022). However, virtual identity alignment plays a crucial role in preventing impulsive purchases. Users are more likely to make thoughtful, rational decisions and resist impulsive temptations when their virtual identities align with their real-world values (Akram et al., 2018). Authenticity fosters a deeper emotional connection to virtual possessions, leading users to prioritize meaningful purchases over impulse purchases motivated by fleeting emotions or external influences (Chopdar & Balakrishnan, 2020). As a result, the study proposes hypotheses:

H3: Metaverse engagement presence (MEP) positively affects impulsive buying in the metaverse (IBM).

H4: Alignment virtual identity (AVI) negatively affects impulsive buying in the metaverse (IBM).

2.3.3) Impulsive buying in metaverse and compulsive buying in metaverse.

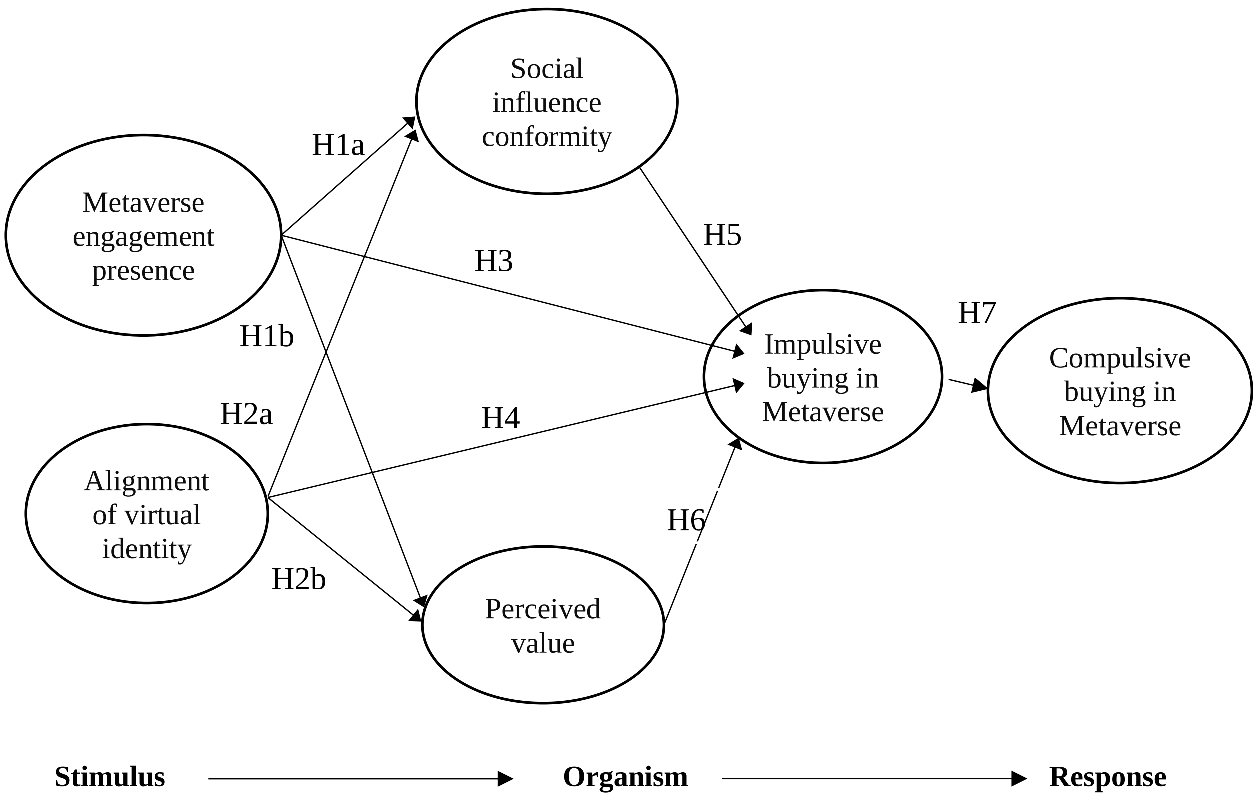
There will be a positive correlation between conformity to social influences in the metaverse and impulsive purchasing behavior (Moon et al., 2022; Yu et al., 2022). We hypothesize that users who are more susceptible to being swayed by the deeds and perspectives of others within the virtual community, as well as those who are more likely to conform to prevalent social norms and behaviors, will be more likely to engage in impulsive purchasing. The greater the social influence and conformity, the greater the tendency for users to make unplanned and spontaneous purchases driven by the influence of the behaviors and decisions of others (Maraz et al., 2015). This tendency increases as social influence and conformity increase. Additionally, there is going to be a positive correlation between the perceived value in the metaverse and impulsive buying behavior. We have a hypothesis that users who place a higher perceived value on the virtual experiences, goods, and services that the metaverse has to offer will be more likely to engage in impulsive purchasing. When users place a higher value on the virtual offerings, they are more likely to make hasty purchases to capitalize on the perceived benefits and satisfy immediate desires while interacting within an immersive digital environment. A strong positive correlation will exist between impulsive buying behavior in the metaverse and compulsive buying behavior in the same virtual environment when it comes to shopping online (Yu et al., 2022). Users who demonstrate a higher tendency towards impulsive purchases within the metaverse will also demonstrate a higher likelihood of engaging in compulsive buying behaviors, as this is what we predict will happen to them. When a person has a greater propensity for making impulsive and unplanned purchases that are triggered by immediate stimuli or feelings, there is a greater likelihood that they will make repeated and excessive purchases that are triggered by uncontrollable urges or dependencies within the same virtual environment. Following, the study hypothesizes:

H5: Social influence conformity (SIC) positively affects impulsive buying in the metaverse (IBM).

H6: Perceived value (PCV) positively affects impulsive buying in the metaverse (IBM).

H7: Impulsive buying in metaverse (IBM) positively affects compulsive buying in the metaverse (CBM).

