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The Main Influences On The Implementation Of Metaverse To Personalize The Consumer Experience

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Resumo

Na era digital, a personalização da experiência do consumidor tornou-se um elemento estratégico para as empresas que procuram aumentar a satisfação dos clientes e potenciar as suas receitas. Este projeto centra-se na análise do papel do Metaverso na personalização dessas experiências em ambientes virtuais.

O principal objetivo da investigação é compreender como o Metaverso, aliado a tecnologias como realidade virtual (VR), realidade aumentada (AR), blockchain e inteligência artificial (AI), pode criar experiências mais imersivas, individualizadas e eficazes para os consumidores. A pesquisa desenvolve-se a partir de uma contextualização teórica dos conceitos-chave, seguida da análise das principais oportunidades e desafios associados à personalização no Metaverso.

A metodologia utilizada assenta numa revisão da literatura científica e técnica, complementada pela análise crítica dos avanços tecnológicos e das suas aplicações práticas no contexto empresarial. Esta abordagem permite identificar não só os benefícios, mas também os riscos, limitações e implicações éticas da adoção destas tecnologias.

Entre os principais resultados, destaca-se o papel central da AI na criação de conteúdos personalizados e na otimização da experiência do utilizador, bem como o impacto positivo destas práticas no envolvimento e fidelização do cliente. Contudo, a investigação também evidencia desafios significativos, como a proteção de dados e as exigências técnicas para garantir escalabilidade e adaptabilidade. Por fim, explora-se a influência de fatores como competências em recursos humanos e perceção de riscos na adoção do Metaverso por parte das organizações.

Palavras-chave: Personalização, Mundos Virtuais, Metaverso, Blockchain, Realidade Virtual, Realidade Aumentada.

Abstract

In the digital age, personalizing the consumer experience has become a strategic element for companies looking to increase customer satisfaction and boost their revenues. This project focuses on analyzing the role of Metaverse in personalizing these experiences in virtual environments.

The main aim of the research is to understand how Metaverse, combined with technologies such as virtual reality (VR), augmented reality (AR), blockchain and artificial intelligence (AI), can create more immersive, individualized and effective experiences for consumers. The research starts with a theoretical contextualization of the key concepts, followed by an analysis of the main opportunities and challenges associated with personalization in the Metaverse.

The methodology used is based on a review of scientific and technical literature, complemented by a critical analysis of technological advances and their practical applications in the business context. This approach makes it possible to identify not only the benefits, but also the risks, limitations and ethical implications of adopting these technologies.

Among the main findings is the central role of AI in creating personalized content and optimizing the user experience, as well as the positive impact of these practices on customer engagement and loyalty. However, the research also highlights significant challenges, such as data protection and technical requirements to ensure scalability and adaptability.

Keywords: Personalization, Virtual Worlds, Metaverse, Blockchain, Virtual Reality, Augmented Reality.

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List of Abbreviations

VR – Virtual Reality

AR – Augmented Reality

AI – Artificial Intelligence

HR – Human Resources

ML – Machine Learning

UX – User Experience

XR – Extended Reality

BCI - Brain-computer Interface

3D – Three Dimensional

ER – Extended Reality

GDPR - General Data Protection Regulation

NPCs – Non-Playable Characters

NFT - Non-Fungible Token

BCI - Brain-computer Interface

MR – Mixed Reality

MMOGs - Massively Multiplayer Online Game

CX – Customer Experience

IoT – Internet of Things

Gen-AI – Generative AI

SEM - Structural Equation Modeling

PLS – Partial Least Squares

INTRODUCTION

Framework and Research Problem

The research will be focused on investigating how Metaverse technologies can be adopted to improve customer experience. The study intends to connect the adoption of the Metaverse with management practices by analyzing the critical factors within the business environment that influence this adoption. By identifying and exploring these factors, the research aims to provide insights into how organizations can successfully implement Metaverse technologies to enhance their customer engagement and overall experience. The study seeks to clarify the manager's view of the Metaverse and investigate its potential applications in businesses focused on improving customer experience. This topic is relevant across multiple fields of study.

The goal is to investigate the factors that influence managers' willingness to use Metaverse technologies, both positively and negatively, with a particular focus on the context of personalization. In addition, the study aims to understand how the perception of risk can generate resistance to the implementation of technologies like Metaverse. Furthermore, it will examine the role of HR skills within the organization, assessing whether they facilitate or hinder the adoption of these technologies in the specified context. Once the variables under analysis have been explained, the study will then move on to understanding their degree of influence on the implementation of Metaverse technologies to improve personalization technologies.

The underlying purpose of this research is to make a significant contribution to the scientific community with new and necessary knowledge around emerging technologies, like the Metaverse. To fulfill this, it will be crucial to identify and examine key factors that influence its adoption and utilization. Additionally, understanding the impact of the Metaverse on personalization systems is vital. Through this comprehensive understanding, businesses can strategically leverage the Metaverse to create immersive and personalized experiences that resonate with their customers.

Objective and Research Question

The current research hopes to address one specific objective, and for that, the research question below will guide the study. The topic of this research is "*W*illingness to adopt personalization technologies in the Metaverse", in hopes of relating the subject of Metaverse to management, particularly focusing on personalization technologies. This study aims to demystify and uncomplicate the Metaverse and expose its applicability for personalizing experiences, making it relevant research.

The general scope is to positively contribute to the development of personalization techniques in the Metaverse. Additionally, this study plays a significant role in advancing the development and, overall, comprehension and understanding of the Metaverse. With those two areas in mind, the

research will investigate what influences weigh the most for managers wanting to implement the Metaverse to personalize the user journey and experience.

To complete the objective proposed, this research aims to address the following research question:

RQ1. Which factors influence the willingness to adopt personalization technologies in the Metaverse?

This research question aims to take a deep look into how the Metaverse can be a vehicle for personalization methodologies and what the role of management is in integrating said personalization technologies. It aims to investigate internal and external factors that affect an organization's likelihood to adopt personalization technologies in the Metaverse. Those factors can present as benefits of Metaverse personalization for engagement, satisfaction, and retention, and as obstacles or risks a company may find in implementing Metaverse personalization technologies.

Research Structure

The present research is structured to systematically explore the topic of personalization technologies in the Metaverse.

Chapter 1 sets the foundation for the following research, providing the framework for the study and offering context for the investigation of the Metaverse. The chapter shows the relevance of the study done moving forward.

The next chapter explores the fundamental concept and definition of the Metaverse, observing its technological underpinnings and the theoretical basis. The discussion transitions to the topic of the Metaverse's impact on social identity and interaction, studying how individuals engage in virtual spaces. Chapter 2 ends with research into the role of AI and machine learning (ML) in driving innovation within the Metaverse.

The third chapter discusses personalization technology, beginning with an overview of its definition and concepts. Then, it explores how personalization is integrated into the Metaverse, highlighting its potential to enhance user experience (UX). It also considers the existing opportunities for personalization, emphasizing its impact on transforming the experience. Chapter 3 finishes with a discussion around the prospects, positioning the study within current research and emerging trends.

The fourth chapter draws the theoretical approach, supported by the objective, and presents the research question that guides the investigation in more depth. This ensures a more focused investigation of the topics.

Chapter 5 details the methodology employed, explaining the research model of the study, and the methods used for data collection and analysis. These are critical to ensure the transparency and rigor of the research.z

This study ends with Chapter 6, which discusses the final considerations and key findings reflecting both theory and practice that was presented. This chapter also acknowledges the limitations of the study, providing a balanced perspective on the outcomes of the research done. This paper ends with suggestions for further studies, offering new paths for exploration that build upon the findings of this paper.

Through this approach, the research addresses a research question, based on a comprehensive analysis of personalization technology in the metaverse while providing insights for future inquiry.

CHAPTER 1

Metaverse: Concept and Technologies

1.1 Concept and Definition of the Metaverse

Metaverse is a blend of shared spaces and mutual experiences taking place in digital realms without boundaries. In it, individuals have avatars that live and work, turning these activities into immersive encounters. (Mittal et al., 2024) The Metaverse has been defined as a virtual extension of digital interactions between individuals. A space that goes beyond the limits of physical dimension to connect, network, and socialize within a digital community. (Ghosh et al., 2024a)

Metaverse has its origin in Neal Stephenson's 1992 novel “Snow Crash” where the author envisioned a real-time digital reality accessible through a head-mounted display (Awadallah et al., 2024)Click or tap here to enter text.. The term ‘Metaverse’ is formed by an amalgamation of the mystical word ‘meta’ and the vast and wide ‘verse’. It evolved to describe a universe where virtual environments and social interactions can intertwine seamlessly. (Ghosh et al., 2024b) Large and well-known tech companies such as Meta, Amazon, Apple, Netflix, and Google have announced the release of Metaverse-related aspects and plans for their users, showing signs of relevant adoption by very relevant retailers and platforms. (Zawish et al., 2024)

When describing the Metaverse, its three main features can be summarized as the gathering of different technologies used for an immersive experience, the merging of real and virtual worlds, and a continuous multi-sensory experience that doesn’t have physical borders. (Rocha et al., 2023) Normal daily activities like traveling, working, shopping, and going to concerts can also be held in the Metaverse. There, users can operate avatars from different parts of the world, bringing a greater connection between the online community, independently of where they are physically. (Deng et al., 2023)

As such a complex system of interconnected virtual worlds, the Metaverse, must be upheld by a frame capable of handling communication, computation, and storage of information. This infrastructure grants the big data needed to keep the Metaverse engine running, while powered by 6G technologies like extended reality (XR), brain-computer Interface (BCI), AI, and digital twins. Using multiple technologies, the Metaverse can provide users a multi-sensory audiovisual content. (Getu et al., 2024)

Like many online platforms, the Metaverse can be susceptible to security issues, largely stemming from a prioritization of user interaction over robust security measures. As a result, social engineering attacks became more frequent, and harassment and verbal abuse became more impactful on the overall experience users can have on the Metaverse. Factoring in the anonymity created by using avatars, the risk of identity theft and impersonation increases. (Deng et al., 2023)

The gaming industry has been a pioneer in the development and popularization of the Metaverse. However, beyond its initial applications within gaming, the Metaverse holds the potential to revolutionize everyday activities, including entertainment, education, e-commerce, healthcare, and tourism, as shown by the interest of big retailers.(Awadallah et al., 2024) It's possible to confirm the potential in the existing shift in trading virtual assets like objects, user identities, and digital goods amid different virtual worlds with the possibility of having them mirrored into reality, solidifying a market for goods in the Metaverse that can intertwine with the offline world. (Getu et al., 2024) Metaverse is revolutionizing all activities, from e-commerce to broadcasting and entertainment, opening up new venues for social interactions. (Saboune, 2022)

1.1.1 Evolution of Virtual Worlds

The adoption of the Internet in the nineties caused a shift in the traditional interactions among agents, like scripts, figures, and advancements in three-dimensional (3D) technology, VR and AR. This digital transformation culminated in the development of the Metaverse, establishing it as an eternal shared environment (Rocha et al., 2023), enabled by technologies like extended reality (ER) and AI. (Lee, 2022)

The Metaverse marks the evolution of virtual worlds developing real-time interaction for their users. It began as a fully virtual world, later developing into a space where AR enabled an overlay of digital elements into the real world around users. This combined with MR made possible the association of real and virtual spaces in one, culminating in XR as an all-encompassing framework. The progression seen in digital worlds echoes a shift toward more immersive experiences for the user, although there is still a considerable journey ahead before achieving true realism and immersion. (Paweroi & Köppen, 2023) Early movers in the Metaverse space, such as gaming leaders, Roblox, VRChat, Zepeto, and Second Life, allow their users to develop simulated lives and social experiences through technologies like AR, VR and MR. (Zawish et al., 2024) We can see those technologies also used by companies like Snapchat, IKEA, and Pokémon Go to blend digital elements, such as filters, furniture, or Pokémons, with physical realities like bodies, houses, and streets, creating a mixed experience, as seen in Figure 1. (Raina et al., 2022)



Figure 1 Pokemon GO ios and android smartphone game with augmented reality with Drowzee and biker. Image: Veredict

Simpler versions of the Metaverse are already present in Massively Multiplayer Online Games (MMOGs), although the full-fledged Metaverse could result in a much more complex world in the future. (Truong et al., 2023) MMOGs share other similar features with the Metaverse, such as users' ability to establish personalized online avatars and to purchase in-game tokens using digital currencies. (Awadallah et al., 2024)

The tremendous growth of technologies such as AR and VR accelerated the evolution of the Metaverse as a tool for retail luxury brands, like Gucci's store in Figure 2. This allowed a new type of commerce, enabling a transformation from electronic commerce (e-commerce) to immersive commerce (i-commerce), where there is a new space to develop and shape strong relationships with consumers, making use of this new technology. (Wasiq et al., 2024) It is anticipated that by 2030, annual global investments in the Metaverse will exceed 5 trillion dollars, showing its potential for retail brand visibility. (Rahman et al., 2025)



