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Consumer Behaviour in the Metaverse: Empirical Insights From a Meta-Analysis

Wagner Junior Ladeira[1,2] | Fernando de Oliveira Santini[1,2] | Weng Marc Lim[3,4,5,6,7] | Tareq Rasul[8,9] | Tiago Oliveira[10] | Shakeb Akhtar[11]

[1]Universidade do Vale do Rio dos Sinos (UNISINOS), Sao Leopoldo, Brazil | [2]School of Business, Woxsen University, Hyderabad, India | [3]Sunway Business School, Sunway University, Sunway City, Selangor, Malaysia | [4]ASU-Cintana Alliance Global Partner Affiliate Faculty, Arizona State University, Tempe, Arizona, USA | [5]School of Business, Law and Entrepreneurship, Swinburne University of Technology, Hawthorn, Victoria, Australia | [6]Global Research Centre, Sungkyunkwan University, Suwon, Gyeonggi, Republic of Korea | [7]Jaipuria Institute of Management, Lucknow, Uttar Pradesh, India | [8]College of Business Administration, Gulf University for Science and Technology, Hawally, Kuwait | [9]University College, Korea University, Seoul, South Korea | [10]NOVA Information Management School (NOVA IMS), Universidade NOVA de Lisboa, Lisbon, Portugal | [11]Department of Economics and Business Administration, University of Technology and Applied Science, Ibra, Oman

Correspondence: Weng Marc Lim (marcl@sunway.edu.my)

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ABSTRACT

Metaverses are rapidly expanding, yet the complexities inherent in these virtual environments remain insufficiently understood, which, in turn, limits the ability to anticipate potential challenges and capitalize on emerging opportunities. In response, this study establishes and examines a *metaverse behaviour model* using meta-analytic structural equation modeling (MASEM) and hierarchical meta-regression on 412 effect sizes drawn from 39,580 participants. Findings suggest that interactivity and vividness are drivers of telepresence in the formation of consumers' metaverse immersiveness, and that enjoyment, rather than flow, acts as the core mediator between telepresence and attitude in consumers' metaverse experience. Moderation results reveal further insights into consumers' metaverse behaviour, showing that the impact of telepresence on attitude is stronger among consumers who are older (vs. younger), use a VR headset (vs. traditional screen), and engage in online (vs. offline) retail. Meanwhile, the impact of attitude on intention in the metaverse is stronger among consumers who engage in online (vs. offline) retail or use augmented reality (vs. virtual reality) for hedonic (vs. utilitarian) products, leveraging the functionality of the metaverse as a tool (vs. target). These insights not only challenge existing assumptions about consumer engagement in virtual environments but also equip metaverse developers and marketing managers with informed strategies to optimize consumers' experience and shape their behaviour within the metaverse.

1 | Introduction

The metaverse has significantly reshaped consumer engagement, as exemplified by popular platforms like *Animal Crossing*, *Fortnite*, *Minecraft*, *Nemesis*, *Pokémon Go*, *Roblox*, *Second Life*, *The Sims*, and *ZEPETO* (Dwivedi et al. 2022; Kim 2021). These platforms thrive due to innovative virtual environments designed to foster seamless interactions between avatars and software agents. Recognizing this evolving trend, industry leaders such as *Google*, *Meta*, *Microsoft*, and *Nvidia* have substantially invested in hardware, software, and infrastructure to deepen user immersion and improve interaction quality within metaverses (Hadi et al. 2024).

Traditional retail giants have also responded proactively to this evolution by integrating metaverse strategies into their business models. Noteworthy examples include *Gucci*'s successful sale of digital bags on *Roblox* (Barry 2021), *Uniqlo*'s introduction of *Minecraft*-themed merchandise (Yoo et al. 2023), and the pioneering live broadcast of an *AC Milan* versus *Fiorentina* match within the *Nemesis* metaverse (Dwivedi et al. 2022). These initiatives reflect a market shift, with the metaverse in e-commerce valued at USD 8.3 billion in 2021 and projected to reach USD 128.99 billion by 2030 (SkyQuest Technology 2023). User growth is also expected to match this trend, potentially reaching 2.6 billion users by 2030 (Statista 2025).

The fashion industry, in particular, has embraced the metaverse. Events like *Metaverse Fashion Week* (*MVFW*), which debuted in March 2022, illustrate this engagement. *MVFW* provided global digital access to fashion, attracting more than 100,000 attendees and participation from over 60 prominent brands, including *Adidas* and *Dolce & Gabbana*. Brands invested over $5000 each for virtual storefronts, marking it as the metaverse's most significant cultural fashion event to date. A detailed case study of *MVFW* highlighted that sensory experiences, particularly auditory and visual elements, were pivotal in enhancing the virtual consumer environment (Alexander et al. 2025).

Further evidence of metaverse adoption is visible in global brands such as *Amazon*, *Flipkart*, *H&M*, *Walmart*, and *Zara*, which leverage the metaverse to enrich shopping experiences and solidify their competitive positions (Pillai et al. 2024). A compelling illustration of this integration is *Valentino Beauty*'s pop-up event, which employed a smart mirror for digital try-ons, attracting 1500 visitors over 2 days and significantly boosting product sales, thereby demonstrating that the metaverse encompasses not only virtual but also physical retail experiences through the effective merging of immersive technologies with traditional environments (Hirschmiller 2025).

Recognizing the growing adoption across diverse sectors, academic research has increasingly explored the metaverse's multiple dimensions, particularly focusing on augmented reality (AR) and virtual reality (VR) as core enabling technologies (Lim et al. 2024, 2025). Noteworthily, scholars have rigorously evaluated a range of innovative AR and VR applications implemented by leading brands. Examples include *Apple*'s interactive in-store avatar experience (Jin 2009), *BMW*'s immersive 360° VR website simulations (Cowan et al. 2021), *GAP*'s augmented-reality dressing rooms (Nikhashemi et al. 2021), *Gucci*'s immersive *Garden Metaverse* (Kim and Bae 2023), digital enhancements on *L'Oréal*'s virtual reality platform (Butt et al. 2021), *Ray-Ban*'s virtual mirror accessible through their website (Pantano et al. 2017), *Tissot*'s innovative augmented-reality product presentations (Yim et al. 2017), and *Zara*'s virtual try-on application integrated into physical stores (Yuan et al. 2021). Collectively, these cases underline the extensive, transformative impact AR and VR technologies have on redefining consumer-brand engagement within the metaverse.

The concept of the metaverse guiding this meta-analysis represents an immersive, integrated digital environment designed to replicate, extend, and enhance real-world experiences through a network of seamless physical and virtual interactions. More precisely, this analysis adopts the definitions offered by Ball (2022, 35), who describe the metaverse as "*a massively scaled and interoperable network of real-time rendered 3D virtual worlds that can be experienced synchronously and persistently by an effectively unlimited number of users, each possessing an individual sense of presence along with continuity of identity, history, entitlements, objects, communications, and payments*," and Lim et al. (2025, 58), who extend this perspective by characterizing the metaverse as "*a multifaceted phenomenon involving (a) avatars representing users in (b) an interactive and immersive phygital universe that (c) replicates and extends the physical universe and its activities in (d) accessible and virtually-mediated ways at (e) any moment and location as a result of (f) leveraging the power of cutting-edge and new-age technologies such as AR and VR*." Together, these complementary perspectives capture a comprehensive understanding of the metaverse, emphasizing not only the virtual scale, interoperability, and real-time presence highlighted by Ball (2022), but also the critical role of AR and VR technologies and the bridging of virtual and physical realities emphasized by Lim et al. (2025). Therefore, we define the metaverse as *an interconnected realm where consumers and companies engage in immersive, real-time interactions, facilitated by avatars and software agents across digital spaces and physical geospatial locations, utilizing AR and VR technologies*.

Despite growing academic attention to the metaverse (Dwivedi et al. 2022; Hadi et al. 2024; Kaur et al. 2024; Lim et al. 2024, 2025), current research remains fragmented and marked by uncertainty about its core dynamics. Notably, divergent findings and the absence of integrative frameworks underpinned by large-scale empirical evidence—which are essential for reconciling discrepancies and deriving generalizable insights (Lim et al. 2025)—have hindered our understanding of how immersive technologies influence consumer-brand engagement, thereby disadvantaging both theoretical development and practical applications. As organizations increasingly invest in phygital strategies to capture emerging and growing market opportunities (Statista 2025), the lack of a unified model complicates strategic decision-making and limits the full exploitation of the metaverse's potential. Taking a consumer behaviour perspective is essential (Kaur et al. 2024; Lim et al. 2023), as it unravels how individuals interact with immersive technologies—insights that are critical for optimizing engagement (Lim, Rasul, et al. 2022) and driving competitive advantage (Behl et al. 2024) in an increasingly crowded marketplace (Jhawar et al. 2024). In this regard, the present study addresses the pressing need for clarity through a meta-analysis that synthesizes empirical evidence from diverse contexts to reveal the underlying mechanisms of consumer behaviour in metaverse environments, thereby going beyond a thematic understanding of the metaverse, such as those derived from reviews using a bibliometric analysis (Lim et al. 2024), a content analysis (Lim et al. 2025), or an expert analysis (Dwivedi et al. 2022), or via qualitative explorations involving interviews (Kaur et al. 2024). This is in line with Lim et al. (2025), who suggests that a meta-analysis can offer a more precise estimate of effects and uncover patterns that individual studies might overlook, including underlying contextual factors and study attributes that account for differences in outcomes—a particularly valuable contribution when literature findings conflict or when quantifying the varying significance and strength of relationships is essential—thereby deepening our insights into consumer behaviour in the metaverse. Importantly, these insights are especially crucial for guiding investments of scarce resources—which may include talent involving intellect and skills, time involving effort and energy, ties involving connections and networks, and treasure involving finance (E. Lee 2024)—in not only navigating but also harnessing the potential of the metaverse. In doing so, this study offers a theoretically sound and practically relevant framework that will guide future research and inform strategic initiatives in this rapidly evolving digital landscape.

Our inquiry is anchored around four pivotal research questions (RQs) derived from a comprehensive review of metaverse research, which included only studies that provided sufficient statistical evidence to support a meta-analysis.

