TOWARDS A METAVERSE SHOPPING REVOLUTION: A MIXED-METHOD STUDY ON FACTORS INFLUENCING CONSUMERS' INTENTIONS TO ADOPT METAVERSE AS SHOPPING MARKETPLACE

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EUROPEAN JOURNAL OF BUSINESS SCIENCE AND TECHNOLOGY

Volume 10 Issue 2
ISSN 2694-7161
www.ejobsat.com

ABSTRACT

This study aims to understand the factors influencing consumers' intention to adopt the metaverse as a marketplace for physical products and the role of trust specifically focusing on the generation aged 18–28. It also explores the moderating role of trust towards the company Meta in these relationships. An exploratory sequential mixed-method research design was employed to develop an encompassing conceptual model, enhance hypothesis formulation, and validate findings through triangulation. In the first phase of the study, in-depth interviews were conducted with professionals and students ($n = 11$), and in the second phase, Likert-type questionnaire was administered ($n = 386$) to university students. The data collected in the second phase was analyzed using Covariance-Based Structural Equation Modeling (CB-SEM) to validate the conceptual model. This included Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) for reliability and validity, followed by the assessment of path coefficients. Double-mean centering was applied to test moderating effects, with all analyses conducted using the R software's lavaan package. The results confirmed the positive effects of novelty, relative advantage, realism, and compatibility on consumers' intention to adopt the metaverse as a marketplace for physical products, while complexity and financial costs were identified as barriers. Trust towards Meta did not have a moderating effect. The findings provide insights for managers to develop the metaverse in a customer-centric manner and promote its unique features while addressing complexity and financial concerns. The study extends the literature on the metaverse in the consumer goods sector and contributes to Innovation Adoption Theory.

KEY WORDS

metaverse, innovation adoption, metaverse retailing, diffusion of innovations

JEL CODES

M31, M37

HOFMANN, Lisa, AL-DHABYANI, Yaser, and ARSLAN, Erdal. 2024. Towards a Metaverse Shopping Revolution: A Mixed-Method Study on Factors Influencing Consumers' Intentions to Adopt Metaverse as Shopping Marketplace. *European Journal of Business Science and Technology,* 10 (2): 129–155. ISSN 2694-7161, DOI 10.11118/ejobsat.2024.013.

1 INTRODUCTION

Stepping into the Metaverse opens doors where shopping transcends the boundaries of reality, transforming the act of purchasing physical products into a digital odyssey (Dwivedi et al., 2022). Envision a realm where every consumer desire awaits just a click away, liberated from the constraints of time and place. This vision consumes industry experts and enthralls minds worldwide (Koohang et al., 2023). However, the looming question remains: Are we truly prepared to embrace the virtual realm of commerce? (Mkedder and Das, 2024)

Recent findings underscore consumers' eagerness to engage with retailers (78%) and consumer goods companies (77%) within the Metaverse. Additionally, approximately 50% express their willingness to procure physical products within this digital domain (Preuss, 2022). These insights illuminate the burgeoning demand and opportunities for retailers and consumer goods companies to exploit the Metaverse as a marketplace for tangible products. However, within this potential lies hesitancy among people to fully embrace the Metaverse. A study conducted in the U.S. and the U.K. revealed that fewer than 20% of respondents believe brands should invest in branded experiences within this virtual space (Proulx, 2021; Mkedder and Das, 2024).

Furthermore, this trend aligns with the burgeoning body of research on the Metaverse, which witnessed a surge in relevant articles from 2019 onwards, peaking in 2021, coinciding with the company's rebranding (Trunfio and Rossi, 2022). To date, research has predominantly centered on computer science, engineering, and the Metaverse's potential for e-learning and medical education (Crespo-Pereira et al., 2023; Trunfio and Rossi, 2022). Nonetheless, there exists a profound need for additional exploration in various domains, including marketing and communication, particularly within the consumer goods and retail sectors where substantial investments have already been allocated (Huang et al., 2022). Numerous researchers, such as Tan et al. (2023), stress the imperative of comprehending consumer motivations concerning retailing and brand activities. Furthermore, Mkedder and Das (2024), and Dwivedi et al. (2022) specifically advocate for further research into technology adoption models and theories.

Previous research has extensively delved into people's inclinations to adopt the Metaverse, often employing various theoretical approaches (Toraman, 2022) such as the Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB). However, these studies have not specifically addressed the scenario of shopping for physical products within this digital realm. To bridge this gap, the current study employ the Diffusion of Innovation Model (DOIM) presents a novel approach yet to be explored in this context. Unlike the TAM, the DOIM encompasses five distinct attributes, providing a more intricate understanding of adoption processes (Al-Mamary et al., 2016). Demonstrating robustness, this model explains between 49–87% of the variance in adoption rates, offering pivotal insights for practitioners (Rogers, 1995).

Given the intricacies of technology adoption, qualitative methods have emerged as a promising avenue to unearth additional factors influencing adoption rates (Dehghani et al., 2022). Building upon this, the integration of mixed-method research designs has gained momentum, amalgamating robust quantitative measures from models like the DOIM with the nuanced, contextual insights garnered from qualitative research (Wunderlich et al., 2019). This approach facilitates a more comprehensive exploration of technology adoption, ultimately enriching our understanding of consumers' behavioral intentions (Creswell and Plano Clark, 2018).

In addition to delving into research regarding technology adoption theories, Dwivedi et al. (2023) and Mkedder and Das (2024) emphasize the necessity of delving deeper into the ethical challenges entwined with the Metaverse. A pivotal, unanswered query revolves around how consumers will evaluate and perceive matters of privacy and security within this domain. Addressing this concern, Tan et al. (2023)

shed light on the significance of relationship marketing, which heavily relies on the trust consumers place in service providers within the Metaverse. Notably, the company Meta stands as a pivotal force in the industry, rendering its role crucial and deserving of thorough comprehension.

Moreover, trust emerges as a significant concept shaping adoption decisions (Viardot, 2017). A lack of trust in an innovation, particularly in the online sphere, can inhibit adoption intentions (Mkedder et al., 2024b). This encompasses trust both in the innovation itself and in the entity or provider behind it. Focusing on the latter aspect, a Forrester study discovered that 75% of respondents harbor distrust toward Meta's involvement in developing the Metaverse (Proulx and Liu, 2021). Trust toward Meta is anticipated to moderate the relationship between innovation attributes and the intention to adopt the Metaverse as a marketplace for physical products. Consequently, users' trust levels toward Meta can mold their overall perceptions of the Metaverse, thereby influencing their readiness to embrace it. Understanding the role of trust toward Meta as a moderating factor is therefore imperative for researchers and managers seeking to bolster adoption of Metaverse retailing.

The current study adheres to the guidelines outlined by Venkatesh et al. (2013) for mixed-method research. The qualitative segment of the study aims to unearth additional factors pertinent to the adoption of the Metaverse as a marketplace for physical products. Subsequently, the quantitative phase tests the innovation attributes of the DOIM alongside factors identified in the qualitative phase, namely Realism, Novelty, and Financial Costs, along with the moderator Trust towards Meta. This study endeavors to address the following research questions: (1) What factors influence consumers' intention to embrace the Metaverse as a marketplace for physical products? (2) How does Trust towards Meta impact the relationships between adoption factors and consumers' intentions to adopt? Following insight that the metaverse is often perceived as an innovation designed primarily for younger audiences (Oxford Analytica, 2022), the current research focused on young participants aged 18–28.

Therefore, this research marks a pioneering addition to the existing knowledge base surrounding the Metaverse within the realm of retailing and consumer goods. By scrutinizing the moderating role of Trust towards Meta, this study ventures into uncharted territory, offering a fresh perspective on how the company influences the adoption of Metaverse retailing. The adoption of a mixed-method research design represents a novel approach with the potential to establish a new standard for investigating the adoption of innovative technologies. The findings of this study hold significant implications for both academia and industry, as they contribute to a deeper understanding of the Metaverse's evolution into a marketplace for physical products. Crucially, these insights empower managers with the tools to craft customer-centric experiences and make informed decisions regarding partnerships and promotional strategies.