Figure 1: Conceptual Framework



Source: Created by Authors

3. Methodology

To be suitable with the objective of the study, the survey was approached in this study, which is a popular way to obtain primary data (Chakraborty et al., 2024). Instead of focusing on an individual, this method collects information from a large cross-section of the population (Dang Quan et al., 2024). The data gathered from August to September 2023. Google's platform was employed in this study's survey. Before respondents completed the poll, a movie explaining the metaverse's premise and showcasing actual purchasing in the metaverse was included to improve the questionnaire. To assure the selection of participants who could offer useful insights, deliberate sampling was used. As a result, the non-probability with judgmental sampling strategy was selected. The respondents who own digital devices, have engaged in online shopping, and have encountered impulsive purchases to achieve the goal of examining the use of the

Metaverse for shopping. This method has also been used in peer-reviewed study by Dang et al. (2023) and Tan & Ooi (2018).

To ensure an adequate sample size for the analysis using partial least squares-structural equation modeling (PLS-SEM), the "10 times rule" suggested by (Christopher Westland, 2010) was applied. This guideline led to the determination that the required sample size was at least 40 replies. Additionally, the minimum sample size was determined using G*Power version 3 with parameters like a statistical power of 0.9, a margin of error of 0.05, an effect size of 0.15, and 5 predictors. The results indicated that a sample size of 116 would be sufficient. It is important to note that the term "minimum" in this context refers to the smallest practical sample size with a specified level of significance and power for SEMs (Peixoto et al., 2020). However, it is generally recommended to have larger sample sizes as they more accurately represent the characteristics of the target populations. As a result, when doing PLS-SEM analysis, the sample size of 186 respondents exceeds the sample size requirement, requiring further analysis.

In addition, the questionnaire uses a seven-point Likert scale ranging from "strongly disagree" (1) to "strongly agree" (7) to rate the components of the measure. The questionnaire was created using a variety of items that were changed to be used in a metaverse environment and based on metrics that have been validated and used in earlier studies. In detail, the construct MEP adapted from Dhanesh (2017), AVI adapted from Zhao et al. (2022), SIC adapted from Wijenayake et al. (2020), PCV adapted from Yang et al. (2021), IBM adapted from Wu et al. (2020) and CBM adapted from Zheng et al.(2020). Additionally, the survey was initially written in English before being translated into Vietnamese so that it would be appropriate for the situation and the subject of the survey (Quan et al., 2023). Table 1 indicates that female respondents made up 55% of the study's total respondents, with male respondents making up the remaining 40%. Ages 18 to 24 came with 28%, followed by Ages 25 to 34 with 32%, and Ages 35 and older with 39%. When asked how frequently they used online shopping, the majority of respondents said they did so. Moderately often (26%), occasionally (23%), frequently (19%), and very frequently (13%), respectively. Only 19% of respondents said they regularly or never shop online.

Table 1: Respondents Profile (N=186)

Demographic characteristic		**Frequency**	**Percentage (%)**
Age	18-24	52	28%
	25-34	60	32%
	35-44	39	21%
	>44	35	19%
Gender	Male	83	45%
	Female	103	55%
Frequency to online shopping	Rarely or never	36	19%
	Occasionally	42	23%
	Moderately often	49	26%
	Frequently	35	19%
	Very Frequently	24	13%

Source: Created by Authors

4. Results

4.1 PLS-SEM Results

During the quantification phase, each model's reliability and validity must be determined and assessed. According to Table 2, the adequacy (values between 0.70-0.90) of Cronbach's alpha, composite reliability and composite reliability demonstrate the reliability of internal consistency (Hair et al., 2019). In addition, for the convergent validity test, Average variance extracted (AVE > 0.50) and individual factor loading (FL> 0.7) meet the requirements (Nguyen et al., 2023). Next, discriminant validity can be demonstrated by the square root of AVE being bigger than the correlations across the constructs (Hair et al., 2017).

Additionally, the study examined discriminant validity by using the Fornell-Lacker Test and cross loading (Tan et al., 2018; Wong et al., 2022). The square root of AVE for all components on the diagonal was larger than the correlation coefficients with other constructs, as shown in table 3, demonstrating discriminant validity. In addition, according to the cross-loadings test in table 4, the item loadings of the factors are greater than the cross-loading values of the other latent factors, so the cross-loadings conditions are satisfied (Hair et al., 2017). As a result, discriminant validity is fulfilled.

Table 2: Reliability and Convergent Validity

Constructs	**Items**	**Factor loading**	**Cronbach's alpha**	**Composite reliability**	**Composite reliability**	**Average variance extracted (AVE)**
AVI	AVI1	0.836	0.781	0.786	0.859	0.604
	AVI2	0.785				
	AVI3	0.771				
	AVI4	0.712				
CBM	CBM1	0.838	0.815	0.82	0.89	0.73
	CBM2	0.855				
	CBM3	0.869				
IBM	IBM1	0.861	0.787	0.788	0.876	0.702
	IBM2	0.814				
	IBM3	0.838				
MEP	MEP1	0.688	0.790	0.800	0.864	0.615
	MEP2	0.821				
	MEP3	0.799				
	MEP4	0.821				
PCV	PCV1	0.845	0.792	0.796	0.878	0.706
	PCV2	0.818				
	PCV3	0.858				
SIC	SIC1	0.783	0.845	0.850	0.896	0.683
	SIC2	0.845				
	SIC3	0.816				
	SIC4	0.858				

Source: Created by Authors

Table 3: Fornell – Lacker's Criterion

	AVI	CBM	IBM	MEP	PCV	SIC
AVI	0.777					
CBM	0.734	0.854				
IBM	0.686	0.802	0.838			
MEP	0.710	0.730	0.675	0.784		
PCV	0.702	0.795	0.817	0.678	0.840	
SIC	0.701	0.736	0.678	0.691	0.733	0.826