Figure 2 Gucci store in The Sandbox Game with fashion items available for people to buy, own and use in their own experience. Image: Vendôm

Although the diverse array of use cases for the Metaverse, and the initial investments undertaken by major technology companies, the evolution of Metaverse, as the most complete virtual reality space, has been called underwhelming and disappointing, despite more than 10 billion dollars spent on it. Meta, the main driver behind the Metaverse, shared images showing their virtual space as seen in Figures 3 and 4, with comments calling it less advanced than a PlayStation video game developed in the early 2000s. (Saboune, 2022)



Figure 3 Facebook Horizon Worlds
Image: Facebook/REUTERS



Figure 4 Facebook Horizon Workrooms, a remote-working app
Image: Facebook/REUTERS

1.1.2 Technologies Enabling the Metaverse: VR, AR, and Blockchain

Several essential components define the Metaverse and distinguish it from traditional forms of the Internet. (Satyam et al., 2023) VR and AR are some of the main technologies that differentiate the Metaverse. VR describes items that are only actual in virtual spaces, while AR defines the digital merging of virtual characteristics into reality. (Paweroi & Köppen, 2023) Users rely on tools, such as AR/VR headsets, as seen in Figure 5, smart glasses, and haptic gloves, to fully experience and interact with virtual worlds. AR/VR devices also enable users to present themselves in a blend of physical and

digital interactions. Furthermore, those technologies can be used to collect vast amounts of user data through the devices used. (Truong et al., 2023)



Figure 5 Mark Zuckerberg using Oculus Meta Quest Pro VR Headset

Image: Facebook/REUTERS

Blockchain is also a Metaverse motor, known for creating traceable and immutable transactions on a decentralized ledger based on smart contracts. (Badruddoja et al., 2022) (Truong et al., 2023) Blockchain can be used to prevent data breaches and unlawful uses. (Mittal et al., 2024) Since blockchain spreads encrypted records across a decentralized network, unauthorized access to data becomes more challenging, which is one of the challenges the Metaverse faces. (Raina et al., 2022)

AR and VR algorithms can create an immersive experience in virtual spaces; however, users cannot trust the Metaverse unless the space is safe. Blockchain can empower the Metaverse to ensure safer spaces. Smart contracts in blockchain are traditionally designed to execute simple transactions, making Metaverse transactions more expensive. (Badruddoja et al., 2022)Fast technological changes have expedited the rise of a decentralized Metaverse, rooted in more secure and transparent worlds than the traditional Metaverse paradigm. (Ghosh et al., 2024b)

AR is showing fast growth in consumer-based headwear, especially with 360° capture technology, particularly in camera improvements on mobile devices. AR and VR solutions enable customized virtual worlds, creating the perfect space for people and businesses to interact with each other. (Saboune, 2022) VR has been an essential tool in various industries for decades. Since the 1990s, it has been used for pilot training, as seen in Figure 6, and in healthcare, VR has transformed surgical training by providing interactive simulations of procedures, reducing training time, and leading to better surgical outcomes. (Schlichting et al., 2022)



Figure 6 Virtual Reality Glasses used for pilot classes

AR devices, as seen in Figure 7, are generally more comfortable than VR ones, yet they do not have a universal standard, leading to inconsistencies in content. Furthermore, AR struggles with content portability due to local and cloud processing, the need for high bandwidth, low latency, and ongoing optimization. When content portability is inadequate, engagement diminishes. (Murala, 2024)



Figure 7 Lenovo augmented reality headset Image: Angel Garcia/Bloomberg

1.2 Social Identity and Human Interaction in the Metaverse

Metaverse can change human interaction forever. Through entertainment, education, commerce, and community building may disrupt businesses and increase experiences. (Satyam et al., 2023) The appearance of the Metaverse opened a whole new era of cyber-physical interconnectedness, pushing the limit of the cyber interaction known until now. (Raptis et al., 2024)

There is a new social networking model introduced by Metaverse capable of enabling social engagement, evolving from text, images, and videos to 3D virtual and physical experiences. (Peng et al., 2022) Communication is influenced and shaped by social communities in virtual environments. These communities are created based on shared backgrounds or interests, enhancing collaborative experiences. (Yu et al., 2023)

Interaction is made easier with the use of avatars throughout different universes, able to resemble a more personable image to individuals. (Luo et al., 2023)

1.2.1 Virtual Avatars and Social Representation

Virtual avatars take on a graphical embodiment of Metaverse users, to allow users to navigate in the digital space, shadowing the characteristics and actions. (Raptis et al., 2024) Avatars are a form of personal identity in the Metaverse. Users can build avatars resembling themselves or want they want to be, changing characteristics like height, weight, skin, eye color, and clothes, with a wide range of options as seen in Figure 8. (Raina et al., 2022)



Figure 8 Meta's Horizon Worlds Avatars Image: UploadVR

Avatars in the Metaverse can interact in virtual environments, communicate with others via text or voice, and interact with virtual objects. They vary their appearance by platform, emerging as 2D or 3D models, with realism being a key feature. (Paweroi & Köppen, 2023) Avatars are a key part of the Metaverse, enabling real-time interaction. For example, vehicular avatars function as intelligent assistants, capable of understanding needs, assessing emotions, and managing data and services for drivers and passengers in a personalized way. (Kang et al., 2024)

Social IoT (Internet of Things)- enabled representation within virtual environments includes physical interactions, as IoT sensors capture data like lighting or room temperature to adjust the virtual world accordingly, for example, simulating snowfall. (Guan & Morris, 2023)

Since every transaction goes through a digital experience, the Metaverse leads to newer liabilities than the real world. (Badruddoja et al., 2022) For instance, avatars can be subject to attacks by collecting sensitive user information from both the real and virtual worlds to forge identities. This makes it easy for attackers to obtain information from the target through approaches such as dishonesty and persuasion. (Deng et al., 2023)

1.2.2 Social Communities and Group Dynamics in Virtual Spaces

Since individuals can share virtual worlds and communicate in real time, remote collaboration and social interaction are enhanced. This allows the sharing of encounters and activities and nurtures a sense of presence and association. (Satyam et al., 2023) The shared experiences are synchronized regardless of geographic location, creating more interesting dynamics for social communities. (Guan & Morris, 2023) Virtual spaces enable diverse interactions and foster user connections despite physical barriers. While these digital platforms can enhance collaborative efforts, they also present challenges, including the potential for miscommunication and the risk of social isolation among participants. (Huang et al., 2023)

Studies propose that an independent avatar can benefit user navigation among social relationships in the Metaverse by partly offloading some interactions to the avatar. This could potentially lead to a highly immersive atmosphere with a wider spectrum of socialization and collaboration abilities. (Raptis et al., 2024)

The Metaverse encourages collaborative dynamics, social communities, and shared experiences with other users regardless of where they are located, removing geographical limitations and congregating groups in virtual spaces. (Satyam et al., 2023) The social ties established in Metaverse can reflect connections, friendships, and shared activities. Based on the interaction level and intensity of connections, they can be classified as strong, weak, or latent. (Yu et al., 2023) Overall, these spaces reshape traditional social structures and significantly influence group behavior. (Huang et al., 2023)

In educational Metaverse spaces, student interactions are enhanced, promoting knowledge sharing and support through immersive experiences. Personalized learning environments foster a sense of belonging, alleviating isolation common in traditional online education, and encouraging active participation while strengthening relationships between students and educators. (Murala, 2024) Figure 9 presents a new concept, Class VR, an audio and visual 360-degree VR simulation that enables students to observe real life through a virtual environment, enhancing knowledge for individuals of all ages. (Mandala et al., 2023)



Figure 9 Virtual Reality used in children's classes

Communities within the Metaverse mirror the dynamics present in the real world. When evaluating virtual real estate on Metaverse platforms, like the on Figure 9 from Decentraland, the perceived value of meta-estate is influenced by human interactions, with pertinent factors including proximity to notable individuals, community engagement, and visibility within social networks, significantly affecting the valuation of virtual land. (Ruggeri et al., 2024)



Figure 10 Decentraland real-estate

1.3 Artificial Intelligence and Machine Learning in the Metaverse

AI can enhance engagement in the Metaverse by processing data, automating operations, facilitating language processing, and delivering personalized recommendations. (Raina et al., 2022) The Metaverse is a puzzle piece of a more significant digital intelligence revolution, highlighted by AI and ML. (Q. Zhou et al., 2024)

The integration of ML and AI tools can help automate processes within the Metaverse, particularly with General Data Protection Regulation (GDPR) policies. These technologies emphasize the importance of explainability and transparency, essential for a trustworthy Metaverse. To effectively mitigate attacks and curb misinformation, the Metaverse needs to establish an efficient trust-sharing system across its various layers. (Fernandez & Hui, 2022) It can also assist in world creation by automating the generation of realistic environments and Non-Playable Character (NPC) behaviors, allowing more diverse virtual worlds. (Berthault et al., 2023)

1.3.1 AI's Role in World-Building and Content Generation

AI is fundamental to the Metaverse by enhancing interactions and creating dynamic and responsive environments. It enables personalized context-aware interactions, enriching user engagement within Metaverse. (Satyam et al., 2023) AI enriches immersive worlds by also optimizing user interactions,

automating routine tasks, and delivering real-time feedback mechanisms, facilitating engagement through adaptive content delivery. (Murala, 2024)

Studies emphasize AI-driven moderation practices to address toxic behaviors in games, forums, and content creation. These scalable, cross-modality solutions involve platform users and AI tools, extending their application to the Metaverse. (Fernandez & Hui, 2022) AI is a crucial tool to analyze interactions and preferences to generate worlds that adapt to individual or collective UX, leading to optimized resource management and faster creation processes. (Berthault et al., 2023)

Generative AI is a branch of AI centered around creating new data rather than analyzing and classifying it. (Jadhav et al., 2024) Gen-AI is pivotal in shaping and creating content, including chatbot conversations, virtual landscapes, 3D objects, and interactive narratives. Gen-AI models enable realistic content generation and facilitate the creation of realistic virtual beings and adaptive environments, supported by IoT data. This synergy highlights the role of AI in driving personalization, automation, and creativity within the Metaverse. (Chamola et al., 2024)

1.3.2 AI for Behavior Simulation and NPC Interaction

NPCs are 3D AI-driven entities of the Metaverse that can have similar appearances and functions to avatars. (Qin & Hui, 2023) They act as chatbots, serving roles from NPCs in gameplay to virtual assistants in VR workplaces. (Mozumder, 2022) Since NPCs are required to interact with users in a way that simulates humans, decision-making is needed, and the feedback of individuals can improve the performance of NPCs' decisions based on learning models. (Alcántara et al., 2024)

AI-powered multilingual capabilities enable NPCs to process and analyze natural languages, generating responses that improve accessibility and interaction. (Mozumder, 2022) AI can be used to generate these avatars and simulate real human behavior, capable of observation, understanding, and adapting. AI trained with historical data will learn from past outputs to produce ideas, increasingly refined with ML to mimic the real human brain, ultimately leading to the creation of a digital human. (Raina et al., 2022)

When coupled with Natural Language Processing, AI enables intelligent avatars to interact with users more effectively. These technologies create genuine virtual entities by leveraging natural language comprehension, speech recognition, and ML, significantly improving the overall UX. (Satyam et al., 2023) These NPCs can be used in gaming, virtual reality, and educational situations to create more interesting user experiences. (Berthault et al., 2023)

1.4 Current State and Trends of the Metaverse

During 2023, the Metaverse was experiencing rapid growth and strengthening user engagement, with predictions that 25% of people will spend at least one hour daily in it by 2026, although the growth has exhibited signs of deceleration. (Luo et al., 2023) How technology has aged leads to a new point where development and growth are never becoming stationary, with constant room for progress. (Saboune, 2022)

Metaverse will eventually result in a 3D environment combined with virtual and physical worlds, allowing interactions naturally, despite physical distance, but this will take many years to build, as the Metaverse is still in the early stages of development. (Rocha et al., 2023)

1.4.1 Adoption by Businesses and Consumers

Business adoption in Metaverse is enabling brands to reposition themselves within virtual environments, as most companies are ready to use any type of technology they need to keep their competitive market position. (Verma et al., 2022)

High-end brands like Gucci, Dolce & Gabbana, and sports brands like Nike and Adidas are pioneering this digital space, offering unique virtual experiences such as NFT (Non-Fungible Tokens)-based products, virtual apparel, and exclusive digital items for avatars. Collaborations like Gucci's and Roblox or Nike's launch of NFTs, seen in Figure 11, highlight the appeal of immersive brand experiences. Figure 12 shows Adidas collaborating with virtual communities like the Bored Ape Yacht Club to customize digital clothing for avatars. (Wasiq et al., 2024) (Rahman et al., 2025) Both Nintendo, Sony, and personalities like Snoop Dogg have also participated in the Metaverse, created their virtual theme parks, and sold NFTs. (Saboune, 2022)