2 THEORETICAL BACKGROUND AND HYPOTHESIS DEVELOPMENT

2.1 Metaverse as a Marketplace for Physical Products

After Mark Zuckerberg (2021) announced the rebranding of Facebook to Meta in October 2021, the interest in the metaverse has experienced rapid growth (Google Trends, 2023). One of the emerging use cases is metaverse retailing, which can be considered the next iteration of e-retailing undertaken in a three-dimensional (3D) environment (Bourlakis et al., 2009). In this context, Illenberger (2022) distinguishes between digital and physical products. This research focuses on the latter, which encompasses real-time shopping experiences involving physical products. For this, the adoption of

spatial computing and specific hardware such as virtual, mixed, or augmented reality (AR) glasses are required to create an optimal user experience (Illenberger, 2022). According to industry experts' predictions, it will require approximately a decade to fully develop these foundational technologies and establish the metaverse as a marketplace for physical products (Nguyen et al., 2022; Toriello, 2021).

Despite its significance being limited to a future timeframe, researchers underline the importance of understanding the metaverse as a retail channel for physical products to foster customer-centric journeys (Dwivedi et al., 2022). In this context, Yoo et al. (2023) highlight that retailers must attain a deeper comprehension of how to design their product delivery in the metaverse considering consumers' perspectives. This implies that while the full realization of the metaverse as a marketplace for physical products may be several years away, it is imperative to commence our understanding of this emerging retail channel early on.

2.2 Innovation Adoption Theory

The Diffusion of Innovation Theory, originally proposed by Rogers (1995), presents a framework comprising five attributes that influence the adoption rate of innovations: Relative Advantage, Compatibility, Complexity, Trialability, and Observability. All the factors are interrelated but conceptually distinct from each other (van Rijnsoever et al., 2009). Furthermore, one fundamental aspect of the DOIM is that it regards these attributes as perceptions held by consumers rather than evaluations conducted by experts or companies within a specific field (Khosrow-Pour, 2007). This perspective emphasizes the subjective nature of innovation adoption, acknowledging that it is driven by individuals' perceptions and preferences.

The DOIM holds a prominent position in the scientific community and has been widely cited and researched, as highlighted by Hasan et al. (2019) in their comparative study of various innovation adoption theories. The model finds application across diverse disciplines, including marketing and consumer behavior studies, where it is considered especially valuable for analyzing consumers' adoption intentions of new technologies (Huang and Hsieh, 2012).

Despite its widespread acceptance, the DOIM has not been free of criticism in recent years. Meta-analyses have suggested that certain attributes may exert a stronger influence on adoption intentions than others (Kapoor et al., 2014). Furthermore, the significance of these factors can vary significantly in different contexts (Hasan et al., 2019; Tornatzky and Klein, 1982). This critique has prompted discussions about the need to extend the DOIM to better account for these variations, as proposed by Parthasarathy et al. (2021). It is evident that the framework may not universally apply to all innovation adoption scenarios. This represents a clear gap in our understanding of innovation adoption dynamics and underscores the evolving nature of this field of study. In the context of metaverse adoption, this might be even more pronounced as this emerging domain brings a new set of challenges and considerations. Understanding how the DOIM applies or requires adaptation within the metaverse realm is crucial for effectively navigating this evolving landscape.

Recognizing the limitations, mixed-method research approaches have gained popularity in the field of innovation adoption, as highlighted by Dehghani et al. (2022). By integrating both qualitative and quantitative methods, these approaches enable researchers to delve deeper into the complexities and dynamics of innovation adoption, offering a more holistic and nuanced understanding of this multifaceted phenomenon (Venkatesh et al., 2013).

One such mixed-method approach is exploratory sequential research, which can provide important insights that may not have been discovered through a singular method. This approach typically begins with a qualitative exploration study, where researchers delve into the subject matter in-depth, gathering rich qualitative data and insights. This qualitative phase helps identify key factors, and potential variables related to innovation adoption. These findings are then tested quantitatively with

a larger sample to validate and quantify the relationships discovered during the qualitative phase (Creswell and Plano Clark, 2018).

Exploratory sequential research offers several advantages in the context of studying innovation adoption. First, it allows for triangulation, which means that the qualitative and quantitative data can be compared and cross-validated, strengthening the overall reliability of the research findings. Second, this approach facilitates enhanced hypothesis formation. The qualitative phase often generates hypotheses or theories that can be rigorously tested during the quantitative phase, contributing to a more robust research framework. Lastly, it enables a comprehensive understanding of the researched topic. By combining qualitative insights with quantitative data, researchers gain a holistic view of the factors influencing innovation adoption, allowing for a deeper and more nuanced analysis (Wu, 2012). Thus, applying a mixed-method research design to study the metaverse as a marketplace for physical products can therefore be highly beneficial. The metaverse's innovative and multifaceted nature demands a thorough, multidimensional examination, which can be effectively addressed through both qualitative and quantitative methods. Building on the DOIM framework and findings from an exploratory study, we have identified factors that influence consumer intentions to adopt the Metaverse as a marketplace for physical products. These identified factors have subsequently guided the development of our hypotheses.

Relative Advantage refers to the perception that an innovation is superior to the existing solution regarding economic benefits, such as cost savings or increased social prestige (Rogers, 1995). Previous research in various fields confirms the positive influence of Relative Advantage on adoption intentions (Ismail, 2012; Kapoor et al., 2014). In the context of metaverse retailing, the advantages of the metaverse, such as increased convenience, three-dimensional product visualization, and uniqueness, make its use appealing to consumers (Hassouneh and Brengman, 2014). The positive influence of the attribute can also be explained by Expectancy Theory, which suggests that individuals are motivated to engage in a particular behavior when they believe their actions will result in desired outcomes or rewards (Majumdar, 2010). Looking at the interviews conducted, a substantial number of codes related to the factor Relative Advantage. Many interviewees saw opportunities and advantages in the metaverse compared to online shops or physical stores. The metaverse being a convenient and quick way to shop was mentioned by 73% of respondents. Consequently, the first hypothesis was proposed as follows:

H_1: *Relative Advantage has a significant positive effect on the intention to adopt the metaverse as a marketplace for physical products.*

Compatibility refers to the consistency of an innovation with consumers' existing values, experiences, and needs (Rogers, 1995). Studies applying the DOIM have consistently found a positive relationship between Compatibility and adoption intentions (Ismail, 2012; Kapoor et al., 2014). In augmented reality (AR) shopping applications, Compatibility with consumers' existing shopping practices positively influences adoption intentions (Jiang et al., 2021). Given that the metaverse incorporates AR technologies, it is expected that Compatibility will similarly affect the intention to adopt it. This notion was confirmed during the interviews. The ability of the metaverse to extend the physical world and seamlessly integrate with existing user devices seems to enhance consumers' perception and their intention to adopt the metaverse as a marketplace for physical products. Therefore, the following hypothesis 2 was proposed:

H_2: *Compatibility has a significant positive effect on the intention to adopt the metaverse as a marketplace for physical products.*

Complexity refers to the perceived difficulty of understanding and using an innovation (Rogers, 1995). Innovations perceived as more complex require additional learning and may hinder adoption (Hoeffler, 2003). While the influence of Complexity on adoption intentions has been mixed in previous studies, the

factor seems to be significant in the metaverse context. A survey revealed that a low percentage of consumers understand what the metaverse is (Anderson, 2022). Additionally, the use of metaverse technologies like virtual reality headsets can pose physical discomfort (Hamad and Jia, 2022). The issue can be further explained by Cognitive Load Theory, which suggests that individuals' cognitive resources become overloaded when faced with complex tasks or systems, leading to reduced motivation and performance (Plass et al., 2010). The Complexity of the metaverse as a marketplace for physical products can overwhelm users, resulting in decreased intention to adopt due to the perceived cognitive burden. This is in line with interviewees' expectations and apprehensions. Many respondents stated that metaverse (technologies) should be easy to use, intuitive, and not too overwhelming for the user. Thus, hypothesis 3 was proposed in the following way:

H_3: *Complexity has a significant negative effect on the intention to adopt the metaverse as a marketplace for physical products.*