At the intersection of firm brands/retailers and the metaverse is the quintessential component of "immersiveness." Consumer immersion has long been recognized as pivotal in both physical and digital environments. Within the metaverse, however, immersiveness assumes a distinctive character. Immersiveness not only dictates the depth and richness of consumer engagement but also serves as a barometer for the metaverse's efficacy as a platform for brands and retailers. An understanding of the mechanisms underpinning this immersion is, therefore, paramount. Without this foundational knowledge, brands and retailers risk misconstruing the metaverse as merely a novel interface, overlooking the complex interactions that render it truly transformative. Accordingly:

RQ1. *What mechanisms underlie the formation of consumers' metaverse immersiveness?*

Building on traditional retail theory—which emphasizes factors such as ambiance, service quality, and product assortment in shaping consumer attitudes—the metaverse introduces additional elements, including telepresence, enjoyment, and flow. Although these factors are integral to virtual experiences, they remain underexplored within retail contexts. Understanding how these elements combine to shape consumer attitudes is essential for the success of brands and retailers operating in the metaverse. Moreover, clarifying their interactions can inform the design and optimization of metaverse spaces to ensure they effectively engage today's digitally savvy consumers. Hence:

RQ2. *How do telepresence, enjoyment, and flow intersect to shape attitudes in consumers' metaverse experience?*

While attitudes serve as strong predictors of intent, converting a favourable disposition toward a brand or product into a concrete action—such as a purchase—is a subtle process. This progression becomes even more complex within the metaverse's dynamic and phygital environment, where the pathway from attitude to behaviour is less straightforward. Given that behavioural intention, as a forward-looking indicator rather than a retrospective measure like past behaviour, captures anticipated actions—ranging from purchase decisions to recommendations and repeat visits—and thus serves as a tangible metric of a firm's future success, dissecting this transformation is essential. A deeper understanding of how attitude translates into action via intention as a proxy can in turn equip brands and retailers with the insights needed to convert interest into measurable outcomes. Therefore:

RQ3. In what manner does consumers' attitude in the metaverse shape their future behaviour?

Underpinning the metaverse is a rapidly evolving landscape that intersects with distinct dimensions—namely, metaverse place, process, and product—that shape consumer experience. As brands and retailers make significant investments in this space, understanding how these moderating factors influence consumers becomes critical. This inquiry goes beyond technical compatibility and focuses on future-proofing strategies that align with the multifaceted nature of the metaverse. Disentangling the roles of metaverse place, process, and product can therefore enable brands and retailers to prioritize investments more effectively, ensuring they remain competitive in an increasingly dynamic environment. Thus:

RQ4. *Which elements bolster or undermine the potency of the metaverse and its impact on consumers?*

The significance of this meta-analysis extends across multiple dimensions, advancing both scholarly understanding and managerial practice in the metaverse. First, reconciling divergent findings through quantitative synthesis of data from diverse contexts yields a consolidated framework for examining how immersive technologies shape consumer attitudes and behaviours. Second, clarifying theoretical assumptions behind constructs such as telepresence, enjoyment, and flow provides guidance for developing more precise models of consumer engagement. Third, incorporating a wide range of studies ensures that conclusions are not confined to isolated cases, thereby offering a comprehensive reference for future investigations. Fourth, delivering empirical insights into which dimensions—metaverse place, process, or product—exert the strongest moderating effects enables more strategic allocation of resources in an environment marked by continuous competition and innovation. Fifth, focusing on both attitudinal and behavioural outcomes offers a valuable roadmap for practitioners seeking to move beyond superficial engagement toward meaningful, sustained consumer relationships. Sixth, enhancing methodological rigor by revealing clear patterns and effect sizes can support replication efforts and stimulate new research endeavours. Lastly, drawing evidence-based insights illuminates promising pathways for future inquiry into how rapidly changing technologies, evolving consumer preferences, and global market shifts may shape the metaverse in the coming years.

2 | Conceptual Foundation and Model

2.1 | Metaverse

The metaverse has emerged as an influential force with the potential to revolutionize consumer experiences. This transformation is driven by the fusion of AR and VR technologies, which

TABLE 1 | Definitions of metaverse.

Authors	Definition
Neal Stephenson	Virtual reality space inhabited by avatars and software agents that use AR and the internet.
Frey et al. (2008)	A system of numerous, interconnected virtual and typically user-generated meta-worlds all accessible through a single user interface.
Wright et al. (2008)	A 3D networked virtual world with the potential of supporting many people simultaneously for social interaction.
Davis et al. (2009)	A 3D immersive virtual world in which individuals interact as avatars with each other and with software agents.
Dionisio et al. (2013)	An integrated network of 3D virtual worlds.
Ryskeldiev et al. (2018)	Constantly updated collection of mixed reality spaces mapped to different geospatial locations.
Duan et al. (2021)	An evolving virtual world with unlimited interoperability and scalability in which real-time 3D rendering-related technologies like AR/VR are regarded as the main interaction interface.
Lee et al. (2021)	Iteration of the internet that utilizes avatars, blockchain technology, and VR headsets in physical and virtual worlds.
Ball (2022)	A scaled and interoperable network of real-time rendered 3D virtual worlds and environments, which can be experienced persistently and synchronously by an effectively unlimited number of users with an individual sense of telepresence and with continuity of data, such as identity, history, entitlements, objects, communications, and payments.
Dwivedi et al. (2022)	Virtual world with immersive capabilities providing an experience forecast to parallel the real world.
Barrera and Shah (2023)	A technology-mediated network of interoperable and scalable extended reality environments merging the physical and virtual realities to provide experiences characterized by their level of immersiveness, environmental fidelity, and sociability.
Yoo et al. (2023)	Online collaborative shared space built of 3D environments that leverage high consumer immersion techniques to reduce the perception of technological mediation alongside transferrable and unique digital assets while allowing user-generated digital personas to interact with each other.
Hadi et al. (2024)	A network of digitally mediated spaces that immerse users in shared, real-time experiences.
Lim et al. (2025)	A multifaceted phenomenon involving avatars representing users in an interactive and immersive phygital universe that replicates and extends the physical universe and its activities in accessible and virtually-mediated ways at any moment and location as a result of leveraging the power of cutting-edge and new-age technologies such as AR and VR.
The present study	An interconnected realm where consumers and companies engage in immersive, real-time interactions, facilitated by avatars and software agents across digital spaces and physical geospatial locations, utilizing AR and VR technologies.

seamlessly blend real and simulated environments utilizing avatars and holograms (Dwivedi et al. 2022; Hadi et al. 2024; Yoo et al. 2023). While the current surge of interest in the metaverse is substantial, its conceptualization can be traced back to the end of the last millennium (Barrera and Shah 2023; Dwivedi et al. 2022; Joshua 2017). By the mid-1990s, the metaverse had already carved its niche in computer science, predominantly in autonomous agents, interactive worlds, and virtual–human research (Barrera and Shah 2023). Neal Stephenson, in the early 1990s, was credited with introducing the term "metaverse"—a virtual environment inhabited by avatars and software agents leveraging VR and the internet (Joshua 2017). Another pivotal juncture was the 2003 launch of *Second Life*, which used avatars for virtual interactions (Gent 2022). Subsequent developments saw AR being integrated, highlighting the metaverse's scalable and socially interactive features (Davis et al. 2009; Wright et al. 2008).

The allure of the metaverse has been bolstered over time with the emergence of immersive games and virtual environments. In tandem with *Second Life*, a host of interactive multimedia games such as *Fortnite*, *Pokémon Go*, *Roblox*, and *The Sims* emerged (Dwivedi et al. 2022). Cutting-edge interaction technologies—3D platforms, avatars, blockchain, cell phones, and VR headsets—have further blurred the lines between the physical and virtual worlds (Lee et al. 2021).

Likewise, in academic research, the metaverse spans diverse disciplines, from education and information technology to marketing (Dwivedi et al. 2022). Amidst the exponential growth in publications (Lim et al. 2024, 2025), these domains grapple with refining the definition of the metaverse. Within marketing, efforts to define the metaverse intersect with studies spanning subareas such as advertising (Cowan et al. 2021), branding (Lee et al. 2022), e-commerce (Pantano et al. 2017), and luxury (Kim and Bae 2023).

To conceptualize the metaverse, we define it as a network of immersive interactions (Table 1). These real-time experiences seamlessly occur in both online contexts (e.g., e-commerce utilizing mobile AR, prototype designs, or virtual applications) and offline contexts (e.g., physical stores featuring augmented fitting rooms, magic mirrors, or 3D store layouts). These experiences are facilitated through avatars and software agents within digitally mediated spaces and geospatial locales, harnessing either AR or VR. This reflects a spectrum of technological advances in retail from the last two decades, including but not limited to 360° VR, immersive virtual stores, magic mirrors, multisensory VR, smart retailing, smart stores, virtual fitting rooms, VR shopping malls, VR videos, and virtual try-on technology. A wide array of metaverse applications and platforms has also been explored, such as *Animal Crossing*, the *Cluck AR* app, *Fortnite*, *IKEA Place*, *Pokémon Go*, *Roblox*, *Second Life*, *The Sims*, and *ZEPETO*. The ensuing section explains the setup of our meta-analytical model that scrutinizes consumer behaviour in the metaverse.

2.2 | Metaverse Behaviour Model (MBM)

Figure 1 presents the metaverse behaviour model (MBM), which was derived from a comprehensive review of metaverse research that included only studies with sufficient statistical evidence for meta-analysis. This model encapsulates key elements influencing consumer behaviour in the metaverse, beginning with the mechanisms underlying the formation of consumers' metaverse immersiveness, continuing with specific facets of consumers' metaverse experience, and concluding with the manifestations of consumers' metaverse behaviour—all moderated by the dimensions of metaverse place, process, and product. The definitions of the main constructs and exemplars of their application can be found in Table 2.