Source: Created by Authors

Table 4: Cross-Loadings

	AVI	CBM	IBM	MEP	PCV	SIC
AVI1	**0.836**	0.562	0.543	0.542	0.579	0.522
AVI2	**0.785**	0.650	0.599	0.624	0.611	0.583
AVI3	**0.771**	0.545	0.464	0.550	0.533	0.606
AVI4	**0.712**	0.512	0.521	0.478	0.444	0.457
CBM1	0.631	**0.838**	0.638	0.614	0.74	0.687
CBM2	0.644	**0.855**	0.671	0.633	0.682	0.611
CBM3	0.608	**0.869**	0.74	0.625	0.626	0.596
IBM1	0.566	0.686	**0.861**	0.584	0.698	0.577
IBM2	0.633	0.633	**0.814**	0.545	0.694	0.633
IBM3	0.527	0.696	**0.838**	0.568	0.663	0.495
MEP1	0.523	0.466	0.365	**0.688**	0.449	0.526
MEP2	0.584	0.579	0.585	**0.821**	0.566	0.555
MEP3	0.497	0.609	0.532	**0.799**	0.532	0.558
MEP4	0.620	0.622	0.608	**0.821**	0.578	0.534
PCV1	0.533	0.649	0.679	0.567	**0.845**	0.539
PCV2	0.603	0.592	0.634	0.523	**0.818**	0.655
PCV3	0.632	0.754	0.742	0.616	**0.858**	0.652
SIC1	0.518	0.613	0.528	0.553	0.617	**0.783**
SIC2	0.634	0.720	0.654	0.622	0.646	**0.845**
SIC3	0.569	0.513	0.534	0.561	0.605	**0.816**
SIC4	0.586	0.568	0.509	0.537	0.547	**0.858**

Source: Created by Authors

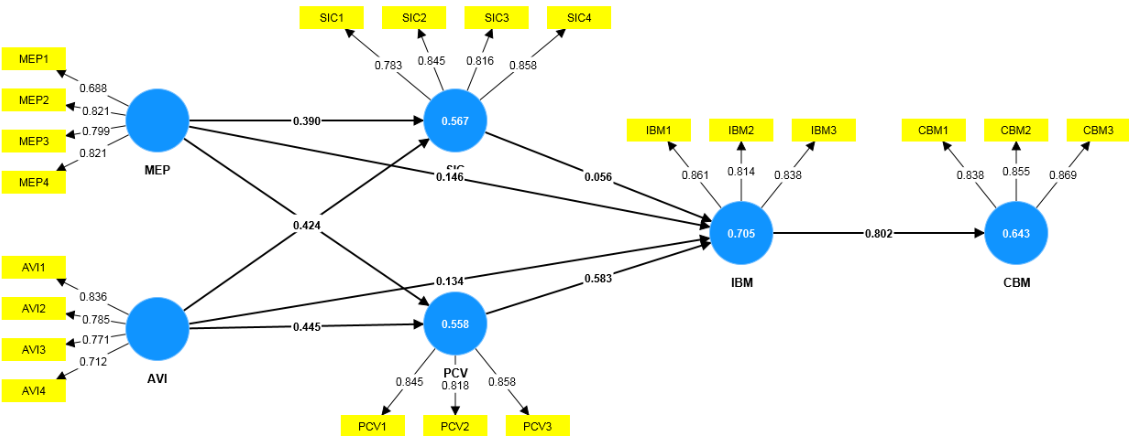
Furthermore, the model does not exhibit common method bias (CMB) because a single factor (42.29%) cannot explain half of the total variation (Nguyen & Nguyen, 2021). The structural model comes next when the measurement model's quality is verified. Before the inner structural model analysis, the collinearity test was carried out to find the presence of components that were firmly related. Variance inflation factors were present for all constructs (VIF) less than 2.266, which is less than the cut-off value of 5.0 (Koohang et al., 2023), indicating that multicollinearity did not occur. The saturated model and estimated model values are 0.051 and 0.059 (less than 1), respectively, in this study, which indicates a good fit for PLS path model. The structural model is the next step after confirming the measurement model. For the result from Table 5 and Figure 2, H1a, H1b, H2a, H2b, H3, H6, and H7 were supported (ρ-value< 0.05). However, H4 (AVI->IBM, ρ-value>0.05) and H5 (SIC->IBM, ρ-value>0.05) were unsupported. Therefore, AVI and SIC are not impacted by IBM.

Table 5: Hypothesis Testing Results

Hypothesis and Path		Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	Remarks
H1a	MEP -> SIC	0.390	0.390	0.072	5.403	0.000	Supported
H1b	MEP -> PCV	0.363	0.363	0.085	4.281	0.000	Supported
H2a	AVI -> SIC	0.424	0.423	0.074	5.765	0.000	Supported
H2b	AVI -> PCV	0.445	0.444	0.086	5.150	0.000	Supported
H3	MEP -> IBM	0.146	0.149	0.070	2.096	0.036	Supported
H4	**AVI -> IBM**	**0.134**	**0.135**	**0.077**	**1.737**	**0.082**	**Unsupported**
H5	**SIC -> IBM**	**0.056**	**0.052**	**0.090**	**0.618**	**0.537**	**Unsupported**
H6	PCV -> IBM	0.583	0.581	0.078	7.487	0.000	Supported
H7	IBM -> CBM	0.802	0.801	0.040	20.217	0.000	Supported

Source: Created by Authors

Figure 2: Structural Model Testing



Source: Created by SPLS Software

The blindfold technique was used to figure out the Q^2 value, which represents the predictive accuracy of the structural model. Table 6 indicates the predictability of the research model because the Q^2 values are greater than zero. Additionally, the R^2 values must be high enough to guarantee that the model has at least some explanatory power (Chin et al., 2020). R^2 should be larger than or equal to 0.1 order of variance. The minimal R^2 value in this situation is 0.553 (higher than 0.3), which is a significant value (Falk & Miller, 1992; Lim et al., 2021; Tan et al., 2022). As a result, it can help explain why a certain dependent variable is regarded as sufficient.