Trialability refers to the extent to which consumers can experiment with an innovation (Rogers, 1995). Studies have shown mixed results regarding the impact of Trialability on adoption intentions, with varying effects based on the context and associated costs (Ismail, 2012; Jiang et al., 2021). In the case of the metaverse, high initial costs associated with hardware and unfamiliarity may lead consumers to hesitate. Offering opportunities for consumers to trial the metaverse as a marketplace for physical products could increase adoption intentions, as it allows them to experience the benefits firsthand. This expectation is in line with Experiential Learning Theory, which posits that individuals acquire knowledge and attitudes through experimentation and reflective observation, including direct product experience (Lantos, 2015). Even though only 2 out of 4 sub-categories related to Trialability were identified in the interviews, an adequate number of respondents expressed their desire to try the metaverse before full adoption, especially due to the high costs for equipment. Hypothesis 4 was proposed as follows:

H_4: *Trialability has a significant positive effect on the intention to adopt the metaverse as a marketplace for physical products.*

Examining the importance of Financial Costs in innovation adoption, several studies are consistent with the findings of the interviews and confirm a significant negative effect of perceived costs on adoption decisions (Hanafizadeh et al., 2014; Kim et al., 2013; Twum et al., 2022). This effect can be explained by Loss Aversion Theory, which states that individuals tend to focus more on potential losses than gains when making decisions that involve behavioral change (Kahneman and Tversky, 1979). Since metaverse retailing is considered a successor to conventional e-retailing (Bourlakis et al., 2009), it is expected that similar results will occur. This is in line with the majority of interviews. Respondents mentioned that additional devices and payments present a barrier to metaverse retailing adoption. Consistent with the qualitative interviews conducted in phase one, a larger global study in 2019 revealed that the price of VR headsets is the leading barrier to mass adoption of VR (Ahmed, 2022; VR Intelligence, 2019). Based on the insights from the qualitative interviews and past research, hypothesis 5 was added as follows:

H_5: *Financial Costs has a significant negative effect on the intention to adopt the metaverse as a marketplace for physical products.*

The importance of Perceived Realism was emphasized during the interviews extensively. The construct emerged recently in Innovation Adoption Theory with the evolution of technologies such as AR (Daassi and Debbabi, 2021). Realism in the context of the metaverse can be defined as the extent to which users perceive the virtual environment and its content as realistic and immersive (Gilbert, 2016). Therefore, a high level of Realism results in products and user activities being viewed as natural and authentic (Daassi and Debbabi, 2021). Kalantari and Neo (2020) highlight that the lack of Perceived Realism and immersion is a fundamental challenge in designing fully

immersive virtual environments. Specifically for VR technologies, Vishwakarma et al. (2020) confirmed that perceived immersion leads to higher perceived value among consumers, leading to higher intentions to adopt virtual reality. A study conducted in the area of AR-based apps supports this notion. Daassi and Debbabi (2021) found that Perceived Realism offers consumers more compelling experiences, leading to higher attractiveness and intention to reuse AR apps. During the interviews in phase one, respondents also emphasized the importance of products being as close to reality as possible. Moreover, interviewees highlighted the need for the metaverse marketplace to imitate real-life experiences. Based on these insights, hypothesis 6 was proposed as follows:

H_6: *Realism has a significant positive effect on the intention to adopt the metaverse as a marketplace for physical products.*

Novelty is the third attribute that emerged during the interviews and refers to the extent to which consumers perceive an innovation to be a new and exciting alternative to an existing technology (Wells et al., 2010). Perceived Novelty significantly impacts product evaluation, customer satisfaction, and intention to adopt (Talukdar and Yu, 2021), which in turn can positively influence consumers' purchase intentions. Wells et al. (2010) investigated the role of perceived novelty in information technology (IT) innovation adoption and found a significant effect on perceived risk, perceived reward, and attitude toward usage. Positive attitudes towards an innovation can thereby be seen as a key driver of consumers' intention to adopt it (Mazambani and Mutambara, 2020). The desire to experience something new and have access to special products that are purchasable exclusively in the metaverse was also expressed by interviewees. In line with the qualitative interviews, 57% of U.S. consumers look forward to experiencing things in the metaverse that they would typically not experience (Sitecore Corporation, 2022). Based on the consistent findings from the qualitative interviews and the literature review, the following hypothesis 7 was proposed:

H_7: *Novelty has a significant positive effect on the intention to adopt the metaverse as a marketplace for physical products.*

2.3 The Moderation Role of Trust on Meta

Trust is vital for cultivating positive relationships between individuals and organizations, providing the basis for cooperation and the sharing of information (Oleszkiewicz et al., 2024). Online environments, which are closely related to the metaverse concept, have long been recognized as requiring a high degree of trust for successful adoption and usage. Wongkitrungruen et al. (2020) underline the critical nature of trust for users in digital environments where face-to-face interaction is absent. The perception of trustworthiness in online platforms influences consumers' decisions to transact and purchase products in a virtual environment.

Sudirjo et al. (2024), in a recent study on online shopping, found that there is a strong link between trust and a company's reputation. The reputation of a business or organization has been shown to directly influence consumers' trust in their products or services. Customers are more likely to trust and engage with entities with positive reputations, making reputation management a critical aspect of building trust in online settings. Furthermore, in virtual environments, data privacy and cyber security have been demonstrated to be significant indicators of consumer trust (Dhami et al., 2013). The metaverse, being a digital realm that often involves the exchange of personal information and digital assets, raises concerns about data security and the protection of users' privacy. These concerns can erode trust in an innovation and impede its widespread adoption.

Given these insights, it's crucial to consider the role of Meta (formerly Facebook) in shaping the metaverse. Meta is a key player in this emerging digital realm, wielding significant influence over its direction and evolution. Previous research about Facebook and consumer surveys about Meta demonstrate a lack of trust related due to low cyber security and

data privacy (Proulx and Liu, 2021). On the one hand, previous research demonstrates that lower levels of perceived security, privacy, and trust lead to decreased information sharing intentions (Dhami et al., 2013). On the other hand Nguyen et al. (2024) argued that benefits of social networks outweigh the risks of disclosing information. Due to these divergent results, further insights are needed to gain clarity on the dynamics of trust in the metaverse context.

Despite the growing relevance of trust in the metaverse and Meta's pivotal role, there remains a noticeable gap in the existing literature. Only a few studies have systematically investigated the role of trust in shaping user behaviors, attitudes, and intentions within this emerging digital landscape. Especially when it comes to Meta, more insights are required to better understand the company's role in this context. Consequently, there is an evident and pressing need for research that delves into trust and its implications for metaverse adoption and user behavior. Closing this knowledge gap is essential for comprehending the dynamics of trust in the metaverse and for better understanding the influence of key players like Meta in shaping the future of this digital realm.

Trust plays a crucial role in innovation adoption and is expected to be a significant factor in the metaverse context. Extensive research in various domains has demonstrated the impact of trust on adoption intentions (Pham et al., 2024; Aldboush and Ferdous, 2023). Significant moderating effects were found by Chen et al. (2015), Hamakhan (2020), and Alsaad et al. (2017), indicating that consumers perceive innovation attributes more favorably if they have a high level of trust in the innovation, ultimately influencing their willingness to adopt. Muharam et al. (2021), discovered that consumers who have a high level of trust in a company are more likely to positively evaluate the quality of a service, leading to increased satisfaction with the overall service experience.

In the context of the metaverse, concerns about safety and security act as barriers to adoption (Hassouneh and Brengman, 2014). This was also mentioned by a small number of respondents during the interviews. The association between the company Meta (formerly Facebook) and data privacy issues may thereby contribute to low consumer trust. Drawing from Relationship Marketing Theory, trust serves as a foundational element in building and maintaining strong customer relationships (Thaichon and Ratten, 2020). Trust towards Meta can be seen as a form of trust in the provider-customer relationship, where Meta is viewed as a reliable and trustworthy partner (Kleinaltenkamp and Ehret, 2006). Since a substantial share of consumers mistakenly believe that the metaverse is exclusively owned by the company Meta (Wright, 2022), it is likely that (lack of) trust in the company will transfer to the metaverse industry and innovation as a whole. Based on the theoretical findings and interviews, the following hypothesis 8 was proposed:

H_{8a-g}: *Trust towards Meta moderates the relationships between each of the following innovation attributes (a) Relative Advantage, (b) Compatibility, (c) Complexity, (d) Trialability, (e) Financial Costs, (f) Realism, and (g) Novelty, and their respective impacts on the intention to adopt the metaverse as a marketplace for physical products.*

3 METHODOLOGY AND DATA

3.1 Exploratory Study (Study I)

The research at hand employed a mixed-method approach, i.e., an exploratory sequential design involving two phases of data analysis. The primary goal of the qualitative study was to explore factors affecting consumers' intention toward adopting the metaverse as a marklace for physical products in addition to the predefined factors of the DOIM. These factors together were used to develop a theoretical framework explaining their relationship, which was tested in phase two.