2.2.1 | Consumers' Metaverse Immersiveness

Central to our model is the formation of consumers' immersiveness, which depends on the interactivity and vividness of telepresence within the metaverse. At its core, interactivity is conceived as an experiential phenomenon that quantifies the extent to which consumers can engage with, modify, and mould the content and form of an environment in real time (Steuer 1992). Viewed through a technological lens, interactivity also gauges dimensions of control, manipulation, and content engagement that are pivotal for navigating the digital terrain (Hoffman and Novak 2009). In the context of the metaverse, interactivity takes centre stage, particularly when consumers manipulate objects that bridge real and virtual worlds (Barhorst et al. 2021). Empirical evidence underscores that heightened interactivity magnifies perceptions of telepresence (Kim et al. 2021). Put simply, the deeper and more immersive the consumer's interaction with technology, the higher the likelihood of engendering a profound sense of presence (Von keman et al. 2017). Moreover, when consumers engage interactively with metaverse tools such as AR and VR, they experience an enhanced sense of presence (Kim et al. 2023). Accordingly, we assert that:

H1. *Interactivity exerts a positive influence on telepresence.*

Vividness, as delineated by Steuer (1992), is a construct used to evaluate the representation quality of a mediated environment. In the context of the metaverse, this construct enables the creation of a rich environment through non-sensory engagement with imaginary objects (Barrera and Shah 2023). Moreover, in various metaverse formats, vividness contributes to environments characterized by great aesthetic allure and exemplary product presentation (Barhorst et al. 2021; Yim et al. 2017). Vividness stands as a cornerstone of the metaversal experience, amplifying the realism of virtual images and, in turn, bolstering telepresence in these technologically mediated spaces (Pantano et al. 2017; Steuer 1992). Yim et al. (2017) have suggested that vividness is an indispensable dimension in evoking a profound sense of telepresence. Anchoring on this understanding, we expect that:

H2. *Vividness exerts a positive influence on telepresence.*

2.2.2 | Consumers' Metaverse Experience

In our model, the direct relationship between telepresence and attitude—coupled with the potential mediation effects of enjoyment and flow—encapsulates the essence of consumers' metaverse experience. Telepresence is a pivotal construct in technological interaction studies as it captures the psychological state in which consumers feel immersed in a mediated environment, as if present within that technology-facilitated domain rather than in the immediate physical world (Han et al. 2020; Steuer 1992). In essence, telepresence gauges the sensation of inhabiting a technologically mediated sphere, thereby offering a reconceptualization of one's surroundings. Given its foundational role in recreating these environments, telepresence has varying implications for consumer attitudes across distinct metaverses (Lee et al. 2022). Within such mediated contexts, telepresence amplifies concentrated attention (Mollen and Wilson 2010), wherein these mediated experiences yield states marked by spontaneous perceptual reactions, purposeful attention direction, and deliberative processes (Steuer 1992). Moreover, the immersion states spurred by telepresence enhance the stimulus–organism–response mechanism through heightened sensory arousal, control, and immersion (Yim et al. 2017). From this perspective, a link between telepresence and attitude within the metaverse emerges, as evidenced by recent findings (Brengman et al. 2022; Kim et al. 2021; Kinzinger et al. 2022). As such, we hypothesize that:

H3. *Telepresence exerts a positive influence on attitude.*

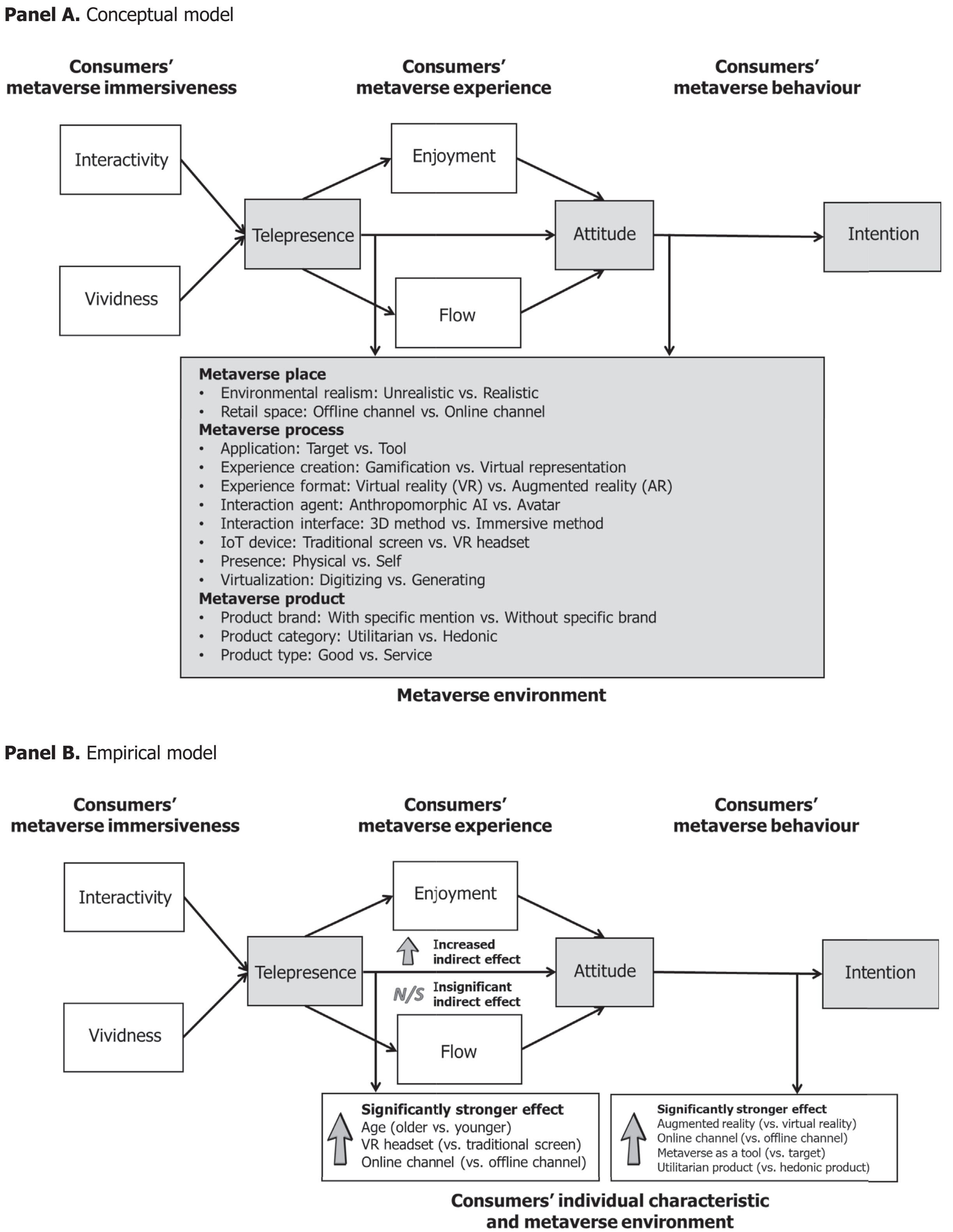

FIGURE 1 | Metaverse behaviour model.

Enjoyment, a recurrent construct in research into technological interactions, gauges the pleasurable aspects of using technology (Kowalczuk et al. 2021). This construct captures the essence of delightful experiences, occasionally independent of consequential outcomes (Butt et al. 2021). Noteworthily, elevated telepresence levels invariably boost feelings of enjoyment (Martínez-Molés et al. 2022). Recognizing its predictive power over consumer behaviour and its encapsulation of pleasurable interactions, enjoyment has been studied as a potential intermediary in the influence of telepresence (Bigne and Maturana 2023; Martínez-Molés et al. 2022). Building on this premise, we hypothesize that:

TABLE 2 | Constructs in the metaverse behavior model.

Construct	Definition	Examples of interactive environment where construct has been studied
Interactivity	The extent to which individuals can interact, participate, modify, control, and manipulate the content of the environment in real time (Steuer 1992; Yim et al. 2017).	Apps for virtual garment fitting of fashion brands (e.g., Adidas and Topshop) (Lee et al. 2022), apps for fitting rooms (e.g., GAP) (Nikhashemi et al. 2021)
Vividness	The ability of technology to produce a sensory rich environment in terms of the aesthetic appeal and the quality of the product presentation (Steuer 1992; Yim et al. 2017).	AR of beauty products (Whang et al. 2021), virtual mirror (e.g., Ray-Ban) (Pantano et al. 2017)
Telepresence	The experience of presence in an environment through a communication medium in which the individual feels that he or she is in a mediated environment (Han et al. 2020; Steuer 1992).	AR product display (Sun et al. 2022), VR shopping (Han et al. 2020)
Enjoyment	The extent to which using some technology is perceived as enjoyable without considering the consequences (Butt et al. 2021; Davis et al. 1992).	AR app (e.g., IKEA) (Kowalczuk et al. 2021), AR website (e.g., L'Oréal) (Butt et al. 2021)
Flow	Holistic sensation by which the individual feels involved, immersed, and motivated when they act within an experience (Barhorst et al. 2021).	3D immersive virtual world (e.g., Second Life) (Animesh et al. 2011), Virtual try-on AR application in physical stores (e.g., Zara) (Yuan et al. 2021).
Attitude	A feeling of favourableness or unfavourableness that a consumer has toward an object or a subject (Ajzen and Fishbein 1980).	360-VR simulation (e.g., BMW) (Cowan et al. 2021), garden metaverse (e.g., Gucci) (Kim and Bae 2023)
Intention	Metric that refers to what the individual intends to do (O'Keefe 2002).	Avatar in retail store (e.g., Apple) (Jin 2009), AR-based brand presentations (e.g., Tissot) (Yin et al. 2022)

H4. *Enjoyment mediates the relationship between telepresence and attitude.*

Flow portrays a state marked by profound engagement and involvement (Csikszentmihalyi 1975; Lim 2014). Within this state, consumers are driven by a compelling urge to engage in tasks, resulting in an immersive behaviour (Arghashi and Yuksel 2022). Recognized as a state experienced during immersive episodes that subsequently steers consumer behaviour, flow experience has been examined as another potential intermediary mediating the influence of telepresence (Arghashi and Yuksel 2022; Hsiao et al. 2023). Within the metaverse, flow often stands as the linchpin in the relationship between telepresence and attitude (Hsiao et al. 2023). Consequently, we suggest that:

H5. *Flow mediates the relationship between telepresence and attitude.*

2.2.3 | Consumers' Metaverse Behaviour

Attitude, as a construct, has garnered significant attention across diverse contexts because it plays a pivotal role in shaping behavioural intentions (Goebert and Greenhalgh 2020). The relationship between attitude and purchase intention underscores a consumer's inherent quest for harmony—a consonance between what they feel and how they intend to act (Kawakami et al. 2013). Many studies have found that unfavorable attitudes invariably result in unfavorable behavioural intentions, just as favorable attitudes pave the way for favorable behavioural outcomes (Park and Yoo 2020). In the context of technology adoption, research frequently reveals the positive trajectory between attitudes and the consequent behavioural intentions (Goebert and Greenhalgh 2020). Translating this into the context of the metaverse, one can assume with a fair degree of certainty that consumers with favorable attitudes within the metaverse would show more positive purchase intentions (Goebert and Greenhalgh 2020; Kawakami et al. 2013; Kim et al. 2021; Park and Yoo 2020). From these insights, we propose that:

H6. *Attitude exerts a positive influence on intention.*

2.2.4 | Metaverse Place, Process, and Product as Moderators

The ever-evolving landscape of the metaverse has been discussed by many scholars (Dwivedi et al. 2022). As academia and industry come to grips with the multifaceted metaverse, it becomes evident that there are a wide variety of experiences (Barrera and Shah 2023; Lee et al. 2021). Establishing a definitive conceptualization of the metaverse's role and scope remains a challenging task; pioneering marketing scholars have persistently emphasized the need to decode what consumer experience is and how they behave within the metaverse (Barrera and Shah 2023; Gursoy et al. 2022). Yet, there is a discernible void in the literature; it seldom provides insights into how potential moderators might shed light on defining the roles of the metaverse. Addressing this gap, our model introduces a suite of moderators that offers a more refined understanding of the mechanisms underpinning consumer behaviour in the metaverse. Grounded in the most recent empirical inquiries into the metaverse (Barrera and Shah 2023; Dwivedi et al. 2022; Kim 2021), we offer an exhaustive discussion on 13 moderators across three categories: *metaverse place*, which comprises *environmental realism* and *retail space*; *metaverse process*, which contains *application*, *experience creation*, *experience format*, *interaction agent*, *interaction interface*, *IoT device*, *presence*, and *virtualization*; and *metaverse product*, which consists of *product brand*, *product category*, and *product type*.

2.2.4.1 | Metaverse Place

2.2.4.1.1 | Environmental Realism. Metaverse experiences can oscillate between realms of realism and surrealism (Dwivedi et al. 2022; Papagiannidis and Bourlakis 2010). A *realistic* metaverse mirrors our tangible world, recreating physical elements with high fidelity; interactions remain tethered to the confines of real-world parameters (Dwivedi et al. 2022). Conversely, surreal—or *unrealistic*—metaverse environments transcend the boundaries of time and space, molding an abstract reality (Papagiannidis and Bourlakis 2010). Such settings beguile consumers' senses, birthing and manipulating unreal constructs (Dwivedi et al. 2022).

2.2.4.1.2 | Retail Space. The metaversal consumer trajectory spans both *online channels*, such as web-based e-stores, and *offline channels*, such as mall-based retail outlets. The selected channel invariably influences purchasing expectations and preferences, creating distinct immersion and interaction experiences (Gadalla et al. 2013). Thus, retail strategists must discern the salient metaversal elements that differentiate between brick-and-mortar and online establishments (Dwivedi et al. 2022).

2.2.4.2 | Metaverse Process

2.2.4.2.1 | Application. Metaverse platforms fall into two distinct categories: '*metaverse as a tool*' and '*metaverse as a target*' (Dwivedi et al. 2022). The former denotes utilizing the metaverse as a means to navigate and mitigate real-world challenges, exemplified by platforms such as *HP Reveal*, *Second Life*, *Virtua Works*, and *VRChat*. In contrast, the latter encapsulates endeavours to cultivate the metaverse further, driving innovation and profit, illustrated by applications such as *EndevorRX*, *Pokémon Go*, and *Roblox*. Significantly, the reliance on virtual environments appears to be far more pronounced on "metaverse as a tool" platforms than on their 'metaverse as a target' counterparts.

2.2.4.2.2 | Experience Creation. Immersive experiences offer a wealth of innovative avenues for marketers. *Gamification*, perceived as an immersion variant, can cause abrupt disengagement, paving the way for novel experiences. This immersion style fosters a detachment from the conventional constructs of time and space (Xu et al. 2017). Contrarily, *virtual product representation* maintains some tether to the real world. Rendering these virtual representations requires detailed image animations to convey the product's real-world appearance and functionality (Dwivedi et al. 2022).

2.2.4.2.3 | Experience Format. The architectural framework with which the real world is transposed into the metaverse can critically shape consumer interactions (Dwivedi et al. 2022; Kowalczuk et al. 2021). For instance, *AR* emphasizes the blending of virtual elements into our tangible surroundings (Butt et al. 2021). This synthesis seeks to coalesce tangible and virtual objects, enhancing the overall user experience (Kowalczuk et al. 2021). Contrastingly, *VR* immerses consumers into an entirely virtual universe, dictating interactions and responses. Consumers leverage virtual elements within virtual spaces, augmenting an intricately crafted fictional reality (Dwivedi et al. 2022).

2.2.4.2.4 | Interaction Agent. Behaviour within the metaverse is notably influenced by engagements with *anthropomorphic artificial intelligence* (*AI*) *agents* and *avatars* (Dwivedi et al. 2022; Kozinets 2022). Virtual interactions facilitated by 3D AI agents in VR or holograms in AR can significantly enhance consumer experiences, revolutionizing perceptions related to the surrounding environment (Kozinets 2022). Crucially, avatars and holograms serve as conduits for consumers to interact, fostering sociability through shared simulated experiences. These mediums, in essence, bridge the gap between virtual realms and our tangible world, crafting a seamlessly immersive ecosystem (Dwivedi et al. 2022).

2.2.4.2.5 | Interaction Interface. The metaverse can manifest with varying degrees of detail and sophistication (Dwivedi et al. 2022). The *3D interface* can evoke a profound sense of realism in users, albeit occasionally at the cost of service continuity (González et al. 2013). The *immersive interface* propels consumers into a ceaseless metaverse world; although, it is important to note that extended engagement might give rise to psychological challenges stemming from an acute detachment from reality (Amorim et al. 2014).

2.2.4.2.6 | IoT Device. Engaging with the metaverse via specific equipment can profoundly influence consumers' immersion (Chiu et al. 2021). *VR headsets*, for instance, create digital experiences within an immersive 3D virtual environment. Examples include *Google Cardboard*, *Google Daydream*, *HTC Vive*, *Oculus Rift*, *OSVR*, and *Samsung Gear VR* (Dwivedi et al. 2022). Diverging from *traditional screens* such as PCs and mobiles, these VR headsets are adept at data collection, capturing it with heightened richness and thereby amplifying telepresence within the metaverse (Chiu et al. 2021).

2.2.4.2.7 | Presence. The virtual world can foster diverse psychological states, specifically *physical* and *self* presence (Tussyadiah et al. 2018). The former denotes the mental state in which virtual physical entities are perceived as tangible objects, such as when watching science fiction movies or sports broadcasts (K. M. Lee 2004). Conversely, the latter is the mental space wherein one's virtual avatar is recognized as an extension of one's actual self, as witnessed during video conferences or when interacting with chosen avatars in role-playing games (K. M. Lee 2004; Tussyadiah et al. 2018).

2.2.4.2.8 | Virtualization. The level of embedding virtual experiences can be assessed by the degree of virtualization involved. The process of *digitizing* is anchored in translating physical entities into their holographic counterparts, as seen when Amazon digitally replicates physical items or a consumer visualizes *IKEA* chairs within their living space. Meanwhile, *generating* is about creating entirely unique digital holograms, devoid of any real-world analogues, such as an AR *Pokémon* (Chylinski et al. 2020).

2.2.4.3 | Metaverse Product

2.2.4.3.1 | Product Brand. This moderator assesses the presence of a brand associated with a product. For example, research that analyzes consumer reactions to Gucci's virtual handbags or Nike's metaverse sneakers is considered as *brand present*, whereas studies examining generic products or services without a specific brand are treated as *brand not present*.

2.2.4.3.2 | Product Category. This moderator classifies the key attributes that drive consumer decisions in the metaverse. *Utilitarian* attributes refer to functional and practical-driven features that fulfill a consumer need, such as high-resolution VR environments, haptic feedback in AR shopping, or enhanced security in blockchain-based digital assets (Chiu et al. 2021). *Hedonic* attributes capture experience-focused elements that enhance entertainment, pleasure, or engagement, including customizable avatars, gamified retail spaces, or aesthetically immersive VR product trials (Dwivedi et al. 2022).

2.2.4.3.3 | Product Type. This moderator distinguishes whether a product is a good or a service in the metaverse. *Goods* include digital or tangible offerings that consumers can purchase, own, or interact with in the metaverse—such as virtual goods (e.g., branded virtual fashion, non-fungible tokens, in-game assets), physical goods that integrate metaverse technology (e.g., AR-enhanced shopping), and hybrid goods (e.g., digital twins of real-world products). *Services* refer to intangible offerings that provide access, experience, or utility to digital environments, such as AI-powered digital assistants, metaverse consulting, virtual events (e.g., metaverse concerts, trade shows), and VR-based tourism (Dwivedi et al. 2022).

2.2.5 | Contexts as Covariates

Beyond appraising the potential ramifications of metaverse moderators, our meta-analysis also scrutinizes the impacts of contexts as covariates that might shape consumer behaviour in the metaverse. These include *age*, *female proportion*, *geographical location*, *population sample*, *publication rank*, and *publication year*. Such moderators have been instrumental in analyzing variability in effect sizes across diverse meta-analyses that investigate technology adoption and usage (Ansari and Ghasemaghaei 2023; Blut et al. 2021; Jeyaraj 2022; Luceri et al. 2022; Metha et al. 2022).

3 | Method

We embarked on a systematic literature review (Kraus et al. 2022; Lim, Kumar, and Ali 2022; Paul et al. 2021; Tranfield et al. 2003) using the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (*PRISMA*) protocol (Moher et al. 2009), which comprises four stages (i.e., identification, screening, eligibility, and inclusion), to *search* for relevant articles (Appendix A) and a *meta-analysis* to *synthesize* the results (Lim et al. 2025).