Table 6: Predictive Relevance Q^2 and R^2

Dependent variable	Q^2 (=1-SSE/SSO)	Predictive Relevant	R^2
CMB	0.461	$Q^2 > 0$	0.641
IBM	0.478	$Q^2 > 0$	0.698
PCV	0.377	$Q^2 > 0$	0.553
SIC	0.376	$Q^2 > 0$	0.562

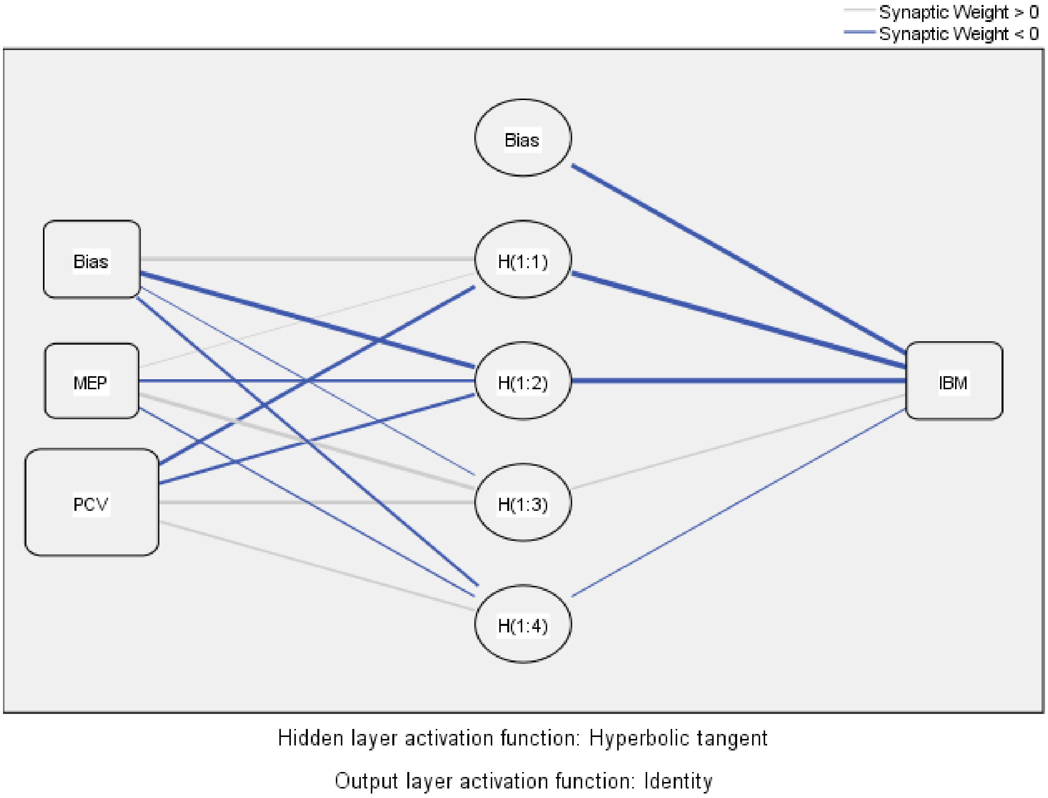
Source: Created by Authors

4.2 ANN results

Standard linear models such as multiple regression analysis (MRA) and structural equation modeling (SEM) are limited in their ability to explain the complexity of human decision-making processes because they can only detect linear relationships (Dang et al., 2023; Nguyen et al., 2022). In addition, MRA and SEM assume compensatory models, implying that a decrease in one component can be compensated for by an increase in other components via a linear equation connecting exogenous and endogenous constructs. In this study, however, the exogenous constructs cannot be compensated. This implies that a decrease in IBM cannot be compensated for by an increase in PCV, as these concepts have distinct definitions and conceptualizations and cannot be interchanged.

Due to its capacity to capture both linear and nonlinear relationships within a non-compensating model, artificial neural networks (ANN) were utilized in addition to the PLS-SEM analysis to address this issue (Yang et al., 2024). Unlike linear models, ANN models are robust against problems such as noise, non-normality of distribution, homoscedasticity, nonlinearity, and multicollinearity (Nguyen et al., 2023) and have demonstrated greater predictive accuracy than conventional statistical techniques (e.g., MRA, SEM, logistic regression) (Dang et al., 2023). ANN models are also known for their ability to learn, which makes them effective statistical models (Theadora et al., 2022). The "black box" nature of ANN, however, renders it unsuitable for determining the significance levels of causal relationships (Wong et al., 2023). To complement one another, researchers combined SEM and ANN, using significant predictors identified by PLS-SEM as input neurons for ANN models (Dang et al., 2024). The architecture of the ANN model consisted of input, hidden, and output layers. Theadora et al. (2022) used the feed-forward-backpropagation algorithm and multilayer perceptron’s to compute the root mean square errors (RMSE) and the normalized importance of the input neurons. Nguyen et al. (2023) employed a ten-fold cross-validation strategy to prevent over-fitting, using 10% of the data for testing and 90% for training the neural networks. As the activation function for both the hidden and output layers, Sigmoid was selected. Fig. 3 depicts the ANN model for IBM. In terms of model fitness, Table 7 reveals that the ANN model for IBM had relatively small RMSE mean values for training and testing (0.711 and 0.658, respectively). To compare the significance of predictors, the researchers calculated the normalized significance by dividing the relative significance by the highest relative significance and expressing the result as a percentage. According to Table 8, PCV had the highest normalized importance for IBM, followed by MEP. In conclusion, this study integrated PLS-SEM analysis with ANN models to overcome the limitations of linear models and successfully capture the complexity of human decision-making processes with non-compensable constructs. The ANN models exhibited excellent fitness and explanatory power, providing valuable insights into the importance of predictors for behavioral intention and cost.