Tab. 1: Profile of interview respondents ($n = 11$)

Respondent	Sex	Age	Position	Residency	VR/Metaverse Experience
111	Female	23	Marketing Management Student	The Netherlands	No experience
204	Female	28	Brand Manager	Switzerland	Limited experience with VR headsets at congresses
867	Male	27	Global IT Support	Germany	Moderate experience with HoloLens at work
645	Male	31	Sales	Germany	No experience
762	Male	25	Recruitment Marketeer	The Netherlands	Extensive experience with VR at home and limited experience with HoloLens at work
197	Female	22	Innovation Management Student	The Netherlands	Limited experience with VR at an exhibition
287	Male	28	Innovation Manager	Spain	Extensive experience with the metaverse at work and at home
489	Female	42	Brand Director	Switzerland	Limited experience with VR at congresses
328	Male	51	Global XR Technology and Metaverse Lead	The Netherlands	Extensive experience with the metaverse at work and at home
716	Male	24	Marketing Manager	Germany	No experience
593	Female	32	Customer Experience Manager	The Netherlands	Moderate experience with VR at home and at work

In-depth interviews were conducted with a small sample of 11 respondents. Interviews are a powerful method to explore individuals' thoughts and behaviors (Boyce and Neale, 2006). In the context of this study, the interviews provided valuable insights into the factors that are important in consumers' decision-making process regarding adopting the metaverse as a marketplace for physical products. Respondents were selected using purposive maximum variation sampling. This method allows for obtaining a broad view of the research topic from different perspectives (Etikan et al., 2016; Mkedder et al., 2024a) and is recommended for the qualitative phase in mixed-method research approaches (Wachter Morris and Wester, 2018). Since the population of online shopping users is very broad and diverse, with several 2.14 billion in 2022 (Rajnerowicz, 2023), it was essential to include consumers with different key demographics such as age and gender, as well as varying levels of experience with metaverse technologies. Also, professionals enrich the dataset with a range of practical experiences and specialized knowledge (Etikan et al., 2016).

The sample consisted of 2 students and 9 professionals working in different fields. The respondents' ages ranged from 22 to 51 years old; 6 of the respondents were males (55%), and 5 were females (45%). Their experience with the metaverse varied from no experience to extensive experience with metaverse technologies, such as VR, in work and home settings. An overview of participants' profiles is displayed in Tab. 1.

Semi-structured interviews were conducted with the interviewees, allowing for consistency and flexibility simultaneously (Leavy, 2014). All interviews were conducted one-on-one and lasted 15–20 minutes. The interviewees were asked for their consent before the interviews commenced. An explanation of the metaverse as a marketplace for physical products was given to ensure a common understanding of the topic. This was followed by the main open-ended question: "Which factors are important to you to decide whether to shop for physical products in the metaverse?" Following the process of semi-structured interviews, follow-up questions and probes were used to gain a deeper understanding of the main drivers

and barriers mentioned by the interviewees (Salmons, 2015). All interviews were recorded and transcribed. Anonymity and confidentiality were guaranteed by data pseudonymization of interview protocols, assigning three-digit codes to interviewees (Flick, 2021).

To analyze the interviews, thematic analysis following a grounded theory methodology with a combined approach of deductive and inductive coding was employed. Recent research suggests that a combination of deductive and inductive methods is particularly suitable for mixed research methods, such as exploratory sequential designs (Proudfoot, 2023).

In the first step, the researcher deductively analyzed the interview transcripts, looking for codes related to the five innovation attributes from the DOIM. This was approached by scanning for keywords related to the constructs and items used in respective measurement scales (Moore and Benbasat, 1991). In the second step, inductive coding was employed to generate open codes that addressed constructs not captured by the DOIM. For this, in-vivo coding, i.e., extracting meaningful words directly from the data, as well as descriptive coding, i.e., summarizing the topic in a word or short phrase, was applied (Saldaña, 2012). The third step involved axial coding to identify underlying sub-categories based on the newly emerged open codes. In the last step, higher-order categories were developed through selective coding and a review of literature in the field of innovation adoption. For each theme, the axial and open codes extracted from the data were compared with existing constructs used in Innovation Adoption Theory. This process led to the addition of new constructs, serving as additional independent variables in the final theory to be tested in phase two of the study.

3.2 Confirmatory Study (Study II)

The current study utilizes Structural equation modeling (SEM) to analyze and validate the conceptual model. Two SEM offers two primary approaches for analyzing relationships within a model. Partial Least Squares SEM (PLS-SEM) is exploratory, focusing on theory prediction and development, whereas covariance-based SEM (CB-SEM) is employed to confirm or refute theories and their associated hypotheses (Hair et al., 2021). Given that the model in this research draws from the DOIM and integrates insights from the qualitative study, the objective of the SEM analysis was to assess the conceptual model and its hypotheses. Consequently, CB-SEM was deployed in two stages, encompassing the analysis of the measurement model and the structural model.

To ensure the reliability of the measurement relationships between items and latent variables in the model, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were conducted first (Harrington, 2009). In the second step, the relationships between latent variables were tested by analyzing path coefficients and their statistical significance. This two-step approach allowed to enhance the validity and reliability of the analysis. All analyses were performed using R. Specifically, the R package lavaan was utilized for the CFA and SEM. To test moderating effects, double-mean centering was used to specify the interaction terms, mitigating potential issues of multicollinearity (Wiberg et al., 2018).

A questionnaire was chosen as the data collection method for the confirmatory study. To ensure academic integrity, informed consent was obtained from all participants at the beginning of the questionnaire (Rose et al., 2014). Participants were required to read and agree to the conditions of the study before answering any content-related questions. Moreover, respondents were informed about the right to withdraw from the study at any time (Weathington et al., 2012). To maintain anonymity and confidentiality, no (combination of) personal information that could identify respondents was requested in the questionnaire (Esteban-Bravo and Vidal-Sanz, 2021). Further, to minimize bias among the respondents about what we mean by the Metaverse as a marketplace for physical products, a definition of the metaverse and examples of physical products were included in the questionnaire's introduction.

Tab. 2: Profile of questionnaire respondents ($n = 386$)

Variable	Group	Frequency	Percentage
Age	18–23	338	87.56
	24–28	44	11.40
	33–38	4	1.04
Gender	Male	264	68.39
	Female	119	30.83
	Other	1	0.26
	Prefer not to say	2	0.52
VR/AR Experience	None at all	35	9.07
	Limited	216	55.96
	Moderate	119	30.83
	Extensive	16	4.14
Privacy concerns	Not at all	25	6.48
	Slightly	158	40.93
	Moderately	129	33.42
	Very much	74	19.17
Social influence	Not at all	25	6.48
	Somewhat	124	32.12
	Moderately	151	39.12
	Very much	86	22.28

Each construct in the model was measured using an appropriate and widely used measurement scale. The scales were adjusted to fit the context of metaverse retailing, resulting in 39 items, as shown in the Appendix. All items were measured on 7-point Likert scales, offering sufficient response options for nuanced measurement while maintaining simplicity for respondents (Russell and Purcell, 2009). Demographic questions about age and gender were included at the end of the questionnaire. Furthermore, respondents were asked about their prior experience with VR/AR, their privacy concerns, and the expected use of the metaverse within their social network. These factors were presumed to influence respondents' perceptions and were therefore used as control variables in the data analysis to better isolate and understand the direct effect of perceived innovation attributes.