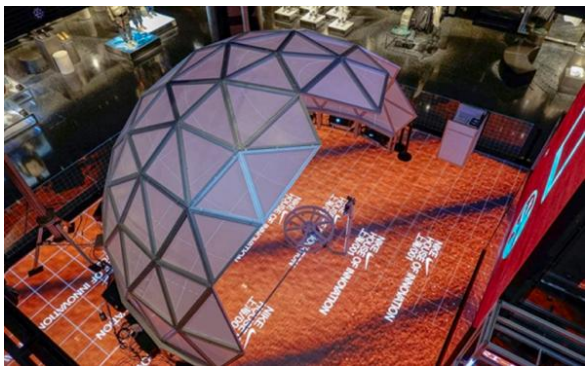


Figure 11 Nikeland in the Metaverse



Figure 12 Adidas Originals: Into the metaverse

In the context of entertainment, the Metaverse serves as a pioneer in immersive gaming, live performances, and virtual events. This is exemplified by notable occurrences such as Ariana Grande's concerts within the Roblox platform, as illustrated in Figure 13. In education, students can explore and interact with historical sites, conduct experiments, and visualize complex concepts through VR and AR. In retail, virtual marketplaces enable buying and selling goods and digital assets. Healthcare applications include virtual simulations for medical training and VR therapy for mental health. Architecture and design industries use Metaverse to create virtual models of projects, allowing clients to interact with designs and facilitating decision-making. (Satyam et al., 2023)



Figure 13 Ariana Grande's Fortnite musical tour

Country initiatives like "The Dubai Metaverse Strategy", were created with the goal of the Metaverse contributing to the economy with 4 billion dollars by 2030 and 40 thousand jobs. The strategy includes a digital twin city of Dubai called One Human Reality, where users can experience cultural attractions and events in a virtual setting. (Saboune, 2022)

During the COVID-19 pandemic, businesses could explore new technologies in more depth since most people were indoors for long periods, seeking online entertainment. So, companies invested in technology able to bring real-life experience like stadiums, parks, and zoos right into the palm of people's hands.(Saboune, 2022) This doesn't mean that every person understands this technology, as McKinsey reports that the Metaverse market is steadily growing, in a development

driven by consumers, regardless of how well they grasp the full concept of technology. (Q. Zhou et al., 2024)

1.4.2 Future Directions of Virtual Worlds and Technologies

Future directions for virtual worlds include platform interoperability and improved user governance models. There is also a focus on expanding virtual real estate, enhancing personalization, immersive experiences, and scalability. Additionally, new play-to-earn models and partnerships with gaming companies are expected to drive further growth. (Ghosh et al., 2024b) Economic opportunities may arise as virtual economies enable digital asset ownership and employment for creators, but socioeconomic inequality must be addressed by ensuring equitable access to technology and devices. (Satyam et al., 2023)

VR headsets, AR glasses, and smartphones may broaden user participation in virtual environments. (Berthault et al., 2023) This deployment will become increasingly immersive with 3D experiences, pointing to a future where brands connect with consumers through virtual worlds, setting new standards for brand engagement and digital experiences. (Wasiq et al., 2024) Advancements in 6G technology are expected, resulting in the implementation of low-latency wireless systems to support VR and AR devices and high-quality communication. (Mozumder, 2022) Upcoming technologies like 6G will be capable of handling the high data throughput that is required to give users immersive experiences. (Guan & Morris, 2023)

This space is changing from a platform primarily focused on gaming to a more diverse universe catering to all groups, with product placement ads gradually being integrated into a virtual shopping experience. (Luo et al., 2023) Currently, there doesn’t seem to be a definite roadmap in place to guide Metaverse's direction, reflecting its dynamic environment led by actors with varying opinions on ownership, value, and control. (Q. Zhou et al., 2024)

CHAPTER 2

Personalization Technology in the Metaverse

2.1 Personalization Technology: Definition and Core Concepts

Personalization designates the act of producing in a way that resonates with customer preferences. Personalized products reduce fatigue and time spent making choices, decreasing cognitive burden. (Chandra et al., 2022) Customers expect personalized interactions from a company if they are looking for long-term success. (Averineni et al., 2024)

Tailored recommendations are preferred by most customers, with personalization significantly increasing purchase likelihood. Personalized recommendations may be based on individual past purchase history (content-based filtering) or on the preferences and behaviors of similar users (collaborative filtering). (Liao & Sundar, 2022)

Whatever filtering is used, personalization technology ensures that users are shown relevant content reflecting their interests, making the experience more intuitive. The key to achieving this is creating web pages that are flexible and responsive. To stay relevant, technology must continuously adapt to user needs by collecting and analyzing data, to meet users' objectives with ease. (Sakarkar et al., 2021)

2.1.1 Evolution of Personalization Systems

The early days of basic personalization systems based on simple algorithms are gone. (Saboune, 2022) Consumer hopes have shifted since the last decades of the last century when accessibility was the key to acquiring markets. Modern customers want to stand out with products that carry personal signatures while conspicuous. (Chandra et al., 2022) The evolving needs of consumers have shown stubbornness for traditional personalization mechanisms. (Averineni et al., 2024)

Web personalization is an evolution of personalization systems that involves tailoring online experiences by delivering information aligned with user preferences. This involves collaborative filtering, document-based profiling, which builds user profiles by analyzing the textual content they interact with, and concept-based profiling, which categorizes content into themes to better understand user preferences. (Sakarkar et al., 2021) Modern personalization provides seamless experiences across multiple platforms, creating a user-centric immersion incorporating data from several sources in a cohesive approach. (Saboune, 2022)

More recently, personalization is evolving with the use of AI in chatbots, and virtual assistants creating personalized communication channels for users, improving fulfillment when the needs are correctly understood and effectively acted upon. (Peng et al., 2022) Advanced data analytics tools are also being employed to gather insights from user interactions, contributing to more tailored content. (Saboune, 2022)

The evolution of personalization systems has progressed from simple demographic targeting to sophisticated algorithms, leveraging AI and ML. With this evolution supporting business strategies more relevant experiences are created driving marketing effectiveness. (Alshurideh et al., 2023)

2.1.2 Role of AI and Machine Learning in Personalization

Personalization has long been a key element of marketing, but recent technologies such as AI and ML have leveraged this concept to new extent. (Averineni et al., 2024) Personalization has been significantly enhanced by AI, increasing customer loyalty. (Averineni et al., 2024) Especially in the present day where there is an overwhelming number of choices offered to consumers, the ability to identify and recommend products aligned with their interests creates an impact. (Prakash Gupta et al., 2024)

The ability to personalize content is one of the most anticipated outcomes of using ML models trained on data specific to individuals. (Falcetta et al., 2023) AI and ML can improve personalization by using fine-tuning models based on user-generated data. (Sevastjanova et al., 2024) On the one hand, AI allows the customization of avatars and environments by interpreting large amounts of data from user activities, on the other ML algorithms adapt, ensuring tailored social interactions and spaces. (Khosravy et al., 2024)

Web mining, a subdivision of data mining, can also be important in personalization, as it includes practices such as web content mining, focused on extracting valuable information from the content of web pages, and web usage mining, which studies user behavior, like browsing patterns, to infer preferences, and web structure mining that explores the relationships between web pages to improve access to data. (Sakarkar et al., 2021)

Although the potential for success is significant, studies show that AI and ML can affect consumer attitudes and information disclosure, leading consumers to withhold personal information and avoid online activities, as part of the personalization-privacy paradox. (Prakash Gupta et al., 2024) Other study suggests soft personalization to approach this, limiting the extent to which ML and AI are personalized, based on values like fairness, as it helps avoid errors and wrong assumptions while ensuring privacy and security. (Falcetta et al., 2023)

2.2 Integration of Personalization in the Metaverse

Metaverse offers an extremely immersive environment, where personalization is crucial in shaping UX, with AI and ML at its core. (Khosravy et al., 2024) A key element of the Metaverse is the development of product personalization design platforms, which provide tailored services, since users actively seek input in crafting personalized experiences. (Baccour et al., 2024) To improve this, systems like Product Style Automatic Generation System have been proposed to generate images from text inputs, standardizing design elements. (Li et al., 2024)

Tailored management in the Metaverse fosters a deeper connection to the platform, increasing user fulfillment. As a result, users are more likely to continue using the platform and participate actively in it.(Rahman et al., 2025) Research indicates that models can be fine-tuned to generate content tailored to individual traits linked to preferences, like storytelling styles or persuasive strategies, detected through computer vision and simulations of cognitive processes. (Qin & Hui, 2023)

Another side of personalization in Metaverse is related to fashion and granting users the possibility to modify avatars and use them to engage in personalized shopping experiences, like try-ons and curated fashion suggestions, based on user behavior. (Prashar & Prashar, 2024) Companies can use avatars as personal assistants instead of chatbots, helping customers engage with clothes or food brands using AR, virtually trying them, partaking in culinary experiences, or embarking on virtual fashion journeys, mirroring real-world activities. (Kulova et al., 2024)

2.2.1 Personalized Experiences in Virtual Worlds

Companies are integrating Metaverse technologies to create personalized experiences to attract the attention of consumers, aiming to increase brand awareness in online audiences. (Wasiq et al., 2024) (Li et al., 2024) Personalized experiences in virtual worlds involve tailoring content and interactions to meet user preferences. This includes customized avatars and narratives based on users' past interactions. (Qin & Hui, 2023)

With the expansion of the Metaverse, the search for personalization grows, with users pursuing experiences aligned with their preferences. (Li et al., 2024) Individuals look for personalized identities and experiences, fostering self-expression and independence. (Satyam et al., 2023) Personalized experiences promote an exceptional sense of presence and proprietorship within the Metaverse, presenting an extension of oneself. (Jadhav et al., 2024)

Digital avatars are one of the central customizable representations in the Metaverse, enhancing uniqueness in virtual worlds. Users can tailor their avatars to reflect their own style, facilitate social interactions, and immersive experiences. (Khan et al., 2024) For example, models like

Video-Control Net and Synthesia create personalized video content with realistic avatars. (Chamola et al., 2024) While tools like Convai give users the ability to create avatars with customized personalities and behaviors, based on AI-driven interactions. (Alcántara et al., 2024)

Metaverse is a highly social space, and personalized environments can also take form in shared personalization, balancing group objectives with individual user preferences, where each user can have their own personalized interfaces in a team meeting or tailored virtual tools for distinct tasks. (Guan & Morris, 2023) Regarding the future of work the Metaverse can offer customizable virtual workspaces to enhance comfort and productivity, with AI-driven insights helping to optimize workflows and collaboration based on personal work habits and needs. (Schlichting et al., 2022)

2.2.2 How AI Enhances Personalization in the Metaverse

AI enhances personalization in user experiences via adaptive interaction and storytelling, creating narratives that respond to user choices in real-time. (Khan et al., 2024) (Khosravy et al., 2024) For example, Gen-AI can be used in interactive game settings to create videos with personalized avatars mimicking the user's body language in the physical world. (Chamola et al., 2024) Sensors, like gyroscopes, can be attached to users to track and realistically allow control of avatars. (Fernandez & Hui, 2022)

Gen-AI has also been advancing to unprecedented stages of realism, leading to the augmentation previously envisioned for Metaverse personalization. (Qin & Hui, 2023) This extends to virtual commerce, with AI-driven recommendation systems analyzing user preferences to suggest products or virtual assets. (Khosravy et al., 2024) AI can fully automate all customization choices, limiting access to personalized marketing messages crafted for individuals or groups. (Kulova et al., 2024)

AI can create populated Metaverse environments, enhancing realism and interactivity by creating digital twins representing real-world entities in the virtual dimension. (Qin & Hui, 2023) Biometric data coupled with AI can adapt avatar expressions in real time, creating a stronger emotional connection between the Metaverse and users. (Basyoni et al., 2024) Such personalized environments leverage data analytics to create memorable experiences, influencing purchase decisions, and fostering brand loyalty. (Luo et al., 2023) Metaverse companies need to obtain large amounts of personally identifiable information from users to gather sufficient data and knowledge of users' thought processes and behavioral patterns and provide such experiences. (Murala, 2024)

2.3 Opportunities for Personalization in the Metaverse

Current Metaverse platforms focus on social interaction, gaming, business, and education, leaving room for platform development focusing on personalized design services. (Li et al., 2024) Personalized content is linked to higher success rates, measured with Metaverse metrics. (Luo et al., 2023) Studies show that 76% of consumers prefer to utilize multiple communication channels tailored to specific needs or inquiries. (Kulova et al., 2024)

Businesses can leverage personalization in the Metaverse to improve their advertising strategies and create more loyal relationships with individuals. (Alshurideh et al., 2023) As a result, businesses can foster long-term relationships through these memorable interactions, powered by personalization. (Alshurideh et al., 2023) With traditional advertising becoming increasingly obsolete, the Metaverse can present an opportunity to embrace technology to its full extent in personalization systems. (Saboune, 2022)