Figure 3. Neural Network Model for IBM



Source: Created by SPSS Software

Table 7: RMSE Values of ANN

Input: MEP, PCV; Output: IBM

RMSE Result – Model Summary								
		Training			Testing			
Neutral Network		**N**	**SSE**	**RMSE**	**N**	**SSE**	**RMSE**	**TOTAL**
	1	165	334.379	0.715	20	38.731	0.600	185
	2	168	324.719	0.700	17	31.205	0.588	185
	3	169	308.775	0.667	16	29.354	0.688	185
	4	172	342.350	0.738	13	20.769	0.538	185
	5	174	345.968	0.736	11	19.667	0.818	185
	6	163	303.747	0.663	22	38.237	0.800	185
	7	173	298.977	0.665	12	18.525	0.667	185
	8	168	341.756	0.780	17	37.37	0.706	185
	9	180	335.309	0.667	5	7.91	0.400	185
	10	163	327.382	0.791	22	43.992	0.773	185
Means			**326.336**	**0.712**		**28.576**	**0.658**	

Source: Created by Authors

Table 8: Sensitivity Analyses: Normalized Importance of Constructs for ANN Model

Neutral Network	Sensitivity Analysis	
	MEP	**PCV**
1	0.425	0.575
2	0.295	0.705
3	0.294	0.706
4	0.467	0.533
5	0.375	0.625
6	0.262	0.738
7	0.325	0.675
8	0.337	0.663
9	0.282	0.718
10	0.450	0.550
MEANS	**0.316**	**0.684**
Normalized Importance	**46.00%**	**100.00%**

Source: Created by Authors

5. Discussions

Based on the research results of this study, the authors have confirmed the importance of impulsive buying and the factors affecting impulsive shopping in the metaverse environment. This is consistent with previous studies that have also mentioned the importance of impulsive buying in different contexts, such as Zafar et al. (2021) in the social media context, Lo et al. (2022) in live streaming, and P. Yang et al., (2024) in social ecommerce. In addition, the article also identifies compulsive buying affected by impulsive buying in the metaverse environment. In the order words, when it comes to online purchasing, there will be a substantial positive link between impulsive buying behavior in the metaverse and obsessive buying behavior in the same virtual environment (Yu et al., 2022). Furthermore, the study also finds out two factors affecting impulsive buying in metaverse contexts (PCV and MEP) which is suitable with studies by Chopdar & Balakrishnan, (2020) and P. Yang et al., (2024).

In detail, MEP has a positive connection with SIC and PCV. As a result, the study confirmed that users who are more involved and immersed in the metaverse, as well as those who have a stronger feeling of presence, are more likely to conform to social norms and opinions within the virtual world. Furthermore, it highlighted the benefits and levels of satisfaction that users anticipate they will acquire because of their participation in the metaverse or purchase of something from it. This is also consistent with previous studies of Wijenayake et al. (2020) and Yang et al. (2021) in a mobile commerce context. In addition, the stronger the alignment with a user's virtual identity, the more likely it is that users will be influenced by the SCI and PCV of others in the metaverse. It proved that in the previous study in Metaverse by the study of Alvarez-Risco et al. (2022). However, the study indicated AVI and SIC are not impacted by IBM. This can be explained by the impulsive buying behavior factor that will not be affected by social factors. The reason for the impulsive buying factor is that the decision-making is very fast without too much time to think, so the factors from relatives and friends will not have time to affect the buyer's thinking.

However, the lack of a significant effect of Alignment Virtual Identity (AVI) on Impulsive Buying in the Metaverse (IBM) could be explained by virtual experimentation. The metaverse offers users the opportunity to experiment with different identities and personas (Dwivedi et al., 2023). Users may engage in impulsive buying behavior as part of exploring new identities or expressing different aspects of themselves, regardless of alignment with their real-life identity. For example, in the clothing industry, users may be drawn to visually appealing clothing items, virtual fashion events, and interactive experiences within virtual fashion spaces, leading to impulsive buying decisions driven by the desire for immediate gratification and sensory stimulation rather than considerations of identity alignment.

Furthermore, the lack of a significant effect of Social Influence Conformity (SIC) on Impulsive Buying in the Metaverse (IBM) could be justified by diverse social dynamics. In the metaverse, social interactions and dynamics are diverse and multifaceted. Users may engage with a wide range of virtual communities, each with its own norms, trends, and influences (Barreda-Ángeles & Hartmann, 2022). As a result, the impact of social influence on impulsive buying behavior may vary significantly across different virtual contexts, making it challenging to establish a universal effect on IBM. For instance, while a user's real-life social circle may exert influence over their purchasing decisions, the influence of virtual peers and communities within the metaverse may differ significantly, making it challenging to conform to a single social norm or influence.

6. Implications

The investigation of impulsive and compulsive purchasing behaviors in the metaverse using the S-O-R framework contributes significantly to the fields of consumer behavior and virtual environments. Researchers gain a deeper understanding of the interplay between stimuli, organismic factors, and behavioral responses in the context of digital consumption by employing this framework. The examination of metaverse engagement presence and virtual identity alignment provides valuable insights into the impact of immersion and authenticity on consumer decision-making within virtual realms. In addition, investigating social influence conformity and perceived value in the metaverse contributes to the fields of social psychology and marketing by revealing the effect of peer pressure and perceived benefits on impulsive and compulsive purchasing behaviors. In addition, the research paves the way for the study of digital consumer well-being, with the aim of promoting responsible consumption practices and sustainable virtual economies. These theoretical findings ultimately inform evidence-based strategies for businesses and developers to create a balanced, ethical, and thriving metaverse while enhancing user experiences and digital engagement. In addition, Vietnam is currently undergoing a robust digital transition, driven by regulations aimed at reducing cash usage and promoting digitalization (Nguyen et al., 2023). Hence, comprehending and utilizing the metaverse in the realm of commerce presents a lucrative prospect for Vietnamese enterprises.

The application of the S-O-R framework to the study of impulsive and compulsive buying behaviors in the metaverse has significant managerial implications for businesses and developers. Companies can tailor their marketing strategies to deliver personalized messages that resonate with users' preferences and values if they are aware of the factors that influence the decisions of virtual consumers. Insights into perceived value and virtual product design can guide designers in the creation of appealing, user-centric offerings. To ensure ethical practices and promote a positive user experience, managing social influence within virtual communities becomes essential. Encouraging users to align their virtual identities with their real-world values can result in more sustainable purchasing behaviors, whereas promoting consumer well-being initiatives can increase user satisfaction and reduce the likelihood of negative outcomes. By implementing these strategies, businesses can create a thriving metaverse ecosystem that provides long-term benefits to both consumers and developers.