To collect the data, a sample of 396 university students from the VU Amsterdam School of Business and Economics was recruited. University students were chosen for this study due to their typically heightened engagement with digital platforms and virtual environments, both critical aspects of the metaverse (Prensky, 2001; Oblinger and Oblinger, 2005; Mkedder and Özata, 2024). Additionally, students generally possess greater familiarity with and reliance on digital technologies compared to the wider population (Mkedder et al., 2024a). This demographic is frequently leveraged in technology adoption research, highlighting their relevance (Kim et al., 2013; Schepers and Wetzels, 2007). Given their proclivity to be early adopters, this segment constitute an ideal cohort for examining behaviors and attitudes towards emerging technologies like the metaverse (Molina-Castillo et al., 2023). Data collection took place between the 14th and 15th of March 2023 using Qualtrics, leading to 386 valid responses. The mean age of participants was 21.6 years, with a standard deviation of 2.1. Among the participants, 68% identified as male and 31% as female. Most participants had limited VR/AR experience (56%), slight to moderate privacy concerns (74%), and expected their social network would use the metaverse somewhat to moderately in the future (71%). A summary of the demographic characteristics of the respondents is provided in Tab. 2.

4 RESULTS

4.1 Study I Results

Based on the interviews, three other innovation attributes in addition to the five innovation attributes of the DOIM were identified: Financial Costs, Realism, and Novelty. Furthermore, many respondents mentioned during the interviews that their decision to use the metaverse as a marketplace for physical products depends on the product type. However, since research in the metaverse retailing field emerged recently (Yoo et al., 2023), there are no specific insights yet on which products will be more or less favorable to purchase in the metaverse. Therefore, the research decided not to consider the factor and continued focusing on the general category of "physical products". Tab. 3 provides an overview of the thematic analysis that was conducted.

Examining the five innovation attributes of the DOIM, participants mentioned themes related to 4 out of 5 constructs. None of the respondents mentioned Observability as a factor influencing their decision to enter the metaverse. This observation is in line with previous meta-analyses that found no significant effect of Observability on adoption intentions (Kapoor et al., 2014). Furthermore, the construct-wise alpha score for Observability was found to be 0.676, which did not meet the acceptable threshold of 0.7 (Hair et al., 2010). Dropping items from the scale did not lead to an improvement in the score. For these reasons, the decision was taken to delete the construct observability from the conceptual model.

The results from the first phase of the study led to the inclusion of the constructs Financial Costs, Realism, and Novelty to complement the existing five constructs of the DOIM, i.e., Relative Advantage, Compatibility, Complexity, Observability, and Trialability. As suggested by Pandit (1996), a literature comparison was conducted for each of the constructs as well as the moderator before the hypotheses and the conceptual model were derived. The results from study I, combined with the literature review, provide a solid foundation for the final conceptual model as illustrated in Fig. 1. This model was then tested using quantitative research methods in study II.

4.2 Study II Results

4.2.1 Measurement Model

The content validity and reliability of the measurement scales were assessed first. Reliability was examined by observing Cronbach's alpha coefficient, with a threshold value of 0.7 (Hair et al., 2010). All Cronbach's alpha scores, excluding the construct Observability which was removed from the conceptual model as explained in the methodology section, indicated satisfactory levels of reliability, as the results in Tab. 4 show.

In the next step, the EFA was conducted to examine whether the underlying items accurately measure the intended constructs (Cooper, 2018). Following the recommendation of Hwang and Lee (2022), separate EFAs were performed for dependent, moderating, and independent variables. A non-parametric method, i.e., MLR, was employed as the Mardia's skewness and kurtosis test revealed significant deviation from multivariate normality with a skewness test statistic of 18,280.83 ($p < 0.05$) and a kurtosis test statistic of 35.61 ($p < 0.05$), see Thode (2002). The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity were utilized to assess how suitable the data are for factor analysis. A KMO value greater than 0.5 indicates good sampling adequacy, while a significant Bartlett's test result implies sufficient intercorrelation among the variables to proceed with factor analysis (Child, 2006).

With a KMO value of 0.92 and a significant Bartlett's test result ($\chi^2 = 5{,}708.05$, $p < 0.05$), it was determined that the data for exogenous variables were suitable for EFA. The results of the EFA revealed the identification of seven factors through parallel analysis. As a rotation method, oblique rotation, specifically oblimin, was specified to allow for correlations between the innovation attributes (van Rijnsoever et

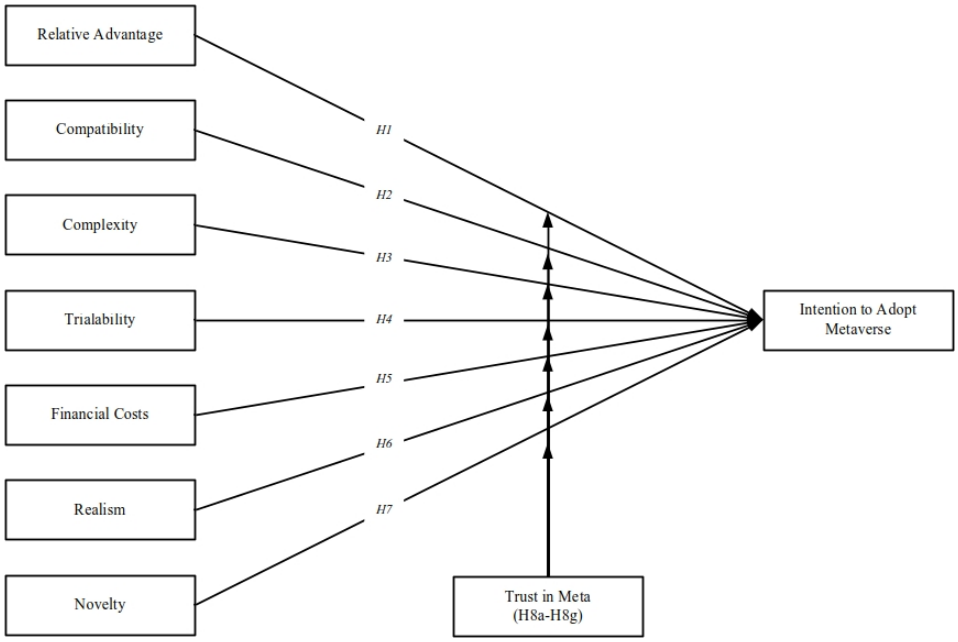

Fig. 1: Framework of the Study

al., 2009). Three items, CA4, TR1, and RE3, were removed from further analyses as their factor loadings were below the commonly applied threshold of 0.5 (Hair et al., 2010). The requirements for the EFA for the endogenous variable were also met. The KMO value was identified at 0.76, and Bartlett's test yielded significant results ($\chi^2 = 959.54$, $p < 0.05$). A single factor was identified with all factor loadings exceeding the threshold of 0.5. Finally, the EFA was performed for the moderating variable. The KMO value was satisfactory at 0.81, and Bartlett's sphericity test produced significant results ($\chi^2 = 1{,}452.46$, $p < 0.05$). Unexpectedly, two factors were identified instead of one single. TM1–4 and TM5–6 loaded on separate factors. Consequently, TM5 and TM6 were not included in the subsequent CFA and SEM analysis.

Model fit, convergent validity, and discriminant validity were assessed as part of the CFA. Commonly used fit indices, including SRMR, GFI, TLI, IFI, CFI, and RMSEA, were considered to evaluate the model fit (Hwang and Lee, 2022; Pituch and Stevens, 2015). As shown in Tab. 5, all fit indices indicated a satisfactory model fit for the measurement model.

Convergent validity was examined by assessing the construct reliability (CR) and average variance extracted (AVE) indices for each measured variable. A CR value of 0.7 or higher and an AVE value of 0.5 or higher are typically considered indicative of convergent validity (Hair et al., 1987; Nunnally, 1978). As presented in Tab. 4, the CR values ranged from 0.768 to 0.932, and the AVE values ranged from 0.522 to 0.820, demonstrating that all constructs met the respective criteria for convergent validity. Furthermore, discriminant validity was assessed, referring to the distinctiveness of measurements, indicating that they have low correlations with each other and can be treated as separate constructs (Campbell and Fiske, 1959). It was verified by comparing the AVE square root with the correlation coefficients between the construct and other constructs (Fornell and Larcker, 1981). The results are presented in Tab. 6. All AVE square roots are larger than the correlation coefficients with other constructs, ensuring discriminant validity.