2.3.1 Immersive Customer Experiences and Brand Loyalty

Prioritizing customer experience is essential. (Kulova et al., 2024) Adopting the Metaverse enhances UX, creating tailored CX and supporting brand capabilities. (Wasiq et al., 2024) Ensuring high-quality experiences in the Metaverse is critical for growth and brand success. However, CX measures have yet to be adapted to the unique context of the Metaverse. (Rahman et al., 2025)

Brand loyalty is fostered when users feel that a platform caters to their preferences. This makes them more likely to return, encourages brand loyalty and repeated purchases. (Li et al., 2024) Personalized experiences can lead to higher conversion rates by fostering more relevant connections. (Luo et al., 2023) Seventy-eight percent of customers feel more inclined to suggest, acquire, and repeat purchases if companies can successfully customize their customer experience. (Kulova et al., 2024)

The immersive nature of the Metaverse offers artificial experiences that convincingly simulate real-world environments. This lets users temporarily dissociate from their surroundings, facilitating a deep engagement with the digitally constructed setting. (Talapuru et al., 2023) Customers engage through a variety of channels, often transitioning fluidly among them. UX professionals must adapt to evolving consumer preferences as customers expect rapid responses, increasingly demanding metaverse-specific experiences, like virtual reality retailers, interacting with 3D representations of products and services, utilizing metaverse-compatible offerings, receiving guidance through virtual reality devices and voice commands, and engaging with other innovative developments. (Kulova et al., 2024)

2.3.2 Hyper-Personalized Marketing and Consumer Engagement

Hyper-personalized marketing refers to the use of data analytics and AI to deliver extremely tailored content to consumers. This approach allows individualized marketing strategies based on real-time behavior and interactions within the Metaverse. (Luo et al., 2023) It also allows user needs and preferences to be anticipated and met at the right moment. (Alshurideh et al., 2023)

Consumer engagement can no longer be achieved with a simple logo and nice slogan, as individuals seek companies to catch their attention in a way that feels personal to them. (Saboune, 2022) Metaverse capabilities must be integrated into existing communication channels to meet customer expectations. Businesses must incorporate the Metaverse into their customer experience strategies to align with these preferences. (Kulova et al., 2024)

2.4 Challenges in Implementing Personalization within the Metaverse

Personalization within the Metaverse has excellent potential, but it is not without challenges. It is a complex subject that can pose technical issues, especially understanding and predicting individual preferences while seamlessly incorporating AI, blockchain, and IoT. (Peng et al., 2022) Integrating advanced technologies like AI for real-time customization can be complex and resource-intensive. (Kulova et al., 2024)

The effectiveness of personalized experiences can be compromised by the user's own lack of expertise, with many individuals who are not well-versed in wearable technology encountering difficulties in effectively navigating and optimizing these tailored functionalities. (Talapuru et al., 2023)

The technologies surrounding Metaverse, like VR or AR headsets, wrestle with the execution of the rendering of high-definition 3D virtual environments when confronted with extensive data processing. (Yu et al., 2023) In addition, the human brain is highly sensitive to alterations, with even minor incongruity potentially disrupting the overall experience. Headsets currently available remain insufficient in addressing this critical aspect. (Murala, 2024)

2.4.1 Ethical Issues: Data Privacy and User Consent

Data use and privacy in the Metaverse have yet to be legislated and have no defined boundaries or limits. (Luo et al., 2023) To secure data within the Metaverse, it must be a platform "secure by default" across hardware and software. Robust authentication, like fingerprint scanning and user-controlled device locks, can be helpful in preventing virtual attacks. Encryption and blockchain can also enhance security by decentralizing encrypted data. (Satyam et al., 2023)

AI's collection and use of personal data for training and personalization in the Metaverse can lead to privacy violations. (Qin & Hui, 2023) Deepfake technologies have the potential to be misused for identity theft and digital fraud, leading to potential scams with digital assets, cryptocurrency, and token ransomware attacks. (Talapuru et al., 2023) It is important to be aware of these risks as technology evolves. For cases like such, current privacy laws, such as GDPR, apply, but privacy protection in the Metaverse needs to evolve to account for multidimensional data collection. (Raina et al., 2022)

Lack of user understanding regarding how their data is collected, used, and shared can be a cause of impending harm to privacy rights. (Alshurideh et al., 2023) Even though the Metaverse counts on large amounts of data to enhance user experiences, this should not influence or compromise user privacy. (Basyoni et al., 2024) A recent study showed that individuals see the Metaverse as a greater threat than an opportunity for society, highlighting risks related to data privacy and amplification of algorithmic bias. Individuals emphasized that the Metaverse's dangers stem not from the technology itself but from the targets of those who control it. (Q. Zhou et al., 2024)

When discussing Gen-AI used for personalization within Metaverse concerns, content ownership and copyright may arise, especially regarding accountability for AI copyright infringement. (Qin & Hui, 2023) More privacy questions arise from avatar usage, with potential for unauthorized cloning or lack of awareness of how their avatar-related data is used, leading to transparency dilemmas. (Alcántara et al., 2024)

2.4.2 Overcoming Technical Limitations: Scalability and Real-Time Adaptation

A major technical limitation is the constant reliance on the need to always use the Internet and tools that consume electricity, leading to more energy destruction and a negative impact on the environment. (Verma et al., 2022) Metaverse applications across multiple industries face technical complications like unrealistic avatar embodiment, language interface, and network latency due to technological issues developers are having. As an outcome, consumers are discouraged from interacting due to a lack of immersive metaverse apps. (Talapuru et al., 2023)

Blockchain can be a key element to overcoming security limitations and ensuring decentralization in data management. Blockchain's architecture supports safe data exchange, vital for managing large amounts of user-generated content and virtual assets within the Metaverse. (Li et al., 2024) Using blockchain lessens the risk of single points of failure intending to make data nearly impossible to tamper with. (Peng et al., 2022)

Designing Metaverse environments using a modular components system design can result in easier scaling of specific aspects, for example, creating new virtual spaces, without overhauling the entire system. (Guan & Morris, 2023)

Another major factor to overcome the limitations of personalization in the metaverse is edge computing, a technology helpful in effectively rendering immersive experiences by interpreting social cues, reducing latency, and supporting real-time processing. (Yu et al., 2023) IoT edge devices can also be valuable to capture and process local environmental data effectively and lightweight protocols like MQTT, Socket.IO, or HTTP/2 can minimize delays in data transmission. (Guan & Morris, 2023)

2.5 State of the Art and Future Prospects

Studies show that out of 102 active metaverse applications, the majority contribute to gaming, immediately followed by business. This puts business and commerce at the front of the metaverse race. (Talapuru et al., 2023)

2.5.1 Emerging Technologies and Trends in Personalization for the Metaverse

The growth of the Metaverse presents significant opportunities for the finance sector. Innovative fintech solutions are likely to emerge to provide services in this new virtual environment, consolidating the employment of blockchain as an alternative financial structure. (Verma et al., 2022)

2.5.2 Business Models and Monetization of Personalized Experiences

The growth of personalized experience has led to new business models focused on engagement and satisfaction. These models can be focused on recurring subscription fees for personalized content or services on freemium models, where basic services are not paid but personalized features cost a premium. (Prashar & Prashar, 2024) Monetization of personalized experiences in the Metaverse can also include in-game purchases or advertising partnerships using user data for targeted marketing. (Luo et al., 2023) Personal virtual shopping is one of the main attractions of the Metaverse, as it provides users with the chance to own what they purchased in the actual world. Figure 14 shows a release of Zara's collection for avatars and people, where individuals can order apparel from a virtual store, in real or NFT form, and try it on at their own time and location. (Talapuru et al., 2023)

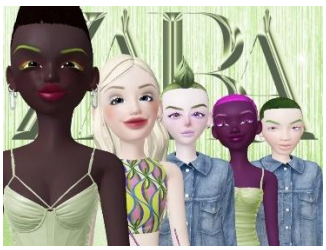


Figure 14 Zara Lime Glam" Metacollection Spring-Summer 2022

CHAPTER 3

Theoretical Approach

3.1 Research Problem and Question

Upon completing Chapters 2 and 3 of this research, a key question warrants further exploration. Based on the available information, I propose investigating a research question aimed at relating the concept of the Metaverse to management, particularly with an emphasis on personalization technologies. This seeks to clarify the complexities of the Metaverse and reveal its potential for personalizing user experiences, making it a pertinent area of research.

This study aims to contribute to the advancement of personalization techniques and to enhance our current understanding of the Metaverse. With these two domains in mind, the primary objective of this research is to identify the most significant influences affecting managers who wish to implement the Metaverse for personalizing user journeys and experiences.

The research question digs into how the Metaverse can serve as a vehicle for personalization methodologies and the role of management in integrating these personalization technologies. The question investigates the internal and external factors influencing an organization's propensity to adopt personalization technologies within the Metaverse, examining the benefits of Metaverse personalization in terms of engagement, satisfaction, and retention, and addressing the challenges associated with implementing personalization technologies in the Metaverse.

Personalization technologies are vital to the creation of stronger and more modern management strategies. This research will primarily focus on how the Metaverse can be integrated with personalization, demonstrating if managers can leverage the Metaverse to achieve significant efficiency in implementing personalization systems.

Furthermore, the study aims to understand how technologies such as AI and ML can enhance the development of personalization in the Metaverse. To fulfill the objectives outlined before, the following research question will be addressed:

RQ1. Which factors influence the willingness to adopt personalization technologies in the Metaverse?

RQ1 delves into the potential of the Metaverse as a medium for personalization methodologies, examining the role of management in the integration of these personalization technologies. It emphasizes the importance of strategic planning, human resources, and cost considerations. Gaining insight into how management perceives the adoption process is essential for ensuring the successful deployment of these technologies. This question aims to offer actionable insights into effective leadership and resource allocation.

The question looks at the internal and external factors that impact an organization's capacity to adopt personalization technologies. Key factors include organizational culture, technological readiness, stakeholder support, and resource availability. By analyzing these elements, the study uncovers potential barriers and enablers to adoption, offering valuable insights for organizations striving to effectively integrate metaverse-based personalization. This question holds particular significance for management professionals seeking to align technological innovations with their organizational objectives.

With this question, the study also focuses on the end-user and investigates the direct benefits of personalization for engagement, satisfaction, and retention within the metaverse. Although the primary emphasis is on user experience, the findings also carry important implications for management, underscoring the necessity of aligning technological investments with user-centric objectives. This insight assists management in justifying and efficiently directing resources toward personalization initiatives.

The study also hopes to merge technical and managerial insights to tackle the barriers encountered in the deployment of personalization technologies. By examining the role of management in alleviating challenges such as privacy issues, data governance frameworks, and technical intricacies, the study offers a comprehensive perspective on the solutions essential for successful implementation. It underscores the necessity for management to adopt proactive strategies that harmonize innovation with ethical imperatives and operational realities.

Considering the limitations identified in the Literature Review regarding the ability to address the research question thoroughly, a methodological approach detailed in Figure 4 will be employed and discussed in the subsequent section of the research.

The theoretical approach will follow the structure and hypotheses presented in Table 1.

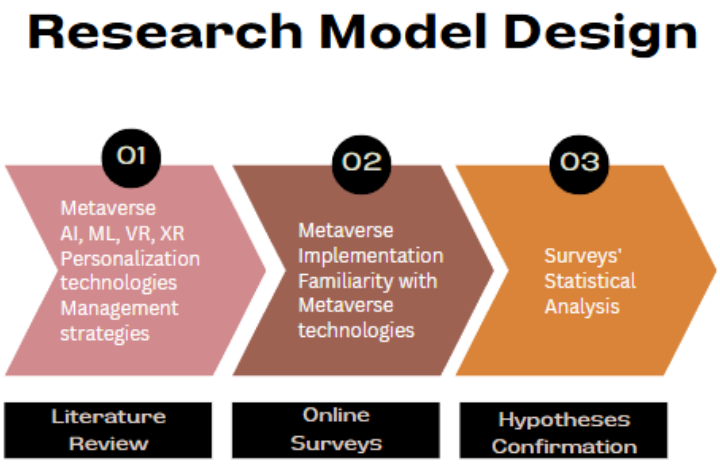


Figure 15 Research Model Design

Table 1 Theoretical Approach

Objective	Research Question	Methodology	References
Evaluate the willingness to adopt personalization technologies in the Metaverse	RQ1. Which factors influence the willingness to adopt personalization technologies in the Metaverse?	Quantitative research methodology - *Structural Equation Modeling (SEM)*	*(Prashar & Prashar, 2024)* (Alshurideh et al., 2023) (Alcántara et al., 2024) (Kulova et al., 2024; Rahman et al., 2025)*(Guan & Morris, 2023)*(Yu et al., 2023)(Badruddoja et al., 2022; Khosravy et al., 2024) (J. Zhou et al., 2020)(Schlichting et al., 2022)*(Basyoni et al., 2024; Chamola et al., 2024; Deng et al., 2023; Falcetta et al., 2023; Fernandez & Hui, 2022; Ghosh et al., 2024b; Li et al., 2024; Liao & Sundar, 2022; Luo et al., 2023; Mandala et al., 2023; Murala, 2024; Qin & Hui, 2023; Raina et al., 2022; Saboune, 2022; Satyam et al., 2023; Talapuru et al., 2023; Truong et al., 2023; Wasiq et al., 2024)*

CHAPTER 4

Methodology

The thorough review of the existing literature conducted earlier led to several hypotheses crafted to tackle the research question. A quantitative research methodology was employed to carry out online surveys. This process required careful design and collection of data pertinent to specific research inquiries. The systematic approach adopted greatly facilitated data collection.