3.1 | Identification

To begin the search for relevant articles, we harnessed the most relevant keywords through the collaborative effort of the co-authors who leveraged their expertise, experience, and exposure (3Es) in brainstorming and scouring relevant literature (Kraus et al. 2022). In this endeavour, we relied upon three databases universally acknowledged for their exhaustive repositories: Scopus, Web of Science, and Google Scholar. Our exploration encompassed publications until 15th July 2023, focusing on the following keyword string that was curated through sensemaking (Lim and Kumar 2024): ('metaverse' OR 'augmented reality' OR 'mixed reality' OR 'virtual reality' OR 'immers*') AND ('retail*'). The title, abstract, and keyword of these articles underwent scrutiny, with an emphasis on domains such as 'business, management, and accounting', 'psychology', and 'social sciences' to enable a comprehensive and relevant search, which returned 684 articles. Post the exclusion of duplicates and non-English articles, 603 articles were retained for screening.

3.2 | Screening

In the screening phase, we scrutinized the aforementioned 603 articles. The litmus test for inclusion was the alignment of each article's title and abstract with our research questions. Following past studies (Ladeira et al. 2023; Santini et al. 2023), we selected articles from academic journals and conference proceedings, sidestepping the hierarchy of their rankings. We did not select books, chapters, editorials, and notes that lacked consistent rigor or had not been peer-reviewed (Kraus et al. 2022; Paul et al. 2021). This filtering yielded 445 articles to be assessed for eligibility.

3.3 | Eligibility

In the eligibility phase, we scrutinized the aforementioned 445 articles. Following past studies (e.g., Babić Rosario et al. 2016; Santini et al. 2020; Ladeira et al. 2023), we read the full text of each article and excluded 164 articles that lacked sufficient content relevance (i.e., consumer behaviour in the metaverse) or statistical relevance (i.e., effect size), retaining 281 articles. One additional article meeting these criteria was added following a cross-referencing check, resulting in 282 articles, which provided 7641 effect sizes from a pool of 73,124 participants.

All authors involved in this project held a meeting to build and agree upon a coding protocol. Following this meeting, key information was extracted from or sourced for each article: article title, journal title, construct characteristics (e.g., construct name, theoretical relationship found, and effect size), and methodological characteristics (e.g., age, female proportion, and type of sampled population; geographical location of where the study was conducted; rank and year of publication). Two authors independently coded the articles and achieved an inter-coder agreement of 92%, with all disagreements resolved between the two authors in consultation with a third author (Rust and Cooil 1994). Through this exercise, we identified 146 articles (Appendix B), which analyzed at least one theoretical relationship with sufficient statistical evidence and in turn provided 412 effect sizes from a pool of 39,580 participants (Figure 1), comprising:

- Seven constructs that can be organized into three conceptual categories with theoretical relationships, each supported with sufficient statistical evidence (effect size): *consumers' metaverse immersiveness* (i.e., interactivity, vividness, and telepresence), *consumers' metaverse experience* (i.e., enjoyment and flow), and *consumers' metaverse behaviour* (i.e., attitude, intention).
- Thirteen constructs that can be organized into three conceptual categories and used as moderators for theoretical relationships (Appendix C): *metaverse place*, which includes environmental realism (0 = unrealistic; 1 = realistic) and retail space (0 = offline channel; 1 = online channel); *metaverse process*, which includes application (0 = metaverse as a target; 1 = metaverse as a tool), experience creation (0 = gamification; 1 = virtual representation), experience format (0 = virtual reality; 1 = augmented reality), interaction agent (0 = anthropomorphic AI; 1 = avatar), interaction interface (0 = 3D method; 1 = immersive method), IoT device (0 = traditional screen; 1 = VR headset), presence (0 = physical; 1 = self), and virtualization (0 = digitizing; 1 = generating); and *metaverse product*, which includes product brand (0 = with specific brand; 1 = without specific brand), product category (0 = utilitarian; 1 = hedonic), and product type (0 = good; 1 = service).
- Six covariates that can be tested against the theoretical relationships (Appendix C): age (average), female proportion (percentage), geographic location (0 = Eastern; 1 = Western), population sample (0 = non-students; 1 = students), publication rank (0 = lower than h-index median; 1 = h-index median or higher), and publication year (0 = older than median; 1 = median or newer).

3.4 | Inclusion

In the inclusion stage, we engage in a meta-analysis based on the effect sizes extracted from the aforementioned 145 articles by constructing a *meta-analytic correlation matrix* and performing *meta-analytic structural equation modelling* (*MASEM*) and *hierarchical meta-regression*.

To begin, a meta-analytic correlation matrix was constructed following past meta-analysis (e.g., Kim and Peterson 2017). The effect size was measured using Pearson's correlation coefficient (r). For studies in our article sample that did not provide correlation effects (e.g., χ^2, F, t, z, and β), we converted the available statistics into correlations (Hunter and Schmidt 2004). A random-effects model was applied to account for heterogeneity (Rosenthal 1979) across the studies. We also assessed the 95% confidence interval for each effect size, evaluated heterogeneity for each relationship using the I^2 statistic (Higgins et al. 2003), and examined publication bias using Egger's test, which measures funnel plot asymmetry based on the intercept from a regression of standard normal deviates on precision (Egger et al. 1997). The consistency of relationships was assessed using the Fail-Safe Number (FSN)—which indicates the number of studies with contradictory findings required to refute the results (Rosenthal 1979)—with this analysis conducted using the 'metacor' function in R's 'meta' package (Viechtbauer 2010).

Next, the direct (main) and indirect (mediation) effects were tested using MASEM. MASEM was applied via the two-stage approach (Jak 2015) in R's 'metaSEM' package (Cheung 2015). In the first stage, correlation matrices were combined into a pooled correlation matrix, which was then used in the second stage to fit the structural model using likelihood-based confidence intervals (Neale and Miller 1997) at the 95% level and weighted least squares (WLS) estimation (Cheung & Chan, 2005). MASEM conducts a meta-analytic analysis of covariance structures using standard structural equation modelling estimation (Cheung 2015). We fitted the path model using a 7 × 7 pooled correlation matrix and corresponding variance–covariance matrices, and evaluated model fit according to common guidelines (i.e., CFI and TLI $\geq$ 0.90, RMSEA $\leq$ 0.08; Cheung 2015; Jak 2015).

Finally, hierarchical meta-regression was performed to test for moderation effects. In this step, we utilized R's 'metafor's rma' function (Viechtbauer 2010) to accommodate and analyze both categorical and continuous moderators (Harrer et al. 2021).

4 | Results

4.1 | Meta-Analytic Descriptive Statistics

The descriptive statistics of constructs on intention in the MBM are presented in Table 3. The results demonstrate that all six constructs provide positive and significant effects on intention in the metaverse. The strongest effect was found for attitude (r = 0.581), followed by flow (r = 0.505), enjoyment (r = 0.482), interactivity (r = 0.425), telepresence (r = 0.416), and vividness (r = 0.381). All relationships exhibited considerable heterogeneity, with I^2 values above 90% (Higgins et al. 2003), thereby warranting scrutiny of moderators that could explain such heterogeneity (Lim et al. 2025). In contrast, Egger's test revealed non-significant effects for all relationships, attesting to the absence of funnel plot asymmetry (Egger et al. 1997), whereas the FSN showed that all effects are highly robust (above 5000), confirming the absence of publication bias and the stability of our meta-analytical findings (Rosenthal 1979).

4.2 | Meta-Analytic Correlation Matrix

The meta-analytic correlation matrix is presented in Table 4. Both interactivity and vividness exhibit noteworthy correlations with telepresence, with values of 0.463 (n = 14) and 0.515 (n = 13), respectively. This indicates the integral roles that

TABLE 3 | Descriptive statistics of constructs on intention in the metaverse behavior model.

Construct	*O*	*N*	*r*	Confidence interval (95%) Lower bound	Confidence interval (95%) Upper bound	I^2	*FNS*	*Egger's*
Interactivity	24	6166	0.425	0.287	0.546	97.4%	37,324	0.419
Vividness	16	3774	0.381	0.288	0.467	90.1%	5167	0.403
Telepresence	33	7491	0.416	0.345	0.482	92.1%	26,002	0.958
Enjoyment	40	10,016	0.482	0.404	0.552	95.7%	80,396	0.875
Flow	16	3820	0.505	0.410	0.589	92.5%	12,047	0.633
Attitude	47	12,115	0.581	0.518	0.638	96.0%	234,737	0.380

Abbreviations: Egger's = asymmetry test; FNS = fail-safe number; I^2 = scale-free index of heterogeneity; *N* = number of accumulated samples taken from the assessed studies; O = number of observations taken from the analysis of the assessed studies; r = correlation found in the studies corrected by sample size.

TABLE 4 | Meta-analytic correlation matrix.

Construct	Interactivity	Vividness	Telepresence	Enjoyment	Flow	Attitude	Intention
Interactivity	1						
Vividness	0.545	1					
Telepresence	0.463	0.515	1				
Enjoyment	0.469	0.473	0.551	1			
Flow	0.466	0.494	0.547	0.635	1		
Attitude	0.444	0.568	0.410	0.517	0.440	1	
Intention	0.391	0.371	0.398	0.449	0.477	0.544	1

interactivity and vividness play in fostering consumer immersiveness, with telepresence acting as a pivotal intermediary. Delving into metaverse experience creation, telepresence shows pronounced correlations with both enjoyment (0.551) and flow (0.547). The number of effect sizes for these relationships was 11 and 14, respectively. The strong correlation of 0.635 between enjoyment and flow ($n = 10$) further underscores how these constructs collectively contribute to shaping attitude in the metaverse.

4.3 | Meta-Analytic Structural Equation Modelling (MASEM) for Main and Mediation Effects

MASEM was applied to a model encompassing seven variables and two mediation conditions. Note that, for MASEM, only the most prominent relationships that exhibited effects across constructs in the model were considered (Cheung 2015; Jak 2015). The results demonstrated good model fit—that is, CFI = 0.910 (≥ 0.90), TLI = 0.977 (≥ 0.90), and RMSEA = 0.001 (≤ 0.08) (Hair et al. 2017)—and are presented in Table 5.

4.4 | Consumers' Metaverse Immersiveness

Directing attention to consumers' metaverse immersiveness, the findings highlight the positive and significant influence of interactivity ($\beta = 0.433$, $p < 0.01$) and vividness ($\beta = 0.413$, $p < 0.01$) on telepresence.