4.2.2 Structural Model

SEM path analysis was applied in two steps to examine the relationships in the research model.

Tab. 3: Overview of thematic analysis

Construct	Sub-category	Significant Statement Examples	*f*	%
		Diffusion of Innovation Model		
Relative Advantage	Quickly	"Timewise it would be a benefit." (762)	8	72.73
	Easy	"The goal is to just stay at home and have an easy purchase." (197)	6	54.55
	Convenient	"The purpose is to not have the inconvenience of going to a shop or log in on a web page." (197)	8	72.73
	Advantageous	"I think it's very important that there's a clear advantage of the metaverse." (716)	9	81.82
Compatibility	Lifestyle	"… see if it fits what I need." (593)	1	9.09
	Current way to shop	"That same experience you want to have in an in a shopping world which is virtual." (328)	1	9.09
	Shopping style	"… if it delivers good products like the same products I could get in the store." (762)	4	36.36
	Current situation	"… connected to existing solutions like a store or an online shop, where you could seamlessly move from one to the other" (489)	4	36.36
Complexity	Cumbersome	"… have the hassle …" (489)	6	54.55
	Frustrating	"… not too overwhelming." (204)	1	9.09
	Difficult to use	"The most important for me is it's easy to use." (645)	7	63.64
	Mental efforts	"You need to get used to it, to get familiar with it." (197)	3	27.27
Trialability	Desire to try	"I really think I would try it." (716)	2	18.18
	Expectation to try	Not mentioned	0	/
	Use on a trial basis	Not mentioned	0	/
	Trial before decision	"I would test it and if it's easy to use and there are no problems, or I see the advantage compared to the real world, I definitely would use it." (645)	4	36.36
Observability	How to use	Not mentioned	0	/
	See if beneficial	Not mentioned	0	/
	Get clarity	Not mentioned	0	/
	Become apparent	Not mentioned	0	/
		Additional constructs		
Financial Costs	Additional devices	"I would be more likely to buy things in the metaverse if I don't need any additional gadget." (111)	9	81.82
	Payments	"The platform should not have many costs for the customer." (645)	8	72.73
Realism	Products close to reality	"Consistency with what I see in reality." (204)	9	81.82
	Realistic platform design	"The frames would need to be high, the frames per second in any virtual reality headsets." (762)	4	36.36
Novelty	New experience	"I need to experience something new." (287)	5	45.45
	Special products	"If they would do special products that you can only buy in the metaverse and not in an online store or in physical stores, that would also be a factor where I would consider going in the metaverse." (716)	2	18.18
Product type	Product type	"… depends on what product you buy." (197)	5	45.45

Note: excluding newly emerged categories that were mentioned in less than 4 interviews.

In the first step, the direct causal relationships between the seven innovation attributes and consumers' intention to adopt the metaverse as a marketplace for physical products were observed. In the second step, separate models were used to test the moderating role of Trust towards Meta.

Next to the seven innovation attributes and the dependent variable, the structural model included the control variables age, gender, VR/AR experience, social influence, and privacy concerns. The fit indices for the structural model were again satisfactory and met all the requirements. The path estimates of the constructs are shown in Tab. 7, providing evidence for hypotheses H_{1-3} and H_{5-7}. However, Trialability was found to be statistically insignificant ($\beta = 0.075$, $p = 0.342$), leading to the rejection of H_4.

Notably, Novelty exhibited the highest impact on metaverse retailing adoption intentions, with the highest estimate and lowest signifi-

Tab. 4: Reliability and convergent validity analysis

Construct	Loadings	Cronbach's alpha	CR	AVE
RA (Relative Advantage)	[0.653; 0.885]	0.902	0.903	0.701
CA (Compatibility)	[0.453; 0.879]	0.924	0.925	0.804
CX (Complexity)	[0.650; 0.826]	0.806	0.810	0.522
TR (Trialability)	[0.315; 0.813]	0.765	0.768	0.528
RE (Realism)	[0.414; 0.775]	0.820	0.829	0.618
FC (Financial Costs)	[0.668; 0.878]	0.816	0.819	0.603
NO (Novelty)	[0.636; 0.805]	0.802	0.811	0.596
IA (Intention to Adopt the Metaverse)	[0.866; 0.930]	0.932	0.932	0.820
TM (Trust Towards the Company Meta)	[0.834; 0.901]	0.849	0.925	0.757

Tab. 5: Fit indices for confirmatory factor analysis

Index	SRMR	GFI	TLI	IFI	CFI	RMSEA
Baseline	< 0.08	> 0.8	> 0.9	> 0.9	> 0.9	< 0.08
Observation	0.040	0.912	0.970	0.974	0.974	0.037

cance ($\beta = 0.483$, $p < 0.001$). As expected, Complexity ($\beta = -0.128$, $p = 0.040$) and Financial Costs ($\beta = -0.132$, $p = 0.011$) demonstrated a negative effect on the intention to adopt the metaverse as a marketplace for physical products, while the other innovation attributes played a favorable role.

Regarding the control variables, social influence ($\beta = 0.210$, $p < 0.001$) and VR/AR experience ($\beta = 0.135$, $p = 0.050$) had significant effects. To further understand the impact of these control variables, a comparison was made between the model that included the covariates and a model that excluded them. Notably, the inclusion of the control variables led to an increase in the significance of the innovation attributes. This implies that controlling for social influence and VR/AR experience allowed for a more accurate assessment of the relationship between the innovation attributes and the adoption of the metaverse as a marketplace for physical products. The path coefficients between age ($\beta = -0.006$, $p = 0.998$), gender ($\beta = 0.143$, $p = 0.141$), privacy concerns, and the dependent variable were statistically insignificant. This implies that, within the framework of this research model and when considering other influential variables, these factors have no notable impact on consumers' adoption decisions.

Tab. 6: Discriminant validity analysis ($n = 386$)

	RA	CA	CX	TR	RE	FC	NO	IA	TM
RA	0.837								
CA	0.667	0.897							
CX	−0.388	−0.359	0.722						
TR	0.389	0.375	−0.214	0.726					
RE	0.447	0.599	−0.203	0.281	0.786				
FC	0.066	0.019	0.058	−0.012	0.114	0.777			
NO	0.389	0.457	−0.172	0.372	0.426	0.178	0.772		
IA	0.601	0.666	−0.379	0.451	0.546	−0.009	0.519	0.906	
TM	0.283	0.312	−0.005	0.214	0.425	0.019	0.252	0.329	0.870

Note: AVE square roots are highlighted in hold.

Tab. 7: Model estimation without moderators ($n = 386$)

Hypothesis	Path	Standardized estimate	Standard error	z-value	p-value	Result
H_1	RA → IA	0.245	0.079	3.104	0.002	Confirmed
H_2	CA → IA	0.250	0.084	2.986	0.003	Confirmed
H_3	CX → IA	−0.128	0.062	−2.057	0.040	Confirmed
H_4	TR → IA	0.075	0.079	0.949	0.342	Rejected
H_5	FC → IA	−0.132	0.052	−2.556	0.011	Confirmed
H_6	RE → IA	0.209	0.070	2.998	0.003	Confirmed
H_7	NO → IA	0.483	0.122	3.967	< 0.001	Confirmed

Tab. 8: Moderation effects

H	IV	DV	Standardized estimate	Standard error	z-value	p-value	Result
H_{8a}	RA	IA	0.034	0.080	0.432	0.666	Rejected
H_{8b}	CA	IA	−0.025	0.079	−0.313	0.754	Rejected
H_{8c}	CX	IA	−0.001	0.040	−0.026	0.979	Rejected
H_{8d}	TR	IA	−0.054	0.051	−1.067	0.286	Rejected
H_{8e}	RE	IA	0.049	0.059	0.836	0.403	Rejected
H_{8f}	FC	IA	−0.047	0.043	−1.098	0.272	Rejected
H_{8g}	NO	IA	0.041	0.093	0.443	0.658	Rejected

The moderation effect was assessed through an additional structural model that incorporated the interaction terms between the innovation attributes and the moderating variable. The moderating role of Trust towards Meta could not be confirmed. Therefore, hypothesis 8 was rejected due to insignificant results. The estimates for each construct and moderator are presented in Tab. 8.