Regarding the responses of the online surveys, this research follows Structural Equation Modeling (SEM). SEM is an advanced method of data analysis that explores and obtains relationships between latent variables in structural models through multiple regression analyses. (Yang et al., 2023)

SEM can be comprised of six main guidelines that allow a correct validation of the information collected using a measurement model, to ensure generalization of the model. The six guidelines are to define individual constructs; create the measurement model; plan a study that can produce empirical results; verify how valid the measurement model is; specify a structural model; and then assess how valid the structural model is. (Tan & Koh, 2023) SEM can be used across multiple fields of science, ranging between economics and psychology. (Yang et al., 2023)

SEM can be implemented through two distinct approaches: covariance-based structural equation modeling (CB-SEM) and partial least squares structural equation modeling (PLS-SEM). While some studies depict these as opposing techniques, others argue that they can be complementary. PLS-SEM is particularly relevant in situations where theoretical foundations are limited, as it emphasizes predicting and explaining the variance of key target constructs. In contrast, CB-SEM is used more reliably in scenarios that require a confirmatory approach and strong theoretical backing. (Bayaga & Kyobe, 2022)

Considering the hypotheses under analysis and based on the lack of theoretical evidence to support them, this research will be guided by PLS-SEM. PLS-SEM has as its main objective the determination of a causal model, testing if the set of variables in the model is adequate. PLS-SEM can show the amount of variance found in the dependent variable. (Bayaga & Kyobe, 2022)

SmartPLS 4 was selected for data analysis because of its effectiveness in performing SEM analyses. Utilizing a PLS-SEM path modeling approach, SmartPLS 4 offers a variance-based SEM technique that is particularly advantageous for smaller sample sizes or datasets that do not fulfill the stringent assumptions of alternative statistical methods.

4.1 Research Model

The methodological framework employed to address the research inquiry surrounding adopting and integrating personalization technologies within the metaverse follows a comprehensive review of the extant literature, formulating several hypotheses aligned with the research question posed in this study. A quantitative research methodology was deemed most suitable for obtaining measurable insights into the phenomenon under investigation.

An online survey was conducted to operationalize this methodology, with questions targeting the nuances of the research question. This allowed for a structured collection of relevant and robust data, pivotal for addressing the intricacies of the research question effectively. The survey structure was informed by key interrelationships identified in the literature, emphasizing factors influencing the possibility of implementation. These relationships, which guided hypothesis formulation, include the following:

1. Advantages to implementing personalization technologies in the Metaverse → Willingness to implement personalization technologies in the Metaverse
The perception a manager has regarding the benefits of personalization in the Metaverse plays a significant role in the likelihood of possible implementation. When managers perceive the advantages of personalization as substantial, it increases the potential for adopting these strategies within their organizations.

2. Resources and Human Resources Skills to implement personalization technologies in the Metaverse → Willingness to implement personalization technologies in the Metaverse
The availability of organizational resources, including personnel, skills, and training, significantly enhances a manager's likelihood to implement strategic choices. When an organization has well-trained human resources, it fosters an environment conducive to effective decision-making.

3. Risks of personalization technologies within the Metaverse → Willingness to implement personalization technologies in the Metaverse
Risk perception plays a crucial role in evaluating the possibility of the implementation of personalization in the Metaverse. When individuals or organizations perceive risks as being high, it can significantly diminish their likelihood of pursuing or implementing those options. Perceived risks reduce the willingness to adopt personalization technologies, creating doubts and resistance.

4. Trust in personalization technologies in the Metaverse → Willingness to implement personalization technologies in the Metaverse
Trust plays a crucial role in the willingness to implement changes in an organization. When trust levels

are low, this can adversely affect the likelihood of successful implementation. On the contrary, high levels of trust can foster a more conducive environment for implementation.

5. Benefits generated by implementing personalization technologies in the Metaverse → Willingness to implement personalization technologies in the Metaverse

The perception of benefits boosts the willingness to implement personalization technologies, as it provides motivation and justification for investment.

6. Trust in personalization technologies in the Metaverse → Risks of personalization technologies within the Metaverse

The level of trust that managers develop regarding personalization technologies in the Metaverse can significantly influence their perception of associated risks. As managers become more knowledgeable and aware of these risks, they can exhibit increased trust.

7. Resources and Human Resources Skills to implement personalization technologies in the Metaverse → Benefits generated by implementing personalization technologies in the Metaverse

Investing in both organizational and human resources can have a positive impact on the perceived benefits of implementing personalization technologies.

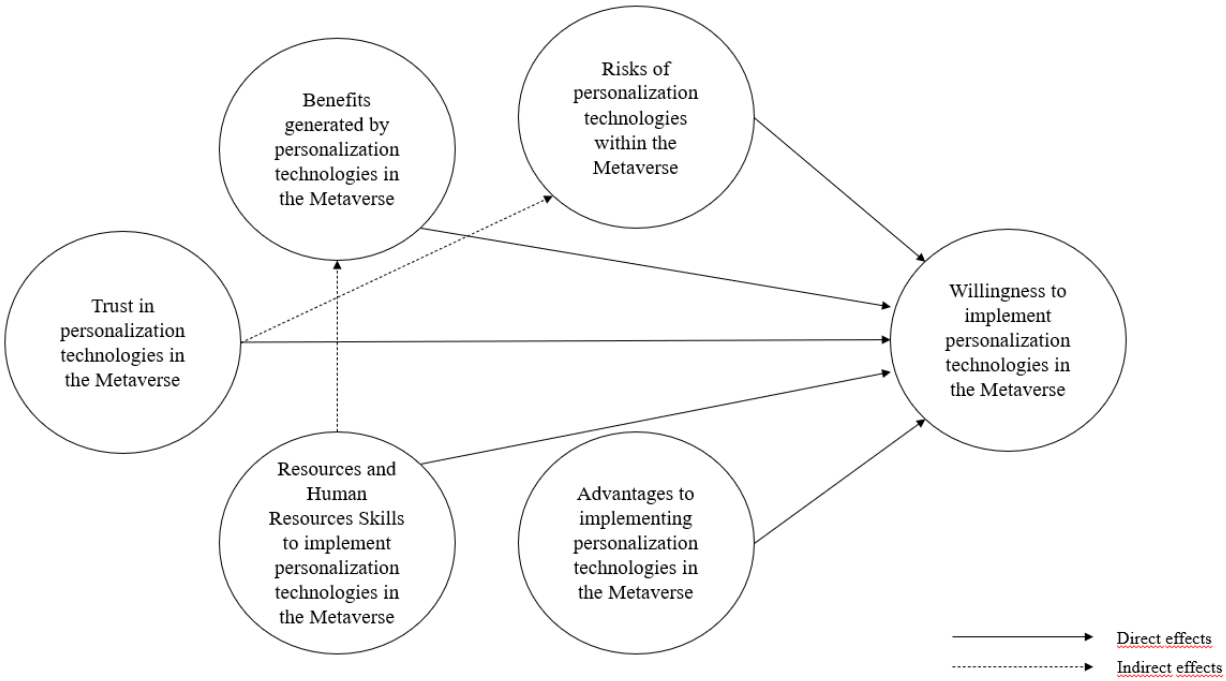


Figure 16 Conceptual model and hypotheses to be tested with SmartPLS

The inclusion of these interconnections provided a theoretical foundation for crafting targeted survey questions. The primary focus of this research is to employ a quantitative approach through the development of a questionnaire to uncover new findings. This approach is a research instrument that encompasses a variety of questions, intending to obtain responses in a standardized format. This method is particularly suitable when the unit of analysis involves people, making it widely utilized in the management field. It offers significant advantages in terms of cost-effectiveness, data processing efficiency, and error reduction. (Taherdoost, 2022)

The questionnaire included closed-ended questions, such as multiple-choice or Likert scales, which allow for a straightforward quantitative analysis. Open-ended questions can also be included to gather qualitative insights, although these require more complex coding and analysis. However, low response rates and biased answers can affect the reliability of results. Respondents may also misinterpret questions, leading to inaccuracies in the data collected. To maximize effectiveness, questions should be simple, clear, and free of leading language or double meanings. (Karunarathna et al., 2024) For that reason, all the questions on the survey conducted were closed-ended using a 7-point Likert scale, ranging from 'Strongly Disagree' to 'Strongly Agree'.

Questionnaires are especially helpful when personal interaction with participants is not possible. They also make data analysis easier using statistical tools. It is advisable to conduct pilot testing to identify potential issues and ensure the questions are suitable for the target audience. (Taherdoost, 2021)

4.2 Sample Description

The questionnaire included four initial questions to understand the sample and its characteristics. These questions concerned gender, age, educational level, and years of work experience. Although the questionnaire is entirely anonymous, the information gathered is valuable for assessing whether the samples are sufficiently diverse to ensure the validity of the results obtained from the questionnaire.

The sample included 100 individuals. Regarding the participants' gender distribution, 48 (48%) were female and 52 (52%) were male. No respondent chose the options "Non-binary" or "Prefer not to say". Figure 6 shows the gender distribution.



Figure 17 Survey's Gender Distribution

Regarding the respondents' age, 17 (17%) individuals were under 18, 45 (45%) were between the ages of 18 and 25, 15 (15%) were between 26 and 35, 13 (13%) were between 36 and 45, 9 (9%) were between 46 and 55, 1 (1%) was between 56 and 65 years and none were over 65 years. Figure 7 shows the age distribution.

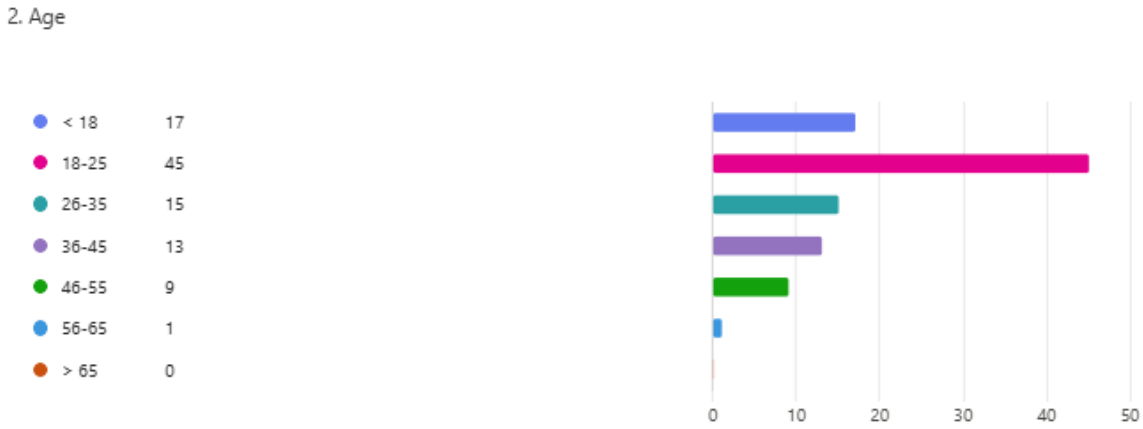


Figure 18 Survey's Age Distribution

In terms of educational attainment, none (0%) of the individuals had Basic Education, 34 (34%) had completed Secondary Education, 1 (1%) did not possess a university degree, 25 (25%) held a bachelor's degree, 36 (36%) had earned a master's degree, and 2 (2%) obtained a PhD or Doctorate. Additionally, 2 (2%) individuals pursued another form of education. The distribution of educational levels is illustrated in Figure 8.