7. Conclusions

Using the S-O-R framework to investigate impulsive and compulsive purchasing behaviors in the metaverse contributes significantly to consumer behavior and virtual environments. This framework permits researchers to comprehend the relationship between stimuli, organismic factors, and behavioral responses in digital consumption. The research investigates metaverse engagement presence, virtual identity alignment, social influence conformity, and perceived value, shedding light on the influence of immersion, authenticity, peer pressure, and perceived benefits on consumer decision-making within virtual realms. Businesses and developers can use these findings to create an ethical and thriving metaverse ecosystem by customizing their marketing strategies, designing user-centric products, and managing social influence. The study validates the significance of impulsive purchasing and its influence on compulsive purchasing in the metaverse environment, identifying two factors (PCV and MEP) that influence impulsive purchasing. However, AVI and SIC do not significantly influence impulsive purchasing behavior, suggesting that social factors have less of an impact on impulsive decisions. This research provides valuable insights for comprehending and managing metaverse consumer behavior.

References

Akram, U., Hui, P., Khan, M. K., Yan, C., & Akram, Z. (2018). Factors affecting online impulse buying: Evidence from Chinese social commerce environment. *Sustainability* (Switzerland), *10*(2).

Ali, F., Ali, L., Gao, Z., Terrah, A., & Turktarhan, G. (2022). Determinants of user's intentions to book hotels: A comparison of websites and mobile apps. *Aslib Journal of Information Management*, *76* (1), 16-41.

Alvarez-Risco, A., Del-Aguila-Arcentales, S., Rosen, M. A., & Yáñez, J. A. (2022). Social cognitive theory to assess the intention to participate in the Facebook Metaverse by citizens in Peru during the COVID-19 pandemic. *Journal of Open Innovation: Technology, Market, and Complexity*, *8*(3).

Barreda-Ángeles, M., & Hartmann, T. (2022). Psychological benefits of using social virtual reality platforms during the covid-19 pandemic: The role of social and spatial presence. *Computers in Human Behavior*, *127*(October)

Bighiu, G., Manolică, A., & Roman, C. T. (2015). Compulsive buying behavior on the internet. *Procedia Economics and Finance*, *20*(15), 72–79.

Black, D. W. (2022). Compulsive shopping: A review and update. *Current Opinion in Psychology*, *46*.

Brunelle, C., & Grossman, H. (2022). Predictors of online compulsive buying: The role of personality and mindfulness. *Personality and Individual Differences*, *185*(September 2021).

Buhalis, D., Lin, M. S., & Leung, D. (2023). Metaverse as a driver for customer experience and value co-creation: Implications for hospitality and tourism management and marketing. *International Journal of Contemporary Hospitality Management*, *35*(2), 701–716.

Barreda-Ángeles, M., & Hartmann, T. (2022). Psychological benefits of using social virtual reality platforms during the covid-19 pandemic: The role of social and spatial presence. *Computers in Human Behavior*, *127*(October).

Cahyani, S. R., & Artanti, Y. (2023). Pengaruh online customer trust dan online store environment terhadap online impulse buying melalui perceived enjoyment sebagai variabel mediasi Studi pada konsumen TikTok shop [The influence of online customer trust and online store environment on online impulse buying of fashion products through perceived enjoyment of TikTok shop consumers]. *Jurnal Ilmu Manajemen, 11(2)*, 252–265.

Chakraborty, D., Polisetty, A., & Rana, N. P. (2024). Consumers' continuance intention towards metaverse-based virtual stores: A multi-study perspective. *Technological Forecasting and Social Change*, *203*.

Chin, W., Cheah, J.-H., Liu, Y., Ting, H., Lim, X.-J., & Cham, T. H. (2020). Demystifying the role of causal-predictive modeling using partial least squares structural equation modeling in information systems research. *Industrial Management & Data Systems*, *120*(12), 2161–2209.

Chopdar, P. K., & Balakrishnan, J. (2020). Consumers response towards mobile commerce applications: S-O-R approach. *International Journal of Information Management*, *53*.

Christopher Westland, J. (2010). Lower bounds on sample size in structural equation modeling. *Electronic Commerce Research and Applications*, *9*(6), 476–487.

Dang Quan, T., Wei-Han Tan, G., Aw, E. C.-X., Cham, T.-H., Basu, S., & Ooi, K.-B. (2024). Can you resist the virtual temptations? Unveiling impulsive buying in metaverse retail. *Asia Pacific Journal of Marketing and Logistics*, *36*(10), 2259–2280.

Dang, T.-Q., Tan, G. W.-H., Aw, E. C.-X., Ooi, K.-B., Metri, B., & Dwivedi, Y. K. (2023). How to generate loyalty in mobile payment services? An integrative dual SEM-ANN analysis. *International Journal of Bank Marketing*, *41* (6), 1177-1206.

Dang Quan, T., Wei-Han Tan, G., Aw, E. C.-X., Cham, T.-H., Basu, S., & Ooi, K.-B. (2024). Can you resist the virtual temptations? Unveiling impulsive buying in metaverse retail. *Asia Pacific Journal of Marketing and Logistics*, , *36* (10), 2259-2280.

Dhanesh, G. S. (2017). Putting engagement in its PRoper place: State of the field, definition and model of engagement in public relations. *Public Relations Review*, *43*(5), 925–933.

Dwivedi, Y. K., Hughes, L., Wang, Y., Alalwan, A. A., Ahn, S. J., Balakrishnan, J., Barta, S., Belk, R., Buhalis, D., Dutot, V., Felix, R., Filieri, R., Flavián, C., Gustafsson, A., Hinsch, C., Hollensen, S., Jain, V., Kim, J., Krishen, A. S., … Wirtz, J. (2023). Metaverse marketing: How the metaverse will shape the future of consumer research and practice. *Psychology and Marketing*, *40*(4), 750–776.

Falk, M., & Miller, A. G. (1992). Infrared spectrum of carbon dioxide in aqueous solution. *Vibrational Spectroscopy*, *4*(1), 105–108.