5 DISCUSSION AND CONCLUSIONS

The current study endeavors to delve into the factors influencing consumers' inclination to embrace the metaverse as a marketplace for physical goods, while also exploring the impact of trust in Meta. Analysis revealed that consumers' perception of the metaverse as novel, advantageous, realistic, and compatible positively influences their intention to adopt it for shopping physical products. Conversely, viewing the metaverse as complex and expensive diminishes consumers' adoption intentions.

Three hypotheses (H_1, H_2, H_3) rooted in the DOIM were confirmed, while one (H_4) was rejected. Additionally, all three hypotheses (H_5, H_6, H_7) derived from qualitative in-depth interviews garnered support. These findings furnish valuable insights for crafting the metaverse as a customer-centric marketplace for physical products, thereby bolstering its adoption rate.

Setianti et al. (2024) underscore that relative advantage significantly enhances trust levels, website perceptions, and attitudes toward online commerce. This aligns with Kapoor et al.'s (2014) meta-analysis, accentuating the importance of presenting the metaverse as an advancement to traditional e-retailing. It's imperative to spotlight metaverse features that add value to customers, such as online social interaction, personalization, and enhanced product visualization (Hennig-Thurau et al., 2022).

Compatibility emerges as a significant predictor of innovation adoption (Jiang et al., 2021; Kapoor et al., 2014). This study reaffirms its relevance in metaverse retailing adoption, ad-

vocating for a seamless transition from existing solutions to the metaverse, considering consumers' online shopping habits and preferences. Integrate frequent devices to facilitate a smooth transition when building the metaverse as a marketplace for physical products. Moreover, ensure seamless connections to existing websites and platforms, enabling consumers to navigate effortlessly between conventional online shops and the metaverse.

Novelty emerged as a highly influential factor in metaverse retailing adoption. Novelty emerged as a highly influential factor in metaverse retailing adoption. This finding is consistent with Mkedder et al. (2024b) and Talukdar and Yu's (2021) research on virtual reality, which highlights the importance of presenting the metaverse as a unique technology that enriches the shopping experience. As such, it is advisable to emphasize innovative features such as virtual showrooms and interactive product displays when marketing the metaverse as a marketplace for physical products. Additionally, innovative strategies, such as integrating real users and products into the metaverse and refining pricing strategies, can promote social interactions among different market participants including platforms, producers, consumers, and their avatars, as suggested by Zhang and Ye (2023).

On the other hands, realism plays an essential role in metaverse retailing adoption particularly regarding shopping for physical products. This finding confirms the findings of Daassi and Debbabi (2021) and extends them from an AR to the metaverse context more broadly. Consequently, companies should invest in Digital Twinning and accelerate the progress of underlying technologies, such as the Internet of Things and Machine Learning (Fuller et al., 2020). This ensures that the metaverse marketplace and the products offered within it will be represented as realistically as possible, leading to higher customer satisfaction, positive word-of-mouth, and higher intentions to (re)purchase.

Contrary to Jiang et al.'s (2021) findings, this study confirms the significant influence of Complexity as a barrier in the metaverse context. Similarly, Farajnezhad et al. (2021) also emphasize the significant link between DOIM and complexity. Therefore, it is crucial to simplify the user experience by designing an intuitive and effortless interface for consumers. Explicit guidance and visual aids facilitate consumers' navigation and interaction within the metaverse marketplace, thus minimizing cognitive load and expediting users' acclimation to the novel platform (Balakrishnan et al., 2024).

Financial Costs have been recognized as a significant predictor of consumers' adoption intentions across different contexts (Twum et al., 2022). This research confirms the relevance of Financial Costs in adopting the metaverse as a marketplace for physical products (Mkedder and Das, 2024). In accordance with Ahmed (2022) and the survey conducted by VR Intelligence (2019), equipment costs seem to be a significant barrier for consumers. Therefore, to encourage adoption, consumers should be assured that the added value of the metaverse as a marketplace for physical products outweighs the expenses associated with purchasing equipment. Furthermore, it can be valuable to emphasize that metaverse equipment is not solely used for shopping purposes but can be leveraged for other use cases, such as attending virtual trips and events, gaming, or remote work (Mystakidis, 2022).

The finding that Trialability did not yield significant results raises important questions about the effectiveness of offering free trials as a strategy to reduce perceived risk and mitigate high costs, as suggested by Zhu and Chang (2014). One possible explanation for the contradicting finding could be related to the nature of the metaverse as a disruptive and complex innovation and the degree to which consumers feel they can adequately evaluate the metaverse as a marketplace for physical products through a simple trial (Mkedder and Das, 2024). To gain a deeper understanding of the relationship between Trialability and metaverse retailing adoption, further research is warranted. Future studies could explore the reasons for the insignificance and gain a deeper understanding of the construct's role in meta-

verse retailing adoption by using qualitative research methods, such as in-depth interviews or focus groups.

The unexpected finding regarding the lack of confirmation of the moderating role of Trust towards Meta in the study has significant implications for the understanding of consumer behavior and the metaverse. Several previous studies (Alsaad et al., 2017; Hamakhan, 2020) had suggested that trust in innovations and service providers would play a crucial role in shaping consumers' perceptions and behaviors. These studies implied that consumers' mistrust in Meta would act as a barrier due to potential privacy and data security concerns or issues. However, this study's results challenge this assumption, indicating that consumers may not have significant concerns about Meta's actions in the metaverse.

This unexpected finding might be attributed to several factors, such as consumers may prioritize alternative considerations, like the novelty and advantages of the metaverse, thereby diminishing the role of trust in their decision-making. Additionally, the company's successful rebranding from Facebook to Meta may have effectively disassociated it from past negative incidents concerning data privacy and cybersecurity (Mkedder and Das, 2024). Furthermore, it is possible that consumers lack comprehensive awareness of the privacy and security risks within this novel metaverse context (Mkedder et al., 2024b). Delving into these hypotheses and uncovering the underlying causes of this phenomenon necessitates further comprehensive research.

From a practical point of view, it is recommended that companies like Meta do not raise potential issues in their communications, as focusing on privacy concerns may inadvertently reinforce negative beliefs about the company and the metaverse (Sanderson, 2009). For instance, Gale et al. (2022) argues in their research that users struggle with overcoming cybersecurity because it represents a relatively unknown risk. On the other hand, Mkedder and Das (2024) finding raises several intriguing questions about consumer rights and protection in the context of emerging technologies and virtual environments. It is essential to consider whether consumers are sufficiently informed about the potential risks and challenges associated with the metaverse, suggesting a need for continued research in the area.

6 IMPLICATIONS

The outcomes of this study carry significant implications for corporate managers involved in developing and entering the metaverse marketplace. To increase metaverse retailing adoption among consumers, it is recommended that businesses, particularly in the technology and retail sectors, implement strategies aligned with the key drivers and barriers identified in this study. Marketing campaigns should emphasize the metaverse's Relative Advantage, Compatibility, Novelty, and Realism while addressing negative perceptions regarding the Complexity and Financial Costs of the metaverse as a marketplace for physical products.

Furthermore, it is advised that managers incorporate these attributes into their product development efforts, prioritizing user-friendliness, innovative features, and highly realistic interfaces. Exploring different pricing strategies is essential to ensure customers do not abstain from using the metaverse as a marketplace for physical products due to high equipment costs. Implementing flexible payment plans or subscription-based models that enhance affordability can help mitigate financial barriers and foster wider and more rapid adoption of the metaverse as a marketplace for physical products.

Additionally, retailers seeking to join the metaverse marketplace to offer their products do not need to fear potential negative spillover effects and harm on their brand reputation stemming from consumers' mistrust in the company Meta (Raufeisen et al., 2019). This finding has significant implications for partnering selection, indicating that companies do

not need to be concerned about co-branding with Meta. More specifically, it implies that businesses can be more open to collaborations with Meta without worrying about any adverse effects on their own brand image. This is particularly relevant in the context of the metaverse, where innovation and collaboration are essential for success. Businesses can tap into Meta's resources, expertise, and vast user base to enhance their presence within the metaverse, without the fear that any potential controversies or negative perceptions of Meta will harm their own brand. It allows businesses to harness the opportunities presented by the metaverse to the fullest extent.