4.5 | Consumers' Metaverse Experience

Transitioning to consumers' metaverse experience, the findings indicate that telepresence exerts a positive and significant influence on enjoyment ($\beta = 0.693$, $p < 0.01$), flow ($\beta = 0.667$, $p < 0.01$), and attitude ($\beta = 0.189$, $p < 0.05$). Further analysis reveals that though both enjoyment ($\beta = 0.310$, $p < 0.01$) and flow ($\beta = 0.399$, $p < 0.05$) positively impact attitude, only enjoyment mediates the relationship between telepresence and attitude, yielding a positive and significant indirect effect ($\beta = 0.297$, $p < 0.10$), while flow experience does not, as evidenced by a non-significant indirect effect ($\beta = -0.182$, $p > 0.05$).

4.6 | Consumers' Metaverse Behaviour

Rounding up with consumers' metaverse behaviour, we observe a positively strong and significant relationship between attitude and intention ($\beta = 0.627$, $p < 0.01$).

4.7 | Hierarchical Meta-Regression for Moderation Effects

Informed by the foundational assumptions of heterogeneity analysis (Geyskens et al. 2009), hierarchical meta-regression was employed to examine the moderating influence on two pivotal relationships—namely, *telepresence on attitude* and *attitude on intention*—with the aim of comprehending the variance in

TABLE 5 | Meta-analytic structural equation modeling (MASEM).

Independent variable	→	Dependent variable	Beta	Standard error	Significance
Panel A. Main effects in consumers' metaverse immersiveness					
Interactivity	→	Telepresence	0.433	0.083	***
Vividness	→	Telepresence	0.413	0.092	***
Panel B. Main effects in consumers' metaverse experience					
Telepresence	→	Enjoyment	0.693	0.074	***
Telepresence	→	Attitude	0.189	0.182	**
Telepresence	→	Flow	0.667	9.67	***
Enjoyment	→	Attitude	0.310	2.61	***
Flow	→	Attitude	0.399	2.22	**
Panel C. Main effects in consumers' metaverse behavior					
Attitude	→	Intention	0.627	11.93	***
Panel D. Mediation effects between consumers' metaverse experience and behavior					
Telepresence → Enjoyment → Attitude			0.297	0.150	*
Telepresence → Flow → Attitude			−0.182	0.081	n/s

Note: *** = $p<0.01$. ** = $p<0.05$. * = $p<0.10$. n/s = not significant. Only a single MASEM is performed with panel-style reporting segmenting the results based on phases of the metaverse behaviour model (MBM) and types of effects (direct or main vs. indirect or mediation). Although insignificant, the negative mediation effect observed for the Telepresence → Flow → Attitude pathway may be attributed to a suppression effect. In suppression, the mediator removes variance in the outcome that is not related to the independent variable, which can cause the overall indirect effect to appear negative despite both individual paths being positive (MacKinnon et al. 2000).

effect sizes that underpins the observed heterogeneity. The results for the *covariates* (six: age, female proportion, geographical location, population sample, publication rank, and publication year) and *moderators* (13: environmental realism, retail space, application, experience creation, experience format, interaction agent, interaction interface, IoT device, presence, virtualization, product brand, product category, and product type) are presented in Table 6.

4.8 | Covariates

For the telepresence–attitude relationship (Table 6 Panel A), only age emerged as a significant covariate ($\beta = 0.0108$, $p < 0.05$), indicating that older consumers tend to exhibit a stronger association between telepresence and attitude. In contrast, other covariates—including female proportion, geographic location, population sample, publication rank, and publication year—did not yield statistically significant effects. Similarly, in the attitude–intention relationship (Table 6 Panel B), none of the covariates reached significance. These findings suggest that demographic and publication-related factors exert limited moderating influence on the core relationships in the model.

4.9 | Moderators

For the telepresence–attitude relationship (Table 6 Panel A), retail space ($\beta = 0.2156$, $p < 0.05$) and IoT device ($\beta = 0.1979$, $p < 0.05$) were significant moderators, indicating that the impact of telepresence on attitude is stronger among consumers engaging via online channels and using VR headsets. For the attitude–intention relationship (Table 6 Panel B), retail space ($\beta = 0.2929$, $p < 0.01$), application ($\beta = 0.2235$, $p < 0.05$), experience format ($\beta = 0.3644$, $p < 0.001$), and product category ($\beta = 0.1892$, $p < 0.05$) were significant moderators, indicating that the influence of attitude on intention is more pronounced when consumer interactions occur through online channels, when the metaverse is employed as a tool rather than as a target, when virtual environments are presented using AR rather than VR, and when products are categorized as hedonic rather than utilitarian. These findings provide further insight into the contextual factors that shape consumer behaviour in the metaverse.

5 | Discussion

In the contemporary digital landscape, characterized by growing interactions in the metaverse, marketing managers are recalibrating their strategies to fortify brand prominence and expand product reach (Dwivedi et al. 2022; Hadi et al. 2024; Kim 2021). Observations from prior research underline a growing tendency among brands and retailers to invest in the metaverse, thus affirming its strategic significance (Dwivedi et al. 2022; Yoo et al. 2023). Responding to this evolving paradigm, this study defines three pivotal stages of consumer behaviour in the metaverse: consumers' metaverse immersiveness, experience, and behaviour. We investigate the main drivers shaping these stages, as well as the conditions in which metaverse place, process, and product act as potent moderators, influencing these stages.

5.1 | On Consumer Behaviour in the Metaverse

Our study sheds light on the interlinkages in the formation of consumers' metaverse immersiveness. Our findings substantiate the roles of interactivity and vividness as precursors to telepresence (the sensation of 'being there' in the metaverse), with interactivity yielding a slightly more influence than vividness. This finding suggests that to truly captivate and immerse consumers, metaverse developers need to prioritize interactive elements. While the allure of rich graphics and immersive soundscapes is undeniable, it is the ability of consumers to interact, shape, and be a part of the narrative that elevates their sense of presence. This has profound implications for metaverse platforms and developers: investments should be channelled not just into creating high-definition virtual worlds but also into crafting dynamic, interactive, and responsive environments.

Echoing the sentiments from prior research (Butt et al. 2021; Martínez-Molés et al. 2022), our study reinforces the symbiotic relationships in consumers' metaverse experience: telepresence, enjoyment, flow, and attitude. This network of interconnections implies that these elements do not operate in isolation. The heightened sense of presence in the metaverse augments enjoyment, which, in turn, may foster deeper immersion (flow) and culminate in a favourable attitude towards the metaverse. For stakeholders, from marketing managers to metaverse developers, understanding these interconnected dynamics is essential. To truly harness the potential of the metaverse and ensure its widespread acceptance and success, efforts should be directed at nurturing and enhancing each of these intertwined constructs.

Another pivotal finding from our study accentuates the central role of enjoyment in consumers' metaverse experience. Observations indicate that the sheer pleasure or fun derived from the metaverse—emanating from the sensation of telepresence—directly molds consumers' attitudes. This underscores the importance of the hedonic dimension: for consumers, it is not just about being in the metaverse, but about enjoying it to the fullest. This revelation offers practical insights for marketing managers and metaverse developers, suggesting a strategic emphasis on enhancing the joyous facets of the metaverse experience to cultivate a positive disposition among consumers. Whereas, the unexpected non-mediation of flow offers a contrasting perspective. While consumers might lose themselves in the immersive world of the metaverse, this deep engrossment alone does not guarantee a favourable attitude. This implies that a mere state of flow, while valuable, is not the silver bullet. The metaverse experience, beyond mere immersion, needs to be both captivating and rewarding for consumers to hold a positive attitude towards it.

Our study also underscores a pivotal realization about the metaverse ecosystem: the bridge between consumers' attitude and their consequent behaviour is not only correlational, but also foundational. This means that in the dynamic environment of the metaverse, how consumers feel about a particular setting, interaction, or experience becomes the key driver behind their subsequent actions. The implication for marketing managers and metaverse developers is profound: to predict, guide, or even influence consumers' behaviour within the metaverse, one must first understand, shape, and nurture their attitudes. For instance, if a brand or retailer seeks to enhance consumer engagement or purchasing behaviour within

TABLE 6 | Hierarchical meta-regression.

Panel A. Telepresence → Attitude								
						Confidence interval		
Model	Variable	Estimate	Standard error	t	Pr(>|t|)	Lower bound	Upper bound	p
Covariate	Intercept	0.4769	0.0645	7.3931	< 0.0001	0.3505	0.6033	***
	Age (average)	0.0108	0.0043	2.4947	0.0126	0.0023	0.0193	*
	Female proportion (percentage)	0.0046	0.0064	0.719	0.4722	−0.0079	0.0172	n/s
	Geographic location (Eastern vs. Western)	−0.0943	0.1090	−0.8652	0.3869	−0.3079	0.1193	n/s
	Population sample (non-students vs. students)	−0.0657	0.100	−0.6568	0.5113	−0.2616	0.1303	n/s
	Publication rank (lower vs. higher)	−0.1011	0.1030	−0.9822	0.3260	−0.3030	0.1007	n/s
	Publication year (older vs. newer)	0.0519	0.1900	0.2731	0.7848	−0.3205	0.4242	n/s

(Continues)