Giang, B. K., & Shah, D. (2023). Marketing in the Metaverse: Conceptual understanding, framework, and research agenda. *Journal of Business Research*, *155*.

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, *31*(1), 2–24.

Hair, J., Hollingsworth, C. L., Randolph, A. B., & Chong, A. Y. L. (2017). An updated and expanded assessment of PLS-SEM in information systems research. *Industrial Management and Data Systems*, *117*(3), 442–458.

Jafar, R. M. S., Ahmad, W., & Sun, Y. (2023). Unfolding the impacts of metaverse aspects on telepresence, product knowledge, and purchase intentions in the metaverse stores. *Technology in Society*, *74*.

Karim, M. W., Chowdhury, M. A. M., Masud, M. A. Al, & Arifuzzaman, Md. (2021). Analysis of factors influencing impulse buying behavior towards e-tailing sites: An application of S-O-R model. *Contemporary Management Research*, *17*(2), 97–126.

Kim, J. (2021). Advertising in the Metaverse: Research agenda. *Journal of Interactive Advertising*, *21*(3), 141–144.

Koohang, A., Nord, J. H., Ooi, K.-B., Tan, G. W.-H., Al-Emran, M., Aw, E. C.-X., Baabdullah, A. M., Buhalis, D., Cham, T.-H., Dennis, C., Dutot, V., Dwivedi, Y. K., Hughes, L., Mogaji, E., Pandey, N., Phau, I., Raman, R., Sharma, A., Sigala, M., … Wong, L.-W. (2023). Shaping the Metaverse into reality: A holistic multidisciplinary understanding of opportunities, challenges, and avenues for future investigation. *Journal of Computer Information Systems*, *63*(3), 735–765.

Lee, J., Park, D.-H., & Han, I. (2008). The effect of negative online consumer reviews on product attitude: An information processing view. *Electronic Commerce Research and Applications*, *7*(3), 341–352.

Lim, A.-F., Lee, V.-H., Foo, P.-Y., Ooi, K.-B., & Wei–Han Tan, G. (2021). Unfolding the impact of supply chain quality management practices on sustainability performance: an artificial neural network approach. *Supply Chain Management: An International Journal*, *27*(5), 611–624.

Nguyen, L. T., Dwivedi, Y. K., Tan, G. W. H., Aw, E. C. X., Lo, P. S., & Ooi, K. B. (2022). Unlocking pathways to mobile payment satisfaction and commitment. *Journal of Computer Information Systems*, *63*(4), 998-1015.

Nguyen, L.-T., Duc, D. T. V., Dang, T.-Q., & Nguyen, D. P. (2023). Metaverse banking service: Are we ready to adopt? A deep learning-based dual-stage SEM-ANN Analysis. *Human Behavior and Emerging Technologies*, *2023*. Retrieved from https://onlinelibrary.wiley.com/doi/10.1155/2023/6617371

Nguyen, H.-B., & Nguyen, L.-T. (2021). Factors influence blockchain adoption in supply chain management among companies based in Ho Chi Minh City. *Proceedings of the Conference Towards ASEAN Chairmanship 2023* (T-A-C 23 2021). 1–13. Dordrecht, The Netherlands: Atlantis Press.

Nguyen, L., Nguyen, D., Ngoc, K. N.-N., & Duc, D. T. V. (2023). Blockchain adoption in logistics companies in Ho Chi Minh City. *Cogent Business & Management*, *10*(2), 1–24.

Lo, P. S., Dwivedi, Y. K., Wei-Han Tan, G., Ooi, K. B., Cheng-Xi Aw, E., & Metri, B. (2022). Why do consumers buy impulsively during live streaming? A deep learning-based dual-stage SEM-ANN analysis. *Journal of Business Research*, *147*, 325–337.

Quan, T. D., Thanh, L. N., & Thuy, T. N. T. (2023). The capability of e-reviews in online shopping. Integration of the PLS- SEM and ANN method. *International Journal of Professional Business Review*, *8*(7).

Maraz, A., Eisinger, A., Hende, B., Urbán, R., Paksi, B., Kun, B., Kökönyei, G., Griffiths, M. D., & Demetrovics, Z. (2015). Measuring compulsive buying behaviour: Psychometric validity of three different scales and prevalence in the general population and in shopping centres. *Psychiatry Research*, *225*(3), 326–334.

Moon, M. A., Faheem, S., & Farooq, A. (2022). I, me, and my everything: Self conceptual traits and compulsive buying behavior. *Journal of Retailing and Consumer Services*, *68*(June).

Mehta, M., Pancholi, G., & Saxena, D. A. (2023). Metaverse changing realm of the business world: A bibliometric snapshot. *Journal of Management Development*, *42*(5), 373–387

Payal, R., Sharma, N., & Dwivedi, Y. K. (2024). Unlocking the impact of brand engagement in the metaverse on real-world purchase intentions: Analyzing pre-adoption behavior in a futuristic technology platform. *Electronic Commerce Research and Applications*, *65*.

Peixoto, S. A., Vasconcelos, F. F. X., Guimarães, M. T., Medeiros, A. G., Rego, P. A. L., Lira Neto, A. V, de Albuquerque, V. H. C., & Rebouças Filho, P. P. (2020). A high-efficiency energy and storage approach for IoT applications of facial recognition. *Image and Vision Computing*, *96*.

Shi, W., Li, F., & Hu, M. (2023). The influence of atmospheric cues and social presence on consumers' impulse buying behaviors in e-commerce live streaming. *Electronic Commerce Research*, *2023*.

Shiau, W.-L., & Huang, L.-C. (2022). Scale development for analyzing the fit of real and virtual world integration: An example of Pokémon Go. *Information Technology & People*, *36*(2), 500–531.

Suh, A. (2023). How users cognitively appraise and emotionally experience the metaverse: focusing on social virtual reality. *Information Technology & People*, *37*(4), 1613–1641.

Tan, G. W.-H., Lee, V.-H., Hew, J.-J., Ooi, K.-B., & Wong, L.-W. (2018). The interactive mobile social media advertising: An imminent approach to advertise tourism products and services?. *Telematics and Informatics*, *35*(8), 2270–2288.