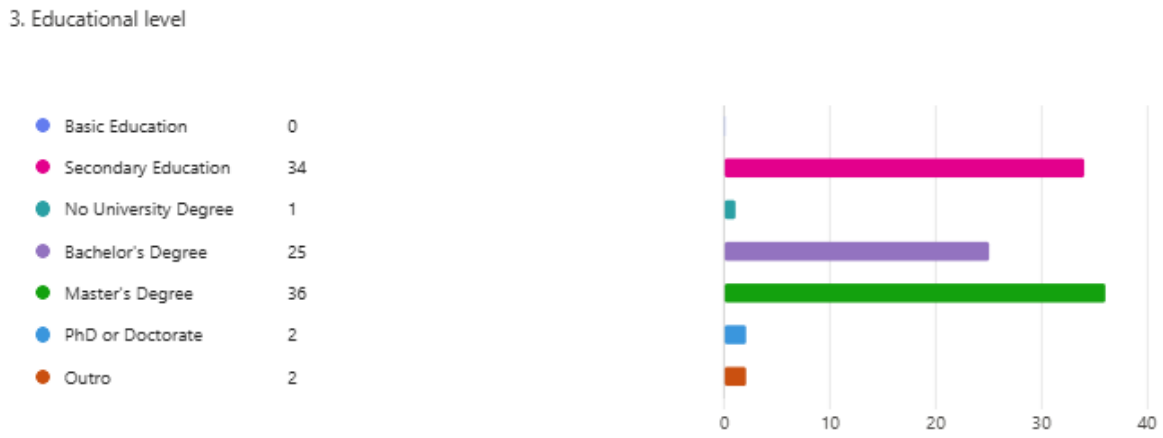


Figure 19 Survey's Educational Level Distribution

Regarding years of work experience, 61 individuals (61%) had less than five years of experience, 15 (15%) had five to ten years of experience, 7 (7%) had eleven to fifteen years of work experience and 17 (17%) had over fifteen years of work experience. The distribution of years of work experience is shown in Figure 9.



Figure 20 Survey's Years of Work Experience Distribution

CHAPTER 5

Results and Discussion

5.1 Research Question

To conduct the testing needed for the proposed conceptual model, a Structural Equation Modeling was applied using the variance-based Partial Least Squares (PLS) approach, implemented via SmartPLS 4 software. (Kwong & Wong, 2015) To complete the analysis, the measurement model was assessed for reliability, convergent validity, internal consistency, and discriminant validity, and then the structural model was evaluated. (Cheung et al., 2024)

Individuals in management positions who understand personalization technologies constituted the target population for this study. Data was collected using an online questionnaire developed based on a comprehensive literature review. The final version of the questionnaire was distributed through social media and email, resulting in 100 complete responses. The data collection process occurred between February 18 and May 8, 2025.

Hypotheses for the Research Question – RQ1. Which factors influence the willingness to adopt personalization technologies in the *M*etaverse?

H1a - The perceived advantages of implementing personalization technologies positively impact the willingness to adopt these technologies in the Metaverse.

H2a - The availability of resources and skilled human resources positively affects the willingness to adopt these technologies in the Metaverse.

H2b - The availability of resources and skilled human resources positively affects the perceived benefits of implementing personalization technologies in the Metaverse.

H3a - The perception of risks associated with personalization technologies in the Metaverse negatively affects the willingness to implement them.

H4a - Trust in personalization technologies within the Metaverse positively influences the willingness to implement them.

H4b - Trust in personalization technologies within the Metaverse positively influences the perception of risks.

H5a – The perceived benefits of personalization technologies within the Metaverse positively influences the willingness to implement them.

These hypotheses collectively illustrate the intricate relationships between perceived benefits, resources, trust, risk perception, and the willingness to adopt personalization technologies in the emerging Metaverse landscape.

Table 2 Relationship between variables in the conceptual model and the questions in the questionnaire

Which factors influence the willingness to adopt personalization technologies in the Metaverse?		
Dependent Variable		**Questionnaire Question**
Willingness to implement personalization technologies in the Metaverse		Immersive customer experiences generated by personalization technologies in the Metaverse are perceived as a benefit.
Independent Variable	**Indicator**	**Questionnaire Questions**
Benefits generated by personalization technologies in the Metaverse	User engagement (Satyam et al., 2023)	User engagement generated by personalization technologies in the Metaverse is perceived as a benefit.
	Customer satisfaction (Prashar & Prashar, 2024)	Customer satisfaction generated by personalization technologies in the Metaverse is perceived as a benefit.
	Brand loyalty (Li et al., 2024) (Luo et al., 2023)	Brand loyalty generated by personalization technologies in the Metaverse is perceived as a benefit.
	Conversion rates (Luo et al., 2023)	Conversion rates generated by personalization technologies in the Metaverse are perceived as a benefit.
Trust in personalization technologies in the Metaverse	Data privacy compliance (Alshurideh et al., 2023) (Alcántara et al., 2024)	Data privacy compliance impacts trust in personalization technologies in the Metaverse.
	Transparency in AI-driven personalization (Qin & Hui, 2023) (Kulova et al., 2024)	Transparency in AI-driven personalization impacts trust in personalization technologies in the Metaverse.
	Accurate recommendations (Liao & Sundar, 2022) (Raina et al., 2022)	Accurate recommendations impact trust in personalization technologies in the Metaverse.
	User control over personalization settings (J. Zhou et al., 2020) (Satyam et al., 2023)	User control over personalization settings impacts trust in personalization technologies in the Metaverse.
	Secure data handling (Satyam et al., 2023) (Ghosh et al., 2024b)	Secure data handling impacts trust in personalization technologies in the Metaverse.
	Clear ethical boundaries (Basyoni et al., 2024)	Clear ethical boundaries impact trust in personalization technologies in the Metaverse.
Risks of personalization technologies	Data privacy violations (Qin & Hui, 2023) (Talapuru et al., 2023)(Deng et al., 2023)	Data privacy violations are perceived as a risk of personalization technologies within the Metaverse.
	High implementation costs (Badruddoja et al., 2022)	High implementation costs are perceived as a risk of personalization technologies within the Metaverse.

within the Metaverse	Lack of scalability (Guan & Morris, 2023) (Yu et al., 2023)	Lack of scalability is perceived as a risk of personalization technologies within the Metaverse.
	Ethical concerns for AI (Falcetta et al., 2023; Qin & Hui, 2023) (Khosravy et al., 2024)	Ethical concerns for AI are perceived as a risk of personalization technologies within the Metaverse.
	User resistance (Chamola et al., 2024)(Murala, 2024)	User resistance is perceived as a risk of personalization technologies within the Metaverse.
	Limited user understanding (Basyoni et al., 2024) (Alshurideh et al., 2023)	Limited user understanding is perceived as a risk of personalization technologies within the Metaverse.
Advantages to implementing personalization technologies in the Metaverse	Stronger brand differentiation (Wasiq et al., 2024) (Rahman et al., 2025) (Qin & Hui, 2023) (Li et al., 2024)	Stronger brand differentiation is perceived as an advantage to implementing personalization technologies in the Metaverse.
	Higher marketing ROI (Saboune, 2022) (Luo et al., 2023)	Higher marketing ROI is perceived as an advantage to implementing personalization technologies in the Metaverse.
	Operational efficiency (Raina et al., 2022) (Fernandez & Hui, 2022)	Operational efficiency is perceived as an advantage to implementing personalization technologies in the Metaverse.
	First-mover benefits (Zawish et al., 2024) (Raina et al., 2022)	First-mover benefits are perceived as an advantage to implementing personalization technologies in the Metaverse.
	Customer insights (Schlichting et al., 2022) (Saboune, 2022)	Customer insights are perceived as an advantage to implementing personalization technologies in the Metaverse.
Resources and Human Resources Skills to implement personalization technologies in the Metaverse	Skilled Personnel (Kulova et al., 2024)	Skilled personnel are important to implement personalization technologies in the Metaverse.
	Training programs (Schlichting et al., 2022) (Mandala et al., 2023)	Training programs are important to implement personalization technologies in the Metaverse.
	Technological tools (Guan & Morris, 2023) (Alcántara et al., 2024) (Fernandez & Hui, 2022)	Technological tools are important to implement personalization technologies in the Metaverse.
	Budget allocation (Badruddoja et al., 2022) (Truong et al., 2023)	Budget allocation is important to implement personalization technologies in the Metaverse.
	External expertise (Talapuru et al., 2023)	External expertise is important to implement personalization technologies in the Metaverse.

5.3 Statistical Analysis

For the questionnaire, *The Main Influences on Implementing the Metaverse to Personalize the Customer Experience* [Annex A], a 7-point Likert Scale was used. (Rinker, 2024) Once the responses were gathered, it was the moment to proceed to test the conceptual model using SEM, specifically employing a PLS path modeling approach. It began by evaluating both the reliability and validity of the measurement model. Once these aspects were confirmed, it was possible to move on to assess the structural model. To gauge the quality of the model, individual reliability indicators, convergent validity, internal consistency reliability, and discriminant validity were examined. (Hair et al., 2017)

The results showed that five indicators should be removed since their standardized factor loadings were below 0.6. The removed indicators were "First-mover benefits are perceived as an advantage to implementing personalization technologies in the Metaverse.", "Training programs are important to implement personalization technologies in the Metaverse.", "High implementation costs are perceived as a risk of personalization technologies within the Metaverse."; "Lack of scalability is perceived as a risk of personalization technologies within the Metaverse.", and "Stronger brand differentiation is perceived as an advantage to implementing personalization technologies in the Metaverse.". After the five indicators were removed, reliability was assured, with all the standardized factor loadings of all the remaining items above 0.6 and significant because $p < 0.001$, which highlighted the reliability of the individual indicator. The reliability of the internal consistency was confirmed when all the values of Cronbach's Alpha and Composite Reliability exceeded the minimum value of 0.7. (Hair et al., 2017) Table 3, below, shows the results obtained.

Table 3 Composite Reliability, Average Variance Extracted, Correlations, and Discriminant Validity Checks

Latent Variables	*a*	*CR*	*AVE*	*Advantages*	*Benefits*	*Resources*	*Risks*	*Trust*	*Willingness*
Advantages	0.765	0.768	0.680	**0.824**	0.756	0.537	0.795	0.462	0.788
Benefits	0.851	0.863	0.690	0.625	**0.831**	0.371	0.537	0.555	0.769
Resources	0.814	0.862	0.634	0.455	0.343	**0.796**	0.785	0.605	0.302
Risks	0.702	0.741	0.521	0.513	0.441	0.585	**0.721**	0.925	0.407
Trust	0.802	0.806	0.505	0.378	0.466	0.491	0.732	**0.711**	0.427
Willingness	1.000	1.000	1.000	0.691	0.716	0.299	0.354	0.393	**1.000**

*Note: a-Cronbach Alpha; CR-Composite Reliability; AVE-Average Variance Extracted; **Bold**-Square roots of AVE; Below diagonal elements-correlations between the constructs; Above diagonal elements-HTMT ratios.*

Table 3 confirms the convergent validity for three key reasons. All items within their respective constructs were found to be statistically significant and positive. Each construct demonstrated composite reliability values exceeding the 0.70 threshold. Finally, the average variance extracted for all constructs surpassed the minimum acceptable value of 0.500. (Bagozzi & Yi, 1998)

Discriminant validity was assessed through two methods. The first method used the Fornell and Larcker criterion, which stipulates that the square root of a construct's AVE, indicated diagonally with bold values in Table 3 must be greater than its highest correlation with any other construct. (Fornell & Larcker, 1981) Table 3 illustrates that this criterion is satisfied for all constructs. The second approach utilized the Heterotrait-Monotrait ratio criterion. As shown in Table 3, most Heterotrait-Monotrait ratio values remain below the conservative threshold of 0.85, further reinforcing the evidence for discriminant validity. The Heterotrait-Monotrait ratio value between "Trust in personalization technologies in the Metaverse" and "Risks of personalization technologies within the Metaverse" showed was of 0.925, which exceeds the conventional thresholds (0.85/0.90), but the constructs are theoretically distinct in the research done prior although closely linked in the context of this study, as the risks have a close relationship with confidence perceived. Additional evidence, including cross-loadings and AVE comparisons, supports discriminant validity. (Hair et al., 2017) (Henseler et al., 2015)

The structural model was tested by examining the sign, magnitude, and significance of the structural path coefficients, as well as the R^2 values for each endogenous variable, which serve as indicators of the model's predictive accuracy. Stone-Geisser Q^2 values were utilized to evaluate the model's predictive relevance. To check for collinearity, the VIF values were tested, and what was found among the items was a range of 1.000 to 2.676, all of which fell below the critical value of 5, indicating that collinearity was not an issue. (Hair et al., 2017)

The coefficient of determination R^2 for the three endogenous variables: Benefits generated by personalization technologies in the Metaverse; Risks of personalization technologies in the Metaverse; Risks of personalization technologies within the Metaverse; Willingness to implement personalization technologies in the Metaverse were 11.7%; 53.6%; 62.5%, respectively, exceeding the threshold of 10%. (Hair et al., 2017)

Table 4 Direct effects between constructs

	Original Sample	*Standard Deviation*	*T Statistics*	*P values*
Advantages -> Willingness	0.459	0.110	4.170	0.001
Benefits -> Willingness	0.445	0.114	3.901	0.001
HR and Resources -> Willingness	-0.041	0.122	0.334	0.738
Risks -> Willingness	-0.167	0.135	1.233	0.218
Trust -> Willingness	0.154	0.097	1.593	0.111
HR and Resources -> Benefits	0.343	0.101	3.393	0.001
Trust -> Risks	0.732	0.051	14.320	0.001

Table 5 Indirect effects between constructs

	Original Sample	*Standard Deviation*	*T Statistics*	*P values*
HR and Resources -> Benefits -> Willingness	0.152	0.057	2.671	0.008
Trust -> Risks -> Willingness	-0.122	0.102	1.191	0.234

The findings presented above in Tables 4 and 5 offer very relevant insights into the factors influencing the willingness to adopt personalization technologies in the Metaverse and their interactions with one another.