Panel A. Telepresence → Attitude

Model	Variable	Estimate	Standard error	t	Pr(>|t|)	Confidence interval		p
						Lower bound	Upper bound	
Moderator	Intercept	0.4695	0.0696	6.7474	< 0.0001	0.3331	0.6059	***
	Metaverse place							
	Environmental realism (unrealistic vs. realistic)	−0.0555	0.1383	−0.4015	0.6880	−0.3267	0.2156	n/s
	Retail space (offline vs. online)	0.2156	0.1018	2.1185	0.0341	0.0161	0.415	*
	Metaverse process							
	Application (target vs. tool)	0.0576	0.0969	0.5945	0.5522	−0.1323	0.2475	n/s
	Experience creation (gamification vs. virtual representation)	−0.2012	0.1673	−1.2031	0.2289	−0.5291	0.1266	n/s
	Experience format (virtual reality vs. augmented reality)	−0.1384	0.0938	−1.4747	0.1403	−0.3223	0.0455	n/s
	Interaction agent (anthropomorphic AI vs. avatar)	0.1487	0.1311	1.1339	0.2568	−0.1083	0.4056	n/s
	Interaction interface (3D method vs. immersive method)	0.117	0.1071	1.0926	0.2746	−0.0929	0.3270	n/s
	IoT device (traditional screen vs. VR headset)	0.1979	0.0803	2.4659	0.0137	0.0406	0.3553	*
	Presence (physical vs. self)	—	—	—	—	—	—	—
	Virtualization (digitizing vs. generating)	0.1421	0.1021	1.3913	0.1641	−0.0581	0.3423	n/s
	Metaverse product							
	Product brand (with specific brand vs. without specific brand)	−0.1395	0.0972	−1.4355	0.1511	−0.3299	0.0510	n/s
	Product category (utilitarian vs. hedonic)	0.151	0.0915	1.6504	0.0989	−0.0283	0.3303	n/s
	Product type (good vs. service)	0.1235	0.0894	1.3812	0.1672	−0.0517	0.2987	n/s

(Continues)

TABLE 6 | (Continued)

Panel B. Attitude → Intention

Model	Variable	Estimate	Standard error	*t*	Pr(>|*t*|)	Confidence interval Lower bound	Upper bound	*p*
Covariate	Intercept	0.6700	0.0625	10.7137	< 0.0001	0.5474	0.7925	***
	Age (average)	0.0357	0.1063	0.3355	0.7373	−0.1727	0.244	n/s
	Female proportion (percentage)	0.0051	0.003	1.723	0.0849	−0.0007	0.0109	n/s
	Geographic location (Eastern vs. Western)	0.0066	0.0105	0.6303	0.5285	−0.014	0.0273	n/s
	Population sample (non-students vs. students)	−0.0346	0.100	−0.3463	0.7291	−0.2307	0.1614	n/s
	Publication rank (lower vs. higher)	0.0564	0.1003	0.5628	0.5736	−0.1401	0.2529	n/s
	Publication year (older vs. newer)	−0.0868	0.1057	−0.8207	0.4118	−0.294	0.1205	n/s
Moderator	Intercept	0.4739	0.1219	3.8862	0.0001	0.2349	0.7129	***
	Metaverse place							
	Environmental realism (unrealistic vs. realistic)	0.1458	0.1099	1.3263	0.1847	−0.0696	0.3612	n/s
	Retail space (offline vs. online)	0.2929	0.1053	2.782	0.0054	0.0866	0.4993	**
	Metaverse process							
	Application (target vs. tool)	0.2235	0.0933	2.3944	0.0166	0.0405	0.4064	*
	Experience creation (gamification vs. virtual representation)	−0.0284	0.1176	−0.242	0.8088	−0.2589	0.2020	n/s
	Experience format (virtual reality vs. augmented reality)	0.3644	0.0861	4.2302	< 0.0001	0.1956	0.5332	***
	Interaction agent (anthropomorphic AI vs. avatar)	−0.0128	0.1179	−0.1085	0.9136	−0.244	0.2184	n/s
	Interaction interface (3D method vs. immersive method)	0.1509	0.1824	0.8270	0.4083	−0.2067	0.5084	n/s
	IoT device (traditional screen vs. VR headset)	−0.1118	0.101	−1.107	0.2683	−0.3099	0.0862	n/s
	Presence (physical vs. self)	−0.0996	0.1432	−0.696	0.4865	−0.3802	0.181	n/s

(Continues)

TABLE 6 | (Continued)

Panel B. Attitude → Intention

Model	Variable	Estimate	Standard error	t	Pr(>|t|)	Confidence interval: Lower bound	Confidence interval: Upper bound	p
	Virtualization (digitizing vs. generating)	0.099	0.1187	0.8347	0.4039	−0.1335	0.3316	n/s
	Metaverse product							
	Product brand (with specific brand vs. without specific brand)	−0.0028	0.1033	−0.0266	0.9788	−0.2053	0.1998	n/s
	Product category (utilitarian vs. hedonic)	0.1892	0.093	2.0344	0.0419	0.0069	0.3714	*
	Product type (good vs. service)	0.1736	0.1576	1.102	0.2705	−0.1352	0.4824	n/s

Note: ***$p < 0.001$. **$p < 0.01$. *$p < 0.05$.

its virtual storefront, it must first ensure that consumers hold positive attitudes toward that space. This might involve refining the aesthetics, ensuring interactive engagements, or fostering community-driven experiences. In essence, within the metaverse, attitude serves as the compass that directs behavioural journeys, and understanding this relationship is paramount for anyone looking to craft meaningful and impactful metaverse experiences.

5.2 | On Moderators of Consumer Behaviour in the Metaverse

Our study also offers several noteworthy insights into how different contextual factors influence core relationships in the metaverse.

Starting with the telepresence–attitude relationship, three factors—age, retail space, and IoT device—significantly moderated this relationship. Age is particularly intriguing because the data do not suggest that 'older adults' in a traditional sense are driving the effect, but rather consumers older than the youngest cohort. For example, millennial consumers who were once seen as early adopters during their younger years are now transitioning into middle adulthood (Lim et al. 2023). Since millennials came of age in a digitally transformative era, they may be especially receptive to immersive features that amplify a sense of telepresence, indicating that as one's life stage progresses, the ability to harness immersive experiences remains strong. This observation sets a potential precedent for how future generations may respond as they move through similar life stages. Retail space emerged as another significant moderator, underscoring that online channels heighten the effect of telepresence on attitude. This finding aligns with research suggesting that digital interfaces can stimulate sensory engagement more intensively than traditional channels, reinforcing the importance of well-crafted online experiences (Lim and Rasul 2022; Lim, Rasul, et al. 2022). Similarly, IoT device moderated the telepresence–attitude relationship, suggesting that advanced hardware like VR headsets enhances immersion—an insight that also extends extant understanding on consumer adoption of IoT beyond typical privacy, risk, and trust issues (Ladeira et al. 2025). Thus, consumers who engage with higher-end or specialized devices may develop stronger attitudes shaped by their immersive experiences, challenging assumptions that metaverse participation can rely on generic hardware solutions (e.g., traditional sensors like microphones and webcams) (Sami et al. 2024).

Turning to the attitude–intention relationship, four moderators—retail space, application, experience format, and product category—were influential. Retail space, again, demonstrated that online channels strengthen the link between positive attitudes and tangible intentions, reiterating the practical benefits of a strong virtual presence for brands (Cowan et al. 2021). The finding on application (metaverse as a tool vs. metaverse as a target) implies that platforms explicitly addressing real-world challenges (e.g., *HP Reveal*, *Second Life*, *Virtua Works*, and *VRChat*) prompt more decisive consumer commitments than those primarily seeking to cultivate novel metaverse experiences (e.g., *EndevorRX*, *Pokémon Go*, and *Roblox*). This finding highlights that consumers may be likelier to act (e.g., purchase, return, and recommend) in metaverse environments perceived as serving functional or problem-solving purposes. The role of experience format, however, raises a critical tension: although advanced technologies like VR strengthened the telepresence–attitude link, AR proved more potent than VR in converting attitudes into intentions. This divergence underscores that attitude formation (enhanced by VR immersion) does not automatically translate into tangible behaviours. Brands and retailers targeting measurable outcomes—such as increased sales and net promoter scores—must, therefore, consider that fully immersive technology alone does not guarantee a higher degree of behavioural intentions. Solutions that blend real-world elements into virtual experiences, as AR does (Soon et al. 2023), may offer a more seamless path to behavioural action (Sharma et al. 2024). Lastly, product category revealed that hedonic products display a stronger capacity to convert attitudes into intentions compared to utilitarian offerings, reiterating that pleasure-driven consumption often spurs more decisive actions. However, many offerings occupy a continuum between hedonic and utilitarian dimensions, and thus, positioning can shift a product's perceived value in either direction (Lim, Ahmed, and Ali 2022). A furniture retailer, for instance, might typically market seating as a functional household item, yet embed playful features in the metaverse—such as customizable colour palettes or gamified design suggestions—to transform it into a more entertaining and immersive experience. This approach can appeal to both functional and experiential motivations, suggesting a strategic opportunity for brands to broaden a product's perceived benefits and encourage stronger behavioural responses in metaverse environments.

6 | Conclusion

As the boundaries between the virtual and the physical continue to blur, the ramifications for theories and practices in the metaverse remain ever evolving. Our findings extend theoretical and empirical insights that contribute to both academic and commercial spheres, underscoring the need for ongoing research and adaptive strategies in this rapidly shifting landscape.

6.1 | Theoretical Contributions

First and foremost, our study advances the conceptualization of the metaverse grounded in the latest technological innovations. By defining the metaverse as 'an interconnected realm where consumers and companies engage in immersive, real-time interactions, facilitated by avatars and software agents across digital spaces and physical geospatial locations, utilizing AR and VR technologies', we demystify and delineate its realms, elucidating the multifaceted opportunities and inherent challenges (Dwivedi et al. 2022; Lee et al. 2021; Yoo et al. 2023). This comprehensive understanding moves beyond the mere incorporation of AR or VR by offering a holistic overview of notable metaverse platforms and tools in use.

Nevertheless, despite the growing interest in metaverse-oriented studies, there exists a glaring knowledge gap on the interplay between brands/retailers and consumers within this expansive ecosystem (Dwivedi et al. 2022; Kim and Bae 2023). Our tri-phase model offers a cohesive analysis of consumer behaviour in the metaverse, delving into direct, mediating, and moderating relationships. This meta-analysis synthesizes effect sizes from pioneering studies, which, in turn, result in a panoramic view of consumer behaviour in the metaverse while laying the foundation for future research trajectories.

Noteworthily, our meta-analysis not only corroborates earlier findings of significant variables but also breaks new ground by identifying three pivotal moderators for consumers' metaverse experience and four for consumers' metaverse behaviour. Therefore, by defining these influencers and inhibitors, we illuminate the underlying dynamics steering consumer behaviour in the metaverse.

Moreover, our examination of demographics and publication characteristics as covariates lends clarity to debates surrounding factors that could skew effect sizes (Lim et al. 2025). Echoing sentiments from previous meta-analyses, we spotlight potential heterogeneities stemming from varied data collection and analysis approaches (Ansari and Ghasemaghaei 2023; Blut et al. 2021; Mehta et al. 2022; Jeyaraj 2022; Luceri et al. 2022), thereby ensuring that our conclusions remain rigorous and robust.