Tan, G. W.-H., Ooi, K.-B., Dwivedi, Y. K., & Wei, J. (2022). Guest editorial: Advancing mobile payment research in the age of digital acceleration. *Internet Research*, *32*(6), 1753–1756.

Tarka, P., Kukar-Kinney, M., & Harnish, R. J. (2022). Consumers' personality and compulsive buying behavior: The role of hedonistic shopping experiences and gender in mediating-moderating relationships. *Journal of Retailing and Consumer Services*, *64*.

Theadora, C., Amelia, M. V., Tan, G. W. H., Lo, P. S., Ooi, K. B., & Dwivedi, Y. K. (2022). How does involvement build loyalty towards music-streaming platforms? A multi-analytical SEM-ANN technique. *Journal of Product and Brand Management*, *4*(November 2022), 645–660.

Wijenayake, S., van Berkel, N., Kostakos, V., & Goncalves, J. (2020). Impact of contextual and personal determinants on online social conformity. *Computers in Human Behavior*, *108*(February).

Wong, L.-W., Lee, V.-H., Tan, G. W.-H., Ooi, K.-B., & Sohal, A. (2022). The role of cybersecurity and policy awareness in shifting employee compliance attitudes: Building supply chain capabilities. *International Journal of Information Management*, *66*.

Wong, L.-W., Tan, G. W.-H., Lee, V.-H., Ooi, K.-B., & Sohal, A. (2023). Psychological and system-related barriers to adopting Blockchain for operations management: An artificial neural network approach. *IEEE Transactions on Engineering Management*, *70*(1), 67–81.

Wu, I. L., Chiu, M. L., & Chen, K. W. (2020). Defining the determinants of online impulse buying through a shopping process of integrating perceived risk, expectation-confirmation model, and flow theory issues. *International Journal of Information Management*, *52*(February).

Yang, F., Tang, J., Men, J., & Zheng, X. (2021). Consumer perceived value and impulse buying behavior on mobile commerce: The moderating effect of social influence. *Journal of Retailing and Consumer Services*, *63*(December 2020).

Yang, P., Sheng, H., Yang, C., & Feng, Y. (2024). How social media promotes impulsive buying: Examining the role of customer inspiration. *Industrial Management and Data Systems*, *124*(2), 698–723.

Yu, C., Cheah, J. H., & Liu, Y. (2022). To stream or not to stream? Exploring factors influencing impulsive consumption through gastronomy livestreaming. *International Journal of Contemporary Hospitality Management*, *34*(9), 3394–3416.

Yuan, S., Liu, L., Su, B., & Zhang, H. (2020). Determining the antecedents of mobile payment loyalty: Cognitive and affective perspectives. *Electronic Commerce Research and Applications*, *41*.

Zafar, A. U., Shen, J., Shahzad, M., & Islam, T. (2021). Relation of impulsive urges and sustainable purchase decisions in the personalized environment of social media. *Sustainable Production and Consumption*, *25*, 591–603.

Zhang, L., Shao, Z., Li, X., & Feng, Y. (2021). Gamification and online impulse buying: The moderating effect of gender and age. *International Journal of Information Management*, *61*.

Zhao, Y., Jiang, J., Chen, Y., Liu, R., Yang, Y., Xue, X., & Chen, S. (2022). Metaverse: Perspectives from graphics, interactions and visualization. *Visual Informatics*, *6*(1), 56–67.

Zheng, Y., Yang, X., Liu, Q., Chu, X., Huang, Q., & Zhou, Z. (2020). Perceived stress and online compulsive buying among women: A moderated mediation model. *Computers in Human Behavior*, *103*(January 2019), 13–20.

Zheng, Y., Yang, X., Liu, Q., Chu, X., Huang, Q., & Zhou, Z. (2020). Perceived stress and online compulsive buying among women: A moderated mediation model. *Computers in Human Behavior*, *103*(January 2019), 13–20.

Appendix: Questionnaires

Construct	Items	Source
Metaverse engagement presence (MEP)	MEP 1: I experience a profound sense of engagement when engaging in the metaverse. MEP 2: I often participate in business activities within the metaverse. MEP 3: I experience a profound sense of connection to the virtual environment when engaging with others. MEP 4: I identify myself as a member of the metaverse community.	(Dhanesh, 2017)
Alignment of virtual identity (AVI)	AVI1: My virtual persona faithfully mirrors my authentic self in the physical world. AVI2: I manifest various facets of my personality through my virtual persona. AVI3: I think that my online representation corresponds effectively with my actual personality. AVI4: I experience a profound sense of coherence between my authentic self and my digital persona.	(Zhao et al., 2022)
Social influence conformity (SIC)	SIC1: I am inclined to adhere to the viewpoints of others within the metaverse. SIC2: I consider the behaviors of other users when making decisions in the metaverse. SIC3: I have modified my conduct in the metaverse to align with the prevailing consensus. SIC4: The behavior of others in the metaverse has a substantial impact on my own behavior.	(Wijenayake et al., 2020)
Perceived value (PCV)	PCV1: I consider the experiences, goods, and services provided in the metaverse to be valuable. PCV2; The perceived advantages of virtual items play a significant role in my decision-making process when it comes to making purchases. PCV3: I am convinced that the virtual offerings in the metaverse are a worthwhile investment of both my time and money.	(F. Yang et al., 2021)
Impulsive buying in Metaverse (IBM)	IBM1: I often participate in impulsive buying while participating in activities inside the metaverse. IBM2: I have a strong urge to make spontaneous purchases to enhance my experiences in the metaverse. IBM3: I have experienced remorse for my impulsive purchases in the metaverse.	Wu et al., (2020)
Compulsive buying in Metaverse (CBM)	CBM1: I often engage in unplanned purchases in the metaverse. CBM2: I am experiencing a lack of control over my compulsion to purchase items in the metaverse. CBM3: I have encountered financial hardships due to extravagant spending in the metaverse.	Zheng et al., (2020)

Source: Author's Compilations