The results from the statistical analysis reveal that the perceived advantages of implementing personalization technologies in the Metaverse have a strong and statistically significant direct effect on the willingness to adopt these technologies (β = 0.459, p < 0.001), supporting *H1a*. This finding aligns with existing literature, which suggests that a positive perception of potential outcomes encourages managers to take action regarding implementation.

Regarding the impact of organizational and human resources on the willingness to implement, *H2a* is not supported, as the result is not statistically significant (β = -0.041, p = 0.738). However, *H2b* is supported, indicating that organizational and human resources positively influence perceived benefits (β = 0.343, p = 0.001). These results suggest that while human and organizational resources do not significantly affect the willingness to adopt new technologies in the Metaverse, they do have a positive and significant impact on perceived benefits. This, in turn, can influence willingness, as evidenced in the first line of Table 5, where the connection between resources, benefits, and willingness is established as significant and positive (β = 0.152, p < 0.008).

H3a is not supported, as the influence of perceived risks on willingness through resources is not statistically significant (β = -0.167, p = 0.218). This indicates that the negative aspects do not significantly impact the decision-making process for choosing to implement personalization technologies in the Metaverse.

The findings indicate that *H4a* is not supported, as trust in personalization technologies within the Metaverse does not significantly influence the willingness to adopt them (ß = 0.154, p < 0.111). While the results demonstrate a positive relationship between the two constructs, it lacks statistical significance. In contrast, the impact of trust on the perception of risks associated with personalization techniques in the Metaverse supports *H4b* (ß = 0.732, p = 0.001). This result reveals that trust influences the perception of risks. Although this may seem counterintuitive, it suggests that as managers grow more trusting and aware, they also become cognizant of potential risks. Consequently,

this strong effect of trust equips individuals with the awareness needed to identify risks, empowering them to mitigate these risks while maintaining high levels of trust.

Is hypothesized, based on the literature review, that perceived benefits have a strong and significant positive effect on the willingness to implement personalization technologies in the Metaverse (ß = 0.445, $p < 0.001$), thereby supporting H5a. This finding indicates that managers are more inclined to proceed with implementation when they recognize substantial benefits associated with the use of these technologies.

5.4 Discussion

The conceptual model under study was subjected to various tests using the software SmartPLS4 to answer the research question of this study "Which factors influence the willingness to adopt personalization technologies in the *M*etaverse?".

As shown in Figure 21, the model identified six main factors based on the Literature Review conducted for the research. They are "Benefits generated by personalization technologies in the Metaverse" identified by (Satyam et al., 2023), (Prashar & Prashar, 2024), (Li et al., 2024) (Luo et al., 2023), (Talapuru et al., 2023), (Wasiq et al., 2024); "Trust in personalization technologies in the Metaverse", identified by (Alshurideh et al., 2023), (Alcántara et al., 2024), (Qin & Hui, 2023), (Kulova et al., 2024), (Liao & Sundar, 2022), (Raina et al., 2022), (J. Zhou et al., 2020), (Satyam et al., 2023), (Ghosh et al., 2024b), Basyoni et al., 2024); "Risks of personalization technologies within the Metaverse", identified by (Qin & Hui, 2023), (Talapuru et al., 2023), (Deng et al., 2023), (Badruddoja et al., 2022), (Guan & Morris, 2023), (Yu et al., 2023), (Falcetta et al., 2023), (Khosravy et al., 2024), (Chamola et al., 2024), (Murala, 2024), (Basyoni et al., 2024), (Alshurideh et al., 2023); "Resources and Human Resources Skills to implement personalization technologies in the Metaverse", identified by (Kulova et al., 2024), (Schlichting et al., 2022), (Mandala et al., 2023), (Guan & Morris, 2023), (Alcántara et al., 2024), (Fernandez & Hui, 2022), (Badruddoja et al., 2022), (Truong et al., 2023), (Talapuru et al., 2023) and "Advantages to implementing personalization technologies in the Metaverse", identified by (Wasiq et al., 2024), (Rahman et al., 2025), (Qin & Hui, 2023), (Li et al., 2024), (Saboune, 2022), (Luo et al., 2023), (Raina et al., 2022), (Zawish et al., 2024) and (Schlichting et al., 2022).

These categories served as latent variables in the model being evaluated through SmartPLS4, with their validity demonstrated in the prior section. The indicators for each factor were individually assessed through an online survey, with all receiving a valuation exceeding 0.6. This suggests that the indicators are reliable, particularly given the statistical significance at $p < 0.001$. (Hair et al., 2017)

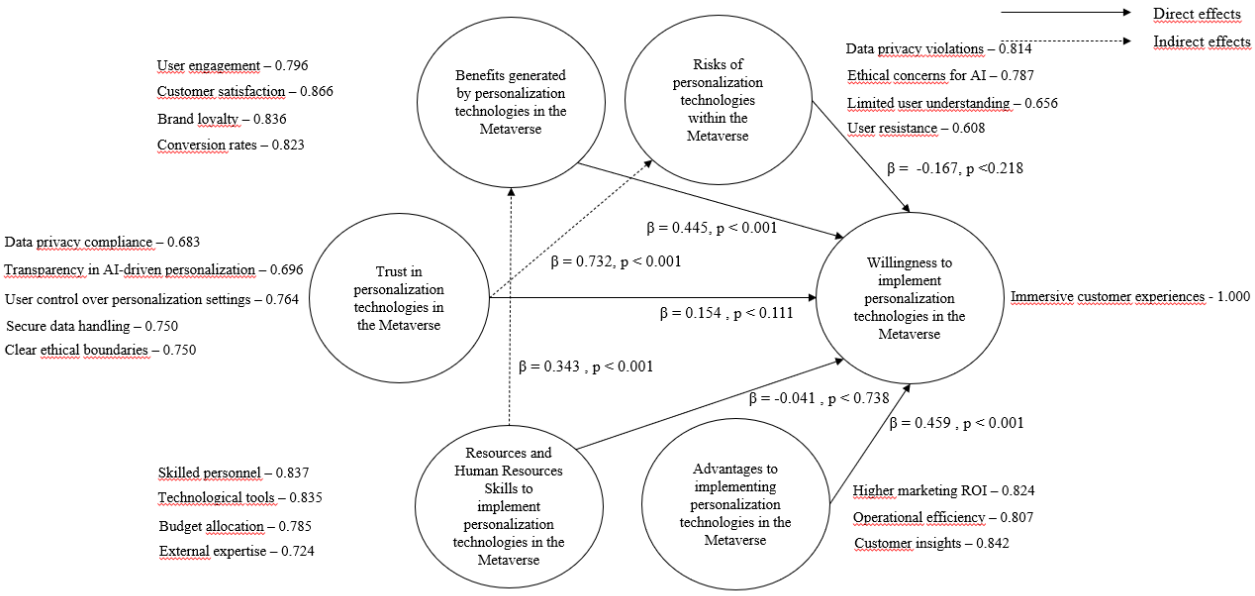


Figure 21 Conceptual model tested with SmartPLS4 with associated values

Regarding the influence of perceived benefits, the findings demonstrate a strong and statistically significant positive effect on the willingness to adopt personalization technologies in the Metaverse (ß = 0.459, p < 0.001), supporting hypothesis H1a. This result aligns with existing literature, reinforcing the idea that when managers perceive clear advantages in adopting a technology, they are more inclined to support its implementation.

In relation to human and organizational resources, hypothesis H2a was not supported, as the direct effect of these resources on willingness to adopt personalization technologies was not statistically significant (ß = -0.041, p<0.738). However, H2b was confirmed, showing that the availability of resources and skilled human capital positively influences perceived benefits (ß = 0.343, p<0.001). These results suggest that while resources alone may not directly drive adoption, they enhance managers' perception of potential benefits, an indirect pathway supported by the significant mediation link between resources, perceived benefits, and willingness (ß = 0.152, p<0.008). This result is interesting as it suggests that human and organizational resources are not significant factors in fostering a willingness to implement changes. However, they do act as motivators for recognizing potential benefits. Merely having resources is insufficient to encourage managers' willingness to act, this factor must be combined with additional elements to become significant. Otherwise, managers may possess the necessary resources and still choose not to proceed with the implementation of personalization technologies in the Metaverse.

With respect to risk perception, hypothesis H3a was not supported. The path from perceived risks to willingness to adopt through resources showed no significant effect (ß = -0.167, p<0.218),

indicating that concerns around risks do not substantially deter managers from considering the implementation of personalization technologies in the Metaverse. This finding is crucial for demystifying the use of the Metaverse in the context of personalization. It indicates that even when managers acknowledge potential risks, these concerns do not significantly affect their willingness to implement such strategies. This insight is noteworthy because existing literature suggests that managers may be less inclined to adopt new technologies when they perceive associated risks. However, the statistical analysis of the sample revealed that while managers may view these risks negatively, their apprehensions do not significantly impact their decisions. Future research could benefit from looking deeper into how the perception of risks influences implementation decisions.

As for trust, hypothesis H4a was not confirmed, since the direct effect of trust in personalization technologies on willingness was positive but statistically non-significant (ß = 0.154, p< 0.111). Nonetheless, H4b was supported, as trust was found to have a strong and significant influence on the perception of risks (ß = 0.732, p< 0.001). This result highlights that increased trust leads to a heightened awareness of potential risks, suggesting that as trust develops, so too does a more nuanced and responsible understanding of associated challenges. Managers may therefore be more vigilant, not due to lack of confidence, but precisely because they trust the technology enough to evaluate it critically. It's also interesting to note that trust alone is not capable of significantly impacting willingness to adopt, although it shows positive effects, they are not strong enough to motivate adoption. It's possible to conclude that trust is not one of the factors influencing adoption from a manager's perspective.

Finally, in line with the literature and expectations, hypothesis H5a was supported. The perceived benefits of personalization technologies in the Metaverse exert a strong and statistically significant positive effect on the willingness to adopt these technologies (ß = 0.445, p < 0.001). This result reinforces the conclusion that when managers recognize clear advantages, they are significantly more likely to pursue implementation strategies within their organizations. The advantages highlighted through the online survey are compelling enough to influence managers to adopt personalization in the Metaverse on their own. This factor strongly supports the case for implementation and should be a key focus for those advocating for this shift. It is evident that managers need to perceive tangible and impactful benefits for the company in order to move forward with the implementation process.

Concerning the primary characteristics of personalization technologies in the Metaverse that enhance trust in managers, the findings don't totally align with the perspectives of the authors reviewed. They highlight clear ethical boundaries (Basyoni et al., 2024), secure data handling (Satyam

et al., 2023), and user control over settings (J. Zhou et al., 2020). Accurate recommendations was excluded due to its minimal significance for the model (Liao & Sundar, 2022) (Raina et al., 2022).

As for the main advantages of implementing personalization technologies in the Metaverse, the results partially diverge from the theoretical frameworks proposed by the authors reviewed, which led to the exclusion of certain factors. The model indicates that the primary advantages encompass customer insights (Schlichting et al., 2022) (Saboune, 2022), increased marketing ROI (Luo et al., 2023), and operational efficiency (Fernandez & Hui, 2022). However, there is contention regarding the variables of stronger brand differentiation (Wasiq et al., 2024) (Rahman et al., 2025) and first-mover benefits (Zawish et al., 2024) these were deemed to have little significance in influencing implementation and were subsequently removed from the model.

The results of the major risks of implementing personalization technologies in the Metaverse are again not in complete agreement with the authors studied. The main limitations are data privacy violations (Qin & Hui, 2023) (Talapuru et al., 2023)(Deng et al., 2023) and ethical concerns for AI use (Falcetta et al., 2023; Qin & Hui, 2023) (Khosravy et al., 2024). According to the conceptual model, high implementation costs (Badruddoja et al., 2022) and lack of scalability (Guan & Morris, 2023) (Yu et al., 2023) are of little significance when it comes to influencing the implementation and were excluded from the model.

Regarding the advantages of personalization technologies within the Metaverse, the findings are consistent with the perspectives of the reviewed authors. The main benefits are customer satisfaction (Prashar & Prashar, 2024), brand loyalty (Li et al., 2024) (and conversion rates (Luo et al., 2023). Finally, the resources and human resources most valuable for the implementation were not in line with expectations, which resulted in the removal of training programs (Mandala et al., 2023) due to a lack of significance. Otherwise, the most important were skilled personnel (Kulova et al., 2024) and technological tools (Guan & Morris, 2023).