6.2 | Managerial Implications

The main and mediation effects findings demand a strategic focus on interactive features that drive consumers' metaverse immersiveness. The evidence indicates that interactivity and vividness significantly influence telepresence. Marketing managers and metaverse developers should invest in dynamic interfaces and advanced AR/VR tools that allow consumers to vividly experience and actively shape their digital environments. The central role of enjoyment as a mediator between telepresence and attitude further signals that technological enhancements must be paired with efforts to enrich the hedonic aspects of consumers' metaverse experience. Neglecting these dimensions risks relegating metaverse interactions to mere novelty, rather than creating compelling experiences that drive favourable consumer attitudes and intentions.

The moderation effects findings call for tailored strategies that reflect the varied responses across consumer segments and metaversal contexts. Older consumers and those using VR headsets exhibit a stronger telepresence–attitude link, suggesting that campaigns and virtual experiences designed for these groups should emphasize interactivity and premium hardware capabilities. Moreover, the stronger conversion from attitude to intention observed in online retail settings and when employing AR for hedonic products highlights a clear competitive edge. Marketing managers and metaverse developers should design digital campaigns and virtual storefronts that not only entertain but also solve real-world problems, positioning the metaverse as a practical tool rather than just a source of distraction. Such targeted strategies are essential for nurturing and sustaining consumer engagement while achieving measurable outcomes in an increasingly crowded and competitive phygital marketplace.

6.3 | Limitations and Future Directions

Confidence in the meta-analytic findings is intact due to its rigor and robustness, yet several limitations avail that warrant cautious interpretation. First, the metaverse concept employed in this article integrates a diverse array of contemporary technologies and applications. This diversity, while comprehensive, introduces substantial heterogeneity in effect sizes—a natural consequence of drawing on diverse sources. Second, the exploration encompasses both theoretical and empirical dimensions of the metaverse; however, given the rapid evolution of digital technologies, emerging innovations could shift the current understanding. A key consideration is that the results are anchored in the literature available at the time of this study, which may render some insights less applicable as the field evolves. Third, the search strategy was restricted to articles published in academic journals and conferences. Although this ensures data quality, it introduces a bias by excluding other valuable sources such as books, chapters, doctoral dissertations, and managerial reports, thereby limiting the overall scope of insights. Fourth, a notable limitation is the absence of direct comparisons across different metaverse platforms—direct contrasts such as *Second Life* versus *Roblox* were not included, leaving detailed evaluations of heterogeneity by specific platform types outside the study's scope.

Future research can address these limitations and explore new avenues to deepen our understanding of consumer behaviour in the metaverse. For instance, researchers could compare consumer experiences and marketing efficacy across individual metaverse environments to uncover platform-specific characteristics. As metaverse technologies mature, studies should investigate how these technological shifts affect firm strategies within an increasingly dynamic competitive landscape. Expanding the range of data sources to include consumer reviews, firsthand case studies, and industry reports would provide a more comprehensive perspective and strengthen the evidence base, while further research should identify additional factors influencing purchase decisions, brand loyalty, and word of mouth in these phygital spaces. Overall, this article lays a critical foundation for subsequent inquiries and invites further exploration to refine our understanding of this evolving field.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data can be made available upon reasonable request.

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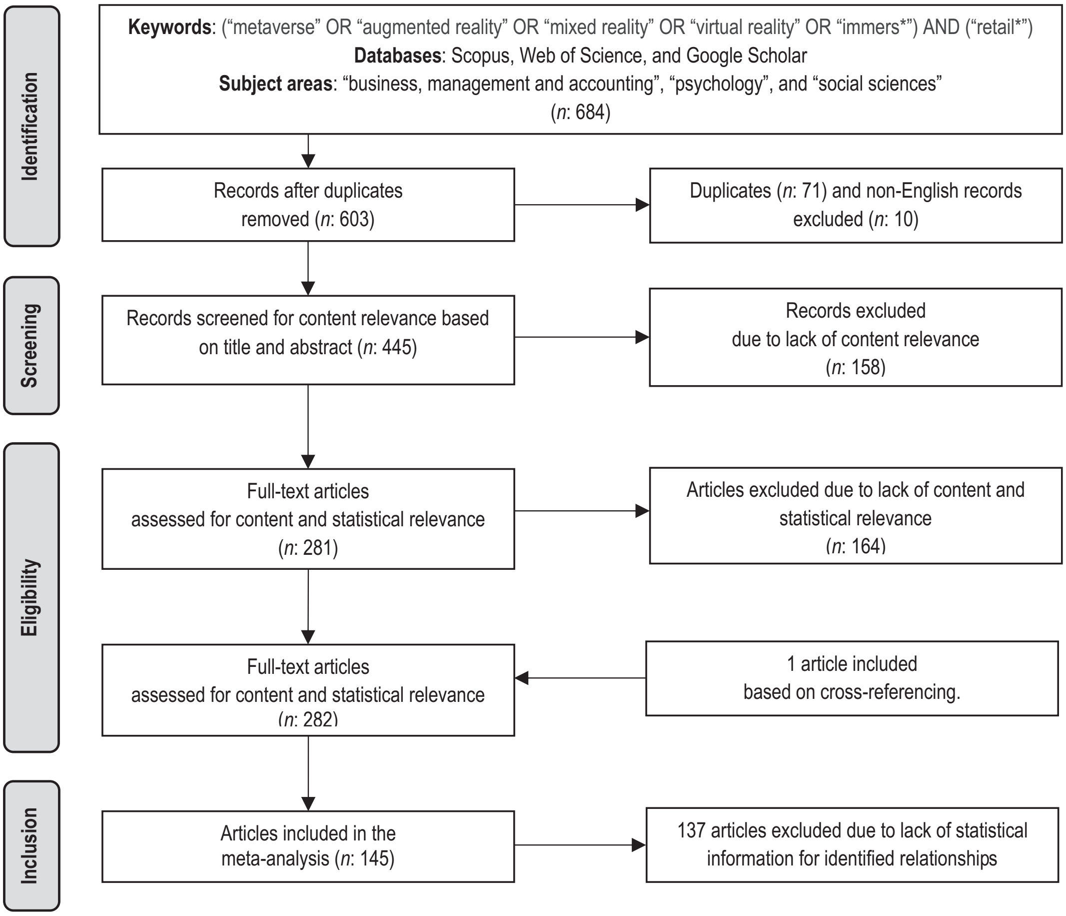
Appendix A

The Review Procedure Based on the PRISMA Protocol



Note: The search was conducted on July 15, 2023.

Appendix B

Studies Included in the Meta-Analysis

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Appendix C

Coding of Covariates and Moderators in the Meta-Analysis

Covariates

Age is calculated based on the *average age of participants* derived from the age statistics reported in each study.

Female proportion is calculated based on the *percentage of female participants* derived from the gender statistics reported in each study.

Geographical location is coded based on whether respondents reported in each study were from 0 = *Eastern countries* (e.g., China, Japan, South Korea) or 1 = *Western countries* (e.g., Germany, UK, USA).

Population sample is coded based on whether respondents reported in each study as 0 = *non-students* or 1 = *students*.

Publication rank is coded based on whether the journal publishing the study was considered to be 0 = *lower* than the *h*-index median or 1 = *h*-index *median or higher*.

Publication year is coded based on whether the study was published 0 = *older* than median or 1 = *median or newer* to account for the technological advancements in the metaverse (Dwivedi et al. 2022).

Moderators

Metaverse place

Environmental realism is coded as 0 = *unrealistic* (i.e., offering abstract, fantastical, or surreal digital worlds) or 1 = *realistic* (i.e., replicating physical environments with high fidelity) (Dwivedi et al. 2022).

Retail space is coded as 0 = *offline channel* (e.g., mall-based retail outlets) or 1 = *online channel* (e.g., web-based e-stores, virtual malls).

Metaverse process

Application is coded based on whether metaverse is used as 0 = a *target* (e.g., drive innovation and profit) or 1 = a *tool* (e.g., navigate and mitigate real-world challenges) (Dwivedi et al. 2022).

Experience creation is coded as 0 = *gamification* (i.e., game-like mechanics) or 1 = *virtual representation* (e.g., 3D models, AR overlays, interactive avatars) (Dwivedi et al. 2022).

Experience format is coded as 0 = *virtual reality* (*VR*) (i.e., fully immersive, computer-generated environments) or 1 = *augmented reality* (*AR*) (i.e., overlaying digital elements in the real world) (Dwivedi et al. 2022).

Interaction agent is coded as 0 = *anthropomorphic AI* (e.g., human-like gestures, expressions) or 1 = *avatar* (i.e., without anthropomorphic cues) (Dwivedi et al. 2022; Kozinets 2022).

Interaction interface is coded as 0 = *3D method* (e.g., VR-based, immersive environments) or 1 = *immersive method* (e.g., enhanced interaction with haptic feedback or spatial computing) (González et al. 2013).

IoT device is coded as using 0 = *traditional screen* (e.g., PCs, mobile devices) or 1 = *VR headset* (immersive experiences) (Chiu et al. 2021).

Presence is coded as 0 = *physical* (i.e., virtual physical entities perceived as tangible objects) or 1 = *self* (i.e., mental space wherein one's virtual avatar is recognized as an extension of one's actual self) (K. M. Lee 2004; Tussyadiah et al. 2018).

Virtualization is coded as 0 = *digitizing* (e.g., real-world objects rendered digitally) or 1 = *generating* (e.g., fully digital constructs without physical counterparts) (Chylinski et al. 2020).

Metaverse product

Product brand is coded as 0 = *with specific brand* or 1 = *without specific brand* (Dwivedi et al. 2022).

Product category is coded as 0 = *utilitarian* (i.e., functionality-driven; e.g., VR training tools and workspaces) or 1 = *hedonic* (i.e., experience-driven; e.g., virtual gaming) (Dwivedi et al. 2022).

Product type is coded as 0 = a *good* (e.g., digital clothing, non-fungible tokens, virtual goods) or 1 = a *service* (e.g., metaverse tourism, virtual concerts) (Dwivedi et al. 2022).