By considering these practical implications, companies can position themselves effectively within the metaverse context and capitalize on the potential opportunities it presents as a marketplace for physical products. Employing these strategies can help companies gain a competitive edge, enhance customer satisfaction, and drive business growth in the evolving digital landscape.

From an academic perspective, a major contribution of this research is its pioneering use of a mixed-method research approach to investigate metaverse retailing adoption. The research findings demonstrate the ability to generalize qualitative insights through quantitative research. The exploratory sequential research design provides a comprehensive understanding of metaverse adoption in shopping for physical products, surpassing the limitations of relying solely on qualitative or quantitative methods.

The application of the DOIM revealed the significance of three innovation attributes – Relative Advantage, Compatibility, and Complexity. Even though only three out of five hypotheses were confirmed, this research reaffirms the generalizability of (some aspects of) the DOIM. Previous studies have consistently identified these three attributes as significant factors (Tornatzky and Klein, 1982). In contrast, Trialability often yields insignificant results, raising questions about its role in Innovation Adoption Theory (Kapoor et al., 2014). It is suggested that the factor may only have relevance in specific contexts, prompting a review and potential adjustment of Rogers' original DOIM. The qualitative study findings, which were subsequently validated in the quantitative phase, provide valuable insights into metaverse retailing adoption. The three constructs, Novelty, Realism, and Financial Costs, emerged as highly influential factors for consumers, underscoring their significance in researching metaverse technologies moving forward.

7 LIMITATIONS AND FUTURE PROSPECTS

The design of this research is subject to several limitations that open avenues for future exploration. One key limitation is the lack of specificity regarding the types of physical products evaluated in Study II. Although we aimed to cover a broad range of products commonly purchased online, the absence of detailed product categories might have introduced some variability in respondents' perceptions and attitudes. To mitigate this, we included a comprehensive definition of the metaverse and examples of physical products (e.g., clothes, furniture, consumer electronics) in the introduction of the questionnaire. However, future research should aim to specify product categories more clearly or investigate the influence of different product types on consumer intentions to adopt the metaverse as a marketplace.

Additionally, the qualitative study within this research suggested that the adoption of the metaverse and consumers' perceptions are likely to vary across different product types. Consequently, it would be beneficial to explore the role of product type as a potential moderator in future studies. By delving into specific product categories, future research could determine whether the observed effects become stronger or diminish under certain product conditions.

Another promising avenue for future research concerns the evolving nature of the metaverse. Changes in the interpretations among consumers may impact their perceptions and

the significance of factors over time. This means that the study's temporal validity is questionable, suggesting the need for ongoing research as the metaverse develops. Furthermore, the quantitative research data are limited to Dutch consumers, indicating a potential culture bias. In countries where the metaverse is less evolved, different results might occur and the perceptions and intentions of consumers might be lower. Therefore, future research is encouraged to include consumers from different countries to validate and expand upon the findings presented here or identify geographical differences.

Furthermore, nearly 90% of participants were between 18 and 23 years old, which limited the ability to interpret age effects, even though the metaverse is often viewed as an innovation tailored for younger consumers (Oxford Analytica, 2022). Future studies should aim to explore the metaverse's broader adoption by including participants from a more diverse age range. This approach could uncover how the significance of influencing factors varies across different age groups, or identify new drivers and barriers. Besides that, Generation Alpha, a promising target for the metaverse (McCrindle et al., 2021), was excluded due to the ethical complexities associated with researching minors. Future research could explore potential generational effects specific to these "digital natives" and thereby answer the question whether Generation Alpha exhibits distinct metaverse adoption patterns compared to other age groups, and what factors drive these differences. For instance, younger individuals may perceive complexity as a less significant factor due to their rapid acclimation to new technologies. Conversely, novelty could hold greater importance among Generation Alpha due to their innate curiosity and propensity for exploring novel experiences.

Certain limitations in the measurement scales were identified, including low Cronbach's alpha scores and items not loading onto intended scales. Future research should conduct a pretest of the questionnaire and review scales for clarity and data quality improvement. The nonconfirmation of the moderating role of Trust towards Meta and the unsatisfactory factor loadings of the trust scale suggest the need for further exploration of trust aspects and measurement refinements.

Especially with regard to the insignificances of Trialability and Trust towards Meta, it is advisable to pursue further research, specifically using qualitative research methods. This approach holds the potential to unveil the underlying reasons that have led to the unexpected findings of this research, which stand in contrast to prior research outcomes. This not only aids in making sense of the current results but also contributes to a deeper and more holistic understanding of consumer behavior in this rapidly evolving digital landscape.

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9 ANNEX

Construct	Items (measured on a 7-point Likert scale)	References
Perceived relative advantage	RA1: I think using the metaverse will enable me to shop physical products more quickly. RA2: I anticipate using the metaverse will make it easier for me to shop physical products. RA3: I believe using the metaverse will be a convenient way to shop physical products. RA4: Overall, I expect using the metaverse for shopping physical products will be advantageous.	Moore and Benbasat (1991), Ismail (2012), Jiang et al. (2021), Tan and Teo (2000)
Perceived compatibility	CA1: I anticipate shopping physical products in the metaverse will match my lifestyle. CA2: I think using the metaverse will fit well with the way I like to shop physical products. CA3: I believe using the metaverse will fit into my shopping style. CA4: I expect using the metaverse will work well with my current situation.	Moore and Benbasat (1991), Ismail (2012), Jiang et al. (2021), Tan and Teo (2000)
Perceived complexity	CX1: I believe that it will be challenging to use the metaverse to shop physical products. CX2: I think learning to use the metaverse to shop physical products will be frustrating. CX3: Overall, I believe that the metaverse will be difficult to use to shop physical products. CX4: I expect using the metaverse for shopping physical products will require a lot of mental effort.	Moore and Benbasat (1991), Ismail (2012), Jiang et al. (2021), Tan and Teo (2000)
Perceived trialability	TR1: I believe the metaverse will be available to me to adequately test shopping physical products. TR2: I anticipate having the opportunity to try the metaverse for shopping physical products. TR3: I expect to be able to use the metaverse on a trial basis long enough to see how to shop physical products. TR4: Before deciding whether to use the metaverse for shopping physical products, I think I will be able to properly try it out.	Moore and Benbasat (1991), Ismail (2012), Jiang et al. (2021), Tan and Teo (2000)

Perceived observability	OB1: I think that I would have no difficulty telling others about the result of using the metaverse to shop physical products. OB2: I believe I will be able to communicate to others the consequences of using the metaverse to shop physical products. OB3: I expect that I will see others using the metaverse to shop physical products. OB4: I anticipate that it will be easy for me to observe others using the metaverse to shop physical products.	Moore and Benbasat (1991), Ismail (2012), Jiang et al. (2021)
Trust towards Meta	TM1: I believe that Meta as a company would act in my best interest. TM2: The company Meta is interested in my well-being, not just its own. TM3: Meta as a company is truthful in its dealings with me. TM4: I would characterize the company Meta as honest. TM5: The company Meta is competent and effective in developing the metaverse. TM6: In general, Meta as a company is very knowledgeable about the metaverse.	McKnight et al. (2002)
Perceived realism	RE1: In comparison to the real world, I expect the metaverse to seem real. RE2: I think my shopping experience in the metaverse will be consistent with my real-world experience. RE3: I expect that the things that will be sold in the metaverse will look like things that are sold in real life. RE4: I anticipate that the metaverse shopping experience will be similar to in-store shopping experiences.	Daassi and Debbabi (2021)
Perceived financial costs	FC1: I think the equipment required to use the metaverse is expensive. FC2: There are financial barriers in the way of my using the metaverse. FC3: I think it costs a lot to start using the metaverse.	Twum et al. (2022)
Perceived novelty	NO1: I think using the metaverse to buy physical products will be a novel experience. NO2: I expect using the metaverse to buy physical products will be new and refreshing. NO3: I believe the metaverse represents a neat and novel way of shopping physical products.	Wells et al. (2010)
Intention to adopt	IA1: I intend to adopt the metaverse in the future. IA2: I intend to adopt the metaverse to buy physical products in the future. IA3: I intend to adopt the metaverse frequently in the future.	Taylor and Todd (1995), Rodríguez-del-Bosque and Herrero-Crespo (2011)

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