CONCLUSIONS

Final Considerations

Given the potential of the Metaverse to enhance personalization and redefine the way consumers interact with brands, it is essential to understand the factors that most influence their implementation.

Once the literature review was completed, it was possible to define the research question along with the variables that would provide the answers to it. The variables were found in the various types of literature coming from different authors referenced throughout chapters two and three. The research question sought to understand which variables influenced the implementation of personalization technologies in the Metaverse.

After the literature review was completed, the conceptual model was created with variables were divided into 5 groups, namely benefits generated by personalization technologies in the Metaverse, trust in personalization technologies in the Metaverse, risks of personalization technologies within the Metaverse, advantages to implementing personalization technologies in the Metaverse and resources and human resources skills to implement personalization technologies in the Metaverse.

Based on the findings from the SmartPLS 4 analysis, it is evident that advantages and benefits are key factors influencing the willingness to adopt personalization technologies in the Metaverse. This outcome supports two hypotheses derived from existing literature.

Even with the presence of risks acting as a latent concern in the literature, as pointed out by (Talapuru et al., 2023), the statistical analysis indicates that their impact on the willingness to adopt such technologies is not significant. Moreover, risks serve as a mediator between trust and the willingness to adopt these technologies, demonstrating that negative aspects can be managed or alleviated through trust in technology. This insight underscores the importance of user perception management, highlighting that effective communication plays a crucial role in facilitating technological adoption. (Wigert et al., 2012)

Contrary to expectations, neither risks nor trust demonstrated a statistically significant direct effect on willingness. This demonstrates that these concepts are important in theory, but may not have a direct influence on decision-making. In contrast, even though resources did not directly affect willingness ($\beta = -0.041$, $p = 0.738$), they showed a significant positive indirect effect through their influence on benefits ($\beta = 0.152$, $p = 0.008$). This shows the indirect importance of organizational resources, suggesting that their value lies in enhancing perceived advantages.

In summary, the adoption of personalization technologies in the Metaverse is driven by perceived benefits and advantages, with organizational resources and trust playing indirect roles. These findings suggest that to enhance adoption, organizations can invest in infrastructure and expertise as well as communication that builds trust, emphasizing transparency and ethical practices.

The current discussion on emerging technologies has notably transitioned from an emphasis on the Metaverse to a focus on AI and its vast potential. With many still viewing the Metaverse as a critical evolutionary space, the substantial body of research and discussion surrounding it suggests that its implications may be even more far-reaching. As these technologies continue to evolve, the interplay between AI and the Metaverse could lead to innovative applications and changes that redefine our digital experiences. (Zawish et al., 2024)

Looking into the future, it's likely that more and more sectors and industries will increasingly explore different uses in the Metaverse. The current study seeks to enhance the understanding of the evolution of business management by not only discussing the Metaverse in a broad sense but also investigating managers' perspectives on the implementation of this technology and its potential benefits. To this end, the main factors that influence the possibility of implementing the Metaverse for personalization techniques were addressed, such as the main motivations, the concept of Metaverse and current personalization technologies used there, as well as limitations of the Metaverse that can affect their implementation, as well as the impacts of AI, ML and blockchain as enablers of Metaverse adoption.

Although the idea of Metaverse has been around for almost thirty years, its broad adoption is yet to be fully explored in different cases, as most of the research done so far is focused mostly on uses for education or healthcare. For that reason, this study aims to contribute to the scientific literature by studying in detail the implementation of personalization systems using the Metaverse, challenges in this implementation, and future trends for the Metaverse. The study examines the characteristics of the Metaverse that most effectively facilitate user personalization, including elements such as avatars and social interactions. It highlights the primary motivations behind its implementation as well as the limitations that may arise. Additionally, the research explores how brands have utilized the Metaverse as a distinguishing factor, while also considering how complementary technologies like NFTs can enhance the overall customer experience.

It is important to note that research on these topics should continue to deepen existing knowledge, thereby providing a better understanding in organizations about the Metaverse and its uses.

Limitations

It’s important to recognize some limitations that may hinder generalization for this study, despite its relevancy to the field. Its main limitation is the questionnaire sample size, consisting of 100 responses, because although this number can be used for exploratory analysis based on statistical modelling, it can still be scarce to guarantee a robust representation of the universe of managers who interact with personalization in the context of the Metaverse. Consequently, the results should not be generalized to other contexts.

Another limitation concerns the emerging nature of the topic itself. The scientific literature available on the adoption of personalization technologies in the Metaverse is still in its primary stages, with few empirical studies delving into this specific intersection.

Suggestions for further studies

Future studies could investigate how this topic impacts various fields and sectors, aligning with the perspectives of different managers, from top, middle, and first-line managers. It may be beneficial to explore how companies of varying sizes perceive this opportunity and to further personalize the research for specific countries, given that the questionnaire received responses in both Portuguese and English, limiting the ability to generalize the participants' nationalities.

In addition to this possibility, future research could look deeper into the future of the Metaverse, particularly concerning the current significant focus on AI. This could involve examining whether AI will serve as an enabler for advancements or, conversely, divert resources solely toward itself, neglecting the Metaverse. It will be intriguing to observe whether major technology players, like Meta, will invest in making the Metaverse a part of everyday reality, integrating it into everyone's daily lives, or if it will continue to exist as a niche space, mainly associated with video gaming.

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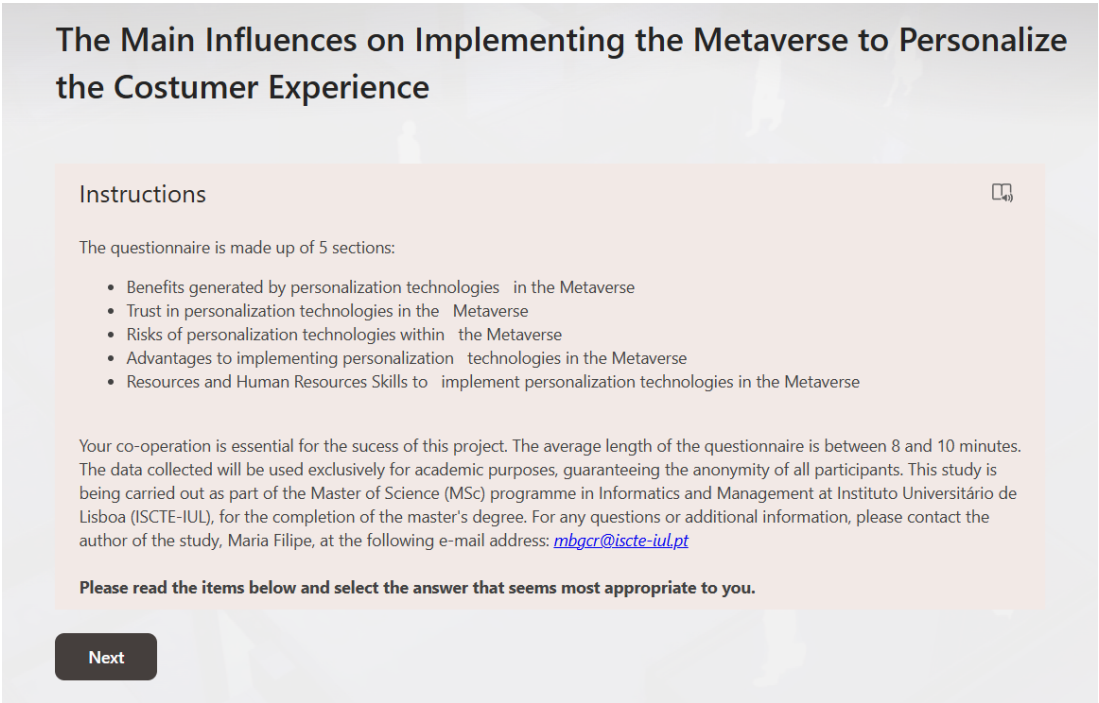
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Annexes

Anex A. Survey





Demographic Information

1

Gender *

- ◯ Woman
- ◯ Man
- ◯ Non-binary
- ◯ Prefer not to say

2

Age *

- ◯ < 18
- ◯ 18-25
- ◯ 26-35
- ◯ 36-45
- ◯ 46-55
- ◯ 56-65
- ◯ > 65

3

Educational level *

- ◯ Basic Education
- ◯ Secondary Education
- ◯ No University Degree
- ◯ Bachelor's Degree
- ◯ Master's Degree
- ◯ PhD or Doctorate
- ◯ Outro

4

Years of Work Experience *

- ◯ < 5 years
- ◯ 5 to 10 years
- ◯ 11 to 15 years
- ◯ > 15 years

Willingness to Adopt Personalization Technologies in the Metaveverse

Personalization Technologies: Ensures that users are shown relevant content reflecting their interests, making the experience more intuitive.
Metaverse: The merging of real and virtual worlds, a digital identity, and a continuous multi-sensory experience.
User engagement: Measure of how users interact with a website, app, or other digital product.
Customer satisfaction: Measures how happy customers are with a company's products, services, and capabilities.
Brand loyalty: Tendency to continue using the same brand of goods rather than competing brands.
Conversion rates: Measures the number of users who converted as a percentage of the total number of users that interacted with a company.

5

Benefits generated by personalization technologies in the Metaverse.

Please, rate the benefits generated by personalization technologies in Metaverse from the manager's point of view.
*

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
User engagement levels generated by personalization technologies in the Metaverse are perceived as a benefit.	○	○	○	○	○	○	○
Customer satisfaction generated by personalization technologies in Metaverse is perceived as a benefit.	○	○	○	○	○	○	○
Brand loyalty generated by personalization technologies in the Metaverse is perceived as a benefit.	○	○	○	○	○	○	○
Conversion rates generated by personalization technologies in the Metaverse are perceived as benefit.	○	○	○	○	○	○	○
Immersive customer experiences generated by personalization technologies in the Metaverse are perceived as a benefit.	○	○	○	○	○	○	○

6

Trust in personalization technologies in the Metaverse.

Please, rate the factors affecting trust in personalization technologies in Metaverse from the manager's point of view.
*

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
Data privacy compliance impacts trust in personalization technologies in the Metaverse.	○	○	○	○	○	○	○
Transparency in AI-driven personalization impacts trust in personalization technologies in the Metaverse.	○	○	○	○	○	○	○
Accurate recommendations impact trust in personalization technologies in the Metaverse.	○	○	○	○	○	○	○
User control over personalization settings impacts trust in personalization technologies in the Metaverse.	○	○	○	○	○	○	○
Secure data handling impacts trust in personalization technologies in the Metaverse.	○	○	○	○	○	○	○
Clear ethical boundaries impact trust in personalization technologies in the Metaverse.	○	○	○	○	○	○	○

7

Risks of personalization technologies within the Metaverse.

Please, rate the risks generated by personalization technologies in Metaverse from the manager's point of view.
*

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
Data privacy violations are perceived as a risk of personalization technologies within the Metaverse.	○	○	○	○	○	○	○
High implementation costs are perceived as a risk of personalization technologies within the Metaverse.	○	○	○	○	○	○	○
Lack of scalability is perceived as a risk of personalization technologies within the Metaverse.	○	○	○	○	○	○	○
Ethical concerns for AI are perceived as a risk of personalization technologies within the Metaverse.	○	○	○	○	○	○	○
User resistance is perceived as a risk of personalization technologies within the Metaverse.	○	○	○	○	○	○	○
Limited user understanding is perceived as a risk of personalization technologies within the Metaverse.	○	○	○	○	○	○	○

B

Advantages to implementing personalization technologies in the Metaverse.

Please, rate the advantages generated by personalization technologies in Metaverse from the manager's point of view.
*

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
Stronger brand differentiation is perceived as an advantage to implementing personalization technologies in the Metaverse.	○	○	○	○	○	○	○
Higher marketing ROI is perceived as an advantage to implementing personalization technologies in the Metaverse.	○	○	○	○	○	○	○
Operational efficiency is perceived as an advantage to implementing personalization technologies in the Metaverse.	○	○	○	○	○	○	○
First-mover benefits are perceived as an advantage to implementing personalization technologies in the Metaverse.	○	○	○	○	○	○	○
Customer insights are perceived as an advantage to implementing personalization technologies in the Metaverse.	○	○	○	○	○	○	○

9

Resources and Human Resources Skills to implement personalization technologies in the Metaverse.

Please, rate the resources and human resources skills needed to implement personalization technologies in Metaverse from the manager's point of view.
*

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
Skilled personnel are important to implement personalization technologies in the Metaverse.	○	○	○	○	○	○	○
Training programs are important to implement personalization technologies in the Metaverse.	○	○	○	○	○	○	○
Technological tools are important to implement personalization technologies in the Metaverse.	○	○	○	○	○	○	○
Budget allocation is important to implement personalization technologies in the Metaverse.	○	○	○	○	○	○	○
External expertise is important to implement personalization technologies in the Metaverse.	○	○	○	○	○	○	○